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TECHNOLOGY, COMMUNICATION AND TRANSPORT

ITEM DATA MANAGEMENT IN SPARE PART PROCESSES

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Abstract

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Abstract

This thesis was done for Normet Oy, a technology company in the field of mining and tunneling business. The purpose of this thesis was to learn, develop and find out improvement needs of processes involving spare parts and data in the Service department of the company. This topic was chosen because there were issues with the data quality in the field of spare parts.

There was a need to find out and implement possible development fields in the spare part processes as well as report them. Methods used were interviews, meetings, personal experience and feedback. Feedback was received from Normet employees.

The development ideas were implemented in practice. These improvements help the development of processes further. The results of this thesis show that there are still development needs in spare part processes. For further development the processes should be investigated and measured further.

Keywords
spare part, process, parameter, data, management, item, product lifecycle management

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LIST OF ABBREVIATIONS

BOM bill of material

EQ equipment

GCCT ground control and construction technologies

IT information technology

OEM original equipment manufacturer

PLM product lifecycle management

1 INTRODUCTION

1.1 Introduction of the company

Normet is an innovative fast growing technology company. One of the company's main focuses is to help customers to improve sustainability, safety, productivity and processes in the mining and tunneling business. Normet has delivered over 13 000 built for purpose underground machines which are supported and serviced with a broad portfolio. Current amount of employees is over 1400 professionals, spread over 50 locations in 33 countries. This helps customers to get fast and reliable response wherever and whenever they need it the most.

Normet was founded in 1962, and was called Peltosalmen Konepaja. After 10 years of hard work, the company changed its name to Normet Oy, 1972 was also the first year when Normet started making mining machines. After a while the equipment range was widened in a rapid fashion, and is still being updated. The equipment offering is spread in these sections: Charging, scaling, concrete spraying, concrete transportation, underground logistics and lifting & installation. Models of the equipment can be seen in Figure 1. Normet also offers rock reinforcements and construction chemicals. This makes the company unique. To be able to provide such a wide range of important equipment for professionals to be able to work safely underground is highly valuable for customers. (www.Normet.com)

Figure 1. Normet equipment. (www.Normet.com)

1.2 Background and goals

This thesis includes a study of the current spare part processes of the company. One of the main goals of this thesis was to develop internal processes and the quality of item data. The thesis was done for Normet Oy, which has had recent process changes in the service department, where spare parts and item data are handled. This thesis focuses on item data, updating the existing and newly created data to ensure customer satisfaction. The thesis also includes current processes of spare part data gathering tools, creation of spare part kit data, lack of trust in data quality and the process of new spare part creation. This project minimizes risks when dealing with item data in the systems, which are used in the company. Main risks identified are incorrect data input due to operator error or system malfunction and duplicating the existing items.

Normet Oy has a Product Lifecycle Management, also known as a PLM system called Sovelia, where the company stores all of the item data. The most important items in the PLM system needs to be updated in the future. The goal of this thesis was to have a better understanding about item parameters, item

creation process, why data is important, and to learn how the project can be continued in the future. The company needs to have reliable data to be able to identify which items are needed for what machine and/or components. This topic was suggested by Normet employees, who have noticed the lack of trust in data in the PLM system. Other systems used were different supplier platforms for item data and Microsoft Office tools.

The employees of Normet were interviewed to implement their opinions and needs how the data could be improved, how the service department should manage and implement the item parameters for components or spare parts. Other sources were used to identify improvement strategies and new parameters.

The organization consists of three business lines, which are EQ, services and GCCT. This thesis was done mainly in the services department of the company. Normet services are designed to maximize safety, productivity, and profitability in the tunneling or mining business. Services ensure to deliver the correct parts for the customers entire fleet. There are over 40 locations in 30 countries as well as an extensive distribution network. Services are responsible for each and every spare part for the customer. Correct item management is in a highly important role.

1.3 Why is spare part data important

Keeping up, collecting and creating the needed data for each spare part is a time consuming job. This is needed, because it is one of the most important parts of maintenance and reliability program, warehousing and customer service. If the data is proper, this helps excess parts not to be stocked and the right parts to be quickly delivered to the customer. (Berson 2011.)

Collecting the data is not always properly recorded. For each item it is needed to search if it already exists, if the part can be sold as a spare part, collect price information, lead time, pictures, dimensions, weight, commodity code, interval for the part to be changed, needed manuals and where the item can be used. After these are identified, evaluation can be started for the stocking recommendation. Sometimes it is best to use OEM recommendations, but that is always not the case, because of the rough conditions of the machines. Contacting the vendors is a valuable source to maintain the needed amount of correct data, and evaluate what is needed for a certain component.

Spare part data helps the company to be able to provide customers valuable information about their equipment and their lifetime. The value of correct data is also present everyday for the employees of Normet. This is highly needed to be able to make correct decisions and offer correct parts for the machines.

2 ITEM AND DATA MANAGEMENT

2.1 Spare Part Management

Spare Part Management helps to provide the right parts to the right place in the right quality at the correct time, and decrease the costs. Effective management ensures equipment operating performance and helps to minimize maintenance investment. The scope includes all of the functions from the supplier to the end customer, criticality, identification and coding, procurement, quality, stocking, kit management, supplier management and internal performance.

Spare Part Management is important for maintenance, having the correct parts in stock is valuable for machine lifetime, and decreasing the risk of machine downtime. Managing the spare parts correctly helps the company to minimize the capital invested in inventory. A stocking plan needs to be implemented to the most used- and important parts included in the machines. The stocking plan has a positive impact on business performance due to effective management of spare parts, which includes: reduced downtime, reduced inventory costs, increased availability of working capital and improved safety. Spare part management reduces risks of the business operations by ensuring the availability of spares at optimum cost and quality.

Having an accurate spare part management system allows being proactive and responsive to the customer. The customer can save costs in their inventory, if the management system is properly optimized. The best practices for spare part management are to identify all of the needed spare parts which ensures fast response times, availability of the correct spare parts for each machine and/or component, correct classification of spare parts which will support the process to define safety stock and have the right parts available at the right time, managing the Bill of Materials where having an accurate BOM helps the spare part management team to ensure that all of the needed spare parts have been classified and added to stock if needed. If the Bill of Material is missing an important spare part it can be catastrophic to the end customer. (www.g3pconsulting.com)

Limiting access to spare part management systems helps to minimize the risk of incorrect items or the amount of items that are missing classifications. Optimizing the warehouse which ensures the spare parts and the inventory to be easier to manage, optimizing the ERP system with the warehouse management system, if in use, can make a big difference in response times and inventory accuracy. Implementing cycle counting for inventory control which can help in indicating problems. Standardizing spare parts which helps the inventory to have only the necessary spare parts at optimal cost and the machine structures to be more standardized. Developing spare part management processes for optimal performance and optimal quality. Using accurate data which ensures proper decision making and supports the improvement of the process. (www.g3pconsulting.com)

2.2 Spare part standardization

Standardization of spare parts is one of the enduring debates of engineering, maintenance and spare part management. Standardization is said to lead to reduced inventories, but at the same time it could slow the technical development and innovation. Defining standardization according to the Merriam-Webster online dictionary is to change things so that they are similar and consistent and agree with

rules about what is proper and acceptable. Usually it means that inside the company there is an agreement that a certain type or a model will be used and the spare parts required will be the same for each installation. (Slater)

Defining the pros and cons of spare part standardization is complicated, but according to Slater, standardization helps to reduce parts that are needed to be managed, lowers inventory, easier operations, maintenance efficiency is improved, purchasing efficiency is improved, fewer invoices needed to be processed and part costs are lower. For the cons, Slater has listed missed innovations, lower operational efficiency, higher obsolescence risk, higher parts costs, and the risk of using non-OEM parts. (Slater)

Deciding whether to standardize on a particular model of equipment and the needed spare parts starts with determining the real impact on the company in question. There are three questions that should be asked when trying to determine if standardization is needed, is there a genuine innovation or operational advantage, how much does standardization reduce inventory, if a replacement to a newer model of the part is done is there a way to gradually move to the new type as the old ones are used. These questions will help with determine if standardization is needed. (Slater)

2.3 Data quality management (DQM)

Data quality management is a major concern across companies. It is predicted to gain importance when data amount increases, and when the data is more diverse. Data quality management improves analysis capabilities, and business process integration. (Glowalla and Sunyaev 2013.)

Management techniques can be classified into data-driven and process-driven techniques, where data-driven technique focuses on direct modification of the data, for example, normalizing, cleansing and integrating. Process-driven technique focuses on, for example processes on creating and updating the data, while identifying the causes of errors, eliminating them and sustaining improvements. (Glowalla and Sunyaev 2013.)

Data consistency and data completeness are two important aspects of data quality. Consistency is about keeping data uniform as it moves across supply chain, while completeness ensures all of the necessary information being available at the company's data base. These quality attributes are vital for companies IT infrastructure. Properly managed data ensures reliable information and helps the usage of the data. (Glowalla and Sunyaev 2013.)

When the data is incomplete and inconsistent it becomes a large issue for any company. There are many possible faults why data can be flawed for example, input error or a system flaw. When inconsistent data is created it causes a problem in the usage of the data. If this happens often enough it creates a problem in trusting the data and it becomes virtually impossible to restore the data quality. This will negatively affect making data-driven decisions. Maintaining the consistency and completeness is a vital key for any database. (Glowalla and Sunyaev 2013.)

2.4 Importance of data and data quality

Data can be described as one of the most valuable assets and resources of an organization, which has a real and measurable value. Data can also be seen as a commodity. If looking at product data, which can be used for sales, inventory, forecasting, marketing and in supply chain management, good quality data is essential. It helps to provide good customer service, operational efficiency, decision making, business planning, and needs to be managed properly for generating a return. (Kwon 2014.)

When talking about an organization dealing with products, many of the activities and decisions are driven by data. Data helps being able to provide good service and gain competitive advantage. If these products have bad quality data behind them, it becomes a tremendous burden and will create problems. Good quality data can give an advantage, but at the same time bad quality data can put a company at a competitive disadvantage. (Kwon 2014.)

3 ITEM PARAMETERS

3.1 Gate model

Gate model is a project management technique, where different steps of a project are divided into phases, also called gates. This helps the project not to move to the next step, before the previous step is complete. This is a new technique used at Normet. This is still developed and modified when new development ideas are identified.

Gates help the project to be easier to manage and complete. The gates ensure that the correct phases are done in the right time. This helps the project manager to know what is going on and what should be done next. Figure 2. shows how the gate model in the Service department at Normet works.

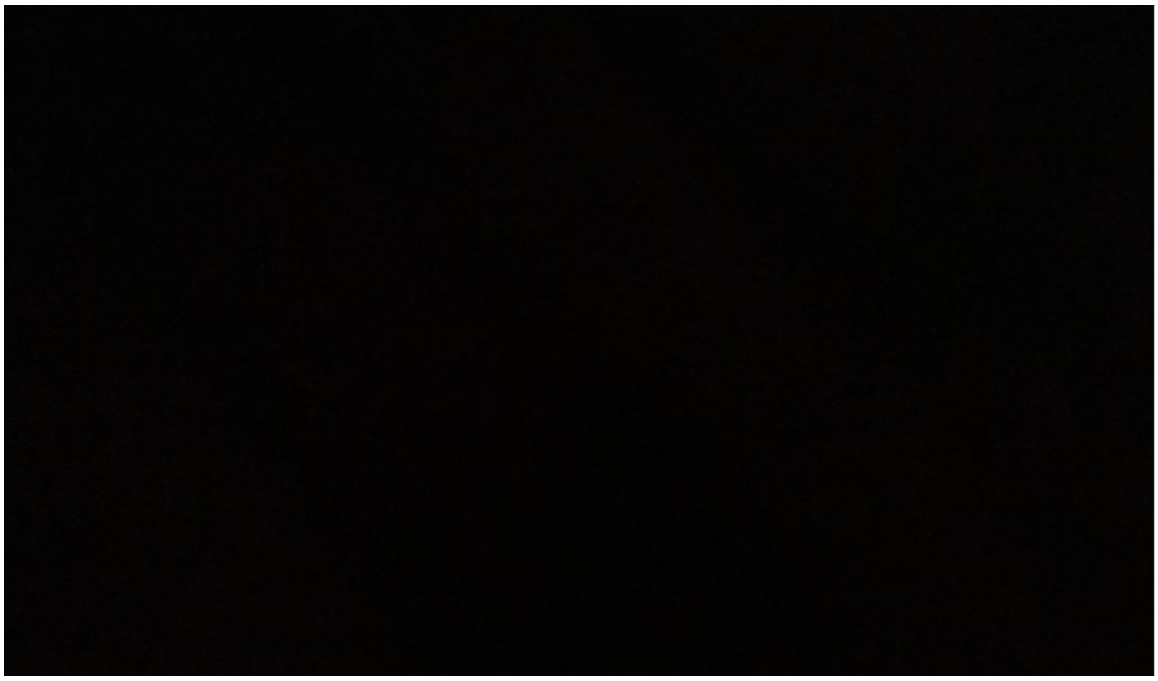

Figure 2. (Figure removed) Gate model in service department. (Kaatrasalo T.)

There are different steps that must be done before the next step. There are always several meetings for the project so the project manager knows when to move to the next gate, what has been done and assign the workload properly. What this thesis focuses on in the gate model is: component parameters and internal spare parts definition, identification of long lead time spare parts, finalization of spare part parameters, an initial package of spare parts, updating spare part content, and global stocking plan after feedback handling.

3.1.1 Spare part parameters

Spare part parameters are the meaning of the values that an item or a part has. This means that the dimensions, weight, commodity code, manufacturer and their ID, product type, spare part class, spare part classification, change interval and possibly a picture must be known. This is the data that is

needed to maintain the items correctly in the PLM system. This means that when a new engine is designed for a machine, the needed parts have to be available, and those parts must have the needed information to be able to provide them to the customers.

When a new machine is passing gate 1, spare part parameters will be addressed by extracting the Bill of material from Sovelia to Microsoft Excel. Typically, the Bill of material will have 10 000 – 30 000 rows of items. After sorting out already updated items and duplicates from the BOM, there can be 1 - 5 000 items that need to be identified according to the parameters. Values that are corrected for each item are: spare part category, spare part classification, spare part interval, spare part checked by, spare part checked date, stocking recommendation and spare part criticality. Spare part category depends on which category the part belongs to, for example 1 – Unique Normet parts. Spare part classification helps to recognize not spare- and spare parts from each other. The classification has five different values, which are: main component, not spare part, spare, periodical maintenance and wear. Spare part interval shows when a certain part has to be changed by hours. Spare part checked by shows the person who has most recently updated the item. Spare part stocking recommendation helps Normet and the customers to keep correct items on stock with three different values: global, global and local, no stocking. Spare part criticality helps Normet to recognize operation- and safety critical parts, which must be kept in stock. The stocking recommendation and criticalities are new values and have not been in use for a long period of time. The criticalities are separated in to two sections: Operation Critical and Safety Critical.

A rulebook for these parameters, created in Microsoft Excel, is in the process of development. This helps to correct the parameter data. Without the file, the process would be to go through thousands of items one by one. The file is shown in Figure 3.

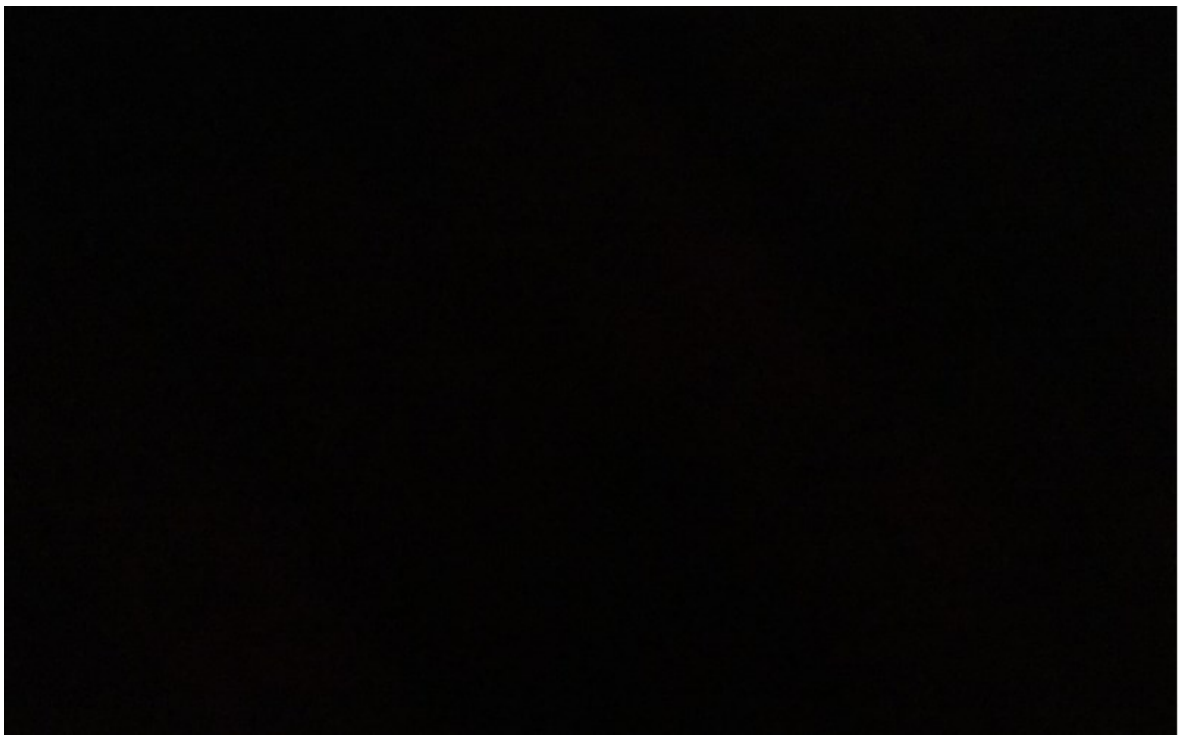

Figure 3. (Figure removed) Spare part parameter correction rulebook. (Muona M. and Pulkkinen J.)

In the Figure, the type for example. 1E01 - Fasteners – Spare can be seen. This means that everything in the Bill of material which are listed in this type will be classified as a spare part. Spare is the category of the item and because Normet does not manufacture the fasteners themselves, the classification of the item will be marked as 3 - Accessories/standard parts. This means that the fastener can be also outsourced, for example from a local hardware store. If the part would be 1N01-Component spare parts, these would usually be 2 - OEM specific parts. This means that the part is specific to a component and can not be outsourced. If Normet manufactures the part for example 2A4 – Weldment, a part like this would be categorized as 1 – Unique Normet parts. These categorization rules help the company to keep track of what can be bought from where, and what items the company or the customer need to have in stock.

There are some case by case items listed in the Excel file, which still need to be addressed manually. These items can take a lot of time, because they have to be confirmed from the PLM system. Usually a part like this has to be checked via pictures and relations/parent items, meaning where it is used. Pictures help to determine whether the item can be sold as a spare part. For example if the part needs to be welded, it can not be sold to the end customer or neither needs to be kept in stock. Sometimes these items can be hard to determine and will be marked uncorrectly. At the time of this thesis, this is one of the development areas in the process.

After the parameters have been determined they will need to be uploaded to the PLM system. There is a way to do this by mass uploading. This is done by uploading the Microsoft Excel file to a server, which then will automatically upload all of the items to Sovelia in a short amount of time. Having a tool like this saves a lot of time. There is a downside to it. It is not fully user friendly. A small typing error can cause thousands of items marked uncorrectly and if unnoticed, will do a lot of harm. A base file for mass uploading was created, which is in use when uploading to the server to minimize the risk of an error.

3.1.2 Long lead time spare parts

Determining long lead time spare parts is not an easy job. There are thousands of items in a machine. Identifying these parts is needed in order to be able to order them in time and have the needed parts in stock for the customers. This is partly done by adding a new field to the PLM, called Stocking recommendation. This field contains three different values which are called no stocking, global and global & local. These values are needed so the items can be ordered, kept in stock, where they need to be stocked and does the customer need to have certain items in stock. Like mentioned, this is a new implementation to the PLM system and will be used more in the future.

Stocking plan will be addressed after the other parameters are updated. If done before other parameters, there is a risk that a non spare part will be accidentally stocked. Before the stocking plan is updated to the PLM system the stocking plan will be checked by a few employees to ensure the quality.

3.1.3 Definition of internal spare parts

Internal spare parts definition mainly focuses on creating new spare parts for internal components inside the machine. This also includes identifying existing spare parts in the PLM system and adding the correct spare parts to the component structure. These are called child items and adding these parts is also known as adding relations to the component. When adding relations it is important to add the quantity of the item inside the structure, and the position which is shown in the components exploded view, if available. This process helps to maintain the correct items and identify which part belongs to which component or machine. Adding the relations is valuable for a spare part manual specialist to pick up the correct parts and create the manuals for the component. Here is a second chance to go through the positions and quantities of the items. In Figure 4. is an example how a structure of a component in Sovelia looks like. As can be seen in the figure, at the top row, headers will show, for example quantities of the items in this component for each part.

	Type	Spare ...	(R).Qty	Spare part category
100140728.1	1G02-Couplings and axles	Spare		2 - OEM specific parts
F00100860.0	Service Item			
F00100084.0	Service Item			
F00100851.0	Service Item			
F00100080.0	Service Item			
100103003.0	1N01-Component spare parts	Spare	16.0	2 - OEM specific parts
57019713.0	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts
100159484.0	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts
100026977.1	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
100067657.0	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
100067672.0	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
57012197.0	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
100103986.0	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts
57009953.0	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts
100085299.0	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
100003060.0	1N01-Component spare parts	Spare	6.0	2 - OEM specific parts
100024725.0	1N01-Component spare parts	Spare	4.0	2 - OEM specific parts
100003050.0	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts
100026976.0	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
100026987.2	1N01-Component spare parts	Spare	1.0	2 - OEM specific parts
57025760.1	1N01-Component spare parts	Spare	2.0	2 - OEM specific parts

Figure 4. Sovelia Component structure with child items.

When creating a new component spare part there had to be a file made, which holds some of the rules of item creation, so the quality of newly created data can be maintained properly. When this thesis was started, there were no data lists available for the most common manufacturers. This meant that when new machines were fitted with new engines, there was no fast way of searching if the items had already been created before, and whether they existed in the PLM system. It would be a lot of work if the items needed to be addressed manually to be able to identify if the PLM system already has a cer-

tain item created. Data files were created with Microsoft Excel for each of the most common manufacturers for a quick search option. This helps to identify which item needs to be created and which can be marked as a child item to the new component. The file helps to maintain a faster response time when creating new component spare parts.

When creating a new spare part, there must be basic information available before the process can be started. This usually begins by contacting the supplier or Normet sourcing. When the information has been received and the item has been identified, it can be added to the PLM system. Usually, it is easiest to copy an old part by the same manufacturer, then modify the needed information which in the designing phase is: weight, name, commodity code, spare part classification, spare part category, item type, brand and manufacturer product code. When these values have been added, pictures, manuals, etc. can be added for the item. The copying of an old item helps to maintain similarity between the items.

The file for internal component spare part creation is still in development and needs more time to be finalized. This can be continued in the future projects. Basic idea of the file was to report what information needs to be listed, and what should not. The file is divided by main components. Main component can be anywhere from an engine to an axle. This allows future development to be made in a more detailed way, and helps the data to be more similar everytime a new item is created.

3.1.4 Initial spare part package for prototype

Initial spare part package contains needed items that will be shipped with the prototype in the testing phase of the machine. This means that for each machine there will be a specific package tailored to fit the needs of the machine. The items included in the package are mainly filters and small parts that might be needed when testing the machine. This package helps to ensure that the testing phase will be fluent, and minimize the risk of the machine being unable to operate. This is mainly done by the service department and technical support.

Identifying the needed items is not always simple. If the machine has never been used, there is no data on which parts might break or need replacement in the early stages of the machines lifetime. Normet has improved their data gathering tools to be able to have good quality information about what is happening when the machine is being used. This is done by adding modules to the machine which can send information wirelessly from anywhere around the world. Specialists analyze the data gathered, this helps to improve knowledge of specific parts and their lifetime. The gathered information is highly valuable in the service department. This information helps to understand more about the machines and the components. Bad quality parts can be seen faster, items that are likely to break can be stocked and it helps to determine change intervals for the items.

4 DATA GATHERING

4.1 How is spare part data gathered

Item data is gathered from different places, depending on the item. If the item is not manufactured by Normet, there are a lot of different suppliers to provide the needed information. The variety of suppliers brings a challenge to receiving the needed information for item creation. This sometimes means that creating new items to Sovelia will take a lot of time and effort. Some of the suppliers will not answer to the request in a reasonable time. Some companies have their own software which deletes the need of contacting them via e-mail or phone. In this section the focus is on engine manufacturers software.

Normet has four main suppliers for engines, which are used the most in the machines. These suppliers will be called: Supplier A, Supplier B, Supplier C and Supplier D. All of the suppliers have their own software which makes it easier to gather item data for each necessary spare part included in an engine.

Supplier A has the best software, if comparing the usage and the variety of data to the other suppliers. Gathering item information from the software is easy, because only the model of an engine, or an item number is needed. The software will show all of the needed information, and more. Figure 5. shows the web view of the suppliers item found via item code. This is a separate software which does not show pictures, where the part can be used, if the part is replaced by a newer version or if the part is an exchange part.

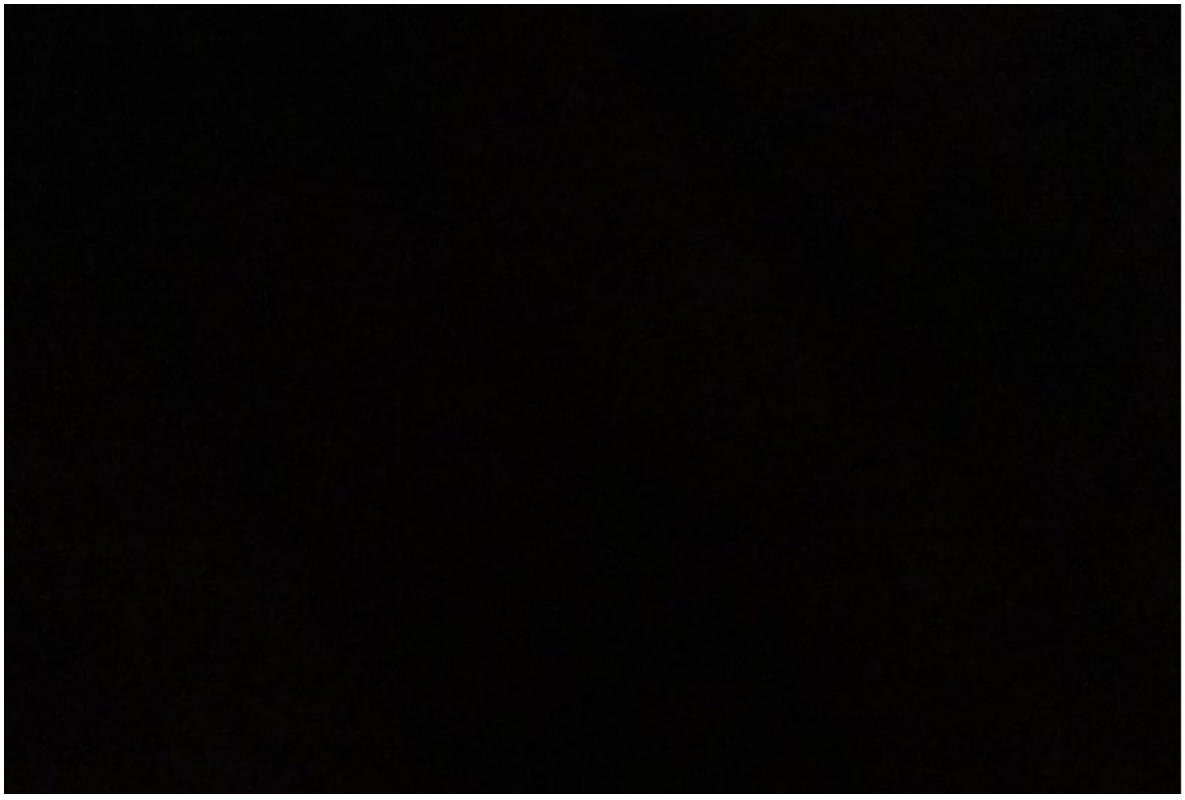

Figure 5. (Figure removed) Supplier A Web view.

Supplier A also has a downloadable software which will include the missing information which the web view does not have. This software includes all of the stored data that the supplier has. This means that there is no need to contact a person to be able to create a new item in the PLM system. When a new engine needs spare parts from this supplier, all of the information for the parts can be found within minutes independently. Web view shows the basic information and the offline software has more detailed information, which unfortunately can not be shown in the thesis.

Supplier B has a web view software which is outdated and hard to manage if comparing to the Supplier A's software. Some of the items have pictures, but for example commodity code is not specified. There is not an easy way to know if the part is compatible for multiple engines. The engine structure is well distributed in to different areas of the engine, but searching for a specific part is not as easy as it should be. The lack of some information brings a challenge for data gathering. With the supplier in question, it is needed to contact a person via e-mail. This software includes valuable information, but the item searching is badly managed. For best results, serial number of the engine is needed. This does not work properly, because the software does not always identify the serial number. A preview of the software shown in Figure 6. For correct results, contacting the supplier is needed.

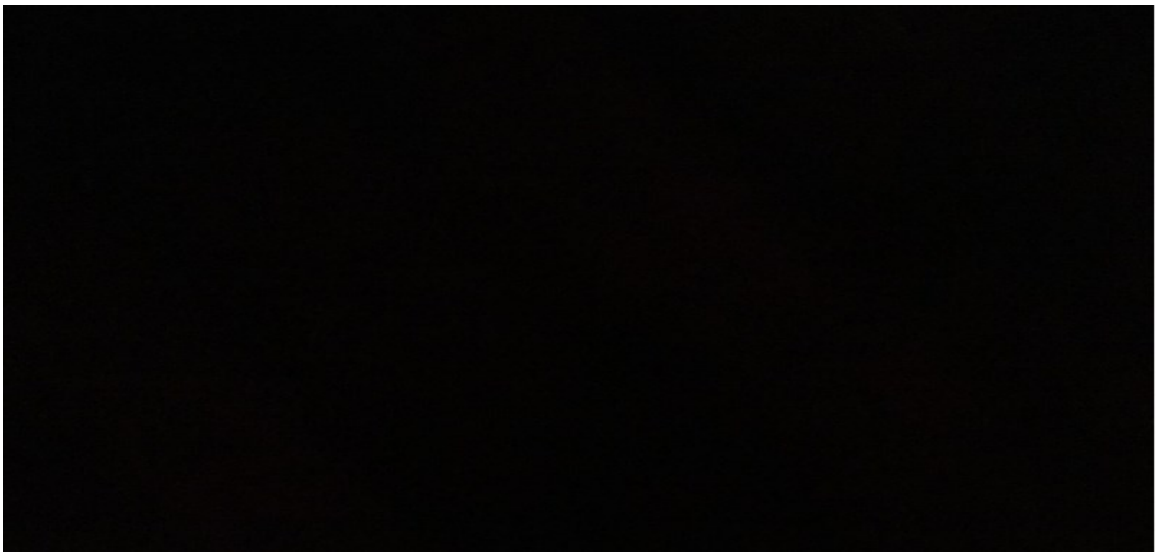

Figure 6. (Figure removed) Supplier B Web view.

Supplier C also has a web view software. This software is user friendly and searching for a part is easy. The software does have many issues, commodity code not specified, no pictures, no dimensions, no way of identifying compatible engines and the descriptions are not well written, for example, an intake manifold gasket can be described just as a gasket, which means that the identification of the items is not always possible. Figure 7. shows the one and only view of the software. The supplier has launched a new software for better user experience. Unfortunately, it is not in use at the time of the thesis.

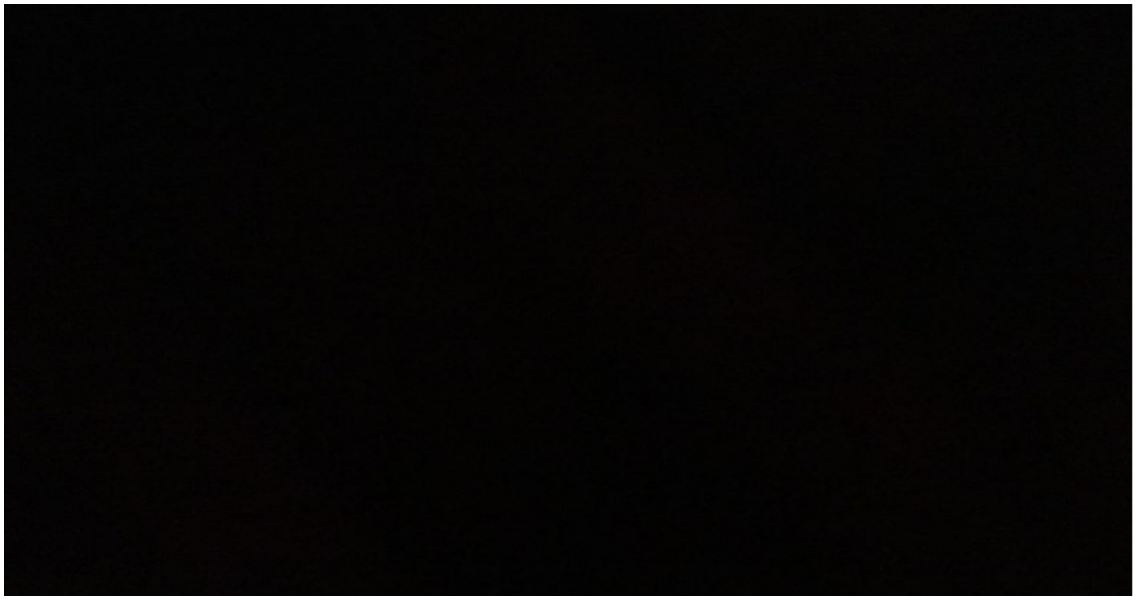

Figure 7. (Figure removed) Supplier C Web view.

Supplier D has a web view software which is a lot like Supplier A's offline- and web view software combined. It is easy to use, parts can be identified with an item code, or with an engine model. Every part has an exploded view of where they belong, this makes the identification process easier. The software has information if a part is replaced by a newer version and in which engines the part can be used. There are still some information missing, for example, commodity code. This means that e-mailing the supplier is needed, which again slows the item creation process. It is a good software which is user friendly and has valuable information, but does not delete the need of contacting the supplier. Supplier D is often quite fast on responding to e-mails, so the information that the software does not include can be still received quickly. Figure 8. Shows a small proportion of the software.

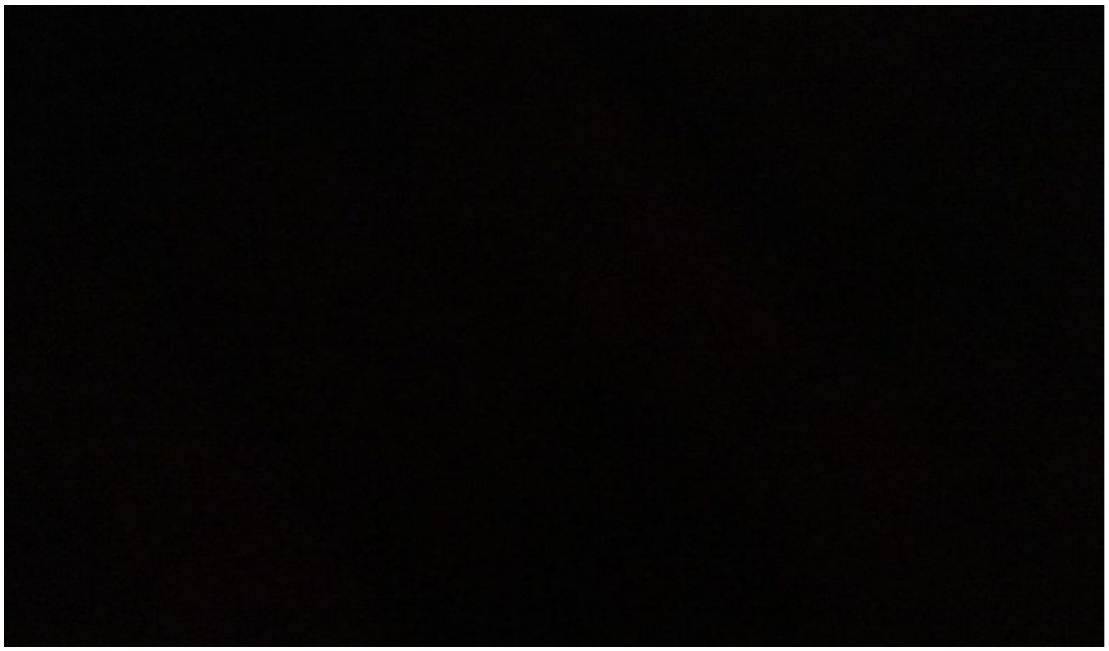

Figure 8. (Figure removed) Supplier D Web view.

4.2 Creating a new item in to PLM

Item creation process starts by getting the information of a new component from Normet Sourcing, or from a supplier. The component will be used in a new machine, or the old component is replaced by a new one which has not been in use before, for example, an engine. When the engine is specified, where it comes from, who the supplier is and when the component will be in use, a request of needed item information is sent to the supplier. The supplier provides a list of all the spare parts they can offer. The next step is to identify which parts does Normet want to offer and which are not needed to be sold. Specifying the spare parts which will be sold, helps to ensure that unnecessary parts will not be kept in stock or created for no purpose. This helps the component structure to be simplified for easier usage. Properly created structures help the documentation team to create the spare part books for a certain component. They can spot needed spare parts and their quantities in a structure. In Figure 9. a basic structure of an axle is shown. In the upper part the headers show the needed parameters for each item, that have been specified in the Gate model "Internal spare part definition" chapter.

	Type	Spare part classification	Spare part category	Spare part interval (h)	(R).Qty	(R).Pos
100140728.1	1G02-Couplings and axles	Spare	2 - OEM specific parts	8000		
DOC058984.0	110-Component TDS					
DOC046323.0	110-Component TDS					
DOC046317.0	110-Component TDS					
52425055.0	1G02-Couplings and axles	Spare	2 - OEM specific parts		1.0	220
54887583.1	1K02-Piping	Spare	3 - Accessories / standard ...	2000	1.0	101
100178433.0	1N01-Component spare parts	Wear	2 - OEM specific parts	4000	1.0	
100045761.2	1N01-Component spare parts	Spare	2 - OEM specific parts	8000	2.0	501
100159484.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	419
100159430.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	224
100145400.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	509
100143367.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	301
100103986.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	307
100103003.0	1N01-Component spare parts	Spare	2 - OEM specific parts		16.0	322
100099173.1	1N01-Component spare parts	Spare	2 - OEM specific parts		3.0	108
100099172.0	1N01-Component spare parts	Spare	2 - OEM specific parts		5.0	109
100085299.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	218
100085284.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	106
100067672.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	420
100067671.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	417
100067657.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	214
100067649.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	105
100067648.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	104
100066667.0	1N01-Component spare parts	Spare	2 - OEM specific parts		4.0	407
100059640.0	1N01-Component spare parts	Spare	2 - OEM specific parts		6.0	410
100059032.1	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	403
100055471.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	304
100049478.0	1N01-Component spare parts	Spare	2 - OEM specific parts		2.0	416
100026987.2	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	328
100026984.0	1N01-Component spare parts	Spare	2 - OEM specific parts		16.0	321
100026977.1	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	216
100026976.0	1N01-Component spare parts	Spare	2 - OEM specific parts		1.0	215

Figure 9. Sovelia Axle Structure.

After the needed items have been identified for a certain component, the item creation in Sovelia can begin. In Figure 10. item tree in Sovelia can be seen, which will specify the type of the part.

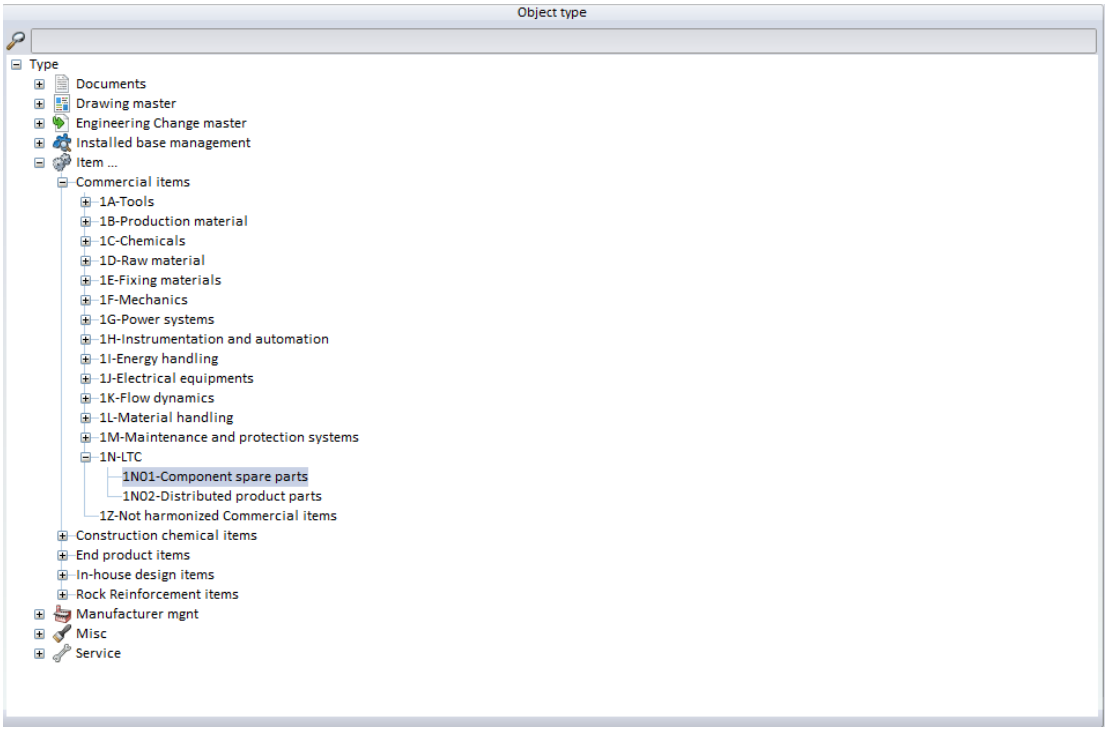

Figure 10. Item tree in Sovelia.

For example, 1N01-Component spare parts type is selected. When the type has been specified, an ID code is created automatically. In Figure 11. the red markings can be seen, these fields are mandatory.

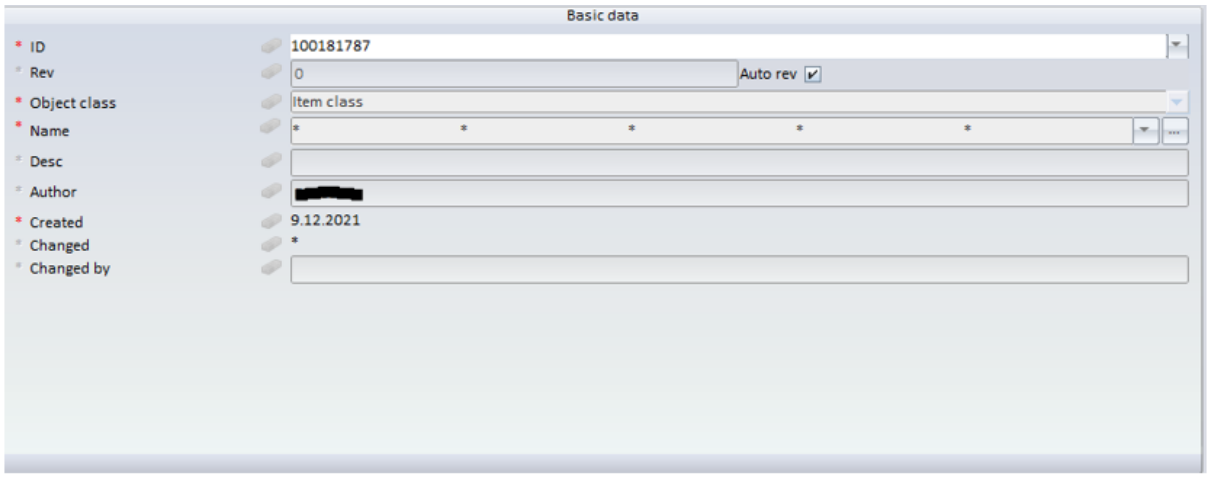

Figure 11. ID Code created.

Name can be chosen from Sovelias dictionary, this helps the items to have correct names and be more similar with each other without typing errors. There can be an item which does not have a correct name in the dictionary. A request can be made for a new name. This allows the dictionary to stay within a certain range and unnecessary requests of names are declined. There are English, Finnish and Spanish translations for each name. There are nine important information fields to fill in Additional data group. Figure 12. shows the most important fields when creating an outsourced item.

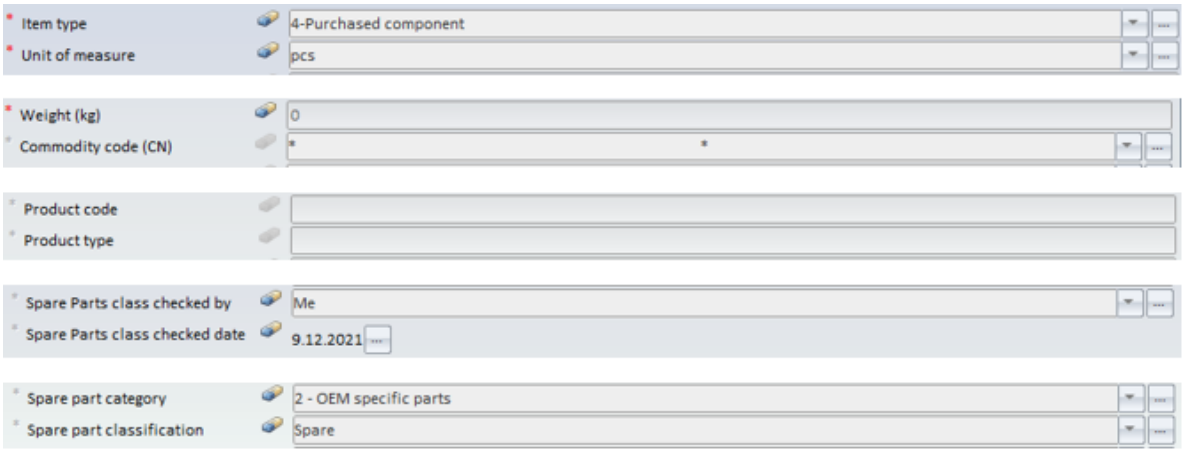

Figure 12. Important information.

These fields ensure that the item has everything needed so the item can be sold to a customer. For newer items these fields are properly filled, but there are a lot of older items that are missing, or have incorrect information written in these fields. Older items are not well managed and aren't similar with each other, even if the parts do not differ from each other in many ways. Before pressing the accept button to create a new item, the manufacturer code should be checked once more to minimize the risk of a duplicate item. After creating the item, it will look like in Figure 13.

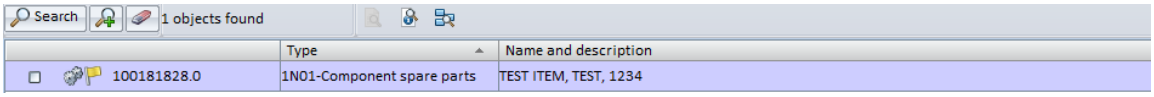

Figure 13. New created item.

100181828 is the Normet ID code, .0 means that the part has not been revised yet, the yellow flag means that the item is still in design and can not be used yet, TEST ITEM is the name of the part, TEST is the brand of the part and 1234 is the manufacturers item code. This description is created automatically from the information that has been inserted in the additional information data group. After the part is ready and all of the needed information is added, here is a good time to add pictures and documents of the part. When the item structure is ready, it must be promoted as design ready, which is shown with a blue flag. From there, an item master can either promote the item as In after sales use, shown as a red flag, or In production, shown as a green flag. These Component spare parts are usually categorized as In after sales use. When the item has been accepted and promoted by the item master, it needs to be added to a structure. When adding an item to a component structure, quantities inside the component needs to be known. If the component has an exploded view and there are many items, position numbering offers an easy way of recognizing a certain part in the structure.

When the component structure has been finalized, the documentation team can start to work on the component. Spare part books will be created and added to Normet's web portal called LinkOne. From

there the structures can be seen easily for the customer or Normet employees. This helps anyone who needs to buy a certain part to see which is the correct item number. Figure 14. shows a hydraulic tank and the components LinkOne page.

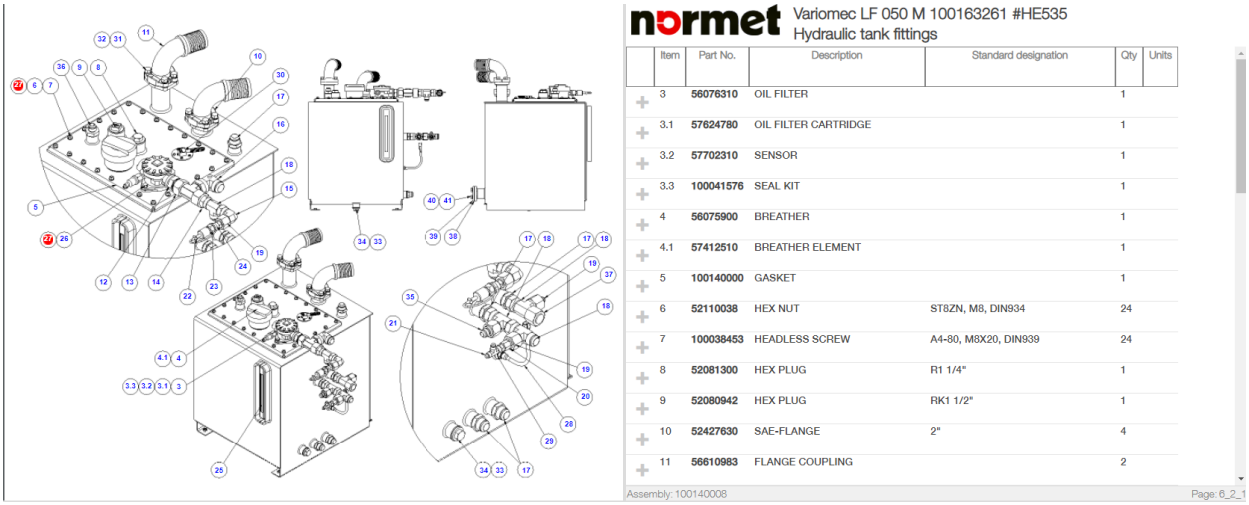

Figure 14. LinkOne

4.3 Spare part kit data

Spare part kits are an important part in the spare part industry. They help the customer to order every item needed for example, to fix a certain component with only one ID code without the need of finding each item independently. The kits help the company to sell more and make more revenue, while helping the customer to receive all of the needed items easier. There were no easy to access information which kits could the company offer to the customer and where does the kits belong. There were kits missing and not every component that needs to have these, had them. It was needed to gather all of the existing kit data from Sovelia and update the information. When the kits currently available were recognized, the missing ones could be addressed. Suppliers were contacted in the need of possible kit solutions for the components.

A Microsoft Excel file was created for Spare part kit data, which holds the most important kits for different components, which are: hydraulic cylinders, axles, concrete pumps, engines, transmissions, hydraulic pumps, compressors, booms, nozzle heads and pressure washers. This file helps in navigating which component has the needed kits created, available and could easily be added to the PLM system. If a component has many kits, a drop-down list can be opened inside the file as in Figure 15.

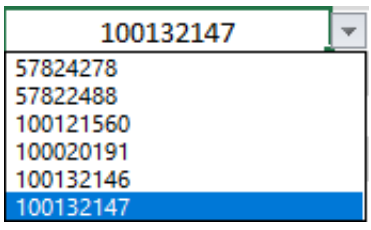

Figure 15. Drop-down list.

When the ID is selected, the description of the kit will change to the correct one, as in Figure 16.

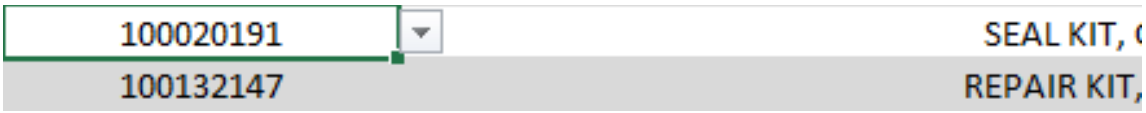

Figure 16. Kit description.

The Excel file helps to thoroughly go through all of the components that need to have for example, a seal kit. If a component is missing the needed kits, the supplier can be contacted to provide the missing information. After receiving the information the kits could be created and can be offered to the end customer. Missing data was an issue regarding the kits. Some suppliers did not answer to the request and some took time to answer. The file holds important information of the component kits, which then could be implemented to the component structure in the PLM system. Adding the kits to the structures help the maintenance department to recognize the needed kits for a certain repair work.

The file needs to be kept up to date and developed. The kit data needs to be added instantly to the PLM system to ensure that the components have the kits needed in the structure as child items, so the same situation will not appear in the future. Kit structures have to be updated in the future to ensure the item relations are corrected inside the kits.

Normet specific kits are under work and will be added to the file. There are many kits under development and few are ready to be added to the component structures to be sold later in the future. The goal for 2022 regarding kits is to have as many as possible available for the most sold and used components. These Normet specific kits are standardized to be suitable for as many components or machines as possible.

5 DEVELOPMENT IDEAS

5.1 Analysis and challenges

In the future, it would be beneficial for the company to take on the data quality issues which were presented in this thesis. Old item data should be addressed as soon as possible, to ensure satisfaction in the quality of the data. This could be done in smaller parts because of the amount of uncorrect data available in the PLM system. Correcting the data quality issues should ease the workload of many employees and ensure better customer satisfaction. What can be seen from the old item data is that there are many items which are replaced by a newer version but the item still has the old item code, manufacturer item codes are written in many formats, there is mandatory information missing, status of the part is incorrect, there is no information where the item belongs to. Correcting the component structures would be beneficial for response times if a customer requests a certain item.

Names and descriptions of the older items could be addressed in the future as well. It would benefit the consistency of the items. This would create an easier way to search for a certain item if the ID code is missing. This would be a huge project, which would need more research to be done.

Ensuring to maintain the needed information and implementing a tool of data quality measurement to measure how the items are done, is there any improvement concerning new- and old items. Making sure to manage the consistency and completeness of the items with no exceptions. This will ensure the easy usage of the items and will be beneficial for employees and customers.

Kit data needs to be developed further for being able to sell good quality kits. Normet specific standardized kits needs more development in the field of kit structures. Some kits could be sent to testing and feedback could be received from the maintenance crew or from the customer. Implementing the needed changes after feedback to ensure customer satisfaction.

Some of the accessory items could be standardized from a certain supplier to ensure the best price and quality for an item. This would ease the sourcing, response times and duplicate items in the PLM system. A good example of this could be bearings, which are sourced from many places. There are some problems identified in the standardizing process and needs further investigation.

5.2 Data gathering challenges

Gathering the needed information is not always easy, usually depending on the supplier. There can be weeks, or even months before receiving an answer. Many of the suppliers respond inside a one week time period, but if the items are needed quickly and the supplier will not answer, this will create a problem and can result in low data quality items. The process of information gathering needs to be developed with the suppliers that have a long response time.

Many of the items that have been replaced by the manufacturer with a newer version, are not updated to the PLM. This can be because no information was sent by the supplier, which will create problems when searching for an item and even when ordering a new item. This process could be developed further to ensure that replacements have been done correctly and the items are up to date.

5.3 Item parameter definition

Parameter definition needs more development and standardizing. This would lower the workload and response times of the process. At the time of this thesis, there are still many items that need manual labor and are hard to define. This could create errors because of the operators opinion. Standardizing the item types and groups could be beneficial to develop the process further, this would ease the workload of the process. At the time of this thesis, depending on the amount of items that are needed to be updated concerning parameters, many of them have to be checked one by one by pictures and relations. This is a tedious process and takes a lot of time. Ensuring the correct information is highly important to ensure the correct spare parts for the customers.

6 CONCLUSION

There were improvements done at the time of this thesis. Many development ideas still remain and will be implemented in the future. Spare part parameters are easier to define. Kit data had huge improvement comparing to the starting point. At the same time as the kit data was developed, there were component structures updated for spare parts and the kits. This helps many employees of the company to have a better understanding of the items needed for customers and should create more revenue for the company. Many kits will be created in the year 2022 and could be available for the customers. Service department has a better understanding of what kits the company can offer and which still need to be defined further. Item creation is a process still in development, but has had improvements while this thesis was in progress. New component structures need to be kept up to date as consistent and complete as possible.

Gate model has proved to be a good tool for item creation- and spare part process. It ensures that the machines will have the needed spare parts available before the customer receives their product. This will reduce the machine breakdown times and response times to the customer. The gates which are defined are well described and serve a purpose in the process.

Data management tools could be implemented to maintain the quality, consistency and completeness. If data measurement is possible, this would help with the quality issues. Old items that are classified as a spare part and still sold, need to be addressed and corrected. These items should be done as consistently and complete as possible to maintain the data quality. Identification of the relations need to be done, which will create many problems in the item identification process. This project would need the help of many suppliers and a lot of their time.

Standardizing as many of the outsourced spare parts as possible could be beneficial for the company and for the customers. This could improve the processes from start to finish and reduce the costs for the company and for the customer. Identification of the same parts with different ID codes will be difficult because of the missing data. This needs further investigation.

The thesis was a good learning experience for understanding different aspects and processes of the Service department in the client organization. Learning item management and data management will help myself in future projects. Previously gained experience and knowledge could be used when conducting this thesis work and the workflow has been fluent throughout the work itself. The importance of data accuracy and spare parts became clear when conducting the thesis work. The importance of data quality was one of the most important lessons learnt at the time of the thesis. Good quality data is the foundation for easier workflow and will help to ensure better experience in many fields.

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