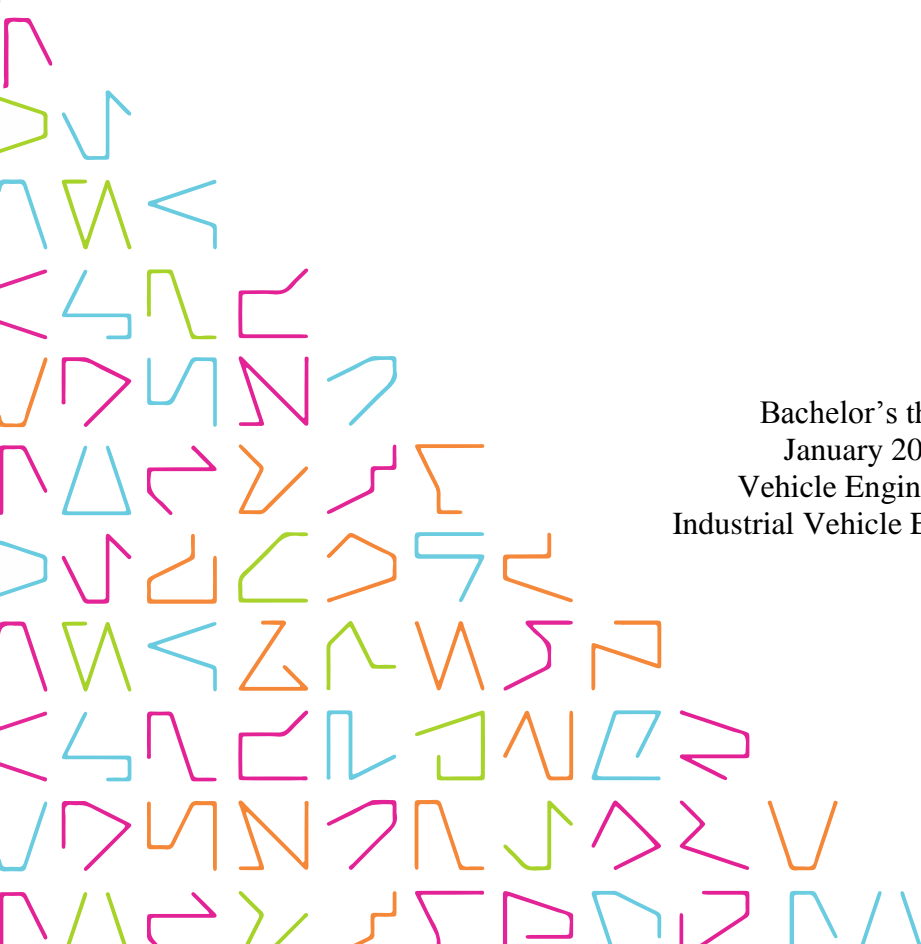


# ACCESSORIZING CONSTRUCTION EQUIPMENT

Dylan Rafferty

Bachelor's thesis  
January 2016  
Vehicle Engineering  
Industrial Vehicle Engineering



## ABSTRACT

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The purpose of this thesis is to create a guide for implementing a new accessorizing process at Volvo CE Finland. The idea is to investigate the problems with the current process, the ways of implementing new processes as well investigating processes used by other companies for accessorizing machinery.

Volvo CE Finland currently accessorizes machinery using the Service Workshop without any standardized method. The service workshop is currently under resourced for accessorizing as well as service work, and as such, the accessorizing process is not functioning as it should. Furthermore, the accessorizing method is too complicated and time consuming, which in part, has to do with the lack of restrictions on what accessories can currently be accessorized. This has led to the situation in which delivery times are impossible to estimate and the delivery of machines is constantly delayed.

Process planning is a combination of quality management, setting process requirements and the use of process models. Quality management is set by the ISO 9001 standard as well as some of the process requirements. Other process requirements are set by the needs of the process that is to be implemented. Lean Six Sigma is a process model that assists in implementing the desired process, reducing waste and increasing efficiency.

Swecon developed a new accessorizing process and implemented it in 2014. Their accessorizing process involved creating a whole new Accessorizing division with its own accessorizing workshop. This new process has increased the amount of machines that Swecon has been able to accessorize. Their process relies on salesmen selling standardized accessorizing packages which are then easier to accessorize. Overall their experience of the new process has been good.

The new process will require a new division inside of Volvo CE Finland as well as new staff. The process will require its own workshop or space in which accessorizing can be performed. The process will require new methods of working as well as standardization in the way accessories are sold. The new process will also require quality to play an important role in the way the process is designed and implemented.

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Key words: pdi, pre-delivery inspection, construction equipment, accessorizing process, process design, quality management

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**GLOSSARY**

CAD	Computer Aided Design
CRM	Customer Relationship Manager
PDI	Pre-Delivery Inspection
Swecon	Swecon Anläggningsmaskiner AB
Volvo CE	Volvo Construction Equipment
Volvo CE Finland	Volvo Construction Equipment Finland Oy

## 1 INTRODUCTION

The Construction Industry in Finland has been predicted to grow at 6,5% in 2016 (Rakennusteollisuus). This has led to an increase in the demand for Construction Equipment. As such Volvo CE Finland has experienced record breaking sales this year which has put pressure on the accessorizing process. Volvo CE Finland commissioned this thesis to research the possibilities that are available in order to streamline the accessorizing process.

This thesis researches the accessorizing process as well as processes and methods for creating a new process. The purpose was to use information gathered from the current employees who work with the current accessorizing process, as well as information gathered from Swecon that implemented their own accessorizing process in 2014. Literature was used in order to gather information on process design and quality management.

This thesis dealt with a lot of new aspects that were new to the author, such as process planning, process methods and quality management requirements that required a lot of researched and literature. There is currently no specific literature on how the accessorizing process should be planned or applied and as result a lot adaptation to the theory was required.

This thesis first analyses Volvo CE Finland's current process as well as staff feedback of the current process. The process planning is then researched with the requirements, the different ways processes can be implemented and the recommended ways to implement them. This thesis then analyses Swecon's current process as well as the feedback and experience they have been able to gain from creating the new process. Finally, possible accessorizing process methods and tools that Volvo CE Finland could implement are analysed and discussed.

This thesis isn't meant to be a handbook to design the new accessorizing process, rather it should function as a guide for the alternatives Volvo CE Finland could use when it starts implementing a new accessorizing process.

## 2 BACKGROUND

Volvo CE Finland is the official dealer and marketer for Volvo Construction Equipment in Finland. It had a revenue of 75 million euro in 2015 and employs approximately 113 staff. Volvo CE Finland is a subsidiary of AB Volvo Concern. (Volvo Construction Equipment 2016c.)

Volvo CE Finland has had a record-breaking year in terms of sales. This has led to a situation where they have had a record number of machines to accessorize. This has exposed the weaknesses of the current method. This highlighted the need to review the current method as well as research a new method of accessorizing that would suit Volvo CE Finland's needs.

### 2.1 Current Accessorizing Process

The current sales and accessorizing process proceeds as follows:

1. The salesman sells a machine to a customer, and during the sales process gathers information from the customer concerning the accessories. The customer informs the salesman what accessories are needed and where they need to be located. This is all done by word of mouth and not much information is written down during this process. It is important to note at this point that the customer can request almost any accessories that are required. (Mörsky T. & Salonen J. 2016; Roos J. 2016.)
2. The salesman fills out a purchase order (picture 1 and 2) in the customer relations management system (CRM). The forms consists of the machine information (model etc.), the accessories the machine needs to be equipped with when delivered from the factory as well as the local accessories that the customer has requested. (Lindell S. 2016a; Mörsky T. & Salonen J. 2016; Roos J. 2016.)

3. The information is sent to the purchase assistant who then inputs the information into Volvo CE's own order management system. The system provides a serial number once it has been allocated to a machine by the production factory. (Lindell S. 2016a; Mörsky T. & Salonen J. 2016; Roos J. 2016.)

Volvo Construction Equipment Finland Oy

SISÄINEN KONE- /TYÖTILAUS

Tarjous ID: [REDACTED]

<b>Tilaja:</b> [REDACTED]	<b>Projekti no:</b> [REDACTED]
<b>Asiakas:</b> [REDACTED]	<b>Puh no:</b> [REDACTED]
<b>Merkki:</b> VOLVO	<b>Malli:</b> L60H
	<b>Valm. no:</b>

Toimenpide/varuste/osa	Varuste/osa no	Toimittaja	Kuka hoitaa	Sovittu hinta
<b>LISÄTTY MRS VARUSTUKSEEN:</b>				
Hydrauliikka 4 toimintoa	WL61017	VOLVO		
Kallistuva tappiikin hydr työvälineihin	WLA84367	VOLVO		
Käsikaasu	WL30009	VOLVO		
LED sarja, tehokkaampi	WL50024	VOLVO		
Peittävät lokasuojat eteen/taakse 65-sarjan renkaisiin	WL22003	VOLVO		
Pitotoiminto, 3:s toiminto	WL65001	VOLVO		
Renkaat, 600/65R25 XLD, Michelin	WL20024	VOLVO		
Roiskeläpät, 65 sarja	WL23001	VOLVO		
Subwooter	WL44100	VOLVO		
Taustapeilit, sähkölämmitys ja -säätö	WL45201	VOLVO		
Työvalot lisävarusteelle, LED	WL50018	VOLVO		
<b>POISTETTU MRS VARUSTUKSESTA:</b>				
Hydrauliikka, 3 toimintoa	WL61016	VOLVO		
LED työvalot eteen ja Halogen taakse	WL50016	VOLVO		
Lokasuojat, täyspitkät, taakse, 80-renkaille	WL22004	VOLVO		
Renkaat, 20.5R25* VSW Bridgestone	WL20013	VOLVO		
Työvalot ohjaamoon, 4 LED	WL50014	VOLVO		
Työvälineihin, valettu, parempi näkyvyys	WLA86454	VOLVO		
<b>PAIKALLISET LISÄVARUSTEET:</b>				
5. lisähydrauliikka				
Aurasähköt				
LA-puhelin				
Luovutushuolto				
Vapaapaluulinja				
			<b>Yhteensä:</b>	

**Muuta huomioitavaa:**

**Allekirjoitus:**

**Tilaus pv:**

**Luovutus pv:**

PICTURE 1. Example of a Purchase Order (Lindell S. 2016b, modified)





assistant is responsible for receiving the machine and takes the keys. The purchase assistant informs the salesman that the machine has arrived. The salesman orders the local accessories either from the workshop or from other distributors. (Lindell S. 2016a; Mörsky T. & Salonen J. 2016; Roos J. 2016.)

5. When the salesman is informed about a machine arriving, the salesman makes a work order, either from the CRM purchase order or from their own worksheet. Sometimes the salesman will only write the instructions on a piece of paper. Currently the work orders aren't standardized. The work order should include the machine details (especially the machine's serial number), customer information, standard factory equipment (not mandatory) and the local accessories with as much detail as possible. The work order is sent to all the workshop supervisors by email. (Mörsky T. & Salonen J. 2016; Roos J. 2016; Viitala R. 2016.)
6. One of the workshop supervisors takes the work order and assigns it to a mechanic to perform the accessorizing. There are no mechanics specifically assigned to accessorizing, but it is thought that there are generally two proficient accessorizing mechanics available. The accessorizing work is then inserted into the mechanic's work schedule and prioritized according to the workshop's own needs. The work order is sent to the mechanic through the timetable system as an attachment. The final pre-delivery inspection form is also attached. (Engman B. 2016; Viitala R. 2016.)
7. The mechanic receives the work order straight to the tablet that is assigned to him. The work order contains the work schedule as well as the inspection form. For the work to begin the mechanic first looks for the machine based on the information in the work order (mostly the serial number), but if there isn't clear enough information, the mechanic queries the information from the salesman. The mechanic also collects the ordered accessorizing parts from where they are delivered to. (Eklund J. 2016; Viitala R. 2016.)
8. The mechanic starts work on the machine and if the accessorizing instructions are unclear, makes contact with either the salesman or customer for

more information on what is needed and wanted. If there are technical problems with the installation of accessories e.g. tilt rotators, the mechanic contacts Volvo CE Finland's own technical support for assistance. Once the accessorizing has been completed the mechanic fills out the PDI form and contacts his workshop supervisor. The workshop supervisor then contacts the salesman. (Eklund J. 2016; Grönroos K. 2016.)

9. Upon receiving information that the machine is completed, the salesman informs the customer and if necessary arranges transport for the machine. The salesman and possibly the customer inspect the machine to make sure it is accessorized correctly before it is sent to its final location. (Mörsky T. & Salonen J. 2016; Roos J. 2016.)

## **2.2 Feedback regarding the Current Process**

The current process isn't currently a process but rather a method of accessorizing machines that has been done based on the feeling of how the people doing it feel that it should be done. This has led to significant problems regarding how the work is done and how the accessorizing process is managed. As there is no set process there can be a clash of culture and work method. As part of the research done for this thesis I have collected feedback from the personnel that work within the framework of the current method of working. I have also collected information on what is currently causing the greatest problems and need to be solved with the new process of accessorizing the machinery.

The current problems from the provided feedback can be divided into five different categories i.e. Data System Restrictions, Lack of Communication, Lack of Leadership, Lack of Standards and Quality Problems. The biggest problem is lack of standardization. Once the way of working and doing things has been standardized it should assist with the problems of communication, leadership and quality. The restrictions imposed by the current data system are more difficult to overcome as replacing or upgrading the data system can be expensive and work intensive.

### 2.2.1 Data System Restrictions

Let us consider the restrictions of the current data system. The data system consists of two separate systems. Sales uses a system for sales called CRM that is Volvo CE Finland's own in house data system based on the Microsoft Dynamics CRM system. The sales team uses it for interacting with the customers as well as making purchase orders and quotations. The rest of Volvo CE Finland uses Volvo CE's data system called IMDS. This system is used for billing as well as for the workshop and spare parts. CRM and IMDS currently don't interact with each other, other than CRM being able to extract a certain amount of information from IMDS. Purchase orders and work orders are then sent by email to the purchase assistant and workshop supervisors. (Lindell S. 2016a.)

The problems with CRM start with the ordering of accessories for the machines. When drawing up the purchase order for a new machine, changes sometimes need to be made to the factory accessories and when doing this the system doesn't consider conflicts. As an example, if a machine requires to be equipped with a longer boom than the original boom, the salesman needs to remove the original boom from the selection. The system doesn't inform the salesman of an inconsistency and thus when the purchase order is sent to the purchasing assistant, the purchasing assistant needs to make sure that there are no inconsistencies. (Lindell S. 2016a; Mörsky T. & Salonen J. 2016)

CRM also has a flaw that causes problems that are linked to standardization. When ordering local accessories, there is not a list of accessories to choose from. The required local accessories are input into a free text box. This can cause discrepancies between work orders as in pictures 3 and 4. (Mörsky T. & Salonen J. 2016.)

#### PAIKALLISET LISÄVARUSTEET:

dieselämmittinkauko-ohjauksella asennettuna

vapaa paluulinja tankkiinja sähköpistoke

PICTURE 3. Local Accessories list (Lindell S. 2016d, modified)

## PAIKALLISET LISÄVARUSTEET:

5. lisähydrauliikka

Aurasähköt

LA-puhelin

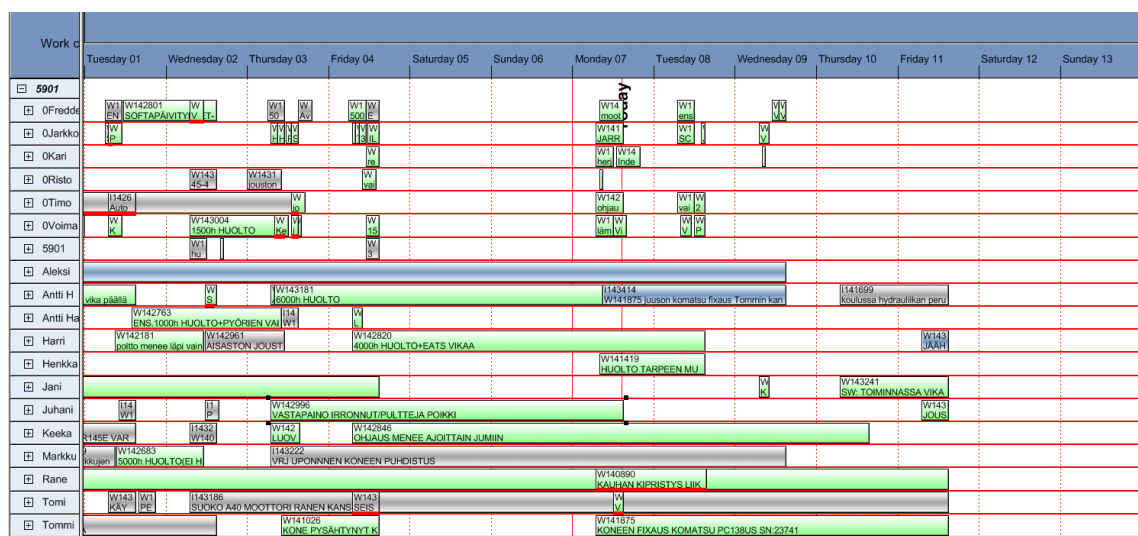
Luovutusluolto

Vapaapaluulinja

PICTURE 4. Local Accessories list (Lindell S. 2016b, modified)

Further to this the IMDS system that the workshop uses, isn't able to produce price quotations for work. This causes problems for the Sales division because they are unable to give the customer a reliable cost quotation, but instead must calculate the work load for each installation from the estimated worktime and use the general hourly price for workshop work. To ease the burden, the Sales division provides a price estimation based on previous experience. (Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

There have also been problems regarding the inputting and changing of the mechanic's work schedules (picture 5). The scheduling system is difficult to modify once the mechanics have been allocated a work schedule. This sometimes causes conflicts within the system, as the mechanic's work schedule may have been changed, but it is not shown in the scheduling system. The overall the feedback that was provided indicates that the system is very difficult to customize. (Engman B. 2016; Viitala R. 2016.)



PICTURE 5. Shift Scheduling System

### **2.2.2 Lack of Communication**

The next problem is linked to a lack of communication. The biggest problem has to do with the communication between the Sales division and the Service division. The problems start with the work orders. Sometimes they are filled out incorrectly or only partially filled out. This causes problems for the mechanics when looking for the machines, as well as problems with accessorizing. It also causes extra work in the workshop as the mechanics or supervisors have to use valuable work time to find out the information. Generally, the biggest problems arise when there is no machine serial number, customer information or detailed accessorizing information on the work order. The work orders should contain more specific information on the way that the customers want the machines to be accessorized. (Eklund J. 2016; Engman B. 2016; Viitala R. 2016.)

There is also the problem of e-mail being used to send work orders to all the workshop supervisors. When the work orders are received by e-mail, nobody answers the e-mail to inform Sales or the other supervisors that they will be handling the work order. This can lead to situations where nobody deals with the work order or more than one person starts to deal with the work order. This sometimes leads to the work order not being forwarded to the mechanic as part of the accessorizing work or the work order is forwarded as incomplete. (Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

A badly constructed work order (picture 6) as well as the lack of communication leads to the workshop supervisors as well as the mechanics not being aware of how the machine should be accessorized, once finished. This generally leads to a situation in which extra work needs to be performed on the machine once the accessorizing process is officially completed and leads to extra costs for either the customer or Volvo CE Finland. (Eklund J. 2016; Engman B. 2016; Viitala R. 2016.)

FERRIS

~~VASARALIIWA X 2~~ / ~~KAVHAAKPYÖRITTÄJÄ~~  
~~EDULLINEN LIIWA X 3~~ / ~~Ei~~  
 VALOJA RIITTÄVÄSTI  
 2 LEDIÄ LISÄÄ HYTYN PÄÄLLE on Huoli  
 LEDIMAAKARAT JOITA VÄLKKYY KOVEN SIVULLI  
 SIVU OVEEN RASVA RÄSÄ TÄLINE  
 POLTTOAINE LETKUN PÄÄHÄN Yhtä  
 NAARAS PUOLENEN PEMOK. on  
 LÄBLARIN TANKETTI OIKEALLE on  
 PUOLELLE SIVU LÄSIIN on  
 LASIEN TUMME NUUKIET (Ei meidän)

PICTURE 6. Example of a badly constructed work order

There is also a lack of communication concerning the subcontractors who are sometimes hired to perform certain parts of the accessorizing process. The subcontractors are hired directly by the Sales division and the Sales division are the only department in direct contact with the subcontractors. This causes problems for the workshop as the workshop aren't always aware as to what is happening in their own premises and with all the machines that are being worked on. (Engman B. 2016; Mörsky T. & Salonen J. 2016.)

When ordering parts, the Sales division sometimes doesn't inform the Service division about incoming accessorizes as well as the delivery reference needed to find these accessories. This leads to a situation where the mechanics are unable to find the parts required for accessorizing. Another challenge is to obtain technical details about the machines from the technical advisors. Sometimes the mechanics find it easier to phone the accessory manufacturer rather than to request help from Volvo CE Finland's own employees. Further to this, most of the mechanics feel that the lack of communication leads to too much of rush with the work being done. (Eklund J. 2016; Engman B. 2016; Grönroos K. 2016.)

### 2.2.3 Lack of Leadership

The lack of clear leadership is very clear when looking at the process. Every single piece of feedback that was received commented on this fact. This places it as central for improving the process as a whole. The problems start once the work order is completed because there is no one assigned to overseeing the accessorizing. This causes the salesmen to send the work orders to all the workshop supervisors. Normally, there is one workshop supervisor who is more responsible, but not totally responsible, for the accessorizing process. Due to this supervisor's main job being to supervise the mechanics on the workshop floor he is overstretched. This in leads to the supervisor delegating a lot of the responsibility for the accessorizing process to the mechanics. This leads to a lack of follow up on the work being done, as well a lack of knowledge about the progress of work. (Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

The lack of leadership and knowledge in the workshop regarding the accessorizing process becomes evident, because sometimes the mechanics are shifted from accessorizing work to service work, even though the accessorizing work could carry a higher priority. This happens generally with very short notice and this is a clear case of lack of planning. (Eklund J. 2016; Grönroos K. 2016; Viitala R. 2016.)

The lack of chain of command in the sense of no clear supervisor for the accessorizing process, causes the problem that there is no time for the supervisors to listen to what the customers want. Due to the lack of resources, the supervisors are unable to demand quality and guide the work of the mechanics. The mechanics are sometimes even left to provide price quotes to the customers even though it isn't their responsibility. This sometimes leads to the dilemma of who will pay the difference if the quoted price is too low. (Eklund J. 2016; Grönroos K. 2016; Viitala R. 2016.)

#### **2.2.4 Quality Issues**

The lack of leadership as well as the lack of communication leads to the problem of the quality not being up to standard. The problems with quality generally start with the mechanics not knowing exactly what the customers require. This leads to the machines being completed, but not accessorized the way customers want them to be accessorized. There is also a general lack of quality inspection by the Service division once the work has been completed. (Eklund J. 2016; Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

There is also an opinion that the subcontractors don't have the same high standards of workmanship that Volvo CE Finland's own mechanics have. (Engman B. 2016.)

### **2.2.5 Lack of Standards**

Almost all of the previous issues could be attributed to the fact of a lack of standards. The lack of standards is causing a situation in which everyone is working in a way they want to work, instead of working in a way that benefits the accessorizing process.

The lack of standards starts to become evident at the beginning of the accessorizing process. When selling the machines, there are no standardized local packages. The current system is based on the ability of the customers to be able to request any sort of accessorizing they feel they will need. This means for instance that if the customer requests work lights, they can request almost any amount, any brand, even provide their own, as well as to request any location for the lights to be placed. This sometimes leads to the machines being over customized. This is time consuming and expensive. (Eklund J. 2016; Engman B. 2016; Grönroos K. 2016; Viitala R. 2016.)

The next problem arises because there is no standardized work order form. Different salesmen use different forms and fill in the forms in different ways. As previously noted, the data system also causes difficulty regarding there being no set local accessorizing items that can be chosen from a dropdown list. There is also no direct pricing when listing the accessories. (Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

A new problem arises when the work orders are sent forward to the Service division. As noted previously the lack of a supervisor dedicated to accessorizing causes confusion. A lack of dedicated mechanics can in turn lead to the work slowing down as the mechanics don't develop a work rhythm. This leads to conflicts within the Service division's own scheduling system as mechanics do both accessorizing as well as servicing. (Eklund J. 2016; Engman B. 2016.)

There is also the lack of a clear priority system. Currently when Sales send accessorizing work over to the Service division, the accessorizing work is rushed, not as per how the



orders are received but rather by who can demand the most. A priority system needs to be implemented in which the priority is based purely on agreed upon standards and is not able to be changed. There also needs to be a system in which general services can't take manpower away from accessorizing. (Eklund J. 2016; Roos J. 2016; Viitala R. 2016.)

### **2.2.6 Other issues**

Apart from the issues discussed below, there are a few smaller issues that were also noticed. These smaller issues are not important regarding this thesis as there are bigger issues that need to be addressed.

The first issue that needs to be addressed is the distrust between Sales division and Service. The Service division feels that there is a lack of respect from the Sales division regarding their chain of command and process. (Engman B. 2016; Viitala R. 2016.)

The second issue is lack of trust regarding the mechanics. Mechanics are not trusted and there is a belief that their skills and motivation isn't up the level needed to accessorize the machines. There is consensus though, that there are basically only a few mechanics that are truly proficient at accessorizing. There is also the feeling that the mechanics need to be able to work more independently and make sure that they can use all the tools that are at their disposal. (Eklund J. 2016; Engman B. 2016; Grönroos K. 2016; Mörsky T. & Salonen J. 2016; Viitala R. 2016.)

Some accessories come from the suppliers with incomplete instructions or installation parts. The Service division feels that the salesmen don't understand some of the accessories well enough and find it difficult to talk about the installation process with the salesmen. The lack of specialised accessorizing mechanics also leads to some of the mechanics not understanding some of the more demanding accessories. (Eklund J. 2016; Engman B. 2016; Grönroos K. 2016; Viitala R. 2016.)

One topic from the feedback was the difficulty of using the tablets. There is the feeling that in some cases, having physical copies of the work orders and forms could help in the sense that the mechanics can write comments on them. There is also a feeling that there

are too many work names when completing a work order. This leads to the situation in which the mechanics aren't interested in using the tablets. (Grönroos K. 2016.)

### **3 PROCESS PLANNING**

#### **3.1 ISO 9001**

Volvo CE Finland uses the Quality Management System ISO 9001:2015 which has a broad range of requirements for how processes must work and how they should be implemented (Volvo Construction Equipment 2016b). The reasoning behind using a quality management system is that it is perceived to assist in improving overall performance as well as being a good platform for developing a sustainable way of doing business (SFS-EN ISO 9001, 7). As Volvo CE Finland uses the system it is important that the new process fits into the requirements of the standard.

There are seven quality management principles listed in the ISO 9000 standard. These are customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making as well as relationship management. (SFS-EN ISO 9001, 8.)

A company generally requires a quality management system for two reasons. Firstly, to show customers and competitors that it is able to provide quality products and services that also meet laws and regulations. Secondly to improve the customer's experience by applying the quality management system, improving their production or service processes as well as changing the process to suit the needs or requirements of the customer and possible laws and regulations. (SFS-EN ISO 9001, 8.)

Volvo CE Finland has a Quality Management Handbook that defines the scope of the ISO 9001 Standard in the organization as well the processes. It is important that the process that is developed in this thesis conforms to the requirements specified in the Quality Management Handbook.

#### **3.2 Process Requirements**

In order for a successful process to be implemented it requires a plan. Successful plans have goals as well as a method of reaching those goals. In order to be effective a plan

needs to specify the responsible people in the project as well as their responsibilities. It also needs to contain goals and objectives that are clear to the people implementing them. The plan needs to be easy to understand and also to be logical in reaching the desired goals. A timetable for implementing the goals must be known, that means the publication of the goals, informing the organization and workforce of the benefits as well as the rationale behind the process, measuring the progress of the goals as well as setting up milestones in order to see the progress of the goals. (Betz K.M., Christensen C. & Stein M.S. 2013, 2.)

When establishing the goals, it is important to know what needs to be done as well as to know what products and services will be provided. In order to have good and understandable goals, it is important to adhere to the SMART rule. (Betz K.M., Christensen C. & Stein M.S. 2013, 4.)

The goals need to be:

Specific (S)

- something that is clear and understandable.

Measurable (M)

- can be measured e.g. improved lead-time for accessorizing.

Attainable (A)

- reachable - the expectations are not too high.

Realistic (R)

- the goals aren't out of the reach with the resources the organization has available.

Time-Bound (T)

- needs to have deadlines in order to drive it forward.

(Betz K.M., Christensen C. & Stein M.S. 2013, 4.)

When implementing the process it is important to have clear and logical goals, with a clear roadmap for implementing them. It is better to break the process down into smaller tasks or milestones in order to simplify it and allow for the goals to be met. Another important factor is that all the resources required for the implementation are known and identified. If there is a lack of resources, then a plan for gaining the resources is needed. Finally, deployment of the planned process is needed. This happens by informing the

employees responsible for executing the plan, as well as informing them of their responsibilities. If there are problems in deploying the plan, then the people responsible must also be held accountable. Once the plan has been deployed the success must be measured in order to see if the plan is effective (Betz K.M., Christensen C. & Stein M.S. 2013, 4–5.)

In order to implement a successful process, the needs of the customer must be a known quantity. Generally, customers want Reliability, Maintainability as well as Safety. It is important to understand what the customers really want, because, if the needs of the customers are lost then it is easy to lose market share. Customers might sometimes want more than reliability, maintainability and safety, but this is something that needs to be researched and documented into the process. (Betz K.M., Christensen C. & Stein M.S. 2013, 5.)

There is a term called “Cost of Quality” that defines the cost of creating a product or service that isn’t of sufficient quality. Insufficient quality creates costs inside the organization especially when the work has to be redone. As such it is important to concentrate on quality in order to minimise the costs of redoing work. (Betz K.M., Christensen C. & Stein M.S. 2013, 8.)

As well as process planning, documentation is an important part of the processes. It is a way of guiding the workforce in their duties, standardizing the work process as well as a way of documenting organizational practices. It is especially important when new employees are hired, as it is an easy and cost effective way of training them for their new position. Documentation also provides employees with a work reference as well as standardizing common work elements. (Betz K.M., Christensen C. & Stein M.S. 2013, 10.)

Documentation is also important when products are under legal threat, when sales and marketing need to advertise the organization’s capabilities, when the performance of the organization needs to be benchmarked as well as when sources of waste and opportunities need to be identified. (Betz K.M., Christensen C. & Stein M.S. 2013, 11.)

### **3.3 Lean Six Sigma**

With competition nowadays being tougher and customer demands for quality growing, the Lean Six Sigma method has become more popular. Lean Six Sigma is a method that's purpose is to increase profitability whilst also improving customer satisfaction. (Taghizadegan, S. 2006, 1.)

The Six Sigma method was developed during the 1980s by Motorola as way of delivering high quality products. Motorola discovered that by producing higher quality products the cost of production actually decreases because of the customer satisfaction that comes with buying a high quality product. (Taghizadegan, S. 2006, 1.)

Lean Six Sigma is a combination of both the Lean method as well as the Six Sigma method. The Six Sigma method has a primary focus on reducing the variation in a process whilst also improving the control of the process. The Lean method is based on the idea that all waste must be eliminated from the manufacturing process and that there must be as much standardization in the process as possible, with a good work flow. (Benbow, D.W. & Kubiak T.M. 2009, 9.)

Generally, the best way of approaching the problem of how to implement the Lean Six Sigma method is to start with the Lean method to eliminate waste in the manufacturing process as well standardizing and making the manufacturing process flow. Once the Lean method is applied and functioning then the Six Sigma method is applied to deal with any process problems that remain. (Benbow, D.W. & Kubiak T.M. 2009, 9.)

In order to obtain the best results with relation to the implementation of the process, it is important to have a group that is in charge of overseeing the implementation with the support as well as participation from top management. The oversight group is responsible for defining as well as prioritizing problems whilst also creating work groups to solve these problems. The group's responsibilities also include the training of the work groups, supporting the work groups, the recognition of good work and the rewarding of the work groups. (Benbow, D.W. & Kubiak T.M. 2009, 11.)

The Lean method is generally regarded as defining eight sources of waste that need to be reduced or cut in order to gain the maximum amount of results. These are overproduction, inventory waste, defective products, over processing, waiting, underutilized people, motion and transportation waste. (Betz K.M., Christensen C. & Stein M.S. 2013, 74.)

Overproduction means that a certain process in the production phase is either producing too much, too early or much faster than what the next process is able to absorb. Inventory Waste means that there is too much of something that the company is unable to utilize, such as raw materials, the work in the process or the complete product. Defective products mean produced products that don't meet the quality requirements. This means that the products have to be inspected, sorted out of the process, scrapped altogether, downgraded to a lesser quality standard, replaced altogether or repaired. Over processing means the over manufacturing of a product, meaning that too much effort is put into a process that doesn't bring any extra value to the customer. Waiting means that time isn't utilized efficiently because there isn't enough manpower, materials haven't arrived, machinery doesn't work, new measurements need to be taken or there is a lack of information regarding the process. Underutilized people means that the workforce isn't used to its full capability either mentally, creatively or skill wise. Motion means that the process forces the workforce, tools or equipment that doesn't add value to the production process to move around. Transportation waste means that parts or materials that are not easily on hand need to be transported around the production factory. (Betz K.M., Christensen C. & Stein M.S. 2013, 74–75.)

### **3.3.1 Setup Reduction (SUR)**

One of the ways to gain efficiency in the process is to reduce the time spent setting up the next production process. Setup Reduction is a philosophy used in the Lean method and is a quick and efficient method of changing the manufacturing process, so that the change-over from making the current product, to making the next product is as smooth as possible. The method reduces the time needed for setting up the machinery and tools used for making the product. The idea is that once the current product assembly is done and the next one is started it shouldn't take more than 10 minutes. (Betz K.M., Christensen C. & Stein M.S. 2013, 75.)

The philosophy has 7 steps that are used to reduce the changeover time. First the current method needs to be observed, then the internal and external activities need to be defined as well as separated. Internal activities are processes that can only be performed when the process is at a standstill. External activities are processes that can be performed whilst the

last steps of the current process, or the first steps of the next process are being implemented. (Betz K.M., Christensen C. & Stein M.S. 2013, 75.)

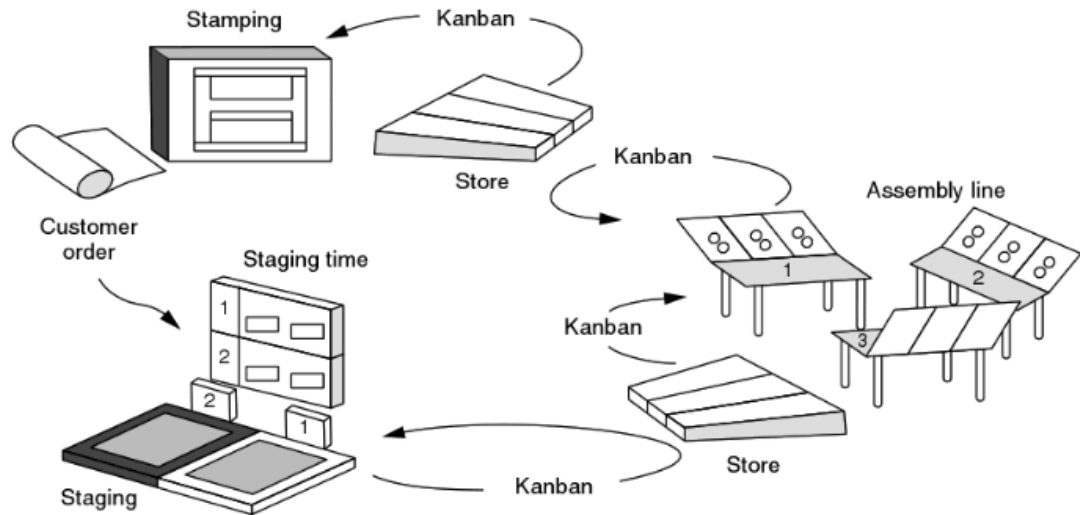
Once the internal and external activities have been defined, then where possible, the internal activities need to be converted into external activities. Once this is done, the internal activities that are left, need to be made as simple as possible e.g. the minimizing of movement etc. The external activities also need to be made as efficient as possible so that they are not any more complicated or time consuming than the internal activities. (Betz K.M., Christensen C. & Stein M.S. 2013, 75.)

Lastly the new process as well as any actions that have not been implemented need to be documented. The method requires constant repetition in order to gain the best result. Each repetition of the method should bring around a 45 % improvement in the setup times, and it will take many repetitions to reduce the setup time to under 10 minutes. (Betz K.M., Christensen C. & Stein M.S. 2013, 75.)

### **3.3.2 Just-in-Time (JIT)**

An important factor of reducing waste is reducing inventory as well as the warehouse space used to store it. Just-in-Time is a method that focuses on having material delivered when and where it is needed. Using this method can radically reduce costs, increase product quality and process efficiency. The Just-in-Time method is used in conjunction with the Kanban method and Pull System (Picture 7), and relies on a notice system that informs the process supervisors of material deficiencies. When the Kanban process is designed it needs to be done with great care as a badly designed process can do more harm than good. (Betz K.M., Christensen C. & Stein M.S. 2013, 76–77)





PICTURE 7. Kanban and the Pull system. (Betz K.M., Christensen C. & Stein M.S. 2013, 76.)

### 3.3.3 5S

5S is a method which should be used with the other Lean methods as a means of clearing workspaces as well as other clutter. It focuses on creating a clean and orderly work space, which increases efficiency as well as decreases waste. A clean work space also allows for errors to be noticed more easily. Picture 8 contains the descriptions of the work methods needed in order to create orderly work space. The method also gives employees control of their work environment and promotes awareness of the advantages of the 5S method. (Betz K.M., Christensen C. & Stein M.S. 2013, 77.)

5S English term	5S Japanese term	Brief description
Sort	Seiri	Separate needed tools, parts, and instructions from unneeded materials, removing the latter
Set in order	Seiton	Arrange and identify parts and tools for ease of use. Where will they best meet their functional purpose?
Shine	Seiso	Clean up the workplace, eliminating the root causes of waste, dirt, and damage
Standardize	Seiketsu	Develop and maintain agreed-on conditions to keep everything clean and organized
Sustain	Shitsuke	Apply discipline in following procedures

*Please note:* These are adopted descriptions and English terms adapted from and not literally translated from the original 5S Japanese terms.

PICTURE 8. Japanese 5S terms and explanations (Betz K.M., Christensen C. & Stein M.S. 2013, 77)

## **4 THE SWECON PROCESS**

Swecon is the official dealer for all Volvo CE's equipment in Sweden, Estonia, Latvia, Lithuania and part of Germany. The Swecon group has around 1000 employees and had sales of 5,2 Billion Swedish Krona (approx. 560 Million Euro) in 2014. (Volvo Construction Equipment 2016a.)

A trip was made to the Swecon headquarters in Eskilstuna, Sweden as a means of researching a new method of accessorizing machines. During this trip, we were able to familiarize ourselves with their accessorizing process whilst also gaining new insight into the methods used and lessons learned by setting up this new process.

### **4.1 Background**

Swecon's need for a new accessorizing process came out of the need to solve problems that had been in the accessorizing process for years and were not unlike the problems currently being experienced at Volvo CE Finland. The process that they had used was also similar to the current process in Finland, in the sense that the accessorizing was performed in the workshop under workshop supervision. There was also a lack of standardization and the Sales division had a lot of control over what kind of accessories were being installed onto the machinery. (Haraldsson P.E. 2016.)

Overall there were four main reasons why Swecon decided to implement an accessorizing process that was to be very different from what they had used in the past. (Haraldsson P.E. 2016.)

The first reason had to do with the workshop's way of making money being counteractive for accessorizing work. The workshop had pressure to sell hours for service and repairs, which made accessorizing less of a priority. Accessorizing wasn't seen as a priority and as such there was no incentive to make sure that the machinery was accessorized on time. (Haraldsson P.E. 2016.)

The second reason is closely linked to the first. When urgent work came into the workshop it would always supersede the accessorizing work. This led to accessorizing always being delayed, which led to long accessorizing times. (Haraldsson P.E. 2016.)

The third reason had to do with the pricing of accessorizing and the lack of standardization. With the lack of different accessorizing packages, the Sales division as well as the Service division didn't have any idea when it came to prices. This led to situations in which prices were quoted differently within Swecon. (Haraldsson P.E. 2016.)

The fourth reason was product safety. Swecon wanted to ensure that all accessorized machinery complied with the CE-directive. By complying with the CE-directive Swecon is making sure that all its accessorized machinery is safe for use by customers. By standardizing all accessorizing equipment, they have full control over the supply chain, which means that they have the ability to make sure that all accessories are CE-approved. (Haraldsson P.E. 2016.)

## **4.2 The New Process**

All the reasons listed in the previous chapter led to the situation in which Swecon came up with a new accessorizing process. Swecon decided that to get the best result it was best to start a new process based on the Lean Six Sigma method. The main objective of the new process was to lower the time used on accessorizing machines, whilst giving a clear completion date. In the long run this saves time and money as well as gives customers a clear idea when their machinery will be ready to use. (Haraldsson P.E. 2016.)

The first step in the new process was to setup a whole new Accessorizing division, with its own personnel and workshop. The idea for the new workshop was to create internal efficiency in both the accessorizing process as well as the whole sales process. The new workshop also needed to simplify the sales of accessories as well as lowering the burden on the servicing workshop. The new accessorizing workshop's business model was to create more time for the other divisions and not to earn money. This means that it's only supposed to break-even and not to try to create a profit. (Haraldsson P.E. 2016.)

Swecon first built a new a completely new accessorizing workshop. The accessorizing workshop has space for simultaneously accessorizing six machines. The workshop also has its own yard and warehouse as well as any other equipment needed in the accessorizing and design processes. This enables the workshop to function independently of the Service division as well as Sales. (Haraldsson P.E. 2016.)

In order to achieve the best efficiency Swecon decided to emphasise the hiring and creating of experts to accessorize their machinery. As the working conditions and process differs from what mechanics are normally used to, there was an emphasis on hiring mechanics which are easily trainable in the new work as well as factory workers who are used to assembly line work. There was also an emphasis on making sure that the new mechanics would not develop the bad habits of service mechanics. (Haraldsson P.E. 2016; Eriksson O. 2016.)

The way the accessorizing process is setup also makes experts out of the personnel. The mechanics accessorize complicated components such as the tilt rotator systems, hydraulic systems as well as lubricant systems that requires a demanding skill set. There is also a lot of repetition in the work that brings confidence and time savings that come from the mechanics being accustomed to the accessories. The way the workshop is setup also allows work to be simultaneously performed on many machines at the same time and allows the workshop to work on accessorizing more specialized machinery. Now that there is an independent Accessorizing division, suppliers also see it as a natural point of contact. Internally the Accessorizing division is also a natural point of contact for pricing and technical know-how. (Haraldsson P.E. 2016; Eriksson O. 2016.)

Due to this process having never been used in Swecon, it took some time to find the correct balance in regard to the organizational structure and employee count. As shown in table 1 their organization has changed when compared to the beginning of the year. As seen in the table, the upper management i.e. workshop planners, package planners, work supervisors etc. has remained the same and the changes have been directed towards the blue-collar workers. (Haraldsson P.E. 2016.)

TABLE 1. Accessorizing workshop's organization (Haraldsson P.E. 2016)

<b>Workforce</b>	<b>01/2016</b>	<b>09/2016</b>
Workshop Planners (includes the Workshop Manager)	2	2
Package Planner / Technical Advisor	1	1
Work Supervisor / Design Engineer / Mechanic	1	1
Mechanics	4	7,7
Yardman	1	0,3
Warehouse workers	0	1
Machine Transporter / Presenter	1	1
Total	10	14

The biggest change has to do with the yardman and warehouse worker. The yardman is now a part-time position in the sense that the position also requires the yardman to work as a mechanic most of the time. A new position of warehouse worker was created as it was seen that it was needed in order to allow the mechanics to focus on their principle job instead of having to do part-time warehouse work. (Haraldsson P.E. 2016.)

There were also a lot of positions created that required the workers to do many different jobs e.g. the package planner also being a technical advisor, one of the workshop planners being the workshop manager, the machine transports also being a delivered machine demonstrator and the work supervisor also being a design engineer as well as a part-time mechanic. (Haraldsson P.E. 2016.)

The whole new accessorizing process has been based on standardizing the accessories as well as standardizing the installation times with clear advantages. It is possible to offer standardized pricing as well as clear and transparent prices to customers. It is also easier to standardize the pricing for separate assemblies and parts. Swecon is even able to offer work internally with standard pricing. The troubleshooting and parts traceability also becomes easier, as the supply chain as well as the parts used in the process, is a known quantity. Currently there are around 100 packages for salesmen to choose from and the goal is for 80 % of accessories to come from packages. (Haraldsson P.E. 2016.)

The new accessorizing process tries to encourage salesmen to use the accessory packages by keeping the process simple and by allowing the salesmen to easily gather information. The packages are standardized parts that the salesmen can then sell. In order to make sure

that the accessorizing process is a valuable tool for Sales, there are also quarterly meetings in which Sales and Accessorizing division can have a healthy dialogue about the process. The salesmen can also order custom accessories based on the customer's wishes, but the customer is informed that this will cost substantially more. (Haraldsson P.E. 2016.)

The current accessorizing process starts with Swecon's accessorizing catalogue which is located online and available for anyone to use. Generally, the salesman will use the catalogue with a customer to show the different choices that are available to them. As shown in picture 9 there is choice of different machinery such as wheel loaders, articulated dumpers, crawler excavators, wheeled excavators and mini excavators. (Haraldsson P.E. 2016; Swecon.)



PICTURE 9. Accessorizing homepage (Swecon)

Once the desired machine type has been chosen, a list is generated of accessory packages that are compatible with the machine type (picture 10). It is then possible to filter the accessories by machine model type as well as the category of accessories required (picture 11).

< Tillbaka till välj kategori

## Grävmaskiner band

**Filtrera**  
 Filtrera via Maskinmodell ▾ Filtrera via Kategori ▾

- Alkolås Dräger 5000**  
 EC140C - EC460C, EC140D - EC480D, EC140E - EC750E, ECR145C - ECR235C, ECR145D - ECR235D, ECR145E - ECR235E, EW140C - EW230C, EW140D - EW210D, EW160E - EW180E, EWR150E
- Alkolås Dräger 7000**  
 EC140C - EC460C, EC140D - EC480D, EC140E - EC750E, ECR145C - ECR235C, ECR145D - ECR235D, ECR145E - ECR235E, EW140C - EW230C, EW140D - EW210D, EW160E - EW180E, EWR150E
- Bandstyrning Steelwrist**  
 EC140D - EC250D, EC140E - 250E
- Belysningspaket 1**  
 EC140D - EC180D
- Belysningspaket 1**  
 EC220D - EC480D
- Belysningspaket 2**  
 EC140D - EC180D
- Belysningspaket 2**  
 EC220D - EC480D
- Belysningspaket Lilla Tyri**  
 EC140E - EC480E
- Belysningspaket Stora Tyri**  
 EC140E - EC480E

PICTURE 10. Accessorizing list for Crawler Excavators (Swecon)

**Filtrera**

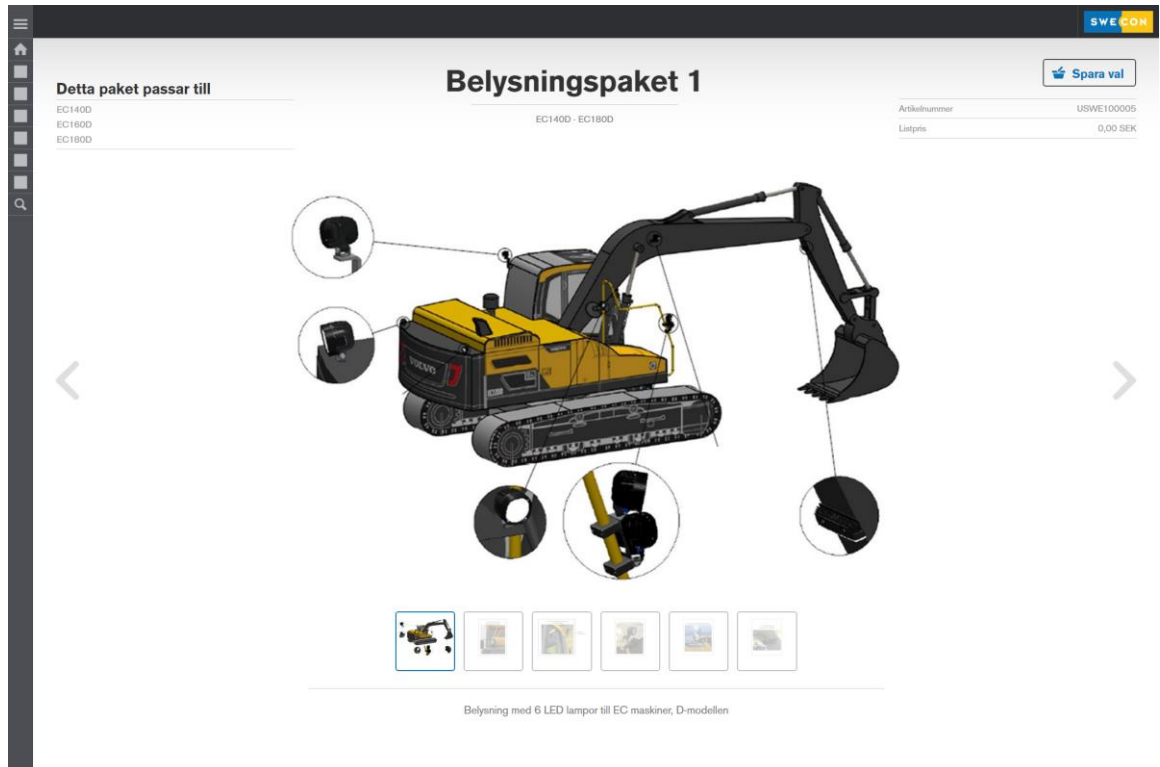
Maskin	Kategori
EC140C	Motor
EC140D	El - Belysning
EC140E	Drivlina
EC140ELM	Ram
EC160C	Redskap
EC160D	Hydraulik
EC160E	Hytt
EC180C	Exteriör
EC180D	General
EC180E	Service & Underhåll
EC210C	
EC220D	
EC220E	
EC220ELR	
EC240C	
EC250D	
EC250E	
EC250ELR	
EC250EN	

PICTURE 11. Filtering possibilities (Swecon)

A package can then be opened from the list as shown picture 12. The page shows the package details such as what machinery it's compatible with, the order number, location



of the accessories on the machinery as well as pictures of the accessories themselves (picture 13). The accessory can then be added to a list of accessories that are to be ordered.

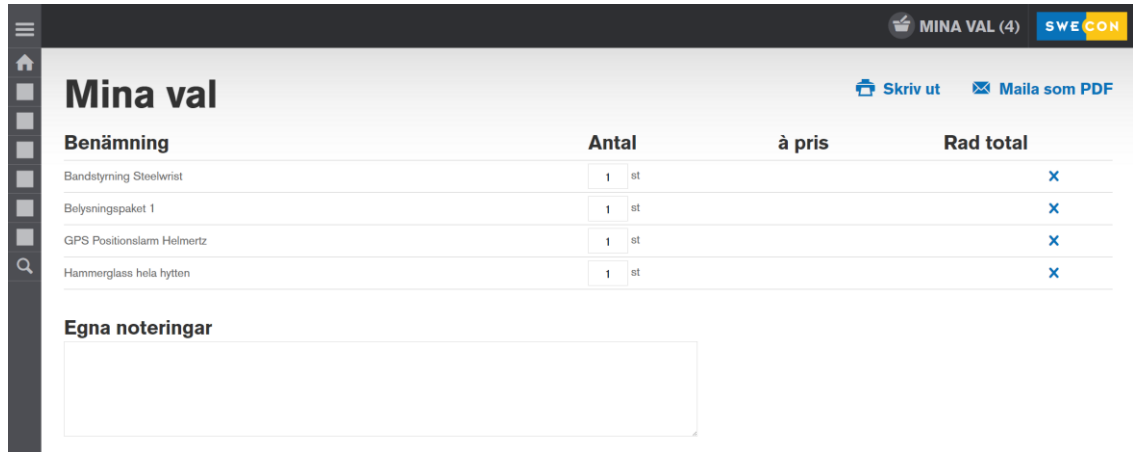


PICTURE 12. Crawler Excavator Lighting Package 1 (Swecon)



PICTURE 13. Crawler Excavator Lighting Package 1's light location image (Swecon)

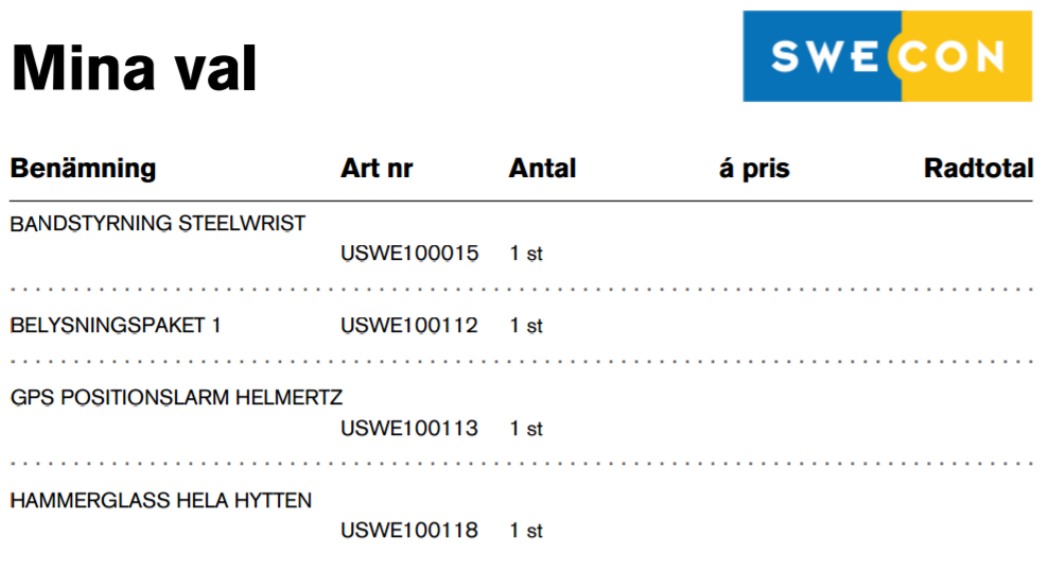
The accessory list (picture 14) shows the accessories that have been added to list as well as allowing the possibility of printing the list or making a pdf file out of it (picture 15) The pdf includes more information, such as the order references of the accessory package. The accessory package order references are inserted into the work orders that are forwarded to the Swecon accessory division (Haraldsson P.E. 2016).



Benämning	Antal	à pris	Rad total
Bandstyrning Steelwrist	1 st		X
Belysningspaket 1	1 st		X
GPS Positionslarm Helmertz	1 st		X
Hammerglass hela hytten	1 st		X

Egna noteringar

PICTURE 14. List of Accessories in the order list (Swecon)



Benämning	Art nr	Antal	á pris	Radttotal
BANDSTYRNING STEELWRIST	USWE100015	1 st		
BELYSNINGSPAKET 1	USWE100112	1 st		
GPS POSITIONSLARM HELMERTZ	USWE100113	1 st		
HAMMERGLASS HELA HYTTEN	USWE100118	1 st		

PICTURE 15. Package order list with order identification numbers (Swecon)

The work orders are received by the workshop planners. Their job is to accept the ordered work, if it fits the requirements for accessorizing work, prioritize the work per the current accessorizing situation as well as to estimate the delivery date. The delivery date estimate is predicted based on when the machine is delivered from Volvo CE's factory. A planning

meeting is held once a week where bigger decisions concerning the machines to be accessorized are made. (Haraldsson P.E. 2016; Eriksson O. 2016.)

The work orders are then placed on the work order wall (picture 16). The work order wall is organized by planned orders and started orders. The work orders have all the customer details i.e. customer name, phone number, contact person etc., machine details (machine type, serial number etc.) as well the accessorizing packages and accessories that have been ordered. They also mark if the accessories have been delivered to the workshop and if the work has been completed. The start and stop date of the work is also marked at the bottom. Work is assigned to the mechanics by the supervisors based on Swecon's own practices.



PICTURE 16. Planned work and started work

Whilst the machines are being accessorized, Swecon controls the access the customers have to the accessorizing process. Customers are only allowed to visit in the company of the salesmen and are restricted in their movements. The Accessorizing division also tries to encourage the customers to use conference calls if they wish to view the work performed on the machines, as this creates the possibility for Swecon to control what the

customer can see, and as such restrict any ideas for new accessories they customer might decide after seeing other accessorizing work. (Haraldsson P.E. 2016.)

Swecon uses their design engineer, who also works as a workshop supervisor and mechanic, to design a lot of their custom brackets and fittings (picture 17) for the accessorizing process. This allows Swecon to standardize the brackets and fittings by sending the designs to manufacturers. This enables savings by allowing the workshop to order the brackets and fittings in bigger quantities as well as providing uniformity. It also saves time, as the mechanics don't have to separately manufacture new brackets and fittings for each machine. Due to the brackets and fittings being designed in a CAD program it is also possible to stress test them. (Haraldsson P.E. 2016.)



PICTURE 17. In-house designed and pre-manufactured brackets

In order to make the installation of the tilt rotators simpler, Swecon complies with the standard set by the Swedish Trade Association for Suppliers of Mobile Machines (picture 18). The standard provides directions on how the tilt rotator must be operated, the default buttons for default actions as well as the correct terms. Currently a new revision of the ISO Standard 10968 - Operator Controls that will include standards for tilt rotator operation is being made. (Eriksson O. 2016; Steelwrist.)

## 5. Funktionstabell

Funktion	Spak	Horisontella rullar eller vippor		Vertikala rullar eller vippor	
		Position	Funktion	Position	Funktion
Tilt <sup>1</sup>	Höger	Nedre	Rullen dras åt höger = Tiltrotatorns högra sida sett från förarposition sänks.  Rullen dras åt vänster = Tiltrotatorns vänstra sida sett från förarposition sänks.	Inre	Rullen dras uppåt = Tiltrotatorns högra sida sett från förarposition sänks.  Rullen dras nedåt = Tiltrotatorns vänstra sida sett från förarposition sänks
Rotation <sup>1</sup>	Vänster	Nedre	Rullen dras åt höger = Tiltrotatorn roterar moturs.  Rullen dras åt vänster = Tiltrotatorn roterar medurs.	Inre	Rullen dras uppåt = Tiltrotatorn roterar moturs.  Rullen dras nedåt = Tiltrotatorn roterar medurs.
Grip/Sax <sup>1</sup>	Höger	Framsida alternativt Övre	Rullen dras åt höger = Grip/Sax öppnar.  Rullen dras åt vänster = Grip/Sax stänger.	Yttre	Rullen dras uppåt = Grip/Sax öppnar.  Rullen dras nedåt = Grip/Sax stänger.
Hjulstyrning <sup>2,3</sup>	Vänster	Framsida alternativt Övre	Rullen dras åt höger = Hjulen svänger höger.  Rullen dras åt vänster = Hjulen svänger vänster.	Yttre	Rullen dras uppåt = Hjulen svänger höger  Rullen dras nedåt = Hjulen svänger vänster.
Hjulstyrning	Höger	Fram/Back vippa	FNR (Front/Neutral/Reverse) vippa kan monteras endera på fram eller baksida beroende på handtagets utförande.  Vippan förs uppåt = Framåt, Vippan för neråt = Bakåt	Fram/Back vippa	FNR (Front/Neutral/Reverse) vippa kan monteras endera på fram eller baksida beroende på handtagets utförande.  Vippan förs uppåt = Framåt, Vippan för neråt = Bakåt
Bandstyrning <sup>2,3</sup>	Vänster	Framsida alternativt Övre	Rullen dras åt höger = Grävmaskinen svänger höger.  Rullen dras åt vänster = Grävmaskinen svänger vänster.	Yttre	Rullen dras uppåt = Grävmaskinen svänger höger.  Rullen dras nedåt = Grävmaskinen svänger vänster.
Bandstyrning <sup>1,3</sup>	Höger	Framsida alternativt Övre	Rullen dras åt höger = Grävmaskinen körs framåt.  Rullen dras åt vänster = Grävmaskinen körs bakåt.	Yttre	Rullen dras uppåt = Grävmaskinen körs framåt.  Rullen dras nedåt = Grävmaskinen körs bakåt.

<sup>1</sup> Om inkoppling av rulle görs så att ytterligare en funktion kan växlas in på aktuell rulle med hjälp av knapp skall inväxling ske med momentant återfjädrande knapp (s.k. "hold-to-run"), dvs inväxling är aktiv endast så länge inväxlingsknapp är intryckt. Om inväxling görs med knapp som ej är momentant återfjädrande (s.k. "press-to-enable/disable") skall visuell indikering finnas att rullen bytt funktion.

<sup>2</sup> Hjulstyrning med rulle i spak är oftast en metod för alternativ styrning som regleras i ISO5010/SS-EN12643. Inkoppling av rulle för hjulstyrning skall göras på sådant sätt att ytterligare funktioner ej kan växlas in på aktuell rulle. När hjulstyrning är aktiverad skall en visuell indikation finnas att funktionen är aktiv. Bandstyrning (höger/vänster) regleras inte i ISO5010/SS-EN12643 men bör kopplas in på samma sätt som hjulstyrning.

<sup>3</sup> Både hjul och bandstyrning skall inkopplas så att funktionerna skall vara urkopplade när grävmaskinen startas eller när grävmaskinens säkerhetsgrind fälls. Föraren skall göra ett aktivt val för att aktivera funktionen. När funktionen är aktiverad skall en visuell indikation finnas att funktionen är aktiv.

PICTURE 18. The Standardized controls set by the Swedish trade association for suppliers of mobile machines (Swedish Trade Association for Suppliers of Mobile Machines)

### 4.3 Outcome and Feedback

The outcome of the new process has been desirable for Swecon. The amount of delivered machines has risen and the delivery time has decreased. Before the new process came into effect it took on average around 60 days for a delivery to be completed. Now the delivery process takes on average 30 days from the delivery of the machine invoice from Volvo CE to Swecon billing a customer. If the machine is in stock, then the delivery time is calculated from the work order being created to Swecon billing a customer. As the process increases the delivery speed it has also managed to decrease the capital, in the form of machines standing in the yard, as the machines spend less time in Swecon's possession. Swecon has also noticed that it is important to create buffers regarding transportation when estimating the delivery time (Haraldsson P.E. 2016.)

The number of deliveries has risen steadily year on year since the accessorizing process was started in 2014. If accessorizing continues at the current pace, there will be an increase of 26,3 % for 2016 compared to 2015 and an increase of 36,5 % for 2017 compared to the estimated result for 2016. (Haraldsson P.E. 2016.)

It has also been noted that logistics and warehouse management is very important. In the past, sorting and finding the different accessories has used up a lot of the mechanics' time that could have been used for accessorizing the machinery. That is why a warehouse worker was hired to make sure that the flow of material works in the interest of the accessorizing process. It is also important to make sure the coordination between the employees and the different divisions work seamlessly. It is equally important that the salesmen and the employees who order the machinery and accessories are encouraged to have everything delivered to only one location. (Haraldsson P.E. 2016.)

Whilst implementing the process Swecon made sure the Sales division felt included in its implementation. This has led to the situation where the Sales division have been mostly happy with the changes made. The Sales division now understands that it's a tool for selling and helps them to focus on their core job and reduces the bureaucratic part of the workload. It also gives them clear profit margins which in turn helps them know their total provision. It is also important to remember, that the process starts with Sales and that Sales drives the process. Accessorizing is one small part of it. (Haraldsson P.E. 2016.)

It's important that all the accessorizing part ordering is centralized, so that if a salesman sells a machine, the ordering isn't performed individually, but rather that the accessories are ordered centrally by the Accessorizing department. This helps to make sure that the correct parts are ordered, as well as making sure that the parts are ordered to the correct location with the correct references. This saves time during the accessorizing process as there is no time lost trying to find the correct parts. (Haraldsson P.E. 2016.)

The efficiency of the work performed needs to be determined and constantly timed to make sure any savings in efficiency are then forwarded on to the company. As the mechanics gain a better rhythm and understanding of the process their work speed will increase. There is a risk that if efficiency is not timed at regular intervals the savings will be lost. It is also important that during the start-up of the process, all the accessorizing processes are timed to gain a baseline for the calculation of accessorizing times. (Haraldsson P.E. 2016.)

It is important to train the accessorizing mechanics differently to the mechanics in the service workshop. Service workshop mechanics work differently and thus require different skills. As stated previously, the mechanics work with tilt rotator systems, hydraulic systems as well as lubricant systems that demand extensive training. It's important to work with the tilt rotator manufacturers as well as the other manufacturers to ensure that the mechanics receive the correct training as well as the correct support. It's important that the mechanics continue to receive Volvo CE training in order for them to understand the machinery they work with. It is also important to make sure that the mechanics are trained to manufacture all the parts that it is possible to manufacture in-house. (Eriksson O. 2016; Haraldsson P.E. 2016.)

The tilt rotator manufacturers are important partners, and it's essential to work with them to make sure that all their documentation is correct and easily understandable. It is also important to make sure that when accessories are ordered, that both the tilt rotators and the steering systems are both from the same manufacturer. It is equally important to make sure that the manufacturers understand the importance of the correct documentation as well as the importance that the correct installation packages are shipped with the ordered items. Incorrect items or documentation can cause significant delays and as a result cost money. (Haraldsson P.E. 2016.)

Overall, the process works well, but there is also room for improvement. The things that need the most improvement have to do with obtaining customer feedback as well as what the operator really wants. Due to the supply chain and the process becoming very hierarchical it is difficult to provide the feedback to the accessorizing management so that it can be implemented into the process. In order to obtain more feedback a more direct channel to the customer needs to be made for the accessorizing management. (Eriksson O. 2016.)

Swecon also needs to develop its own Quality check form for the accessorizing process. Currently the only quality check form is Volvo CE's own PDI form. This form is only meant to check the machine's factory setup and not the local accessories. This can sometimes lead to the quality not being as good as it should be. (Eriksson O. 2016.)



## **5 THE NEW PROCESS**

The previous chapters have delved into the problems with regard to the current process at Volvo CE Finland, the tools that can be used create a new process as well as how Swecon has solved their difficulties with the accessorizing process.

Developing a new accessorizing process will always be a difficult and complicated process. There are a lot of factors that can affect how well it will succeed and this is why it requires an effective plan with clear objectives for the implementation stage.

The new process at Volvo CE Finland cannot be a cut and paste solution in regard to the Swecon's process, as the total number of machines sold by Volvo CE Finland is only a fraction of what is sold by Swecon. There is also the matter of the types of machines sold in Finland. Despite this, the Swecon process does give Volvo CE Finland a good basic model onto which to build its own process.

With that said the aim of a new accessorizing process is to shorten delivery times, save money as well as increase customer satisfaction with the accessorized machines. It is also important that the staff is happy with the results, and it is a system that they are happy to work with or work in.

Swecon's good planning and implementation of the new accessorizing process has helped them streamline the process and brought monetary savings. The staff at Swecon appear to be happy with the results and even the Sales division has been happy. The customers have also started to use Swecon's accessorizing packages. This is a good sign that they have designed and priced the packages so that they are attractive. These are results that Volvo CE Finland must try to emulate.

### **5.1 Organization**

It must be stated that in order to obtain the best results from the accessorizing process, a new division or sub-division needs to be setup inside of Volvo CE Finland. The new division must have its own workshop, or space in the current workshop that is only for their use.

There are three different models as to how the Accessorizing division or sub-division could be placed inside of Volvo CE Finland's current company structure.

The first model (figure 1) would be that Accessorizing is a sub-division of the Aftermarket division. As an Aftermarket sub-division, the changes that would need to happen inside of Volvo CE Finland would be small, as currently, Accessorizing is part of the Service sub-division. The Accessorizing division would need to have direct contact with the Sales division and would use the current warehouse for managing its inventory.

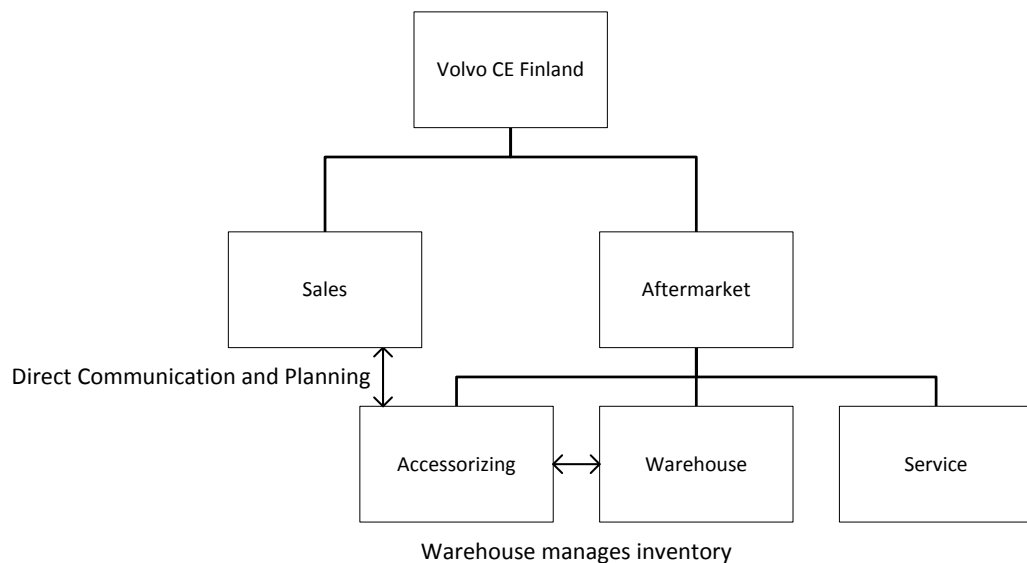


FIGURE 1. Division Model 1

The second model (figure 2) places Accessorizing as a sub-division of the Sales division. This would ease the communication between Accessorizing and Sales, but would cause barrier issues when it comes to maintaining discipline in the accessorizing process. Clear barriers would need to be erected in order to ensure that the process isn't interrupted by the demands of the salesmen or the customers. The Aftermarket warehouse would still be used for managing inventory, but this could also cause internal difficulties when it comes to expenses etc.

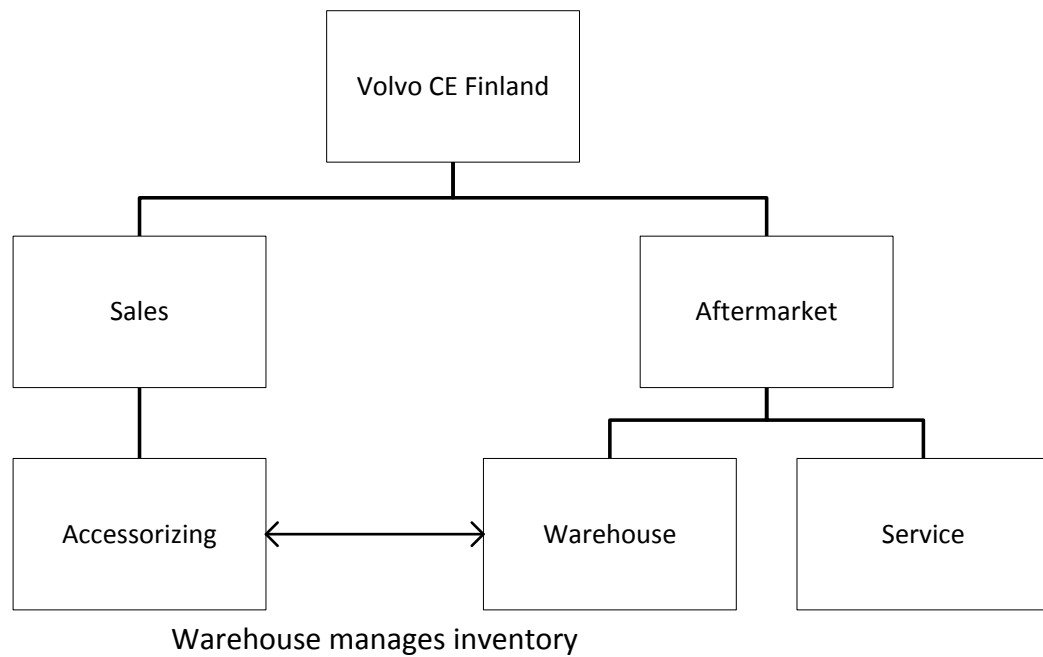


FIGURE 2. Division Model 2

The third model (figure 3) would create Accessorizing as its own independent division. The division would have direct contact with the Sales division and continue to use the warehouse to manage its inventory.

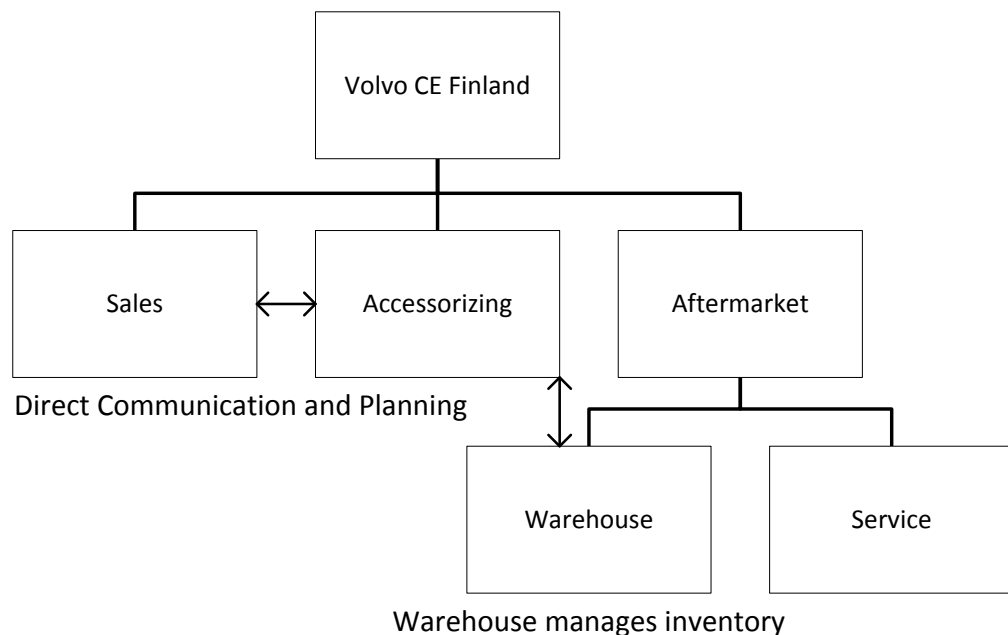


FIGURE 3. Division Model 3

Irrespective of whether Accessorizing is placed either as its own division or sub-division there are a few important facts to take into consideration. Firstly, Accessorizing needs to

work closely with Sales and the salesmen in order to ensure that the accessorizing process is a process that they can accept and that they can understand. The packages need to be designed together with the Sales division in order to ensure that they will be able to sell them to the customers. In order to achieve this, it is important to be in constant consultation with the Sales division during the implementation and planning phase of the new process.

This could be achieved by piloting the accessorizing process with a few of the salesmen who are more open to change e.g. the younger generation of salesmen. Once they are happy with the process and are able to see the benefits of the process it will be easier to demonstrate the advantages to the other salesmen.

The Accessories division is also required to have a certain degree of independence to allow the process to work and have as little interference as possible. The salesmen's and customer's access to the workshop should be restricted to allow the mechanics and supervisors to perform their work without disturbance. Any contact between Accessorizing and Sales, should be handled exclusively by the managers or by the work supervisors. If the customers wish to visit the workshop it should be performed and controlled under supervision of the supervisors, management or salesmen. This will ensure that any requests arising during the customer visits will be handled by personnel with the authority to make the required decisions.

The accessorizing workshop needs to be placed so that it is separated from the service workshop. The Accessorizing division either needs its own complete workshop or barriers need to be erected to create clear boundaries in order to restrict the movement of the service mechanics as well as any other staff or customers. This will also show that this is an area designated purely for the accessorizing of the machines.

A plan will need to be created as to which part of the service workshop will be handed over to the accessorizing process when it is implemented. The size of the accessorizing workshop is very important in regard to how many machines it will be possible to accessorize and to define how large a workforce can be hired in the Accessorizing division.

The best model would be similar to Swecon in the sense that the Accessorizing division shouldn't have any profit expectations, but that it shouldn't make a loss either. It should

be able to run and function with the money generated from accessorizing the machines. This way the accessories as well as the pricing of accessorizing process stays competitive when compared to Volvo CE Finland's competitors, and, the customers are able to see clear benefits of being able to choose accessorizing packages.

## 5.2 Staff

The staff structure of the new division will need to differ significantly from the Swecon model as well the current model used at Volvo CE Finland. A simple representation of the model which could be used is shown by Figure 4. Volvo CE Finland doesn't have the need for such a large organization as Swecon.

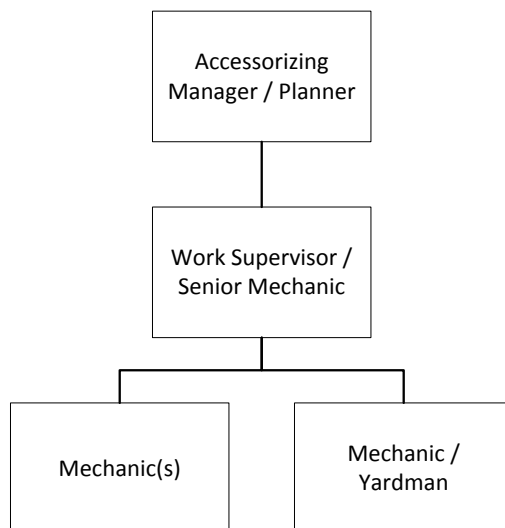


FIGURE 4. Staff Structure

There should be an accessorizing manager, a position that has many different tasks. One of the tasks would be the accessorizing planning. This means receiving the accessorizing orders from the Sales division and planning the accessorizing schedules as well as the delivery date for the completed accessorized machines. When receiving the orders from the salesmen, the accessorizing manager would also be responsible for ordering all of the required accessorizing parts. The accessorizing manager would also be required to plan and design the accessorizing packages together with the Sales division and to be in charge of the whole Accessorizing division.

The position of work supervisor would also be a multiple task position. The work supervisor position would entail the supervision of the mechanics as well as the yardman. This would also include the planning of their work schedules. The work supervisor would have the responsibility of making sure that the accessorizing parts are delivered, sorted and placed by the machines that are required to be accessorized. The work supervisor would report the ongoing accessorizing situation to the accessorizing manager. The work supervisor would be a senior mechanic responsible for helping the mechanics with difficult situations as well as assisting with the machines when possible.

The yardman position will be similar to the Swecon yardman position. The majority of the yardman's work would be as a mechanic and the yardman work would be performed only when necessary. The mechanics will only be responsible for the accessorizing of the machinery and keeping the workshop in an orderly state.

There will be no direct warehouse position and the plan would be to use the service warehouse workers. If this is found to be difficult, then a warehouse worker position should be considered.

The staff should also have their own specific training that differs from the training program given to the service mechanics. Training should place emphasis on the installation of accessories such as the tilt rotators, and should be planned together with the manufacturers. The accessorizing mechanics would still be required to attend the basic mechanic training, especially when considering new machines. The training would not need to be as in depth when compared to the service mechanics' training. Ergonomic work habits and process flow should be included in the training, as these two factors play a large part in increasing the efficiency of the process as a whole.

There must also be a plan to ensure that work motivation remains high and that the mechanics don't learn bad work habits. As the work differs significantly from the service mechanics' work, a different kind of mechanic can be hired. The mechanic will need to have strong language skills in either English or Swedish as many of the instruction manuals can only be found in these languages.

As with Swecon, it would be advisable to hire freshly graduated mechanics, who can then be properly trained, or people with assembly experience as they will be familiar with the

working process. It will be important to place emphasis on hiring mechanics that are highly motivated and are willing to learn.

The senior mechanic should be hired or transferred from the Service division. The senior mechanic must be an experienced mechanic and have significant working experience with the current accessories as the senior mechanic would then be able to guide and train the mechanics.

The mechanics also need to be trained to use equipment that can be used to manufacture custom brackets, fittings, hydraulic hosing etc. There could be situations in which there is no other choice but to make custom items, and it is essential that the mechanics are able to do this. Hydraulic and electrical know-how are also very important as they are a large part of the kind of work that the mechanics will need to perform.

### **5.3 Machinery**

Consideration needs to be given to the types of machinery that will be accessorized by Accessorizing division. Will the Accessorizing division accessorize all machinery that is sold, this will require a large amount of manpower and space inside of the service workshop, or should the Accessorizing division only handle the more difficult accessorizing cases such as excavators?

One solution could be that the Accessorizing division would accessorize the more manpower intensive accessorizing cases. If larger orders such as machinery that is delivered to rental companies and are only basic setups, then a subcontractor could be used to accessorize these cases. Wheel loaders, mini excavators and compactors that don't require complicated accessories could also be accessorized outside of the Accessorizing division.

The types of machines that Volvo CE Finland would like to accessorize will also help to define the type of tools and workshop machinery that will be required.

### **5.4 Packages**

As previously noted the packages would need to be planned closely with the Sales division. The packages need to be planned so that the customers would be interested in buying them, and the Sales division would have incentive to sell them. The best way of providing the salesmen incentive to sell the packages, would be to give them a small commission on every package that they sell. The best way to of providing incentive to customers to buy the packages would be to show the monetary savings, as well as significantly shortening the accessorizing time. It is also important that the quality of the completed product is better than the quality currently being produced. If customers wish for customized accessories the customised accessories need to be appropriately priced so as to cover all the associated expenses.

Quality needs to be ensured in the standardization. The most important aspect in assuring the quality of products leaving the workshop will be a new PDI form that includes checks to ensure that the accessorized parts are of good quality. This must be ensured during the process planning and implementation phase.

Volvo CE Finland will need to approach suppliers in order to secure bulk deals with certain products such as lights etc., and gain a price advantage. A list of approved brands needs to be made with emphasis on all the brands complying with the CE-criteria. In regard to brackets and other fittings that need to be custom made, it would be of great advantage to collaborate with Swecon in order to receive the plans and send them out for manufacture either in Finland or to use the same manufacturing location that Swecon uses.

There must be the possibility for customers to request any kind of accessories they wish, but the accessorizing should be priced so that it reflects the real price that it will cost for Volvo CE Finland to accessorize the machinery. The savings that the customers will achieve by being able to select accessorizing packages will most likely encourage the customers to choose them. Consideration must be placed on the type of accessories that customers are able to demand in the sense that if the customer demands products that are not CE-approved, should they be accessorized onto the machine.

For the tilt rotators, the basic setups should use the control standards that have been defined by the Swedish Association for Suppliers of Mobile Machines. This would simplify



the installation of the rotational tilts and always ensure that the installation can be performed according to the tilt rotator manuals.

## **5.5 Ordering**

The package selection and ordering process could be similar to Swecon's package selection, and have a webpage dedicated to this. The packages should be arranged by the type of machine and have a possibility to filter the information based on the model of the machine. The difference to Swecon's system should firstly be that it will be private and access only given to the salesmen. The salesmen would be able to choose the packages like in Swecon's system and add the selections directly to an accessorizing order list. The package pages will have pictures of where the accessories will be installed on the machinery as well as pictures and information of the installed accessories in order to provide the customers with a realistic picture of the completed work.

The webpage could be built on a simple e-commerce platform in order to minimize the work required to implement it. It should also be easy for Volvo CE Finland to add new accessory packages onto the page, without the need for additional development. The system will have to set standard prices for accessories. The prices should not be shown until the order has been made. There should be an option to save the incomplete package order so that it can be accessed at a later date.

Once the salesman decides to order he will be forwarded to an order form (picture 19), which will require the salesman to input all the customer and machine details. The salesman's details will be directly input from the login information. As the previous process had the problem of the machines serial numbers not being input into the work order, the serial number should be made a compulsory field and as such the orders can only be placed once the machine has been given a serial number from the factory.

## Tilauslomake

Myyjä 1

---

**Tilausnumero**

**Asiakas**

**Puhelinnumero**

**Yhteyshenkilö**

**Yhteyshenkilö Puh.**

**Malli**

**Valmistusnumero**

PICTURE 19. Order form

Once the order form has been submitted, three separate documents will be generated. An accessorizing order form (Appendix 1), a work order form (Appendix 2) and a pricelist (Appendix 3). The system would then forward the accessorizing order form and work order form directly to the accessorizing manager and the pricelist to the salesman. It would also provide an option to save and print these documents.

It would be good to develop a way of adding custom accessories to the order form. The custom accessories could be inputted into text boxes which would then fill in the correct parts of the premade work order forms. The custom accessories would be required to be typed in using standardized names and the prices would be provided to the salesman after the accessorizing manager has received the order and calculated the prices.

Once the accessorizing manager receives the documents he will then either approve or reject the order, with the reasons for rejection by emailing the answer to the salesman. This way there is confirmation that the order is confirmed and if the salesman receives no

confirmation he can then contact the accessorizing manager directly. Using this system would make it possible to remove the local accessories from the purchase orders.

## **5.6 Work Process**

Once the order has been placed, a delivery date estimation needs to be made. The estimation could be made based on how long it will take once the machine has been delivered to Volvo CE Finland.

In order to estimate the time required to work on the machines, dry runs need to be made to time the process. Once the work time for an accessorizing process is determined then it is possible to price the packages based on the work time and accessory prices. It will be important to time the different accessorizing processes at certain intervals in order to be able to reliably price the accessorizing prices.

The scheduling of the mechanic's work will be handled by the Work Supervisor and could either be handled using the current system in IMDS or by manually scheduling using excel or something similar. The schedules could then be placed on a notice wall similar to the one shown in picture 20.



PICTURE 20. Swecon's notice wall

Currently the mechanics at the service workshop use a tablet system for receiving work orders as well as their schedules. The use of tablets for scheduling could be continued, but work orders could also be printed and placed on a work order wall (picture 16). This would allow for the mechanics to make notes on the work orders as well as provide the supervisors and managers with a clear picture as to what machines are currently being accessorized and how far they are in the process.

## 5.7 Quality Control

Quality is important to Volvo CE and its customers and this is why emphasis should be placed on making sure that the accessorizing process has an emphasis on quality.

When the process is designed it will be important to use quality management methods in order create a process that has checks and balances for quality. Using the Lean Six Sigma method should provide a good framework for a quality driven process. The accessorizing

process also needs to be designed so that it fits into the requirements of the ISO 9001 Standard.

The Quality Management Handbook needs to be modified so that accessorizing has its own chapter. This will provide the baseline for how the process should work and the procedures that need to be followed. The Quality Standards should be defined in the Quality Management Handbook.

Documentation needs to be created for as much of the new process as possible. The documentation should provide clear directions to the mechanics and employees as to how the different accessorizing process should work. The documentation should also provide clear directions to the supervisors and management as to how certain procedures should be performed. It is more cost effective to keep the quality high throughout the process than to have to fix quality issues once the product has been accessorized.

The best way of ensuring that accessorized machinery that doesn't meet the quality standards aren't delivered to customers is to use the PDI Sheet. Volvo CE has its own PDI sheet, but this is purely meant for machines that haven't been accessorized. An accessorizing PDI sheet that primarily focuses on checking the accessories that have been installed will need to be created. It will also need to include the inspection of the work quality of the installation.

Customer feedback is an important way of gathering information from the customers. Customer feedback is important in making improvements to the process that will increase customer satisfaction. Feedback should be collected from a customer after a sufficient amount of time after the delivery of the machinery has passed. This will have allowed the customer and operator enough time to form an opinion about the machinery and its accessories. This responsibility could either fall on the Accessorizing division or the Sales division that has formed the customer relationship.

During the implementation of the new process it is important that everything is standardized. All the processes require clear documentation and directions. Every person involved in the accessorizing process needs to be aware of the requirements as well as the processes they must use in order to do something or get something done. If the process doesn't include proper standardization, there is the risk that the process will start to revert back

to the previous ways of doing things. Standardization is key for keeping the quality as good as possible.

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## APPENDICES

## Appendix 1. Accessorizing Order Form



Volvo Construction Equipment Finland Oy

Varustelutilaus

**Tilaaja:** Myyjä 1  
**Asiakas:** Asiakas 1  
**Yhteyshenkilö:** Matti Meikäläinen  
**Malli:** Volvo L120

**Tilausnumero:** 12345678  
**Puhelinnumero:** +358 33 333 3333  
**Yhteyshenkilö Puh.:** +358 44 444 4444  
**Valmistusnumero:** 345677543

Varuste	Määrä	Varustelupaketin Tilausnumero	Valmistajan Tilausnumero
Pyöräkuormaajan Valopaketti 1	1	3242356	3242356
Pyöräkuormaajan Peruutuskamera	1	2143556	2143556
Radiopuhelin	1	RX2143556	RX2143556
Palosammutin	1	YL564654	YL564654

## Appendix 2. Work Order Form



Volvo Construction Equipment Finland Oy

Työmääräys

Tilaaja: Myyjä 1

Asiakas: Asiakas 1

Yhteyshenkilö: Matti Meikäläinen

Malli: Volvo L120

Tilausnumero: 12345678

Puhelinnumero: +358 33 333 3333

Yhteyshenkilö Puh.: +358 44 444 4444

Valmistusnumero: 345677543

Varuste	Tilaus- numero	Varuste- vastaanotettu	Varustelun asentaminen aloitettu	Varustelun asentaminen suoritettu
Pyöräkuormaajan Valopaketti 1	3242356			
Pyöräkuormaajan Peruutuskamera	2143556			
Radiopuhelin	RX2143556			
Palosammutin	YL564654			

Asentaja: \_\_\_\_\_

Työ Aloitettu: \_\_\_\_\_

Työ Valmis: \_\_\_\_\_

Volvo Construction Equipment Finland Oy  
 Kärkikuja 2  
 01740 Vantaa  
 Finland

## Appendix 3. Pricelist



Volvo Construction Equipment Finland Oy

Tarjous

Tilaaja: Myyjä 1

Asiakas: Asiakas 1

Yhteyshenkilö: Matti Meikäläinen

Malli: Volvo L120

Tilausnumero: 12345678

Puhelinnumero: +358 33 333 3333

Yhteyshenkilö Puh.: +358 44 444 4444

Valmistusnumero: 345677543

Varuste	Määrä	Hinta (0% ALV)	Hinta (24% ALV)
Pyöräkuormaajan Valopaketti 1	1		
Pyöräkuormaajan Peruutuskamera	1		
Radiopuhelin	1		
Palosammutin	1		
<b>Kokonaishinta</b>			

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 Kärkikuja 2  
 01740 Vantaa  
 Finland