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ASSESSMENT OF PURCHASING MATURITY IN SPARE PARTS SUPPLY CHAIN

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1 INTRODUCTION

1.1 Background

The importance of purchasing to an organization cannot be overstated. Traditionally purchasing has been seen as an area of the business that manages the inputs into the organization. Good purchasing practice would back in the days generally refer as buying the correct goods and services for the organization at the right quantity, right quality and on time. (Cousins, Lamming, Lawson & Squire 2008, 7.). Due to the increase in global competition during the past few decades, companies have been forced to think also their purchasing processes with more broadened outlook. As a consequence, the strategic importance of purchasing has got growing attention over the years and it has been argued that purchasing must ultimately become supply management (Kraljic 1983).

To describe the change of purchasing moving from administrative to strategic function, academics have put forward maturity models, which help practitioners to compare their purchasing activities to industry top performers and best practices. These maturity models have been found particularly useful in describing the possible direction for future change (Rozemeijer 2008, 206). The level of purchasing professionalism has also a strong influence to the after-sales business, which has become a major source of revenue and profit for many manufacturing firms (Wagner, Jönke & Eisingerich 2012). Ensuring the spare parts supply efficiently for the whole product life cycle is an important managerial task as many customers are nowadays following the total cost of ownership principles.

However, managing the after-sales supply efficiently is difficult and it has many characteristics which differentiate it from managing material flows for production. For example, every new primary product adds up to the spare parts portfolio and makes the managing of the spare parts difficult from the whole supply chain point of view, because the obligation for delivering spares still exists after the actual production of the primary product has ended (Wagner et al. 2012, 82). Also the demand planning for spares is often difficult as the demand for spares may be extremely sporadic and hard to forecast (Boylan, Syntetos & Karakostas 2008, 473). Moreover, service requirements are usually higher for spare parts as the effects of stock outs are in many occasions financially remarkable (Bacchetti & Saccani 2012, 722). On the other hand, stock obsolescence is also a significant issue in spare parts management (Kennedy, Patterson, Lawrence & Fredendall 2002, 202). These characteristics, among others, bring many challenges to the planning of spare parts supply chain, where purchasing has an important role in the overall performance of the supply chain.

1.2 Research problem and sub-problems

This research is done as a case study for a large multinational industrial firm specialized in heavy machinery. Furthermore, the research subject of this study is the European Distribution Services Area (DSA) organization in the Customer Services –division. The European DSA is responsible for spare parts distribution services in Europe, which include procurement, sourcing, inventory management, warehouse operations and logistics functions. Purchasing activities in the organization, referred to as case organization from now on, are divided into operational procurement and strategic sourcing. The goal of this study is to assess the current development stage of the case organization's purchasing practices with a purchasing profile developed by Schiele (2007) and modified by the researcher. Other goal is to find out what are the most important areas that the case organization should focus on to further develop the performance of the purchasing practices in the spare parts supply chain. Thus, the research questions of this study are: **What is current stage of development in the case organization?** and **How could the case organization further improve performance in the spare parts management?** Spare parts purchasing includes some special characteristics and this study aims to find out also: **How applicable is the Schiele's purchasing maturity assessment tool in the spare parts and after-sales context?**

1.3 Main concepts

Terms and concepts are important to define exactly, especially in a young field of science such as operations management, where many concepts and terms have not yet reached universal and unambiguous meaning. For example purchasing is very easy to interpret differently depending on the background of the reader and even academics tend to have varying meanings for the concept.

The following terms are in the core of this study. Spare part is the most concrete and therefore most easily definable word, even though it can also be understood in many ways (Fortuin & Martin 1999). The other main concepts, purchasing, purchasing maturity model and best practice are more abstract in nature, and therefore more difficult to define exactly.

1.3.1 Spare part

An important means to keep customers satisfied is quick repair of a product or system that has failed. Parts that are needed to retain a machine or system to its nominal condi-

tion are usually called spare parts or service parts (Botter & Fortuin 2000, 656). For spare parts (name used throughout this research), three control situations have been distinguished (Fortuin & Martin 1999): 1) spare parts to maintain the company's own facilities and systems, 2) spare parts to service professional systems installed at customer sites and 3) spare parts to repair consumer products.

This study is addressing to the second control situation. The focus is on spare parts supply chain serving the needs of mining equipment on customer sites.

1.3.2 Procurement, sourcing and purchasing

Procurement in this study refers to operational purchasing activities. These include activities such as releasing purchase orders, monitoring supplier performance and managing in general the daily order fulfillment process.

Sourcing refers here to the broadened scope of supply management and it includes areas such as formation of supplier structures and the development of supplier capabilities, among others. Sourcing also includes the efforts of creating new opportunities in terms of process and product innovation. Sourcing is in general more strategically oriented than operative procurement. (Axelsson, Rozemeijer & Wynstra 2005, 16.)

Purchasing is used in this study as a general term to cover both sourcing and procurement in cases when it is not necessary or appropriate to differentiate between the two.

1.3.3 Purchasing maturity model

The principal idea of a maturity model is that it describes in a few phrases the typical behavior exhibited by a firm at a number of levels of maturity, for each of several aspects of the area under study. A maturity model aims to guide companies in benchmarking the maturity of their operations relative to industry best practice. (Netfald & Alfnes 2011, 67.) Maturity models can be also described as road maps for implementing practices in an organization (Niemi, Huiskonen & Kärkkäinen 2009, 162).

In purchasing, individual business units, corporations or even industries will be characterized by certain mixture of purchasing roles or a dominance of particular objectives, at any given point in time. Often, such characterizations have been referred to as stages or phases, reflecting the notion that they follow a certain logical sequence. (Axelsson et al. 2005, 18.)

These characterizations are captured in a purchasing maturity model, which is describing several stages which organizations are expected to go through in order to de-

velop and perform better. Different stages are associated with different kinds of issues, and in order to climb to a more advanced level, organization must first tackle down the issues on the lower levels. (Schiele 2007.) Thus, purchasing maturity models are based on an assumption of purchasing activities developing rather in small evolutionary than revolutionary steps (Lockamy & McCormack 2004).

1.3.4 Best practice

Practice refers to an established process which an organization has put in place to improve the way it runs its business. The scope ranges from organizational aspects such as teamwork and employee involvement to the use of special techniques such as *lean* or *just-in-time*. (Netland & Alfes 2011, 70.)

Best practice stems from the Western effort of identifying and describing the practices which made the Japanese companies so successful (Laugen, Acur, Boer & Frick 2005), and it has been found out, that enterprises with implemented best practices usually perform better than those without (Voss 1995). This underlying assumption of best practices is also apparent in the maturity model used for purchasing maturity assessment in this study.

2 CHARACTERISTICS OF SPARE PARTS SUPPLY CHAIN

After-sales activities are acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing firms (Wagner et al. 2012, 69). During the product life-cycle, after-sales services (including maintenance and spare parts sales) may generate more than three times the turnover of the original purchase. In addition, returning customers are the most profitable ones as they require less marketing effort and relationship building. Hence, after-sales service acquires a critical role as a mean to achieve customer satisfaction and retention. (Saccani, Johansson & Perona 2007, 52-53.)

The performance of the spare parts supply chain is usually in line with the way the company sees the after-sales business (Wagner et al. 2012). Traditionally, after-sales function has been seen only as a cost generator and as a “necessary evil” (Lele, 1997). But the change is in favor of a view that considers after-sales as a source of competitive advantage and business opportunity. As a consequence, the strategic management of the after-sales business should acquire a major role in manufacturing firms. (Saccani et al. 2007, 52.)

If a company wishes to develop the after-sales business, the two key goals could be better financial performance and higher customer satisfaction. These could be achieved by focusing issues such as: improvement of supplier performance, speeding up delivery by the logistics organization, improvement of the stocking strategy and better contract support. It should, however, be noticed that to achieve these goals in practice, none of the issues cannot be dealt in isolation. (Botter & Fortuin 2000, 659-661.) In general, improving the performance of the whole spare parts supply chain requires a system perspective, meaning that the performance of the whole chain should be optimized, not merely a part of it (e.g. Paakki, Huisken & Pirttilä 2011; Bacchetti & Saccani 2012).

The purpose of this chapter is to first introduce relevant aspects of the strategic choices relating to spare parts during the primary product life cycle. The second part of this chapter is interested in the management of the spare parts flow after the demand for spares already exists. Finally, due to the nature of this study, purchasing’s contribution to the after-sales development is discussed.

2.1 Link between primary product and spare parts

Primary product parts are the templates for spare parts and later adjustments or modifications of spares that diverge from the design and specification of primary product parts are costly and difficult to execute. Specific aspects of spare parts, and their provision, should be taken in as early as possible to the primary product development, because

strategies available to spare parts managers are predetermined by the primary product design. For example, a final stock of high value spare parts leads to capital lock up for long periods of time. This could be avoided by choosing a different supply option or by constructing a low cost primary product part. (Wagner et al. 2012, 81.)

2.1.1 Primary product life cycle

Primary product life cycle can be described in three phases: R&D, production and utilization and most of the life cycle costs (60-95 %) are determined by the product development phase (Wagner et al. 2012, 82). Therefore, the specific requirements of spares should be considered at the beginning of R&D phase, where the characteristics of the primary products are specified, and which irreversibly influences the after-sales services (Inderfurth & Mukherjee 2008, 18). With standard parts, more options to meet the demand efficiently after the production phase exists, but with the user specific parts, options are scarce, and therefore companies should in the long run try to standardize parts as much as possible to improve spare parts management (Huiskonen 2011, 132).

A life cycle view helps to improve the delivery service while decreasing the cost of spare parts logistics, because the demand patterns for spare parts can be analyzed to some extent by focusing on wearing parts and to the parts that are assumed to last for a product life time (Wagner et al. 2012, 83).

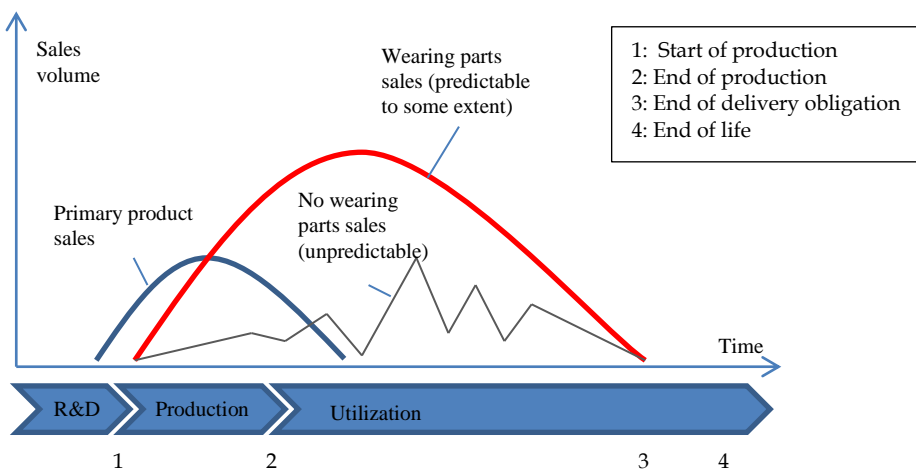


Figure 1 Product life cycle model for spare parts (adopted from Wagner et al. 2012)

Figure 1 demonstrates a typical example of the volume of spares demand during the product life cycle. The demand for spares starts after sales for primary products have been going for a while and continues long after the production and sales of the actual product has stopped. Demand patterns for wearing parts can be forecasted to some extent, but parts that are assumed to last for product life-cycle (no wearing parts) are more difficult to forecast, because part failures are more random. (Wagner et al. 2012, 83.)

This categorization is helpful to roughly group the parts for overall strategy development for different life cycle phases, but more detailed categorization is usually needed for stock control and demand forecasting (Bacchetti & Sacconi 2012). Firms that attempt to form long service contracts with customers generally should be interested in the life cycle of the primary product, because after the production of primary product has ended, a firm is still obligated to supply spares for the customer. Hence, considering demand for spare parts in each life cycle phase is an important managerial aspect in order to meet the demand for spare parts efficiently throughout the product life cycle. (Wagner et al. 2012, 83.)

Furthermore, the spare parts logistics distribution chain should be aligned with the primary product characteristics (Wagner et al. 2012, 80). Primary products have varying requirements for spares provision, delivery time and the quantity of spares demand, and the better the manufacturer's knowledge of the primary products sold, the better the spare parts logistics performance, because the installed base information of e.g. contract type and life cycle phase can be exploited for example in planning the stocking strategies for different spare parts (Dekker, Pince, Zuidwijk & Jalil 2011, 5).

2.1.2 Supply options for spare parts

There are several options for firms to supply spare parts for customers during the product life cycle. Supply options in the production phase are taking spares out of regular production, buying spares externally or reconditioning used parts (Figure 2; Wagner et al. 2012, 81). The start of the production phase is characterized by uncertainty and forecast difficulties, because no prior experience of the required spares over time exists (Dekker et al. 2011, 3). Still, spares demand can be met relatively easily, because the parts can be taken from the regular series production. When the series production has been ongoing for a while, experience has accumulated on the spares demand in the past and spares can be picked out of the regular production or purchased easily from the primary product suppliers. Companies usually prefer the same suppliers for a primary product part and spare if possible (Wagner 2012, 81.)

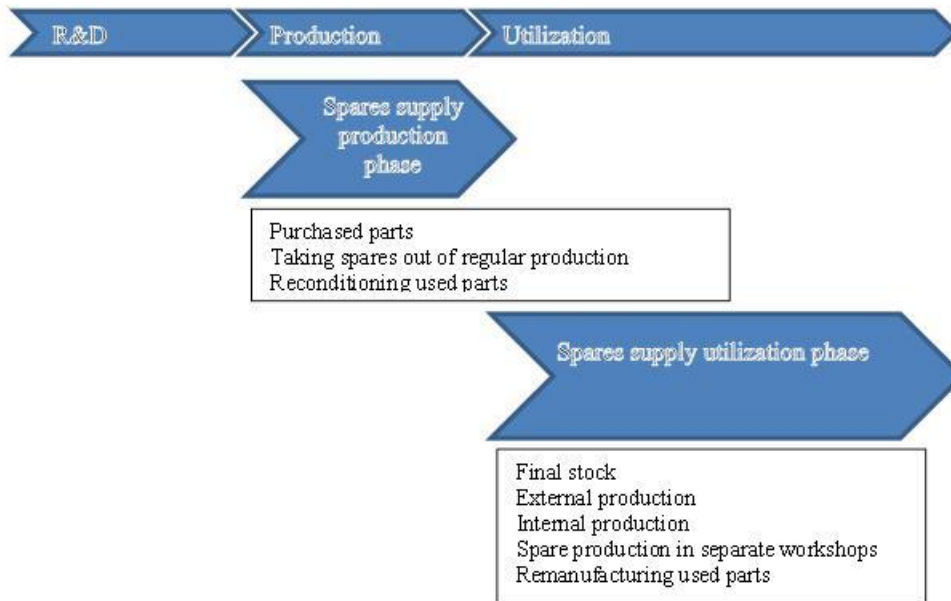


Figure 2 Supply options for spare parts (adopted from Wagner et al. 2012)

The planning of spares supply after the production has ended is the most challenging part of the product life cycle, because the supply of spares has to be ensured over long period of time, but the parts cannot be picked out of the regular series production anymore. At the utilization phase, spares supply can be ensured with five different supply alternatives: building a final stock, internal production, external production, separate work shop production and remanufacturing of used parts. (Wagner et al. 2012, 82.) Each of the options of sourcing spare parts in the utilization phase is associated with some benefits and problems (table 1). The problem of spare parts acquisition after the actual production of the primary product may be solved through an effective acquisition planning from the sources in table 1 (Inderfurth and Mukherjee 2008, 21).

Table 1 Benefits and problems of supply options for spare parts in the post-production life-cycle (based on Inderfurth & Mukherjee 2008)

Supply option	Benefits	Problems
Final stock	Low cost of manufacturing	High level of uncertainty on the future demand
Internal production External production Separate workshop	Relatively low uncertainty	High cost of manufacturing/ purchasing
Remanufacturing	Moderate cost of production, moderate uncertainty	Quantity and quality of returns, difficult to implement

Final stock: This refers to production of additional spare parts at the time of manufacturing the last lot of production at the end of primary product production and it is characterized by following (Inderfurth & Mukherjee 2008, 21):

- Very low cost of manufacturing the spare parts. This is primarily because the manufacturing of spare parts takes place with same facilities meant for large scale manufacturing of the product. Additionally, no extra fixed cost is required.
- High level of uncertainty on the future demand of spare parts essentially because: the lack of knowledge of demand pattern of spare parts after the end of primary product production and incorporation of very long futuristic forecast during manufacturing planning of spare parts.

Internal production, External production, separate workshop: This refers to the option of manufacturing or procurement of additional spare parts after the end of primary product production. The important features are (Inderfurth & Mukherjee 2008, 21):

- Very high cost of manufacturing. Production through additional setups with small lots makes it a costly option due to the substantial amount of fixed costs, which leads to considerably high unit cost caused by a loss in economies of scale. If the firm lacks the production capabilities, demands for additional spare parts will be met by procuring them from suppliers at a high cost.
- Relatively low uncertainty. As the production planning is made based on short term forecasts, the magnitude of uncertainty is expected to be relatively low.

Remanufacturing used parts. This option is possible in the situations where equipment manufacturer has the possibility to receive returns of used parts. Remanufacturing is seen as a supplement to the final lot and this option has the following characteristics (Inderfurth & Mukherjee 2008, 21-22):

- Moderate cost of production through remanufacturing. Remanufacturing cost is cheaper than cost of extra production and usually more expensive than producing with the final lot, given that adequate remanufacturing facilities are available. This option may be restricted of the limited amount of available returns
- The remanufacturing process is typically affected by the uncertainty in timing, quantity and quality of returns.

2.1.3 Maintenance strategy of the customer and spare parts obligations

Maintenance consists of the procedures for the retention and regeneration of a nominal condition of machines as well as the determination and evaluation of the actual condition of the systems. Maintenance strategies determine decisions regarding to the process and kind of maintenance techniques used to achieve particular goals, which can be such

as machine reliability or cost minimization. Maintenance techniques are such as preventive maintenance, condition-based maintenance and predictive maintenance. (Garg & Deshmukh 2006, 216-218.) The selected maintenance strategy directly influences the total demand for spare parts and companies should try to manage long-term service contracts, including preventive maintenance, because if customers simply follow reactive maintenance strategy or no strategy at all, the demand for spares is difficult to forecast and manage (Wagner et al. 2012, 81).

The spare parts obligations influence considerably the appropriate supply and inventory options. Spare parts obligations can be categorized to legal obligations, triggered by the customers' rights in event of defect, and voluntary obligations, which are triggered by contractual agreements or warranty obligations. The spares provision beyond legal obligations is mainly done to differentiate own spares provision from the one that competitors offer to generate strong customer loyalty and acquire new customers. The down sides of offering long-term spares provision is that each new primary product adds up the spares portfolio and increases the amount of spare parts obligations, which again makes the spare parts management more difficult. (Wagner et al. 2012, 82.) In other words, management should have a clear view of how the length and type of the contract affect to the logistics system.

2.2 Integrated view to spare parts management

It is well known that spare parts management is difficult, because the parts can be expensive, their demand highly erratic and intermittent, yet their shortage costs can be very high. Moreover, spare parts typically carry high obsolescence risk due to their specific functionalities. Therefore, companies have often difficulties in striking the right balance between inventory holding, stock-out and obsolescence costs while offering competitive service contracts. (Dekker, Pince, Zuidwijk & Jalil 2011, 1.) In practice, spare parts inventories are often managed by applying general inventory management principles, and not enough attention is paid to control characteristics specific to spare parts only (Huiskonen 2001, 125).

Recent literature highlights that spare parts management should focus on systemic perspective (e.g. Paakki et al. 2011; Saccani et al. 2007), meaning that decisions made on aspects affecting the spare parts management should be done from the whole supply chain point of view. It is argued, that the adoption of an integrated view (Figure 3) is one of the main aspects affecting the overall effectiveness of spare parts management in companies (Bacchetti & Saccani 2012, 733).

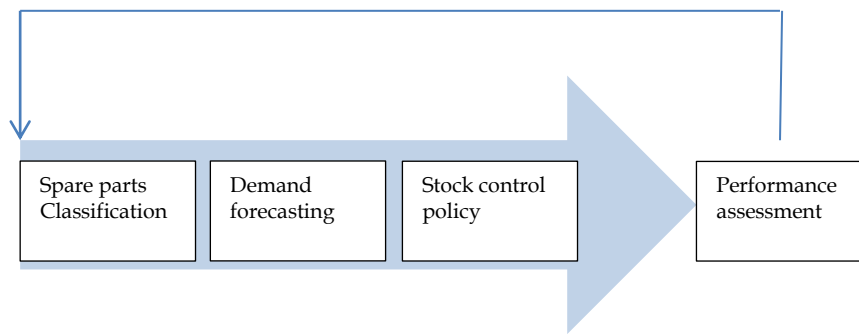


Figure 3 An integrated approach to spare parts management (adopted from Bacchetti & Saccani 2012, 733)

The integrated view (figure 3) stresses the relation between the steps of spare parts classification, demand forecasting and inventory management and the subsequent performance measurement. The key is to understand in a systemic way the need for differentiated approach, where different kinds of parts (according to the classification step) are treated with different demand forecasting and inventory management techniques. Classification means grouping spare parts according to their control characteristics. Demand forecasting refers to anticipating future developments on the demand side. Stock control policy here refers to the employed stock control policy (such as continuous review or order up to level). Finally, the performance assessment and measurement is important in controlling the spare parts with the right indicators and helping the parties in the supply chain to go to the same direction. (Bacchetti & Saccani 2012, 733.)

2.2.1 Unique aspects of spare parts inventories

Spare parts inventories have many characteristics that make them different from the work in process (WIP) or finished product inventories. Kennedy, Patterson, Lawrence and Fredendall (2002, 202) have distinguished the following unique aspects of spare parts inventories which have to take into account when managing spare parts:

- Maintenance policies, rather than customer usage, dictate the need for spare parts inventories. For example, part can be replaced or repaired in case of defect.
- Reliability information is usually not available to the degree needed for prediction of failure times, particularly in the case of new equipment.

- Part failures are often dependent, and this creates a problem, particularly if the dependency relation is not known.
- Demands for spare parts are sometimes met through cannibalism of other parts or units.
- Obsolescence may be a problem as the machines for which the spare parts were designed become obsolete and are replaced. It is difficult to determine how many parts for an obsolescent machine to stock, and it may be difficult to replace part that no one keeps in stock.
- Components of equipment are more likely to be stocked than complete units, if the major unit of equipment is expensive.

2.2.2 Spare parts classification

Improving the spare parts management starts from sufficient part categorization. Many authors highlight the importance of good classification of spare parts in order to improve the distribution chain performance (Bacchetti & Saccani 2012; Paakki et al. 2011; Huiskonen 2001; Syntetos, Keyes & Babai 2009). Various classification criteria such as, part cost, part criticality, supply uncertainty, demand volume, life-cycle phase and specificity have been presented in literature and used in practice (Bacchetti & Saccani 2012).

One can also distinguish between quantitative and qualitative spares classification techniques. The most common technique used in practice is probably the quantitative ABC-analysis (Bacchetti & Saccani 2012). The technique is based on the 80/20 Pareto principle, it is easy to implement, and serves well the inventory management of materials that are fairly homogenous in nature and differ from each other mainly by unit price and demand volume. However, ABC-analysis is usually carried out one-dimensionally and it does not discriminate all the control requirements of different types of items, which is vital especially in the case of spare parts. (Huiskonen 2001, 126).

Qualitative techniques, such as the VED analysis, based on the consultation with experts, try to assess the importance of keeping spare parts in stock, based on information on the specific usages of spares and on factors influencing their management (costs, downtime etc.) (Mukhopadhyay, Pathak & Guddu 2003). VED analysis is a simplified version from the AHP method and the principle idea is to categorize parts to: 1) Vital parts (items that cause high losses due to non-availability of equipment, in case they are needed while not in stock) 2) Essential parts (items that cause moderate losses due to non-availability of equipment, in case they are needed while not in stock) 3) Desirable parts (items that cause minor disruptions, in case they are needed while not in stock). Despite its apparent simplicity, structuring VED analysis might be a difficult task, as its

accomplishment may suffer from subjective judgments of the users (Cavalieri et al. 2008, 384).

Bacchetti & Saccani (2012) found out that most of the firms prefer mono-criterion classification, meaning that only one categorization criterion is used for demand forecasting and stock control. However, for example Huiskonen (2001, 128) points out, that companies should select few most relevant classification criteria for spare parts, and analyze their effects on the logistics system.

Literature has put forward many multi-criteria classification schemes as a management tools to improve spare parts management performance. One example of two dimensional multi criteria classification analysis is the one done by Paakki et al. (2011). They categorized in their case study in an industrial firm parts based on their supply characteristics and demand characteristics and created a two dimensional matrix, so that management could easily see the performance of the distribution chain in various part groups based on the key performance indicators (KPI's) of service performance and stock-out costs. Supply categorization was based on the availability of spare parts: commercial parts, industry specific parts and key parts were distinguished. Demand categorization was based on material price and demand variance as they were identified as the most critical aspects. (Paakki et al. 2011.)

Another example of part categorization case study is the one of Botter and Fortuin (2002). They first used the ABC analysis to identify how many percent of the spare parts assortment account for 90 % of the service level. After they had identified the critical group, where most focus should be put on, they used the VED method to categorize the critical group. After the VED categorization analysis had been done, they linked the two groups to the SIC (sales intensity classification) inventory control classification. After this, appropriate stocking strategy were defined for each group, and for example fast moving high critical item was categorized as VW (vital and fast moving). Criticality is the ruling criterion above, but it could be some other criteria as well, depending on the situation. (Botter & Fortuin 2002.)

In conclusion, spare parts can be categorized and analyzed in many ways. Even though every situation in practice is unique and companies have different starting points (such as the desire to reduce stock out costs or improve service level), frameworks and methods presented in literature have been found useful in business as well (Paakki et al. 2011; Botter & Fortuin 2002). However, there are often obstacles related to the practical applicability of the classification methods and techniques, and the limitations are important to understand. These can be such as data availability, implementation algorithms, classification update regarding to useful classification factors and the role of judgment (Syntetos et al. 2009; 167; Huiskonen 2001, 126; Boylan et al. 2008, 475).

2.2.3 Spare parts demand forecasting

In the machine industry, the spare parts business of manufacturers is subject to fluctuations and uncertainty, because the forecasts of demands are affected by stochastic factors. Fast moving spare parts may not require ad hoc forecasting methods, but a large share of spare parts are slow moving and characterized by intermittent, erratic or lumpy demand requesting for special attention (table 2). (Boylan et al. 2008, 474.)

Table 2 Irregular demand familiar to spare parts (adopted from Boylan et al. 2008)

Type of demand	Definition
Slow moving	Item whose average demand per period is low. This may be due to infrequent demand occurrences, low average demand sizes or both.
Intermittent	Item with infrequent demand occurrences.
Lumpy	An intermittent item for which demand, when it occurs, is highly variable.
Erratic	Item whose demand size is highly variable.

The irregular demand patterns familiar to spare parts (table 2) can be categorized to slow moving, intermittent, lumpy and erratic items (Boylan et al. 2008, 474). Researchers have proposed many advanced techniques and methods to forecast demand for spare parts, such as modified time series methods and Croston's method (Johnston and Boylan 1996; Syntetos and Boylan 2001; Snyder 2002), and some of the studies propose selection criteria for the alignment of particular method and the corresponding control characteristics. For example, Syntetos and Boylan (2005) associate methods to items according to demand-based classification: Croston's forecasting method (or its variants) should be used for intermittent, erratic or lumpy items and exponential smoothing method to smooth items (predictable demand pattern). Also bootstrapping method has been found to perform better than traditional time series, especially in cases where short data history limit the reliability of the time series methods (Gardner and Koehler 2005, 618).

One applied solution to improve the forecasting accuracy of spare parts, with irregular demand patterns in particular, is the *installed base forecasting*. The main idea of this method is to use all available information of the installed base of products (life cycle phase, operating conditions, geographical operating area, service contract type etc.) and combine it with the historical data to improve forecasts. Installed base forecasting is kind of causal forecasting, in the sense that the forecast is not only made based on the historic demand data, but also on data about installed base aspects that trigger demand.

In general, there are various economic benefits of managing the installed base information and using it to enhance the reliability of spare parts forecasts, such as reducing inventory and obsolescence costs. It is particularly useful in managing expensive slow moving spare parts for which it is very difficult to balance stock-out risk with obsolescence risk. (Dekker et al. 2011, 2-3.)

In addition, companies can in some occasions reduce the demand variance of spare parts by focusing on the customer's ordering behavior (Paakki et al. 2011, 167). If large customers constantly employ certain kind of refilling policy, such as EOQ, the patterns can be detected and exploited. After-sales services have also often internal and external customers and it is usually easier to have an effect to internal customer's behavior than to external ones. (Paakki et al. 2011, 167.)

In conclusion, despite many contributions in literature, there is still no conclusive and practitioner-oriented indication on which is "the best" forecasting method for spare parts (Bacchetti & Saccani 2012, 727). However, there are many examples and implications that by systematically aligning forecasting methods based on the demand characteristics and also being proactive in anticipating future developments (installed base exploiting, analyzing customer ordering behavior), substantial cost savings and performance improvements can be obtained.

2.2.4 Stock control policy

Spare parts stock control policies and inventory management should be aligned with the employed classification and demand forecasting practices. Since the amount of inventories due to slow moving parts is generally important, even small improvements in the management of those parts may be translated into substantial cost savings. (Bacchetti & Saccani 2012, 727).

In practice this means, for example, that the demand side stock control parameters, such as the ROP (re-order-point), should be analyzed and set up accordingly to each item class, so that each class corresponds to the relevant performance indicator (e.g. desired service level or stock-out risk). On the supply side, suppliers' lead times are often under control. When analyzing the supplier performance and setting up parameters, it is important to understand if a company is itself creating variance to the system by its ordering behavior or by other means, such as too late registering of the parts to the warehouse systems by warehouse personnel. Variations in purchase order quantities, requested lead times and purchase order frequencies contribute usually, among other aspects, to poor supplier performance and ultimately to poor distribution chain performance. (Paakki et al. 2011, 168.)

In general, companies should not try to adapt to changes in supply chain, but try to change them themselves (Lee 2004, 110). If a company is not proactively managing supply and demand variances, the variances are taken as given from the supply chain, and inventory management has to passively adapt to the constraints of the environment. This creates a situation, where the performance of inventory management is determined by other parties of the supply chain, and even though the function might look good in figures, the reactive approach could be very expensive for the whole distribution chain. The reason is that the optimization of a single member of the distribution chain in a large network produces sub-optimal results for the whole chain, and it can actually decrease the whole chain's performance. For example, if some storage locations change their replenishment behavior in their benefit so that demand types change from stable to unstable in the distribution center. (Paakki et al. 2011, 167.)

2.2.5 Performance assessment

The performance of a particular process or practice is usually measured in companies with key performance indicators. Key performance indicators reflect the critical success factors of an organization. Whatever KPI's are selected, they must reflect the organization's goals, they must be key to its success, and they must be quantifiable (John Reh, 2012).

In the after-sales supply chain there is a chance of conflicting interests as different functions and departments may have different goals. Therefore, management should select KPI's which reduce and minimize the possibility of conflicting interests. Selecting correct indicators is important, because they improve the functions in the supply chain to go to same direction. (Paakki et al. 2011, 167).

2.3 Purchasing's contribution to after-sales performance

It is clear that purchasing has a major impact to the overall performance of the spare parts supply chain. Purchasing is usually responsible for the supply side issues, such as the supplier performance management (Paakki et al. 2011, 168) and the process of determining supply strategies for spares along the primary product life cycle (Wagner et al. 2012, 82). From the after-sales perspective, one of the most substantial contribution purchasing and supply management can have to a company's competitive advantage in a long run is being an active member in the R&D projects, striving for standardization and planning in general the spares supply for the product life time. It cannot be highlighted too much that strategies available for spare parts and after-sales managers are to

a large extent predetermined already in the R&D phase of the primary product (Wagner et al. 2012) and therefore the after-sales strategies should be planned together with the overall supply strategy. Also, management should have a clear view of how the supplying of spares differs from supplying parts for production. For example, the supply base and the number of parts is usually higher for after-sales, but the volumes for single parts are lower than for production based purchasing.

Moreover, purchasing is not operating in isolation dealing only with the supply side issues, but has to take in consideration all of the distribution chain aspects which ultimately affect to the responsibilities that has been traditionally seen as purchasing's concern. For example, the demand forecasts for spare parts might not be the responsibility of the purchasing, but the accurateness of the forecasts affect considerably the performance of the function, because suppliers are informed about the anticipated demand that is based on the forecasts. Again, the much highlighted notion that the distribution chain should be planned with a system view, not in a way where every responsibility area or function is trying to optimize their own performance, is very relevant. In the case of demand forecasts this could mean for example better collaboration and information exchange with the front line supply chain parties, such as the marketing organizations.

Particularly in the spare parts context, where responsiveness of the supply chain is usually the goal to achieve quick deliveries for customers in cases of machine down situations (Dekker et al. 2011, 3), systemic view to spare parts management is in the focus. Therefore, the aspects identified in this chapter affect considerably to the purchasing performance and maturity.

In the next chapter purchasing development models are discussed in general and later spare parts specific findings from this chapter are added to the maturity model when assessing the maturity of the purchasing practices of the case organization.

3 PURCHASING DEVELOPMENT IN ORGANIZATION

Any organizational or process development usually takes place rather in small evolutionary than revolutionary steps (Lockamy & McCormack 2004, 272), and this is the key assumption in the purchasing development approach as well. Developing organization to a more mature state requires a change to the way things are done. Typical steps to change the old way of doing things usually follows the path of: *defining the situation, indicating areas of change, thinking through the process of change (implementation), navigating the implementation process and learning and follow-up.* (Axelsson et al. 2005, 49-52.)

Purchasing maturity models work as a guide in this thinking process. The models are good frameworks for managers to check the current status of the purchasing function (*defining the situation*) and the models also give indication to possible direction for future development (*indicating areas of change*) (e.g. Reck & Long 1988).

This chapter focuses on the purchasing development models presented in the literature during past few decades, and also the meaningfulness of the whole approach is discussed.

3.1 Maturity and knowledge accumulation in organization

According to various studies concerning knowledge accumulation in companies and their business processes (e.g. Niazi, Wilson and Zowghi 2005; Ibbes, and Kwak 2000), knowledge development can be categorized to and described in distinct phases or stages and these models are called maturity models. Their basic idea is that because an organization cannot implement all the best practices in one phase, maturity models help to introduce them in stages (Niemi, Huiskonen & Kärkkäinen 2009, 162).

The maturity models have been developed to describe the knowledge accumulation at various levels of analysis: employee, process and organization levels can be distinguished (Niemi et al. 2009, 163). At employee level, the approaches generally concentrate on the attitudes of employees towards knowledge management. Process level maturity models are interested in specific business processes, such as purchasing or inventory management. The organization level maturity models assess the overall knowledge management performance of a whole company, including for example the estimation of knowledge capital of the company. (Niemi et al. 2009, 163.)

Purchasing maturity is reflecting the level of professionalism in the purchasing function as expressed in dimensions such as role and organizational status of the purchasing department, availability of purchasing information systems, quality of people involved in purchasing and the level of collaboration with suppliers. (Rozemeijer, van Weele &

Weggeman 2003, 10.) The link between firm's performance and purchasing maturity is the underlying assumption in almost all models that are describing purchasing development (Schiele, 2007, 274). Evidence to support the assumption of mature purchasing organizations performing better than undeveloped ones has been found. For example, Chiesa, Coughan and Voss (1996) found out that more developed purchasing organizations apply more easily best-practices while unsophisticated organization's fail to employ them.

3.1.1 Usefulness of the maturity models

The main contribution of the purchasing maturity models is that they indicate in a structured way the possible directions for change. They also help an organization to classify the current position of the purchasing activities. Often, improvement measures are put into operation in nonsystematic ways and maturity models help to see the big picture better.

For example, someone identifies a problem that too high price is paid for some products. A common reaction is to try for a period of time to reach a better balance, and there is nothing wrong with that. But the problem will tend to come back quite soon, if no systematic effort has been made to improve basic processes related to the identified problem (Figure 4). These processes could be such as how to carry out supplier analyses or how to integrate the supply chain better. (Axelsson et al. 2005, 23.)

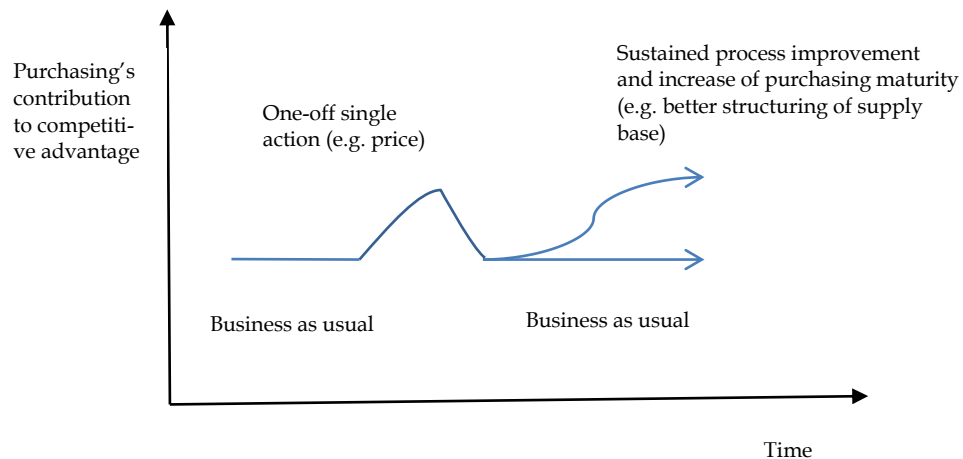


Figure 4 Process improvement vs. single action (Axelsson et al. 2005, 26)

In the figure 4, the difference between single action and sustained process improvement is shown as a purchasing's contribution to competitive advantage as time goes on. It is assumed that a sustained process improvement has better payoff than single action in the long run.

3.2 Contributions from literature to purchasing development

During the past few decades literature in purchasing and supply chain management has put forward several purchasing maturity models, also referred to as purchasing or procurement development models. All of these models in purchasing are describing several stages which organizations are expected to go through in order to develop and perform better (Table 1).

Table 3 Contributions from literature on purchasing development

Author	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Reck & Long (1988)	Passive	Independent	Supportive	Integrative	-	-
Bhote (1989)	Clerical (transactional)	Commercial	Strategic	-	-	-
Cavinato (1990)	Buying (at low prices)	Purchasing	Procurement	Supply acquisition	Facilitate networks	-
Cammish and Keough (1991)	Serve the factory	Lowest unit cost	Co-ordinated purchasing	Strategic procurement	-	-
Van Weele (1992)	Operational/administrative	Commercial orientation	Logistic orientation	Strategic orientation	-	-
Keough (1993)	Serve the factory	Lowest unit cost	Co-ordinated purchasing	Cross-functional purchasing	World class supply management	-
Chadwick and Rajagopal (1995)	Clerical	Commercial	Supportive	Strategic	-	-
Barry, Cavinato, Green and Young (1996)	Basic purchasing processes	Enhanced procurement practices	“World-class” procurement	-	-	-
Van Weele (2000)	Serve the factory	Lowest unit cost	Co-ordinated purchasing	Cross-functional purchasing	Supply chain Management	Value chain orientation
Cousins et al. (2006)	Celebrity purchasing	Undeveloped purchasing	Capable purchasing	Strategic purchasing	-	-
Paulraj et al. (2006)	Nascent	Tactical	Strategic	-	-	-
Schiele (2007)	Stage 1	Stage 2	Stage 3	Stage 4	-	-

Reck and Long (1988) were the first ones to complete a stage-like development model, although similar models, describing for example purchasing departments' negotiation power-maturity –relationship (Jones 1983), had been set up earlier. In their model, Reck

and Long described the first stage as “Passive” which means that purchasing has no strategic direction and that the function primarily reacts to requests from other functions. The second, and more developed stage in their model is “Independent”. At this point purchasing function is adopting the latest purchasing techniques and practices, but its strategic direction is independent of the company’s competitive strategy. In the third stage, purchasing is seen as “Supportive” and it is supporting the firm’s competitive strategy by adopting purchasing techniques and products, which strengthen the firm’s competitive position. Finally, in the “Integrative” –stage, purchasing is fully integrated into firm’s competitive strategy and it constitutes part of an integrated effort among functional peers to formulate and implement a strategic plan. (Reck & Long 1988.)

While purchasing and supply chain management has got over the years growing attention as a crucial element in firms’ performance, more attempts of describing the maturity stage of purchasing has also evolved in literature after Reck and Long’s (1988) initial work. Bhote (1989) investigated the supplier relationship and its affect to the firm’s purchasing performance. He developed a model of how a firm is handling its supplier relationships, and presented a four stage model: ”Confrontation, “Arms length”, “Goal congruence” and “Full partnership”. Also Cavinato (1990) was mainly interested in supplier relationships and presented that in stage 1 a firm is attempting a strategy of “Buying at low prices” followed by the stages of “Purchasing”, “Procurement”, “Supply acquisition” and finally “Facilitate networks”.

One significantly cited purchasing development model is also the one created by Cammish and Keough (1991). In their model, the first stage is to “Serve the factory”, which means that purchasing’s role is only to ensure that a production plant does not run out of raw materials. In the second “Lowest unit cost”-stage a proactive purchasing manager, who can negotiate lower prices with suppliers, is recruited. At the third stage, “Co-ordinated purchasing”, the emphasis is on cross-unit co-ordination and nationally negotiated contracts. Finally “Strategic procurement”-phase means that now the focus is on cross-functional integration and global thinking, as before purchasing acted solely as a separate function. (Cammish and Keough 1991.) In addition, Keough (1993) added one more stage “World class supply management” to the model and later, van Weele (2000) added the final stages 5-6 and named them as “Supply chain management” and “Value chain orientation”, meaning that ultimately the purchasing strategy in this stage will be based on the recognition that most important for success is delivering value to the end-customer.

Despite all of the contribution in developing purchasing maturity models, it was not until year 2006 before first attempts of trying to test empirically the link between purchasing maturity and firm performance emerged in literature (Cousins, Lawson & Squire 2006; Paulraj, Chen & Flynn 2006; Schiele 2007). Cousins et al. (2006) found in their study of UK organizations that there is significant difference in performance de-

pending on the stage of development of purchasing function. They categorized the purchasing function depending of its maturity as “Strategic purchasers”, “Capable purchasers” “Undeveloped purchasers” and “Celebrity purchasers” (Cousins et al. 2006).

According to their model “Strategic purchasers” parallel to Reck and Long’s (1988) “Integrative” group where the purchasing function is highly regarded, tightly integrated with the business and heavily involved in strategic decision making. In addition, “Capable purchasers” bear resemblance to the Reck and Long’s “Supportive”-phase where the function is contributing to strategy, though not as internally integrated nor held in the same esteem as strategic purchasers. Furthermore, “Undeveloped purchasers” are akin to the Reck and Long’s “Independent”-stage where purchasing is a professional function as shown by high levels of purchasing skills and knowledge, but reacting and responding to the needs of business. In exception, they also found a group of “Celebrity purchasers”, which is outside of current classification systems. This group has high levels of status in the eyes of top managers, yet lower skill levels, involvement in strategic planning and internal integration than any other group. (Cousins et al. 2006.)

Also Paulraj et al. (2006) tested empirically in North American firms the link between purchasing maturity and firms’ performance. Based on the firms’ advances along the dimensions of strategic focus, strategic involvement and visibility/status they dissected the strategic level of purchasing into three stages: “Nascent”, “Tactical” and “Strategic”. According to the results, the study provides strong support for the importance of strategic purchasing. Firstly, firms’ at nascent stage of strategic purchasing need to realize that moving towards the more advanced stages engender a better supply integration. Secondly, practicing executives must understand that purchasing function can play a key role in integrating the buyer-supplier dyad by focusing on diverse aspects such as process, relational, information and cross-organizational teams. Thirdly, strategic purchasing can have a profound impact on supply chain performance that subsequently creates win-win situation for both buyer and supplier firms. (Paulraj et al. 2006, 118-120.)

Likewise, Schiele (2007) constructed a maturity model, which impact on firms’ performance was tested empirically. The management-oriented maturity profile follows the five previously elaborated (from prior literature) dimensions: “Procurement planning”, “Organizational structure of purchasing”, “Process organization”, “Human resources and leadership” and “Purchasing controlling”. In the model, the four stages are defined for each management dimension according to best-practices, but if applicable, they are structured to reflect the guidelines adopted from process-organization principles (Schiele 2007). Stage 1 is described as “A particular best-practice tool is known within the organization”. Stage 2 means that, “A position or person is assigned to perform the task”. In Stage 3, “The process for completing the task is defined”. And finally in Stage

4, “Cross-functional integration in the company is assured while basic requirements are met”. (Schiele 2007.)

Schiele found out that on average more mature firms identified larger savings potential than did their more undeveloped counterparts. Moreover, the results indicate that resources dedicated to the purpose of developing more sophisticated purchasing functions have a reasonable chance of paying off. In addition, results show that more developed purchasing organizations profit most from newly introduced knowledge. Finally, he argues that understanding the minimum maturity point of an organization, below which there is nothing to be gained from introducing best-practices, is an important managerial task. (Schiele 2007.)

In conclusion, many authors have created purchasing maturity models over the years. After the first model introduced by Reck & Long (1988), literature has approached the issue from various perspectives in order to understand and give recommendations how purchasing function should be seen in a company and how it could develop to a more mature and professional level and ultimately to improve the overall performance of a business. In practice, the most important managerial value of the models is that they enable management to position the current state of the organization and give direction where the purchasing should be heading to (Axelsson et al. 2005, 23). These models have similarities and differences which will be discussed next.

3.2.1 Major commonalities in the models

The main commonality that purchasing maturity models have is that they usually differentiate from among limited number of maturity stages, ranging from three to six (Table 1). In addition, another commonality in purchasing-related approaches to maturity is the importance of evolutionary process (Schiele 2007, 275). Skipping stages is associated with major difficulties, which is analogous to the underlying assumption in organizational development literature (Reck & Long, 1988). Furthermore, Van Weele (2000, 3) has distinguished four major commonalities: integrated final stage, purchasing’s organizational status, supplier management and supplier relationships.

Firstly, most authors assume the existence of final stage of excellence where all improvement efforts should be directed. Almost all models show a final stage where purchasing is integrated in the major line of business, and at this phase, line management is actively involved in purchasing strategies and tactics. In addition, at this stage purchasing processes are assumed to be organized around multi-disciplinary, team-based structures. Secondly, most models point out that purchasing initially reports to rather low in the organizational hierarchy. In next stages, some degree of centralization may be seen, which in a business unit will turn to some form of coordinated purchasing. Thirdly, the

development of supplier management is another similarity in the models. In the first phase supplier management seems to be reactive. In the next phases it becomes more proactive and finally reaching the stage of relationship management. Fourthly, most authors assume that as purchasing moves through the different stages of development, relationships with suppliers will change. In the first stage, purchasing departments are assumed to handle suppliers at “arms strength”. In the next stages purchasing organization reduce its number of suppliers significantly and eventually form partnerships with few suppliers. (Van Weele, 2000.)

Also Schiele (2007) found out that most models include similar sets of parameters or management dimensions such as planning, structural organization, process organization, human resources, controlling and collaborative supplier management. Procurement planning concerns the first operational steps in purchasing lifecycle and almost all models include some planning of procurement activities such as market analysis or specification of materials (Barry et al. 1996, 41). Also organizational structure of purchasing and its status in an organization is considered as relevant dimension for many authors (Reck and Long, 1988; Keough 1993; Schiele 2007). Research in the field underlines the impact of process organization in development process and mentions cross-functionality and internal collaboration (Schiele 2007; Keough 1993; Barry et al. 1996). In addition, human resources, such as the level of professional staff, is considered important by Cousins et al. (2006) among others. Performance measurement and control is a vital management area as well and it is emphasized by many authors (Barry et al. 1996; Schiele 2007; Cousins et al. 2006). Finally, collaborative supplier relations, meaning focusing more on few suppliers instead of many, have also been a dimension in many purchasing maturity models (Paulraj et al. 2006; Cousins et al. 2006; Reck & Long 1988).

3.2.2 *Major differences in the models*

As one can imagine, purchasing maturity models have also many differences. Schiele (2007, 275) argues that one can distinguish between those maturity models with more deductive character and those that are primarily based on observation i.e. induction (Reck & Long 1988; Cousins et al. 2006). Furthermore, he noticed that most models have not tested empirically the link between firm performance and purchasing maturity (Schiele 2007, 275).

Van Weele (2000) noticed that most models are based on different sets of dimensions, but none of the authors include all of them in the models. Dimensions in the models have been such as: *Top management commitment* which means the interest top management shows into supply management. *Functional leadership* relating to the

management style employed. *Purchasing strategy*, relating to the degree of formalization with which plans have been made and the extent to which purchasing strategies have been integrated in overall business planning *Purchasing activities* covering to with extent purchasing organization is involved in e.g. product development, supplier selection and supplier evaluation. *Supply management* relating to the way supplier relationships are being managed. *Organizational issues* such as reporting relationships, communication structures and role and position of the purchasing function. *People issues* such as degree and characteristics of training and education, career development, buyer skill profiles. *Performance measures* used to measure and monitor purchasing and supplier performance. (Van Weele 2000).

All in all, every purchasing development model differentiate some way from the others and not a single very dominant theory exists, although some works are referred to more often than others, such as the done by Reck and Long (1988).. From a managerial point of view, maturity model should include a comprehensive set of dimensions and parameters in order to be useful (Schiele 2007, 276). However, there is ongoing debate whether the approach brings any value to practitioners and this will be discussed next.

3.3 Discussion about purchasing development approach

The developmental and evolutionary approach to purchasing has generated criticism in literature. Ramsay and Croom (2008) argue that purchasing development models are unhelpful for several reasons. They say that there is a widespread agreement in both practice and the academy concerning the desirability of the purchasing function actively seeking to move away from “clerical” towards “strategic” activities. This general anti-administrative bias may cause problems to an organization, if it trades the critical thinking process of developing the organization to a prescribed evolutionary development model, assuming that “strategic level” is undeniably the place to be, without reasoning why. It should also be noticed, that models that tell what one *should* do, are simply wrong. This is because “the right way” of doing things for any individual purchasing organization will be contingent on a host of factors such as their product lines, the nature of markets in which they trade, the behavior of competitors and the abilities of their suppliers. In other words, it is impossible to generalize “right way” of purchasing development, because every organization is unique. (Ramsay & Croom 2008, 202.)

Also empirical evidence has been found that contradicts with the evolutionary assumptions. For example, in the case of the connection between purchasing activities and its status, Reck and Long’s (1988) evolutionary model propose positive association between the development of strategic alliances and more advanced stages of the model. Stuart (1997, 230) however found out in his study that the data do not support Reck and

Long's (1988) model. The relationship between alliance activities and strategic stance in the model is virtually non-existent (Stuart 1997, 230).

The critique towards the approach is partly confirmed by Rozemeijer (2008, 205-207) who states that development models should be seen as guiding the thinking, but are not substitutes for strategic thinking, influencing and problem solving required in each unique situation. Rozemeijer (2008, 206) also points out, that it is relatively easy to come up with academic critique towards purchasing development models, because the simplicity of the models belies the complexities associated with the real change process. Even though the models should be regarded basically as conceptual frameworks, and not utilized directly as development instruments, it does not mean that the models are unhelpful. *“Development models are helpful not only in terms of classifying organizations in terms of their current position, but are especially relevant for determining in a systematic way the possible directions for organizational change”* (Rozemeijer 2008, 206). In addition, Rozemeijer does not see why development models could not be helpful in the supply management context, because similar kind of evolutionary models have been a relevant body of knowledge in other academic disciplines such as psychology, biology, economy and sociology. (Rozemeijer 2008, 206.)

It seems that there is valid critique toward the whole development approach, but also implications that when understood correctly, models can guide the thinking of managers, and help to see the “big picture”, which is usually considered the most critical aspect when discussing about the broad area of purchasing and supply chain management development. In the next chapter, purchasing maturity model used in this research is introduced.

4 PURCHASING MATURITY ASSESSMENT TOOL

In order to be able to assess the level of purchasing maturity in an organization some kind of purchasing maturity assessment tool must be used. The assessment tool used and tested in this research is the one created by Schiele (2007). The maturity model follows the underlying assumption of mature organization performing better than an undeveloped one (Figure 5).

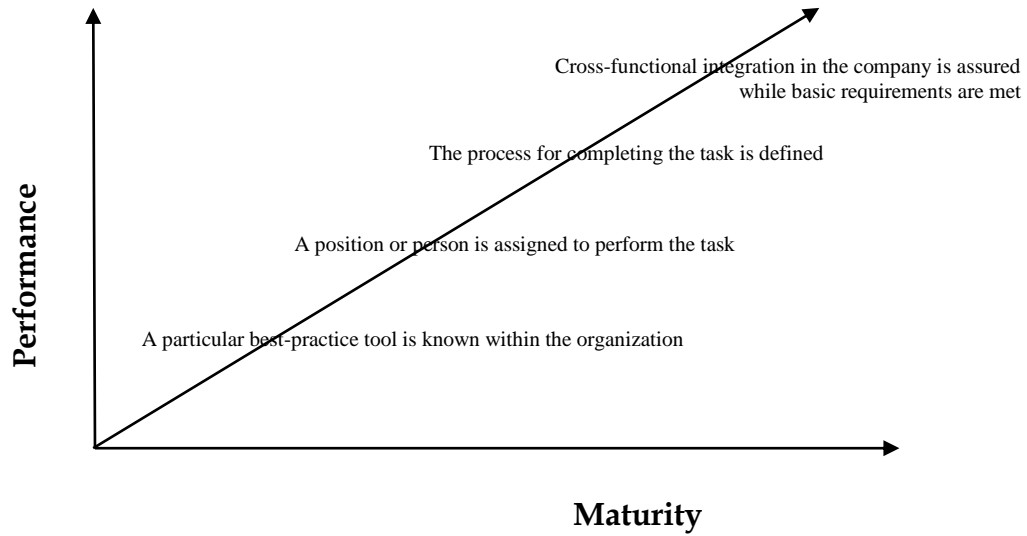


Figure 5 Maturity-Performance –relationship (based on Schiele 2007)

In the first step, a particular best-practice tool is known in the organization, but nothing has yet been done to implement the practice. In the second stage, a position or person is assigned to perform a particular task. On the third step, organization has defined a process for completing the task. Finally, on the final level, cross-functional integration has been achieved.

In this chapter, the maturity assessment tool used in the empirical research is introduced in detail. First the reasons to use Schiele's model (2007) as the basis for the research are discussed and later the dimensions and stages in the model are introduced.

4.1 Management based purchasing maturity assessment tool

A maturity assessment tool should ideally cover every relevant maturity describing dimension (Schiele 2007, 278). A typical maturity assessment tool results in a matrix. On one axis are the dimensions under analysis, and on the other axis are the stages, ranging

from low to high. Management approach to purchasing maturity means that the dimensions in the model are based on the classical management functions: *planning, organization, leadership and control*. *Organization* can be further split into *organizational structure* and *process organization* (Schiele 2007).

Schiele (2007) argues that most purchasing maturity models are incomplete from the managerial point of view. For example, the first model in the field (Reck & Long, 1988) excludes process organization dimension from the analysis, and the more recent work of Paulraj et al. (2006) is ignoring the importance of human resources –dimension when defining the maturity of a purchasing practices. Schiele (2007) also states that, he is dropping only one common dimension found in other models away from his model. *Collaborative supplier relations* -dimension does not fit into the management-based model, because it cannot be deduced from the classical management approach. In addition, *collaborative supplier relations* have a prescriptive character arguing that one sourcing strategy is superior to other, and thus describes higher level of maturity (Cousins et al. 2006). Management-based approach suggests firm only to have a clearly formulated strategy, but does not specify which one it should have (Schiele, 2007, 278).

The advantage of this approach is also that it covers thoroughly relevant management areas relating to purchasing and therefore helps decision makers to see where the most needs for development are. For example, analyzing “purchasing status” (Paulraj et al. 2006) as a dimension in a model is not very informative from the management point of view, if the underlying relationships affecting the status of purchasing are not included in the model as well. In other words, the status of purchasing may depend for example on its hierarchical position, which is again a question of an organizational structure. Therefore, the organizational structure should be a dimension in the model, not just the status of purchasing itself. Furthermore, status can be also influenced by the process definitions, which determine purchasing’s inclusion in decision-making bodies (such as inclusion in development projects) and therefore process definition should be a part of a model also, and so on. Management-based approach is capturing this broad scope of purchasing better than other approaches, because of its comprehensiveness. Many other models use only one frame of reference, such as “purchasing strategy” (e.g. Paulraj et al. 2006), and although important, these models are ignoring the dimensions relating to operational excellence, which is as vital as strategic excellence for a firm. (Schiele 2007, 276.)

In addition, Schiele’s (2007) model is relatively new compared to many other models presented in literature. Considering the rapid changes in the business environment over the last few decades (Baily et al. 2005, 9; Cousins et al 2008, 7), it could be assumed that some of the models may be outdated, and therefore more recent works have better chance of capturing the relevant areas of today’s business environment. Maturity models usually lean heavily on best practices and the notion that best practices are not eter-

nal, which means that best practices do not only have a room side, but also have a time side where the shelf life will influence their validity (Hanson & Voss, 1995), supports also the use of a recent maturity model.

However, the model was tested early on in the research process with the case company's management and it became clear that due to the exceptional environment of spare parts supply chain, some aspects of the Schiele's (2007) model are not applicable in this context, and that some areas should be added to the model. In particular, inventory management was found an important area for purchasing in the spare parts context missing from the model and therefore *inventory management* -dimension is added to the model, even though it cannot be deduced from the classical management approach.

This in mind most of the dimensions in the model are based on the Schiele's work, but *inventory management* –dimension is added to the model. In the next section, the six dimensions (table 3) are shortly introduced and their relationship to purchasing performance is discussed, e.g. why the activities and areas introduced are important for purchasing and worthwhile for auditing.

Table 4 Purchasing maturity model –structure (partly adopted from Schiele 2007)

Management dimension	Areas in the audit
Supplier related processes	Sourcing strategy Supplier selection Supplier negotiation Supplier contract management Supplier evaluation Supplier development
Process integration	Process involvement with other functions Early involvement in R&D processes
Human resources and leadership	Job description and competences Personnel Selection and integration Performance appraisal & career devel.
Controlling & Organizational structure	Controlling system Controlling process & structure Purchasing's organizational structure
Inventory management	Spares classification Demand forecasting Stock control policy Key performance indicators

4.1.1 Supplier related processes and process integration

To cope with challenges they face, organizations have to accept process-based management principles, especially those that wish to successfully manage and develop their supply chains. The process paradigm means that organizations are looked from perspective of processes they perform rather than from functional units, divisions and departments they are divided into. The need to see organizations from the process perspective also stems from the fact that, despite the changes seen in contemporary economic and social environments, management values and principles from the beginning of industrial age still determine the organizational structure of many modern firms. (Trkman, Stemberger, Jaklic & Groznik. 2007, 117.)

The management approach to purchasing maturity also includes the process view to the model, and for the most part, the audit in this section is interested in issues relating to the buyer-supplier processes as well as to process integration within the company. Defining a sourcing strategy should be the first step in the purchasing process and many authors have underlined the importance of long-range sourcing plan and clearly formulated sourcing strategy (Cammish & Keough 1991, 26).

Management-based purchasing maturity profile does not favor any sourcing strategy, but to gain a high score in this section, systematic processes that support the overall competitive strategy must be in place (Schiele 2007, 277). Also A.T Kearney (2008, 15) found out that leading companies are more systematically applying sourcing strategies than undeveloped organizations. For example, in the case of global sourcing, this means systematically expanding the geographical supply base, exploiting global supply/demand imbalances and developing new suppliers in emerging markets (A.T. Kearney 2008, 15).

There is also evidence that supplier development initiatives contribute positively to the purchasing performance. In fact, already basic supplier development activities contribute substantially to purchasing performance. These activities are such as reporting of supplier evaluation results on suppliers, parts standardization and supplier qualification process. (Sanchez-Rodriguez, Hemsworth and Martinez-Lorente 2005, 298-300.) Again, the management-based profile does not favor any supplier development plan (basic or advanced), because the plan should be aligned with the overall sourcing plan, but asks for systematic strategy to develop the substantial suppliers. (Schiele 2007, 277.)

Also the level of process involvement with other functions is under analysis in the model. Goh, Lau and Neo (1999, 20) for example highlight that purchasing managers should seek to integrate processes with other functions to improve the performance of the purchasing function.

4.1.2 Human resources and leadership

Purchasing can develop to a more mature form only if the people working in the area possess the requisite skills to operate in that way. No matter how complex the measures, if the skills are not at the required level, the organization will not be able to fulfill its objectives. (Cousins et al. 2006.)

Skill level of the purchasing function has been found important also in the purchasing performance literature, and for example technical knowledge is considered vital when acting in an interface with more technical functions (Nijssen, Biemans & De Kort 2002, 285). In the management-based purchasing profile, the main interest in the human resources field is on the job descriptions, procedures for recruiting purchasing personnel and career development issues (Schiele 2007).

As purchasing have become more complex, it requires more professional personnel. Purchasing experts are expected to have specific training and are relied upon to provide more in-depth analysis of, for example, sourcing decisions and inventory management. With increased skill and knowledge, purchasing professionals are more knowledgeable of supply market trends and the needs and desires of internal customers. Furthermore, through advanced training, professionals may be aware of new tools and techniques designed to increase the effectiveness and efficiency of their supply bases, which all contribute to better performance. (Ogden, Rosetti & Hendrick. 2007, 15.)

4.1.3 Controlling

Following the saying that “what gets measured can be managed!” the importance of measuring performance in the supply chain measurement is no surprise (Seuring 2008, 132). Controlling and measuring performance is vital for organization that wishes to develop to a more mature state. Much of the performance measurement literature in purchasing is dealing with operational issues, although important, strategic and tactical areas must also be taken into account. In other words, any organization should first ask the question “are we doing the right things?” before asking “are we doing them right”. (Baily et al. 2005, 394.)

Measuring performance is not an easy task, particularly where purchasing and supply chains are concerned. Purchasing controlling is also under analysis in the management-based purchasing maturity profile. Analyzed areas are such as the controlling system and methods and tools used to support purchasing controlling (Schiele 2007, 278).

Purchasing’s contribution to cost savings and overall performance may be hard to assess and measure, but it anyway should be done, because the lack of knowledge to present financial results will also hinder the status of purchasing. Almost 75 % of the re-

spondents to a purchasing survey believed that inability to measure performance had hindered management recognition of the purchasing function. (Baily 2005, 395.)

4.1.4 *Organizational structure*

An established organizational structure is necessary for purchasing to fulfill its duties, and many models have suggested forms of organizational structures. It has been highlighted that structure follows strategy, meaning that the purchasing strategy should define the structure, as one structure suit better to certain strategy than to another. (Schiele 2007, 277.)

Management-based purchasing maturity profile does not prescribe any certain purchasing organizational structure, but asks for roles, responsibilities and interfaces to be established with lasting effect, comprehensively documented and well structured. For example, integration with other functions is under analysis, because poor integration of purchasing with the activities of other functions often results in slow problem solving, poor information exchange and low levels of firm performance, while high levels of integration can improve business performance (Cousins et al. 2006, 778). Thus, under analysis in the profile are structure and mandates of purchasing and strategic integration. (Schiele 2007, 278.)

Management consulting company A.T. Kearney found in their study (2008) that leading companies, which are gaining competitive advantage through purchasing, collaborate more actively across organizational boundaries, than the undeveloped ones. For example cross-functional decision making is regularly assessed. In addition, they found out that leading companies are more involved in developing corporate and business unit strategies than their undeveloped counterparts. The study also showed that the purchasing functions of the leading companies are reporting on much higher level, have more top management focus and have influence over spend more than the undeveloped purchasing functions. (A.T. Kearney 2008, 11.)

Also Paulraj et al. (2006) found out that well performing purchasing functions are more proactive in working with other functions and formulating the competitive strategies for the firm. Furthermore, Carr and Pearson (1999, 516) found out that if companies place emphasis on strategic purchasing, meaning that the firm recognizes the importance of reviewing and adjusting the purchasing's plans to match the company's strategic plans on regular basis, substantial benefits can be gained.

Vice versa, Goh et al. (2007) found out in their study of strategic purchasing, that the reporting structure of the organization was the greatest inhibitor to purchasing achieving strategic involvement in overall business strategy development.

These findings are also captured to some extent in the maturity model, and if a company aims to score high in for example strategic integration activity, purchasing manager must report directly to business unit top management (Schiele 2007, 278.)

4.1.5 Inventory management

To develop spare parts purchasing performance, effective and efficient inventory management is essential, which is why inventory management related dimension is added to the model. Purchasing function is usually in charge of, for example, supplier performance management, where supplier lead time performance is one area under control (Paakki et al. 2011, 167). However, the supplier lead time performance relates also to the company's own ordering behavior, and the ordering behavior is again in most cases determined by the parameters set by the inventory management team. Therefore, better parameter setting can be derived from better demand forecasts and classification, which contribute positively to the performance of the purchasing function as well (Bacchetti & Saccani 2011).

Spare parts controlling requires a level of reliability in forecasting, which cannot be met solely by the time series forecasting methods based on the historical data. Important causes for this non-usability are: lack of demand data due to slow moving and intermittent demand, changes in demand over time caused by product life-cycles, the relatively long lead times in make-to-order situations and the need for very short delivery times in supply from stock situations. The large number of distinct parts and criticality of components in the machines of the customer contribute to the financial consequences of poor forecast reliability. (Dekker, et al. 2012, 2.)

To counter the consequences, Wagner et al. (2012, 83) found out that top performers use combination of forecasting methods aligned to the specific spare parts supply requirements and to the product life cycle phase, and they also conduct frequent revaluations. Hence, even though spare parts demand forecasting is challenging, top performers try to anticipate future developments as well as possible and align their strategy on these forecasts. In contrast, firms that put less effort or no effort at all to anticipate future developments in demand, only randomly come up with good performance results. (Wagner et al. 2012, 83.)

Also Dekker et al. (2012, 6) found out that companies that try to anticipate future developments through installed base data (e.g. life-cycle phase, service contract data) can achieve substantial benefits, not only in form of better demand forecasts, but also to derive other input parameters (such as transportation costs and possible delivery options) for spare parts inventory planning. The use of installed base information has been found particularly useful with lower demand rates (Jalil et al. 2011, 450).

Classifying spares sufficiently increases the performance of the distribution chain and it is argued that companies should categorize spares based on their most relevant characteristics and analyze their effects on the logistics system (Huiskonen 2001, 132). For example, stock-out costs can be reduced substantially and service performance increased significantly with a categorization analysis (Paakki et al. 2011).

In general, efficient inventory management requires proactive attitude and if organization merely adapts to the constraints in the environment, it creates a situation where the successfulness of the function is determined by other parties of the supply chain (Paakki et al. 2011, 166). It is also in purchasing's interest that inventory management is working proactively, which is why areas relating to demand anticipation, classification and key performance indicators are added to the purchasing maturity model.

4.2 Maturity stages

Simply defining the dimensions is not enough if one want to make use of the maturity profile. Each management-dimension consists of many topics under analysis and each topic has four stages which define the maturity stage. The stages of maturity derive either from theory or from survey data analysis (Schiele 2007, 278). In other words, the four stages for each topic are defined according to best practices found in prior studies, but if possible, they are structured to reflect the process-organization principles (Schiele 2007, 278). Stage 1 is described as "A particular best-practice tool is known within the organization". Stage 2 means that, "A position or person is assigned to perform the task". In Stage 3, "The process for completing the task is defined". And finally in Stage 4, "Cross-functional integration in the company is assured while basic requirements are met". In addition, the underlying principle in the model is that a well performing purchasing organization is not depending on individual performance, but is sufficiently structured to perform well despite personnel turnover. Furthermore, large importance is put on cross-functional collaboration, and without being embedded in the firm, no purchasing unit can achieve more than a medium score. (Schiele 2007, 278.)

For example, under the dimension of *supplier related processes* the profile has questions about *supplier evaluation and supplier development* which both are analyzing processes relating to supplier relationships (table 7):

Table 5 Example of maturity stages (Schiele 2007)

Supplier evaluation	Stage 1	Stage 2	Stage 3	Stage 4
Is there a systematic procedure for supplier evaluation in place?	There is no supplier evaluation systematics in place.	Less than 60 % of the purchase volume is evaluated according to applied supplier evaluation systematics	60-80 % of the purchase volume is evaluated according to an applied, cross-functional supplier evaluation systematics	More than 80 % of the purchase volume is evaluated accordingly.
Supplier development	Stage 1	Stage 2	Stage 3	Stage 4
Is there a systematic procedure for supplier development in place?	Supplier development measures are defined individually.	A planning process existing for all substantial suppliers.	The supplier development process is defined.	Development process is implemented and regularly updated.

As one can see (table 5), the stages under the topics are following certain pattern. In the beginning, the process of a task has not been defined properly (supplier evaluation) or it has not been defined collectively and systematically (supplier development). In order to move to more advanced level, organization has to define the process and integrate it to cover all relevant parties to ultimately achieve cross-functional integration.

Also the description of each stage under each topic is a comprehensive way to analyze a particular area. It is more informative to assess the development level, if it is clearly stated what is actually meant by for example stage 2 in the supplier development process. It would be hard to define simply on five-point Likert -scale is there a systematic procedure for supplier development in place or not, because explanation of systematic procedure would not be given. Therefore, it would be difficult to assess if the company is on stage 2 or 3 or maybe even on 4. In general, the differences between stages can be detected more easily and more objectively when the characteristics of each stage under each topic are explained, in particular when the actual stage is somewhere between the extremes. In other words, all of the respondents should understand the levels in a same manner and the scaling problems should be avoided.

However, following the process-oriented stage description pattern has also its downsides. The explanations in the stages may appear too narrow, and a suitable stage could

be hard to assess. Furthermore, organizations may have characteristics from several stages, thus it is hard to define which one represents most the actual status quo.

Despite the downsides, the more comprehensive way of describing the stages is seen as superior compared to the Likert-scale when assessing purchasing maturity qualitatively (Schiele 2007, 279).

5 METHODOLOGY

5.1 Research strategy

Different kind of research strategies are proposed for different kinds of researches and the three conditions that suggest a use of a certain strategy are: 1) the type of research question posed, 2) the extent of control an investigator has over actual behavioral events, and 3) the degree of focus on contemporary as opposed to historical events (Yin 2003, 5). A case study is suggested for a research strategy if the research questions ask mainly “how” and “why” types of questions, the investigator has no control over behavioral events and the research focuses mainly on contemporary events (Yin 2003, 5). Thus, “*a case study is an empirical enquiry that (1) investigates a contemporary phenomenon within its real life context, especially when (2) the boundaries between phenomenon and context are not clearly evident*” (Yin 2003, 13). In other words, being an extremely popular research strategy, a case study aims at understanding the studied case and for this to succeed, the case needs to be investigated in relation to its historical, economic, social, technological and cultural context (Eriksson & Kovalainen 2008, 115-116.)

Mukherjee, Mitchell and Talbot (2000, 166) state that cases are particularly useful when there is uncertainty in the definition of constructs. This is also true in the purchasing development context, where many different models exist (e.g. Reck & Long 1988; Schiele 2007), but there is not a single dominant theory, which would be undeniably the best to describe purchasing development. In general, operations management, where purchasing fits in as well, is a very dynamic field and case research provides an excellent means of studying these emergent practices (Voss, Tsikrikitis & Frohlich 2002, 199).

This research was written on assignment by a global industrial organization and more precisely, on assignment by the European Distribution Services organization in the after-sales division. The case study approach was selected, because the study is examining contemporary event of purchasing development in the organization, but the relevant behaviors cannot be manipulated. In addition, the case method allows the questions of “why”, “what” and “how”, to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon (Meredith 1998, 443-444), and therefore the research questions posed in this study suit well to a case research. A single case study was chosen, because in depth analysis from the case organization was one of the main goals of this reasearch. However, even though the case is expected to be as “typical” and therefore justifiable as a single case study (Yin 2003, 40), this case study cannot be used for generalization and it is not the purpose of this study, because single

case studies cannot in general be used to create formal empirical generalizations (Barros 2003, 39). One of the goals of this study is to give managerial implications for possible future directions to develop spare parts purchasing operations in the case company and in the broader field, and case study suits for this purpose well, because in depth analysis can be made about the research subject.

Case studies can be used for different types of research purposes such as exploration, theory building, theory testing and theory extension/refinement (Voss, Tsikriktsis & Frohlich 2002, 197). Hirsijärvi, Remes and Sajavaara (1997, 129) continue that it is possible for a research to have features from more than one type of such research purpose. Due to the nature of this study and research questions, researcher suggests that this study have features from theory building and theory extension. Theory building purpose can be seen as the aim of distinguishing and identifying key variables that should be included to purchasing development models in the after-sales context. Theory extension could be seen as the aim of analyzing how suitable in general is the purchasing maturity model in this context. However, the theory extension might suffer from the fact that purchasing development models have not been tested empirically despite few exceptions (Schiele 2007; Paulraj et al. 2006; Cousins et al. 2006). Thus, there is not much evidence if the whole purchasing development approach is actually valid in any context. Still, the theory of purchasing developing in evolutionary manner is the key assumption in this study, because otherwise it is impossible to make meaningful sense of the empirically generated data, it is not possible to distinguish positive from negative results, and empirical research merely becomes “data dredging” (Handfield & Melnyk 1998, 332).

One can also distinguish between two commonly used models of social science research: deduction and induction (Eriksson & Kovalainen 2008, 21-23). Furthermore, some studies have been said to follow abductive reasoning process (Kovacs & Spens 2005). Deduction means that research is relying on theory as first source of knowledge. Research process begins with theory, from which hypothesis are generated and continues finally to empirical analysis of the research subject. In contrast, induction logic uses empirical research as the basis of theoretical outcomes. Finally, abduction refers to a process where everyday descriptions and meanings received from people create the basis for understanding and explaining a phenomenon, and it bears some resemblance to both deduction and induction. (Eriksson and Kovalainen 2008, 21-23.)

This research is heavily relying on literature and prior theory about the purchasing development and spare parts management and the reasoning logic have mainly been deduction. However, the model was tested early on in the research process and modifications were made based on the literature and conversations with case organization's managers and this iterative process was similar to the abductive reasoning logic.

5.2 Research process

The research process for case studies is similar to those to other empirical research (Seuring 2008, 130) and also the research process in this study follows the basic outline of the five-staged process proposed by Stuart et al. (2002, 420): 1) *Research question*, 2) *Instrument development*, 3) *Data gathering*, 4) *Data analysis* and 5) *Dissemination*.

The research process began on October 2012 when the subject of the project was defined with the case company contact personnel. The initial business goal was to study the maturity of the spare parts procurement organization by interviewing buyers about the relevant aspects in the organization. Researcher became to explore the literature and what has been wrote about purchasing development, in the spare parts context in particular (figure 6). Quite early on purchasing maturity models were identified as useful theoretical background for the study, following the ambition to capture the findings to some kind of visual and interpretable structure. Even though suitable model was difficult to find specifically from spare parts purchasing point of view, researcher decided to test Schiele's (2007) model, because the model covered both strategic and operational aspects and therefore appeared as a good model for a large multinational organization. The choice to test a model which includes both strategic and operational areas was considered important, because it is very difficult to differentiate between the two even theoretically and even more difficult to take a stand which activities are superior to others in real business context and thus more worthwhile of investigating. In general, following the saying of Rozemeijer (2008, 207) about the importance of strategic and operational activities: "*it is not either or, it is both!*"

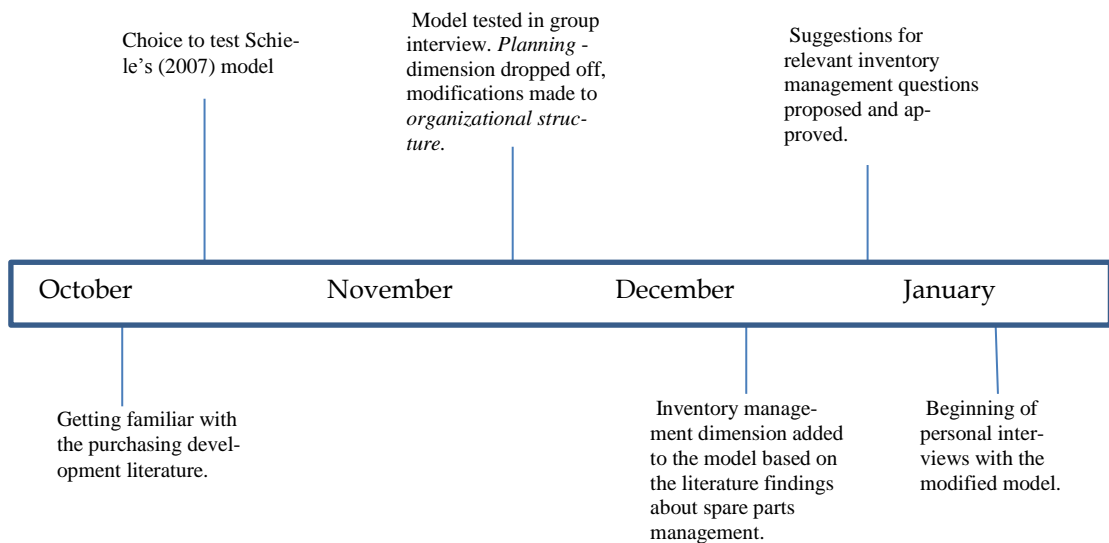


Figure 6 Model modification timeline in the research process

The dimensions were introduced to case organization contact personnel in the beginning of October and the response was that with some modifications, Schiele's model (2007) works sufficiently to map purchasing maturity in the spare parts context as well. As a result, researcher decided to test the suitability of the model in a group interview with the case organization management team, and some modifications were made to the model after the session.

The biggest modification made to the model was the exclusion of *Planning*-dimension. This was due to the fact that even though important, the questions and stages in the model in this dimension did not reflect the relevant issues or possible future direction from the after-sales perspective according to the management team. In addition, the respondents in the group interview highlighted that there is strong need to add *inventory management* -dimension to the model, because it was considered especially important in the after-sales context, because it is one of the core activities in spare parts management.

Inventory management –dimension was structured based on the findings from spare parts management literature and the areas in this dimension are introduced in Chapter 2. Furthermore, the literature based dimension was checked with practitioners in order to verify that the found areas are indeed the most relevant in the after-sales context. After approval, the interviews continued in the late January 2013 with the modified model.

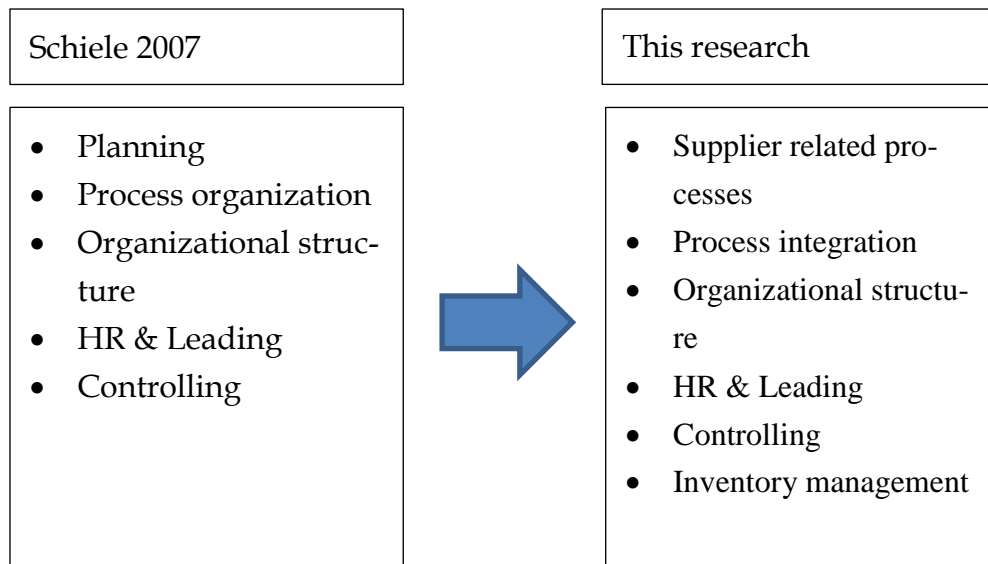


Figure 7 Changes made to the original model

The stages and questions to assess the purchasing maturity in the new model are the same as in the Schiele's (2007) original work (figure 7), despite the added *inventory management* –dimension. *Process organization* was split to *supplier related processes*

and *process integration* to make the model more balanced and manageable when conducting interviews and analyzing results.

5.3 Data collection

Data collection and analysis techniques are an important part of the process in the qualitative case study research (Ellram 1996, 100). Yin (2003, 86) proposes six main sources of evidence in case study research: documentation, archival records, interviews, direct observations, participant observations and physical artifacts.

The key information was collected via interviews in this research. Moreover, the interviews were conducted in a semi-structured manner. In semi-structured interview, the questions and answer possibilities are the same for every respondent, but the order of the questions can vary (Hirsijärvi & Hurme 2001, 47). Semi-structured interviews were chosen, because the research was based on a previous model (Schiele 2007), and the audit is structured to be conducted in a semi-structured manner.

Voss et al. (2002, 205) point out that when designing case research, one key point is the number of respondents. If a set of questions can be reliably answered by one “key informant” then the research process should aim to identify these respondents (Voss et al. 2002, 205). In this study, some of the questions could be answered reliably by “key informant”, but many questions were also related to for example integration of a particular process and for these types of questions, there is usually a high risk of respondent bias. In other words, for some questions data triangulation was considered more important, and for some others, such as the ones relating to for example classification methods, identifying “key informant” was more important. Overall, the respondents were chosen based on the conversations with the case company personnel. Furthermore, researcher got archival records in the form of organizational charts, which gave the possibility to identify and validate the important respondents suggested by the contact personnel. The access to archival records hindered the possibility that the case company personnel had too much influence to the choices made by the researcher regarding to respondent selection (Yin 2003, 90).

Voss et al. (2002, 210) point out that the time to stop interviewing more people and collecting additional evidence, is the point when there is enough data to satisfactorily address the research questions. This in mind, five interviews were conducted and the interviews ranged from one to two hours in duration. In other words, the study did not end due to time or resource constraints (Yin 2003, 86). The first interview differed from the rest, because it was a group interview. The interview was conducted as a group interview, because the organization is scattered in many geographical locations, and at the time the group, which consisted of managers of the case organization, was in the same

location. Furthermore, the group interview was conducted relatively early on in the research process in order to get opinions on how suitable is the proposed model for studying the case company. Based on the group interview and findings from literature, one more dimension, *inventory management*, was added to the model to better reflect the issues relevant in the research context. However, even though the model and questions posed were not fully ready at the phase the group interview took place, it does not affect to the findings significantly, because the areas relating to the extended dimension could be answered reliably with the “key informant”.

All of the interviewees were in a manager, team leader or process owner position in the case company and this choice of respondents was made deliberately to get as broad view as possible. It could be assumed that the people who are responsible of designing and implementing processes and practices are also the ones whom have the best knowledge of describing organization’s current position and on the other hand identifying the relevant areas for development.

Table 6 Interviews

Interviewee	Responsibility area	Date
Group interview: Distribution chain manager Procurement manager Spare parts Sourcing manager Inventory manager 1	European Distribution services	6.12.2012
Procurement team leader	Spare parts procurement in Finland	19.1.2013
Procurement process owner	Global procurement process owner	4.2.2013
Inventory manager 2*	Inventory management	4.2.2013
Global category sourcing manager	Global sourcing, electrics	19.2.2013

*Key informant on inventory management questions

Prior to each interview, researcher sent the questions for the respondents about one week beforehand. In the interviews, respondents were asked to assess the current stage of development in each question, so the whole audit form was in front of the interviewee throughout the interview. The reason to show the stages and questions for the respondents was to more reliably anchor the answers to the development stages. This also ensured that the respondent would actually answer to the question asked and avoided the answers to go aside from the matter on hand. In addition, respondents were also asked is the particular process or activity on sufficient level or should it be developed further. This gave the respondents the possibility to answer more openly.

Researcher also observed the overall attitude and reaction of respondents to the posed questions and to the interview situation in general. All of the respondents were answering openly to the questions without any signs of hostile attitude towards the research. Although all of the interviews were long in duration, it seemed not to affect to the quality of the answers.

In addition to the interviews, researcher gathered data by using copies of organizational charts, web sites and other documents about the case company, and these were mainly used to understand the organization better in order to interview the right people. Ellram (1996, 119) highlight also the importance of case study data base, and in this research, data-base was established containing case study notes and case study documents such as interview transcripts.

5.4 Data analysis techniques

Data analysis is a vital part of the case research process and it is probably the most challenging part of the process (Stuart et al. 2002, 427-428). Specific analyses techniques have been proposed in literature and the ones used in this research are: *data reduction*, *data display*, *data comparison* and *conclusion drawing* by assessing the development stage and selecting the descriptions to support the assessment.

The interview data was first transcribed and then reduced by summarizing the most important points of each respondent in each particular question. After this, the summarized answers were imported to the excel-worksheet, so that the answers from the respondents could be compared. The use of data display helps in general to organize the data and it allows and facilitates conclusion drawing (Miles & Huberman 1994, 10-11). In addition, the structuring of data helped already on the data collection phase, and avoided the data chaos usually familiar to case research (Stuart et al. 2002, 427), because the interviews followed the pre-determined audit structure and the answers were therefore relatively easy to zero in to the right places.

After comparing the interview answers on the data display, development stage was assessed based on the combination of the answers. However, at this point researcher evaluated the connection between the type of question on hand and the respondents' responsibility area, and if the respondent clearly had more information of a particular question area, this was taken into account. In general, most value was given to rich explanations.

5.5 Research quality

No matter what is the purpose of the research, it must demonstrate that its means of measuring are valid (Stuart et al. 2002, 425). Research design quality can be ensured by paying attention to *construct validity, reliability, external and internal validity* (e.g. Yin 2003, 34).

One of the primary concerns in a case study research is construct validity (Voss et al. 2002, 211). Construct validity addresses to the proper operational measures for the concepts being studied, it is part of the data collection phase and is closely tied to reliability (Ellram 1996, 105). One way to improve construct validity is through triangulation. Triangulation means using multiple data sources to corroborate evidence and it helps to overcome the problem of informant bias (Ellram 1996, 105). Multiple informants were also used in this study in order to give the results greater breadth and better validity.

Another way to improve construct validity is by establishing and maintaining chain of evidence (e.g. Ellram 1996; Stuart et al. 2002, 131). The principal idea of maintaining chain of evidence is to allow external observer to follow the derivation of any evidence (Yin 2003, 105). Researcher has added a visual data display of the audit structure and the dimensions which were answered by the respondents (Appendix). This chain of evidence also increases the reliability of the research (Yin 2003, 105).

The reliability in case study context can be addressed by two key concepts: use of a case study protocol and a development of a case study data base (Ellram 1996, 104). This research has not followed very strict case study protocol, because it is usually considered more important in multiple case study research. However, all the data has been gathered to a case study data base, where it is easily accessible.

External validity is dealing with the generalization of the results (e.g. Yin 2003, 34). The purpose of this study is not necessary to provide very generalizable results, but some findings about purchasing development in the spare parts context might be useful in the broader context. *Internal validity* refers to establishing causal relationships, it is only relevant in *descriptive or exploratory studies* (Yin 2003, 34), and is not therefore relevant in this study.

5.6 Case organization

The case organization is a part of a multinational company, which is one of the biggest operators in its industry, specialized in mining machinery. Company's turnover 2011 was c.a. 4 billion euros and it employed 13.300 (Annual report 2011). Furthermore, company is one business area in the group and accounts for about one third of the total revenue of the group. Company is following a division structure and the case organiza-

tion is one department inside the Customer Services -business unit, which is globally responsible for the company's after-sales operations. More precisely, the case organization is responsible for the spare parts distribution services in Europe and it is further divided into sourcing, procurement, warehouse operations, inventory management and logistics functions (organizational charts from company's intranet).

The company has production in several countries in Europe and the suppliers for spare parts are in most cases the same as for the production units. The primary products are relatively complex and one machine may have over 20 000 differentiated parts and large share of the parts are proprietary items (inventory manager 2). The spare parts suppliers are mainly managed outside the case organization (over 80 % contracts) by specific sourcing categories specialized in areas such as steel components, hydraulics and electrics. The sourcing function in the case organization has got mandate over commercial items only.

Due to the structure of the case organization and company in general, the fundamental problem in the audit was how to treat the areas that are not entirely managed by the case organization, such as the areas relating to supplier processes. It did not seem convenient to treat the areas solely from the case organization sourcing point of view, because the function is not managing the supplier accounts which are generating the largest spare parts purchase volume. Therefore, respondents were asked to think the areas from the after-sales and spare parts perspective where it was difficult to draw a line between responsibilities, even though the main responsibility would have been on some other organization, usually on sourcing categories. For example, supplier development clearly affects the spare parts business as well, but the main responsibility of the process is on the specific sourcing categories.

Moreover, the dimensions apart from the supplier processes and process integration were analyzed mainly from the case organization's procurement point of view, because the sourcing function has only few employees and much of the for example controlling processes were still under development due to the infant stage of the spare parts sourcing function (sourcing manager 1). The areas that are for the most part sourcing responsibility are marked as "s" in the results section and the questions that are analyzing case organization mainly from the procurement point of view are marked as "p". Logically, areas where both procurement and sourcing were seen to contribute, are marked as "s,p".

6 RESULTS

This chapter is structured based on the findings from the interviews. The current situation, possible directions for future development and comments about the model are analyzed in each dimension separately.

6.1 Supplier related processes

Sourcing Strategy. Case organization has mandate over commercial parts and sourcing strategy for these items has been defined, but it has not been forwarded anywhere, because the organization's sourcing function is in general in a transformation stage, and the future strategy is still developing (sourcing manager 1). Most of the supplier accounts, from which largest share of spare parts volume is generated, are managed outside of case organization and the major concern was how the specific needs of spare parts are taken into account in the global category sourcing organizations (group interview, team leader 1). It was stated that it depends hugely on specific category and area how the spare parts aspects are taken into account, sometimes spare parts work as a driving force and in other areas it is not relevant for supplier to know whether the parts go to production or for spare parts (sourcing manager 1). The suppliers are pretty much legacy from the production units, and this does not necessarily serve the needs of the after-sales (group interview).

In future, spare parts related matters, such as more specific lead time agreements with suppliers, should be more punctually included to the contracts (group interview). Sourcing manager 1 pointed out that the inclusion of spare parts aspects at the moment depends on the sourcing category and for suppliers for which after-sales is the major client, the contracts cover important aspects from spare parts point of view pretty well. More active role is recalled from the case organization also to ensure that after-sales interests are taken into account in the supplier negotiations in the future (sourcing manager 1)

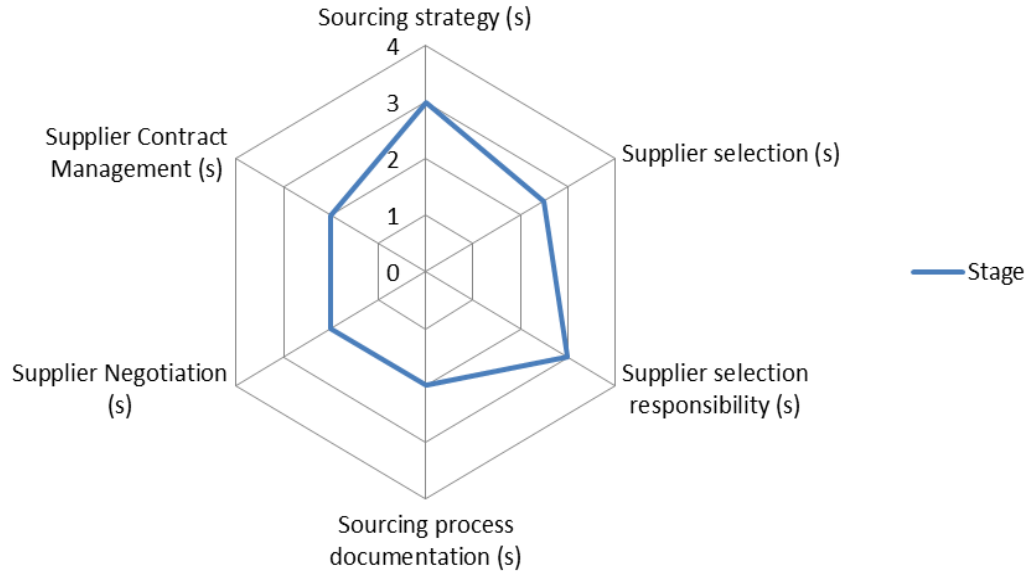


Figure 8 Current state of supplier related processes (1/2)

Supplier selection. Supplier selection in the case organization is carried out based on the principals of the overall supplier selection process of the company (sourcing manager 1). The idea with case organization sourcing is to, when possible, reduce the supply base and move supplier accounts as close to the European distribution center as possible to reduce lead times (group interview). In the supplier selection process, for which case organization has mandate on (commercial items), better traceability should exist in the future. Also the bottom 500-suppliers are consolidated as much as possible in the future to reduce the excessive supply base (group interview).

Supplier selection responsibility. Responsibility for supplier selection is also mainly on the category sourcing organizations of the company. Sometimes in new product development projects, R&D does not follow this formal process (sourcing manager 1). Specifically with the spare parts, quick response time in the supplier selection was considered important, and therefore for example steering committee is not a good option, because it takes too much time (group interview).

Sourcing process documentation. At the moment the overall sourcing process of the spare parts sourcing is documented and defined in the system, and it overall follows the principals of the company's sourcing process documentation (Group interview, sourcing manager 1). Still, more detailed documentation of the whole process should exist (group interview).

Supplier negotiation. Some preparation is done at the moment before supplier negotiations (group interview). In the category sourcing organizations, supplier account manager is defined for each key-supplier to get structured approach for handling main suppliers (sourcing manager 1). It was considered important that when category sourc-

ing goes to negotiations with suppliers, spare parts related aspects are covered beforehand (group interview, team leader 1).

Supplier contract management. Database for contracts exists and most of the contracts, can be found there (group interview). It was also pointed out that there is no need to have contracts for all suppliers. Especially for the low volume C-suppliers price lists are sufficient (group interview). With the contract templates, sourcing categories are pretty independent, but usually at least three different types exist: quick fix, basic commercial contract and partnership contract (sourcing manager 1).

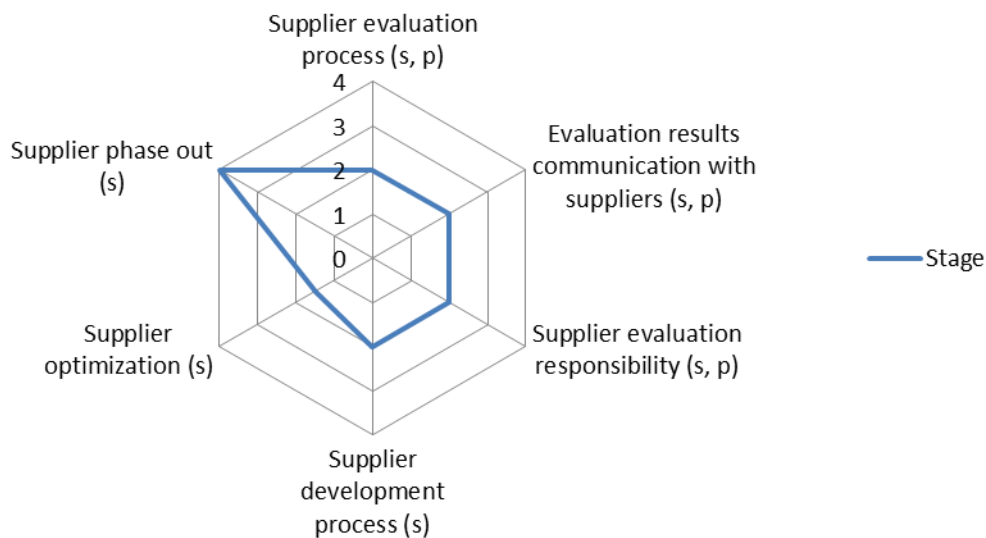


Figure 9 Current state of supplier related processes (2/2)

Supplier evaluation process, results communication and responsibility. Evaluation process from the procurement point of view is well in place. Supplier performance is measured and operative procurement is following metrics such as lead times and order fill rate and the results are also communicated with suppliers (group interview, team leader 1). In other words, the basic supplier evaluation processes are well established, and different approaches are applied for A, B and C suppliers. The spare parts sourcing has not yet got any process for supplier evaluation, because it has been operating for such a short time and it can evaluate purely business based aspects, such as the supplier's ability to supply, because advanced supplier evaluation (such as supplier's quality system evaluation) would require quality function, which does not exist in the case organization (sourcing manager 1, group interview). In fact, supplier evaluation practices are on pretty low level of maturity in most category sourcing organizations as well (sourcing manager 1). In addition, one problem with the results communication with suppliers is that the company's own inbound processes are in a shape where the supplier performance

figures are not reliable and the numbers must be checked many times before contacting the supplier for follow up (sourcing manager 1).

Case organization's procurement is pretty systematic at the moment with the supplier evaluation and results communication with the suppliers, but the goal in the future is that buyers take more responsibility in this area with the procurement related matters (group interview, team leader 1). However, case organization has in general limited possibilities to develop the supplier evaluation, because most contracts are managed by sourcing categories (group interview). Sourcing manager 1 pointed out that there is strong need to develop the supplier evaluation systematics to more advanced form in the sourcing categories, which of course irreversibly affect the case organization as well.

Supplier development process. Planning process in supplier development is existing for substantial suppliers in case organization sourcing, but not possible to do quality-related supplier development, because of the non-existence of quality function (group interview). Ambition is to derive supplier development plans from the supplier evaluations (group interview). From the category sourcing perspective, all the stages on the profile apply, depending on the particular category and supplier, and it is very hard to assess where the whole company is in general (sourcing manager 1). The variation relates to organization maturity, so in general there is idea in the sourcing categories what should be done regarding to the supplier development, but the implementation has many times not yet taken place (sourcing manager 1). Case organization has now mandate over commercial items, and non-quality related supplier development is definitely a goal in the future (group interview).

Supplier optimization. Case organization procurement has selective visits to customer sites to communicate evaluation results and other issues with suppliers. Procurement and sourcing have different agendas when visiting suppliers, and from the procurement point of view, selective visits are considered sufficient (group interview, procurement process owner), because specific workshops and trainings at supplier sites would require too much resources, and they are not considered as an important area from the operational procurement point of view. From the category sourcing perspective, some workshops have been implemented in selected supplier premises, and the strategies for trainings at suppliers depend on each sourcing category (sourcing manager 1).

Supplier phase out. Supplier phase out is probably the most defined and structured process in the case organization and company in general, and it is also followed very strictly, because risk management is heavily involved in this (Group interview, sourcing manager 1). Resources to do supplier phase out smoothly are sufficient, because major disruptions in production or spare parts supply causes major damage (group interview). However, team leader 1 felt that many times the information from closed supplier account reaches operational procurement too late, and that there is not enough time to adjust the inventory levels in these situations.

In addition, sourcing manager 1 pointed out (not specifically about case organization) that company has documented and described all kinds of processes pretty well, but the implementation and follow up is in general on poor level, and that there is a strong need for better process discipline.

6.2 Process integration

Purchasing early involvement in development processes, cross-functional integration. Case organization does not directly take part in the new product development processes (group interview) but the spare parts and after-sales related subjects are defined in the product development process principles (sourcing manager 1) and life-time support organization is sitting in steering committee in all new product development projects to ensure the after-sales interests (group interview). Still, respondents felt that even though the process for after-sales integration in the product development was in place, the implementation of the process does not work the way it is supposed to (procurement process owner, group interview). Sourcing manager 1 pointed out that the product development process is an extremely good example, where there is lack of discipline in following the defined process. In other words, after-sales may have a formal representation in the product development processes, but the comments are often ignored, if the project itself meets, for example, some mile stones because of this. In general there is not any homogenous company approach for after-sales inclusion in development projects, some projects follow the process and others not (sourcing manager 1). In addition, inventory manager 2 commented that the product lines are in general quite fragmented, which brings obstacles to the information flow. In future, the formal process should be followed more strictly to ensure the after-sales interests (sourcing manager 1, procurement process owner).

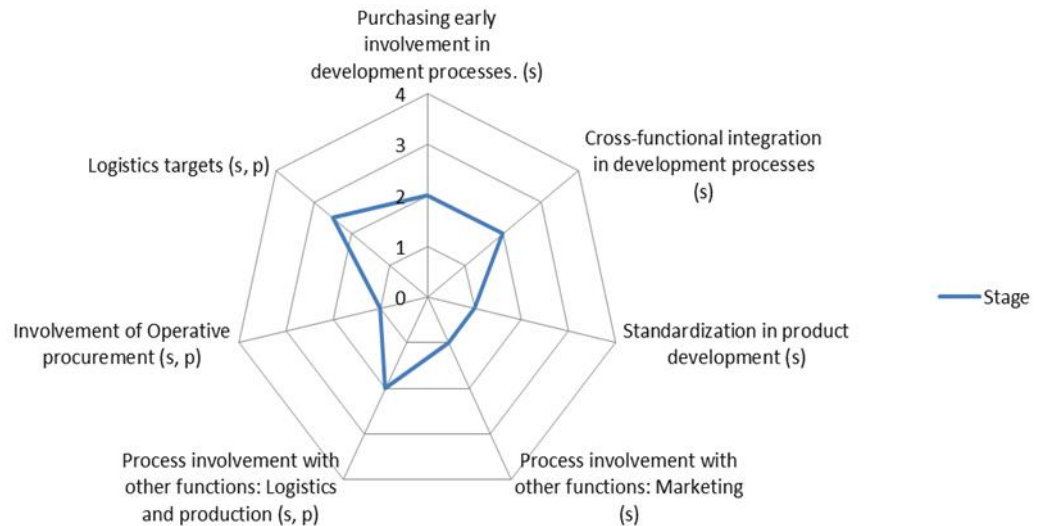


Figure 10 Current state of process integration

Standardization in product development. Standardization of products is one of the biggest issues in the company and this was highlighted by every respondent. Company has grown over the years through acquisitions and this has brought large variety of differentiated parts in the primary products due to the exhaustive supply base and fragmented R&D (sourcing manager 1, inventory manager 2). Some global R&D initiatives have been over the years to make parts more standard, but still product designers like to use new components every time, which then again expands the number of potential spare part items in the system (inventory manager 2). R&D departments are acting too individually on the company level (sourcing manager 1).

The status of standardization has been acknowledged and plans have been made to improve the situation (sourcing manager 1). However, it takes many years of time before any improvements can be seen in the after-sales side. Most of the problems relating to unstandardized parts are especially relevant in the after-sales side and more standardization should exist inside and between the product lines in the future to decrease the amount of potential spares as much as possible (inventory manager 2).

Process involvement with marketing. Marketing organizations are quite unknown to case organization, and there is no exchange of information (group interview, team leader 1). It was highlighted that the case organization should know more and it would be interested to know how the marketing organizations are selling the after-sales services to the end customer (group interview). Sourcing manager 1 pointed out also, that traditionally the company's competitive advantage has come from highly customized products, and therefore the history of the company also affect to the issue that marketing is not probably striving to any kind of standardization.

Process involvement with logistics. Some high level process descriptions about the inbound process (supplier -> DC) exist, but not on very detailed level (procurement process owner). There is no such process description which would describe in detail the whole inbound process, which would be given for example to new employee (inventory manager 2). Process descriptions are improved continuously and hopefully there are enough resources to make more detailed inbound process descriptions in near future to help for example new employee integration (inventory manager 2, procurement process owner).

Process involvement with operative procurement. The integration between category sourcing organizations and case organization's operative procurement is not working properly, and the flow of information is not good to either direction (Group interview, team leader 1, procurement process owner, inventory manager 2). Many times people from procurement or category sourcing do not even know who to contact in some important supplier related matters (procurement process owner, team leader 1). However, some procurement and sourcing personnel have formed good pairs due to the many years of collaboration and know to keep each other well informed, but this is more random (group interview, team leader 1). In general, it was assumed that the geographical distance between people and the relatively unknown procurement function causes friction to the information flow, among other aspects, such as complex organizational structure (purchasing process owner, team leader 1, sourcing manager 1). Need for better collaboration is strong, and at least with the top 50 spare parts suppliers, systematical exchange of information is an important goal in the near future (group interview).

Logistics targets. With the joint logistics targets, purchasing process owner pointed out that there is specifications for spare parts related labeling and packaging requirements in the basic supplier contracts so that items can be put straight to shelves in the distribution center. However, the adaption of spare parts related matters in the supplier contracts is assumed to vary quite a lot (inventory manager 2), and if spare parts and production units have conflicting interests with the supplier requirements, in for example packaging, production units usually dictates the rules (sourcing manager 1).

6.3 HR and Leading

Job descriptions and functions. There is not any global standard for buyer and the DSA's independently decide (procurement process owner). For some part it would be good to make roles and job profiles more standard between DSA's, but the problem is that different DSA's are on very different maturity levels in general and therefore they have different needs and starting points at the moment, which does not support very standardized job profiles in the global scale (procurement process owner).

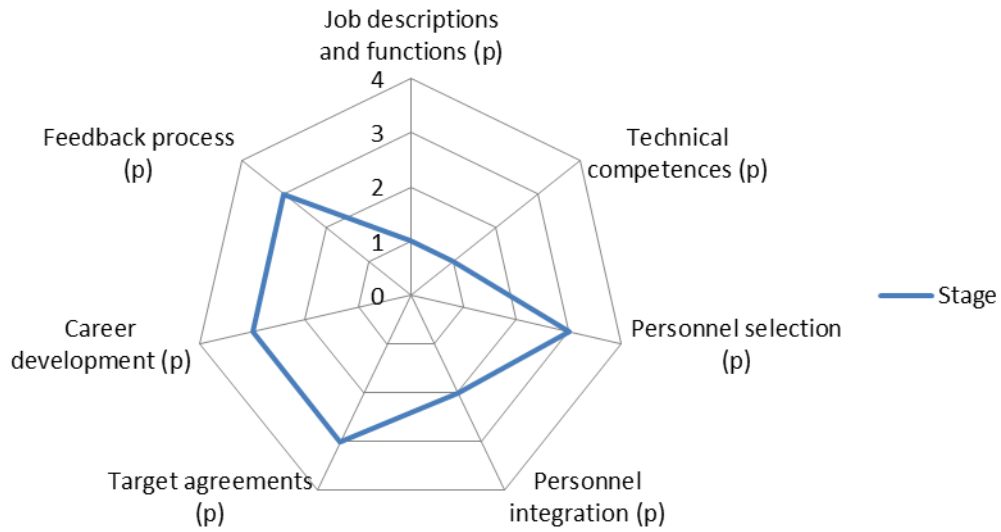


Figure 11 Current state of HR and Leading

Technical competences. Partial existence of technical competence is available in the case organization procurement. Partial existence of technical competence was expected to be sufficient, because the scope of spare parts is so wide that broader technical inclusion would require a very large technical organization to cover all the necessary areas (group interview). However, even though the case organization does not have own official technical competence function, the process of consulting other organizations, sourcing categories in particular, should be better defined (team leader 1). In addition, team leader 1 pointed out, that procurement has technical buyers, because there are plenty of spare parts in the system, which require technical sourcing competence, but nobody is doing the technical spare parts sourcing very officially at the moment, and that this work is not measured in any way. Sourcing manager 1 pointed out also, that there is lack of technical competence resources in the sourcing categories as well.

Personnel selection. Selection of employees is getting very standard and company provides good tools for this (group interview). Global HR systems are in place and position based requirements are also taken into account when recruiting (procurement process owner).

Personnel integration. Case organization does not provide specific training plans for buyers entering the organization, but some courses are available for everybody (group interview, team leader 1). Inventory manager 2 pointed out that in most functions in the company training plans for new employees do not exist. Personnel integration is consid-

ered important and training plans should be developed to better shape in the future (team leader 1, procurement process owner).

Target agreements. Target agreements are on high level of maturity, and the targets are defined on employee level in the procurement. Respondents felt like this is in general on sufficient level (group interview, purchasing process owner).

Career development. Employee development is also standardized and company requires managers to conduct annual development conversations with employees. In general, company provides many systems for employee development, and the implementation is up to the particular organization (inventory manager 2). Company also has a process for detecting top talents (group interview).

Feedback process. Basic idea with the feedback processes in the company is that feedback is mainly given by the manager (inventory manager 2). However, annual employee empowerment research is in place, where employees can give feedback and evaluate their managers. This is considered to be sufficient, if the manager breaks down and communicates the results with his/her subordinates (purchasing process owner). Again, company provides in general good tools to give feedback, but the adoption of the tools depends on the particular manager and function.

6.4 Controlling

Target result definition, Target breakdown, Measurement figures. Target results are derived from the business planning targets of the business unit and are cross-functionally agreed (group interview). The targets are broken down and detailed on employee level and also substantial financial results are defined and reviewed regularly (group interview). Case organization aims to be more involved in the business unit target results definition in the future (group interview). Also more cross-functional targets should be assessed, because for example fill rate is very difficult to see merely as a responsibility of one function and therefore joint targets would enhance functions to go to same direction (procurement process owner).

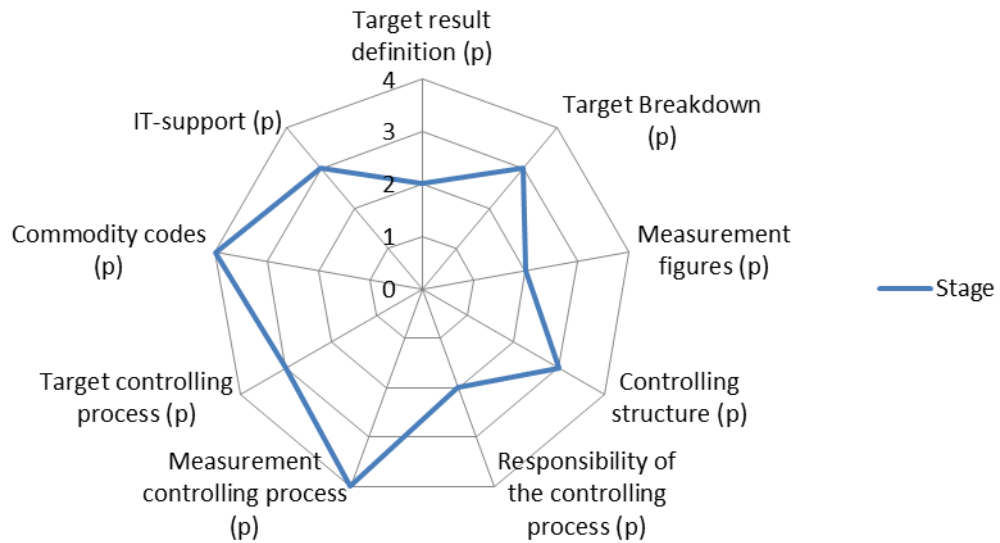


Figure 12 Current state of controlling

Controlling structure, Responsibility of the controlling process. Controlling structure is also in place and well defined in the operative procurement and also the tasks and responsibilities are sufficiently described (group interview). In general, everybody reports to the next level in the organization (team leader 1).

Measurement of controlling process, Target controlling process. The usability of the controlling measures are also controlled and adjusted on regular basis to better reflect the changing business environment. Also the deviations from plans are detected and corrections implemented on regular basis (group interview, procurement process owner).

Commodity codes, IT support. Commodity codes classification is on pretty high level and also IT-support to conduct a spend analysis is well automated (procurement process owner, team leader 1).

6.5 Organizational structure

Organizational structure. Tasks between sourcing and procurement are defined in the case organization and also the organization structure is in place (group interview, procurement process owner). Sourcing manager 1 highlighted that the whole after-sales sourcing should not be operating too individually in the future, but rather in more tight

collaboration between the sourcing categories. In the new DSA structure, after-sales sourcing went too far from the actual sourcing (sourcing manager 1).

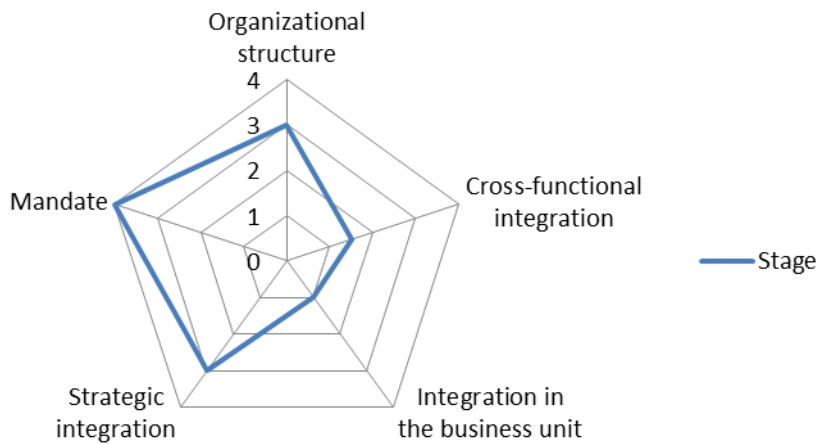


Figure 13 Current state of organizational structure

Cross-functional integration. Cross-functional integration inside case organization is on good level and the higher stages (3-4) would require too much time and effort (group interview).

Integration in the business unit. Integration to the other DSAs had regressed due to new organizational structure and very limited amount of information is exchanged between DSA's at the moment (group interview, procurement process owner). Only common practices in the DSA's are the ones relating to reporting and KPI's (procurement process owner). However, it would be good idea to find and share best practices between the DSA's in some areas (procurement process owner).

Strategic integration. Strategic integration was difficult to assess from the case organization point of view (group interview, procurement process owner). CSSO (chief sourcing & supply officer) is sitting in the board of directors, but not specifically in charge of after-sales –division sourcing and procurement activities (sourcing manager 1). Every respondent finds it important that after-sales sourcing and procurement aspects are represented in the top-management level, and that there is not much difference is the board member from after-sales or from the sourcing side, as long as the specific after-sales related needs are understood and covered.

Mandate. Procurement and sourcing organizations throughout the company are generally in charge for all the purchased materials, but occasionally new product development projects do not follow the process and select prototype parts without understanding the consequences, for example, to later spares supply (sourcing manager 1).

6.6 Inventory management

Spare parts classification. Spare parts are classified upon on two classification techniques. SIC (sales intensity classification) classification is used to track sales hits for spare parts and ABC-classification, is based on the monetary sales volume (inventory manager 2). The possibility to use item criticality as a control criterion has been investigated, but the problem is that the criticality as a criterion suffers from the subjective judgment, meaning that criticality is seen differently depending on the viewer (inventory manager 2).

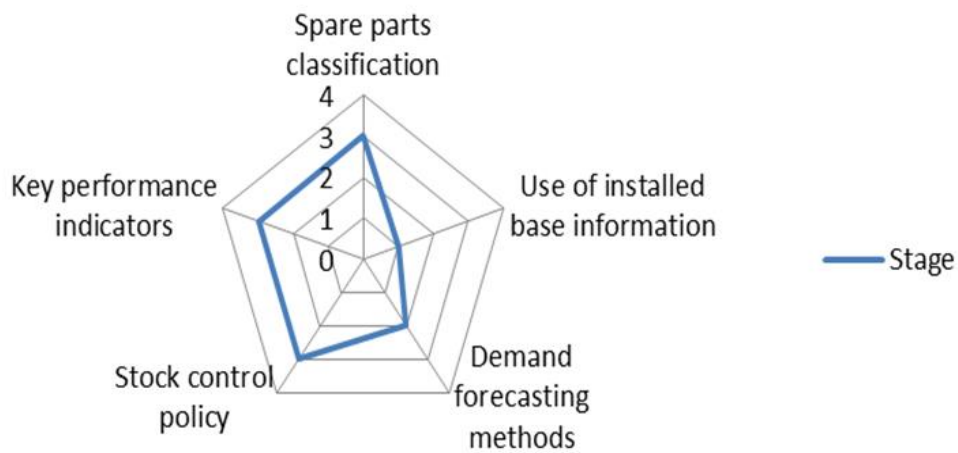


Figure 14 Current state of inventory management

Installed base information. Installed base information is not used in inventory controlling parameter setting, but it is secondarily used for strategic stocking planning in some sites (inventory manager 2, sourcing manager 1). The problem of using installed base information in active parameter setting stems from the fact that company's primary products are highly customized, parts diverged and the sales volumes are too low to build some kind of demand estimation parameters to the system (inventory manager 2). Collecting installed base information requires manual work at the sites and there is not any process or specification to do this on the company-level at the moment (sourcing manager 1). Some projects have been started during years, but no systematical effort to gather data from the front line at the moment (procurement process owner).

There is huge potential in the use of installed base information and it is seen as a relevant development area (procurement process owner, sourcing manager 1, inventory manager 2). For example, preventive maintenance has brought good single results when employed by the maintenance crew on sites (sourcing manager 1). It was also assumed that there are very much slow moving parts in small warehouses whose potential cus-

tomer machine is not in use anywhere anymore and which cannot be detected in the ERP system (sourcing manager 1). In general more installed base information (e.g. operating conditions, contract type) is needed from the front line to improve the spare parts management (procurement process owner).

Demand forecasting methods. At the moment the 12 month forecast is based on the exponential decay curve and historical data about consumption, where the recent months get more weight (inventory manager 2). It was highlighted that the forecast is too much relying on the historical data and in general it should start from the other direction (procurement process owner, team leader 1). Demand forecasts are given to suppliers only from fast moving spare parts, because after that the forecast becomes very unreliable (procurement process owner). Relying to other components than merely historical data in the forecasts would in general require better information exchange with the front line (procurement process owner).

Stock control policy. Demand side parameters (ROPs) for spare parts are well in place and for example different ROPs can be calculated for different kinds of part families and also many kind of adjustments and safety stock factors are possible (inventory manager 2). The use of supply side parameters (lead times) in the inventory calculations is at the moment more random (procurement process owner). There is ongoing project about improving the lead time management and it is seen important, because lead time is one of the most important parameters in the inventory calculations (procurement process owner).

Key performance indicators. Many performance indicators are in place, such as: days in inventory, fill rate, stock turn and obsolescence inventory (inventory manager 2). The biggest issue relate to the alignment of KPIs in the constantly changing distribution network (inventory manager 2). Vision would be that the whole order-to-delivery chain would be under one system and fiscal company in all market areas (inventory manager 2).

6.7 Remarks about the model

One of the goals of this study was to test how suitable is the Schiele's (2007) maturity model in the spare parts context. The following analysis is structured to reflect the issues apparent in the model from *universal* and *case-related* point of view.

Universal issues cover issues encountered that are not specifically context or case-related, but could be apparent in almost every situation. Vice versa, issues encountered in this research, which cannot be universally generalized, are considered as *case related issues*.

6.7.1 *Universal issues*

It could be assumed that in most large modern firms, procurement and sourcing have different agendas when communicating with suppliers. Therefore, it was difficult to assess the overall maturity in the types of questions (s,p) where both functions have clearly different agendas, but the overall process cover both functions. For example, in the supplier evaluation, procurement might communicate on the supplier's ability to supply and sourcing's responsibility would be to analyze the suppliers' quality systems. However, the stages in the model do not separate between the two, and supplier evaluation was understood differently depending on the respondent. Same problem occurred with the supplier optimization question - procurement and sourcing have different agendas on the supplier visits. For procurement, selective visits are usually sufficient (group interview, purchasing process owner), but this would indicate a low level of maturity in the model. In other words, there are problems assessing the overall maturity of purchasing practices in the type of questions which clearly cover both strategic and operational activities.

The question about *job descriptions and functions* was difficult to understand, and it seems to have two levels: on one hand the question relates to the standardization of purchasing functions and on the other hand to standardized job profiles. As procurement process owner pointed out about job profiles, the standardization of job profiles is a good goal in a situation where the procurement functions are on similar maturity stage in general in the company. Therefore, even though the organizational structure for procurement functions is similar in the global scale, it does not necessarily mean that job profiles, for buyers for example, should be similar, because different procurement functions might have different needs in a global scale in any given point in time. Thus, it could be argued that the overall maturity is very difficult to assess and it depends on the company's organizational structure. Also, the answers indicate that standardization is not always necessarily the right direction to go to.

There was difficulties in understanding the *Controlling structure* -question. The question relates to some kind of superior purchasing controlling function, but at least in the case company, this kind of structure did not exist and it was again understood to be more a question about organizational structure than maturity. In addition, there were problems to understand what is meant by the "superior controlling guideline" in the final stage of *Responsibility of the controlling process*. Furthermore, the question about *Commodity codes* was difficult to understand, and the interpretation was that for the most parts the commodity codes are legislation-based, and therefore compulsory.

6.7.2 Case related issues

Supplier related processes –section had a few case related issues. Firstly, most of the supplier contracts in the company are managed outside the case organization, and therefore analyzing only the accounts that are managed by case organization sourcing and procurement, would not give sufficient picture of the reality, because the purchasing volume handled again by the case organization is mostly generated by the supplier accounts managed outside the case organization. Therefore, notions from the category sourcing side were included in this section mainly to give more managerial value to the results.

There was also disagreement about the final stages of maturity in specific questions. For example, the steering committee representing the highest level of maturity in the *supplier selection* was not seen correct from the spare parts point of view, because steering committee requires longer time for decisions, which does not serve the needs of after-sales organization, where quick selection of suppliers was seen more important than going through steering committee.

In the Process integration -part *involvement in the development processes* was considered important from the after-sales side, but the maturity stages in the model did not represent the type of involvement after-sales function should have in all of the development processes. It was stated that the specific needs of the spare parts should be taken into consideration as early as possible in the new product development process, but that the main responsibility of purchasing representation in general should be on the sourcing categories.

In addition, *process involvement with quality* was not included to the maturity results, because case organization does not have own quality function, and borrows quality assistance from the sourcing categories, and therefore the stage cannot be assessed. It could be assumed that it is difficult for companies operating in similar kind of industry to have very sophisticated quality function in after-sales organization, because it would require plenty of resources due to the large variety of spare parts, and therefore more important is to know who to contact if quality assistance is needed

Furthermore, *material/functional release, early supplier involvement* and *technology roadmaps* were not included to the maturity assessment, because they were seen as relevant aspects for production based sourcing, but not for after-sales (group interview, procurement process owner, team leader 1, sourcing manager 1). However, sourcing manager 1 pointed out that supplier involvement from the after-sales perspective is relevant in few high volume items. Suppliers can be asked to put company's own logo and serial number to the sourced spare parts and this is a very good way to boost up the spare parts business (sourcing manager 1).

Also the stages in the *process involvement with marketing* do not represent the desired steps in the after-sales context, because it was assumed that it is not necessary for case organization or after-sales in general to influence heavily to the marketing strategies (group interview).

In the HR & Leadership -section *technical competence* -question is following a more general sourcing based sequence, and for a spare parts organization, the stages are not describing the desired direction of maturity, because it was assumed that it is not convenient to have a large quality function in the after-sales side. In general, the availability of technical competence was seen more as an organizational structure than maturity related issue on the after-sales side.

Organizational structure –section had also issued. The case organization manages only a part of the total purchasing activities of the company, and the scope of the model in this section in particular would require more company-wide assessment and analysis. Therefore, *cross-functional integration* was analyzed from the after-sales business unit perspective, but the stages did not obviously apply fully to the scope of this research, because for example group wide integration analysis would require company-wide scope in the whole research. Therefore, *cross-functional integration* was analyzed from the case organization perspective i.e. how are the functions inside the case organization co-operating between each other. Also the stages in the *strategic integration* would require company-wide assessment, and it was difficult to assess for respondents what kind of role after-sales should play in the strategic integration.

Furthermore, *make-or-buy decisions* were not included to the maturity assessment, because it is relevant for production based sourcing only, thus, not in the scope of this study.

7 CONCLUSIONS

After-sales services have become over the years an important source of revenue and profit for most manufacturing firms as the profit margins for primary products are getting thinner due to the increase in global competition. Efficient purchasing practices can have a great impact to the performance of the firm's after-sales services and ultimately to the value creation and relationship building for the end customer.

The first part of this research introduced characteristics from the spare parts supply chain. Later, purchasing's development in an organization were discussed, and finally the purchasing maturity model developed by Schiele (2007) was introduced and modified to better capture the relevant areas specifically in the after-sales context. The research aimed to answer the following research questions:

What is the current stage of development in the case organization?

It is obvious that the case organization has not reached mature level in many of their spare parts purchasing practices. Lele's (1999) finding that traditionally companies have seen their after-sales business as "necessary evil" can be detected in the case company as well. One of the indicators for this is the lack of collaboration between sourcing categories and operative spare parts procurement. The focus is still mostly in ensuring supply for the primary products and the coverage of spare parts related aspects in the supplier contracts varies a lot depending on the sourcing category and many times spare parts are ignored in the contracts. Some major problems were also identified in the basic supplier management processes. For example, the information from closed supplier account does not reach spare parts procurement before order placement of a spare part takes place, and this makes the whole operative procurement appear unprofessional. Moreover, the lack of proper after-sales inclusion in the new product development processes indicate the lack of understanding about the spare parts supply chain, meaning that most of the strategies available for spare parts managers later are actually defined in the R&D phase of the primary product. It seems that the company does not have a clear strategy for supplying spare parts in the post-production life cycle and this creates problems not only for the spare parts purchasing processes but for the whole planning of the after-sales supply chain as well. Difficulties in managing the after-sales supply relates also to the fact that case company has grown over the years through acquisitions. This has expanded the spare parts portfolio to very large and the standardization of parts between and inside product lines is not as mature as it would be if the company would have grown organically. However, HR and controlling processes are on high level of maturity, and this might be due to fact that these processes are easier to implement without tight collaboration between other functions.

How could the case organization further improve performance? It was highlighted that ultimately the biggest issue in the company's after-sales services is the lack of parts

standardization. Plans have been made to improve the situation, but it takes many years of time before any reduction can be seen in the spare parts portfolio. In the daily supplier management, performance improvements can be obtained by simply paying attention to the information flow between sourcing categories and operative procurement. For example, more clear definition of the inclusion of spare parts related aspects in the supplier contracts could avoid many issues in the supply chain before the actual demand for the spares even start. Furthermore, better process discipline would certainly improve the performance of the whole supply chain, as it is difficult for the supply chain partners, even inside the company, to know what the other members of the chain are doing if the defined processes are not followed. Also managing supply chain of a large complex company becomes very difficult without certain degree of process discipline.

It also became evident that the supply chain has lack of cross-functional targets. These targets were underlined as relevant area for development, because this would enforce the functions to go to the same direction. For example, a KPI such as order fill rate is difficult to see merely as a responsibility of one function.

Also, major performance improvements could be obtained by paying closer attention to the installed base data. Information about the installed base (e.g. operating conditions, service contract type) is exploited only randomly in the spare parts management. In general, the information exchange with the front line is poor and more proactive manner would be required to manage and forecast future demand for spare parts. At the moment the future demand anticipation is based solely on historical demand data about consumption, which is reliable only with the items following smooth demand patterns.

How applicable is the maturity model in the after-sales context? The maturity model worked well in HR & Leading, Controlling and Inventory management -dimensions. Maturity definition in the Supplier related processes, Process integration and Organizational structure –dimensions was more difficult to assess, mainly because case organization is not responsible for all the processes and practices apparent in the model and also the scope and structure in these dimensions would require for some parts more company-wide assessment. In general, choices made by other organizations significantly affect the performance of the after-sales services and therefore the maturity is difficult to assess solely from the after-sales perspective.

The issues related to the use of the model were categorized to universal issues and case related issues. Universal issues related mostly to the chance of misinterpreting the questions or stages in the maturity model. Case related issues occurred mainly due to the focus point of the study, meaning that the original purchasing maturity model (Schiele 2007) was not structured solely from the after-sales perspective.

Despite the issues, the maturity model was seen as a helpful tool to investigate case organization's current state. Although all of the maturity stages in the model did not necessarily demonstrate the possible desired direction for the case organization, it

seemed to cover broadly all the important areas. In other words, according to the results, the model is demonstrating the right processes and practices, but the maturity levels are not always demonstrating the right path for future change at least in this context. It is probably impossible to structure up universally flawless maturity model, which would demonstrate desired development direction for any organization. Therefore, it could be argued that the maturity model developed by Schiele (2007) has proved to be useful in practice as well even if it is only capturing the most important areas, no matter if all of the stages do not demonstrate the future change.

In general, there is scarce amount of practically-oriented studies of how manufacturing companies should align the service business, and more precisely, how the spare parts supply chain should be aligned in a globally operating manufacturing firm. The research about after-sales supply chain performance leans heavily to the inventory modeling about spare parts management and even though important, there is strong need for more broad strategic frameworks as large share of the choices which impact the after-sales performance is done outside after-sales division. After-sales supply chain is an extremely good example where the old functional way of thinking hinders the performance strongly, because deliveries for customers has to be ensured in short notice, yet the actual supply chain may be very long and supply base geographically scattered.

Overall, by developing supply chain practices and processes to more mature state can facilitate the operation of the spare parts supply chain significantly. However, as it became evident with the case organization, the overall performance of the after-sales service seen by the end customer is ultimately affected by every step of the supply chain. Big choices affecting the spares supply are made outside the after-sales division and therefore steady information flow between sourcing categories, R&D, production and marketing is in the focus if company wishes to develop the performance of the after-sales services to a more mature state.

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APPENDIX 1: RESPONSE DISTRIBUTION

	Group in- terview	Procurement team leader	Procurement process owner	Inventory manager 2	Sourcing manager 1
Supplier relat- ed processes	x	x	x	-	x
Process inte- gration	x	x	x	x	x
HR & Leading	x	x	x	-	x
Controlling	x	x	x	-	x
Organizational structure	x	x	x	-	x
Inventory management	-	-	x	x	x

x = Respondent answered to the questions in the dimension

- = Respondent did not answer the questions in the dimension

APPENDIX 2: MATURITY ASSESSMENT TOOL

# of Q Supplier processes	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1 Sourcing strategy	Is the sourcing strategy documented and known to your partner functions?	Definition of sourcing is in progress.	Sourcing strategy is documented and applied to all major material groups.	Sourcing strategy is derived out of corporate strategy and cross-functionally agreed	Sourcing strategy is defined as a roadmap, adjusted to corporate strategy and tied into target agreements.
2 Supplier selection	Is supplier selection carried out systematically and according to requirements profile?	Supplier selection process is not or only partially described.	Selection process is defined and cross-functionally applied.	Selection process is completely applied. Supplier decisions are traceably documented.	Supplier selection is based on complete application and insights throughout the company (eg. pooling organization, supplier evaluation results etc.
3 Supplier selection responsibility	Who is responsible for supplier selection?	Purchasing is not or only partially involved in supplier selection	Purchasing supports supplier decisions.	Purchasing is process owner for the supplier selection.	Cross-functional decision-making committee (eg. sourcing committee) is in charge.
4 Process documentation	Is the sourcing process documented?	Sourcing process is documented insufficiently.	Approach for sourcing has been defined internally in purchasing (sourcing).	Compliance with the documented and cross-functionally accepted sourcing process.	The organization is aligned to support the sourcing process.
5 Supplier Negotiation	If preparing a negotiation, do you follow a uniform and systematic approach?	Less negotiator preparation.	Systematical approach. Negotiation targets are explicitly defined and documented. Customer requirements are considered in the strategy.	Cost structures of suppliers are analyzed. Procurement relevant consequences from possible negotiation results are evaluated.	Future influencing factors on supplier cost structure of suppliers are considered (cost reductions potentials, market prices, funding etc.)
6 Supplier Contract Management	Do you have a contract management function in your organization?	Tasks are hardly described and are covered within other responsibilities. No application of standardized contracts.	Task is described to some degree contract partners are known. Application of company wide and existing standards.	Task is pursued by responsible person. Application of standards under group wide adoption and own structure. (Eg. contract configurator)	Function is an established interface between cross-functional partners and purchasing. Function significantly drives and determines contract management issues.

7	Supplier evaluation process	Is there systematic procedure for supplier evaluation in place?	There is no systematics in place.	Less than 60 % of the purchase volume is evaluated according to an applied supplier evaluation systematics.	60-80 % of the purchase volume is evaluated according to an applied, cross-functional systematics.	More than 80 % of the purchase volume is evaluated according to applied, cross-functional systematics.
8	Evaluation results communication with suppliers	Are evaluation results communicated with suppliers?	Evaluation results are sporadically communicated to suppliers. (eg. during price negotiations)	Evaluated suppliers are promptly informed about the evaluation results. Results are internally recorded.	Evaluation results are discussed with selected suppliers in a cross-functional team (eg. Purchasing, quality etc.)	Evaluation results are discussed with selected suppliers under involvement of the management.
9	Supplier evaluation responsibility	Do you have Supplier Management function in your organization?	Supplier Management function is hardly existing.	Function is documented and implemented.	Function is implemented as described and is actively managing Supplier Management processes.	Function is an established interface between cross-functional partners and purchasing, drives application of agreed supplier strategies.
10	Supplier development process	Is there a systematic procedure for supplier development in place?	Supplier development measures are defined individually.	A planning process is existing for all substantial suppliers.	The supplier development process is defined. Supplier development plans are derived from the supplier evaluations and are implemented.	Development process is implemented and regularly updated. Development plans are harmonized across the firm and derived from the supplier development strategy.
11	Supplier optimization	Do you visit the sites of your suppliers regularly?	Selective visits at suppliers.	Periodical realization of trainings and workshops at the supplier.	On demand internal/external resources are available to support projects, training and implementation.	Professional consulting projects and training take place. Joint continuous measurement of development success with suppliers.
12	Supplier phase out	How would you describe the supplier phase out process?	Suppliers will be phased out based on subjective criteria.	Responsibilities for phase out decisions are defined.	Phase out strategy exists. Process with defined criteria is described.	Consequent application of phase out strategy, cross-functionally agreed.

# of Que	Process Integration	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1	Purchasing early involvement in development processes.	Does the process follow a path? Are tasks and responsibilities well defined within the overall process?	There is no early purchasing involvement process existing. Purchasing is not considered within the product development process.	Processes of early procurement involvement are described, responsibilities defined. Involvement and tasks of purchasing are documented within the product development process.	Processes of early procurement involvement are synchronized with the product development process. Process targets are defined and responsible persons are measured at these targets.	Product development processes are compared and continuously improved by benchmarks of business units/ other companies.
2	Cross-functional integration in development processes	How is purchasing involved in the product development process?	Purchasing is sometimes invited to team meetings by engineering team.	Purchasing is integrative part of the cross-functional engineering team during the design phase.	Purchasing is integrative part of the cross-functional engineering team during the concept phase.	Purchasing is actively involved in the idea phase. (e.g. concept work shops) and supports product planning in respect of feasibility of product ideas.
3	Standardization in product development	Does purchasing pursue consequently measures to reduce complexity of products, processes and sourcing procedures?	Standardization is not consequently considered within the product development process	Purchasing influences consequent reduction of unnecessary complexity of components, processes and sourcing structures.	Defined standards (e.g. modules, component catalogues)	Basic concepts of standardization (e.g. product platforms, modules) are defined cross-functionally together with purchasing.
4	Process involvement with other functions: Marketing	Is purchasing acquainted with marketing strategies and relevant markets?	Marketing strategies are partially known in purchasing. Integration depends on single persons.	Existing and future marketing strategies are known in purchasing.	Purchasing influences marketing strategies or sales prognosis by provision of procurement market know how following a regular process.	Purchasing is integrative part in development of marketing strategies and sales prognosis.
5	Process involvement with other functions: Quality	Is quality management included in supplier selection process? Does quality and purchasing departments show one face to suppliers?	Integration of purchasing depends on single persons. Integration occurs incidentally. Criteria for integration are not existing.	Purchasing supports the quality related issues resp. supplier issues (e.g. claim and extra expenses cases)	Integration and tasks of purchasing are in the quality management system. Responsibilities and tasks of purchasing are clearly described.	Quality engineering function is established in purchasing. Suppliers are integrated into the quality management system.
6	Process involvement with other functions: Logistics and production	How and to what extent is the procurement logistics/material handling process defined?	Inbound logistics processes are unstructured and not or only partially documented.	Logistics processes are structured, documented and implemented. Tasks of operative procurement are described within the logistics processes. Escalation model is described.	Processes are regularly reviewed and improved. Purchasing is involved with all product ramp-ups and phase-outs as well as into the change management procedure.	Logistic processes describe the applied sourcing model. Purchasing drives activities along the value chain and is integrated at each phase.
7	Involvement of Operative procurement	Are agreements of strategic purchasing known by operative procurement? Is consistent information exchange ensured between both departments?	Agreements of strategic purchasing are not known to operative procurement and vice versa.	Agreements of the strategic purchasing are known to operative procurement, information exchange ensured.	Strategic and operative purchasing systematically exchange important subjects about suppliers (approach, agreements, problems).	Strategic agreements with the supplier are fully implemented by operative procurement and are compiled.

8	Logistics targets	Are there and if so, what are the joint targets between purchasing and material handling?	Logistics targets are known to purchasing and sometimes part of supplier negotiations	Logistics targets are partially known to purchasing and are considered in supplier negotiations	In the regular process, logistics agreements are concluded together with logistics department at substantial suppliers	Logistics targets are defined jointly with logistics, continuously updated and implemented.
9	Material/functional release	Has purchasing any impact on material/functional release?	Purchasing remedially determines material/functional release.	Material/functional release occurs cross-functionally by engineering, quality and purchasing	Purchasing is integral part of material/functional release process and driver fro 2nd Source.	Purchasing monitors and improves material/functional release procedure based on jointly agreed targets together with partners
10	Early supplier involvement	To what extent are suppliers incorporated into the phases of product development?	Less involvement of suppliers	Suppliers provide regular focused and comprehensible input. Preliminary value added stages are explicitly considered.	Suppliers are systematically involved following a defined process. Development capacity of the supplier (resident engineer) is used on demand.	Suppliers are integrated on the basis of total cost of ownership criteria. Simultaneous engineering/joint project management with the supplier occurs on demand.
11	Technology roadmaps	For which suppliers do you have their technology roadmaps accessible?	Technology and market strategies of the own product and service portfolio are known.	Technology and market strategies of the suppliers' product and service portfolio are known.	Technology and market strategies of the suppliers' product and service portfolio are known and occasionally adapted to own ones.	Technology and market strategies of the suppliers' product and service portfolio are mutually adapted in substantial commodity groups

# of Ques	HR & Leading	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1	Job descriptions and functions	Are key functions described in purchasing?	Individual purchasing functions are described in general.	Substantial purchasing functions are standardized, described, documented and adapted to firm strategy.	Purchasing functions are described in detail and agreed with cross-functional partners. Descriptions of purchasing functions are standardized at all sites.	Developments of job profiles are observed and forwarded for review on group level.
2	Technical competences	Is there technical competence available in purchasing?	Partial existence of technical competence.	Technical competence in purchasing is existing for almost all substantial commodity areas.	Technical competence in purchasing is existing for all substantial commodity areas.	Competencies for all substantial commodity areas are existing and will be continuously developed.
3	Personnel selection	On which methods is the recruiting based on? Is recruiting executed in systematic manner?	Recruiting is mainly based on experience.	Recruiting is based on generally described purchasing job profiles.	Recruiting occurs methodologically, structured and is aligned to the vacant purchasing function.	Recruiting occurs on the basis of a competence model. Structured interviews on the basis of standardized interview questionnaires with systematic analysis of results.
4	Personnel integration	Are training plans available and to what extent?	Training plans are under development.	Training plans exist for few functions. Supervisor/ Coach is defined.	Systematic integration based on training plans with defined checkpoints. Availability for substantial purchasing functions.	Cross-functional training plans are enhanced by target agreements. Feedback after completion of integration period.
5	Target agreements	Are the targets defined on employee level? To what extent?	Target agreements on the non-managerial level are not existing.	Occasional finalization of target agreements on the non-managerial level. Target agreements include qualitative and quantitative targets.	Target agreements finalized with the staff. Continuous support and review.	Target agreements are coordinated and defined with cross-functional partners if necessary.
6	Career development	Are there regular conversations in respect of employee development?	There are no conversations in respect of employee development.	Irregular exchange with potential candidates.	Annual structured review of potential candidates and initiation of development measures.	Group/regional wide review of potential candidates and introduction to the company procurement network.
7	Feedback process	Is there a formal and regular feedback procedure for monitoring feedback?	There is no feedback procedure in place.	Remedial request of single feedback from employees.	Application of the available human resources instruments and remedial feedback of cross-functional partners.	Annual employee dialogue of employees with purchasing department manager. Cross functional, regular feedback with process partners. (e.g. Workshops, customer satisfaction surveys etc.) Bottom-up feedback established.

# of Questions Controlling	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1	Target result definition Are the targets for the purchasing function derived from the business plan of the group?	Purchasing targets are derived in isolation from business planning targets.	Purchasing targets are derived from the business planning targets under involvement of purchasing. Targets are not cross-functionally agreed.	Purchasing is comprehensively involved in the target setting of the business unit planning process. Purchasing targets are partially cross-functionally accepted based on rolling forecasts.	Purchasing is significantly involved in the target setting of the business unit. Input out of procurement markets are considered in the planning process. Impact of purchasing results are integrated in the budget.
2	Target Breakdown How are targets broken down? Are they detailed on employee level?	There is no structured target breakdown in place.	Single financial results and performance figures are defined and remedially reviewed.	Substantial financial results and performance figures are defined and reviewed regularly.	Targets are broken down and structured based on scorecard targets (e.g. processes, finance, customer, employee) and reviewed regularly.
3	Measurement figures Are measuring parameters defined?	Only limited target follow-up based on existing performance figures is possible.	Substantial performance figures (e.g. balanced scorecard) are implemented.	Group-wide mandatory performance figures are completed by own ones for important areas.	Performance figures for all scorecard targets are continuously and cross-functionally defined.
4	Controlling structure Is the function of planning and steering available and established?	Planning and controlling function for purchasing controlling is not existing.	Planning and controlling function for purchasing controlling is existing.	Planning and controlling tasks of purchasing are described and implemented as own function with defined processes.	Planning and controlling tasks of purchasing are applied as described and are integrated into the operative controlling processes of the business unit.
5	Responsibility of the controlling process Are roles and responsibilities clear and described?	Tasks and responsibilities are insufficiently described.	Tasks and responsibilities are sufficiently described.	Tasks and responsibilities are described according to requirement profiles and are applied.	Tasks and responsibilities are included in an superior controlling guideline of the business unit. Implementation mandate for agreed standards in purchasing controlling is established.
6	Measurement controlling process Is there a procedure for controlling measures/actions? Do you have the degree of implementation logic (or any other milestones) in order to track the realization progress?	Result relevant measures are hardly tracked.	Measures are tracked regularly.	Measures are regularly tracked by the degree of implementation systematic or similar.	All measures are systematically tracked based on their impact on business results. Supervision of measurement implementation by business unit mgmt.

7	Target controlling process	How are deviations from plan handled?	Target/Actual -comparisons are unregularly applied.	Target/Actual -comparisons are regularly applied. Neccessary correction measures initiated partially.	Target/Actual -comparisons are regularly applied on the basis of rollingforecasts. Correction measures are consequently implemented.	Business results of the identified measures are reviewed and documented.
8	Commodity codes	Do you classify your material to any kind of commodity code (e.g. ecl@ss)?	Commodity code classification only for selected commodity areas.	Correct and complete commodity code classification for "direct material" is ensured.	Commodity code is defined as a mandatory data field for order release. Continuous revision of wrong commodity code classifications.	Correct and complete commodity code classification is ensured for the total purchase volume.
9	IT-support	Are you able to perform spend analysis? On what level of automation?	Purchasing volume is available only for the local ERP-systems,	Purchasing volume is generated by calculating according to a group-wide accepted method and can be retrieved to specific purchasing needs.	Regular provision of purchase volume in a central database (e.g. purchasing information system)	Availability of all purchasing volume data in a central database on a monthly basis and active support of standardised supplier number matching process.

# of Ques	Organizational structure	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1	Organizational structure	Is purchasing organization established?	Responsible people for purchasing are named. Purchasing organization is insufficiently established.	Purchasing organization is formally in place.	Purchasing organization is established and in charge of all procurement activities.	Purchasing organization is continuously further developed based on business strategy, benchmarks, interviews or process reviews.
2	Cross-functional integration	Are interfaces towards partner functions defined?	Interfaces of purchasing are known and tasks are partially described.	Interfaces are cross-functionally agreed. Respective tasks and responsibilities of partner functions are known.	Tasks and responsibilities are coordinated with all interfaces according to company wide defined processes, and are described as guideline.	Purchasing drives continuous improvement and the definition of interfaces and guideline.
3	Integration to the group	How is purchasing integrated in the purchasing network of the group?	Purchasing acts locally without exchange with other purchasing departments.	Purchasing remedially exchanges information with other purchasing departments.	Purchasing is an active part of the group-wide procurement network.	Purchasing is integrative part of the worldwide procurement network of the group.
4	Strategic integration	Does purchasing director take part in board meetings?	Purchasing director participates occasionally in the board meetings.	Purchasing director is permanent member of the board committee.	Purchasing director is permanent member of the executive committee of the business unit.	Purchasing director directly reports to business unit Executive Mgmt (CEO)
5	Mandate	Is purchasing responsible for all procured goods and services? Do you have regulations for sanctions in case of non-compliance?	Many commodities are not managed in responsibility of purchasing	Purchasing initiates programs and measures for mandating procurement fields. Penetration 50 %	Purchasing has the mandates for complete purchasing volume defined mandatorily and communicated. Penetration 80 %	Regulations for sanctions in case of non-compliance are introduced. Penetration 100 %.
6	Make or buy decisions	Is purchasing involved in all make-or buy decisions? Does purchasing take part at core competency definition and strategic decisions?	Purchasing is informed about procurement related aspects in make-or-buy projects? Core competencies of the business unit are defined, but without purchasing involvement.	Procurement is involved in major make-or-buy decisions. Core competencies of the business unit are detailed documented and published.	Purchasing is involved in all make-or-buy decisions and influences the definition of core competencies, as part of strategy definition.	Purchasing is an integrative part of the make-or-buy decisions. Purchasing tasks are documented and cross-functionally accepted. Potentials for optimisation of the depth of the own value added are indicated along the product life-cycle.

# of Question	Inventory management	Question for assessment	Stage 1	Stage 2	Stage 3	Stage 4
1	Spare parts classification	How are spare parts classified/categorized?	No effort to classify spare parts.	Spare parts are classified and controlled upon a mono-criteria (e.g. value or volume)	Spare parts are categorized and controlled based on few control characteristics. (e.g. value + criticality)	Spare parts are categorized based on few most relevant characteristics and the different part groups are analyzed based on their effects to the logistics system.
2	Installed base information	Are you gathering installed base information to improve demand forecasting? (e.g. life cycle phase, operating conditions, service contract type)	No effort to gather installed base data	Data gathered by single employees unsystematically and randomly.	Process for gathering installed base information is documented, applied and responsible function for the process is defined (e.g. sales).	Process for gathering installed base information is documented, regularly reviewed and cross functionally agreed.
3	Demand forecasting methods	What kind of demand forecasting methods do you use for spare parts?	No effort to forecast future demand for spare parts.	The demand for spare parts is forecasted based on single forecasting method relying on historical data (time series method e.g. past sales a year ago).	The demand for spare parts is analyzed with several forecasting methods, but methods for different spare part groups are not differentiated.	The demand for spare parts is analyzed with combination of methods aligned to the specific requirements of different part groups and is regularly reviewed.
4	Stock control policy	What kind of stock control policy do you follow? How are the stock control parameters (e.g. ROP, lead times) set up?	Stock control policy follows target level inventory policy, but the inventory levels are not systematically analyzed. No stock control parameters in place.	Stock control policy is selected and it is adopted by personnel. Stock control parameters are set up mainly based on a rule of thumb.	Stock control policy is in place, and the parameters (e.g. ROP, lead times) are set up in a structured fashion based on the control requirements of the particular part group.	Stock control policy is in place, regularly reviewed (e.g. updated based on the primary product life cycle) based on the demand patterns and classification groups and the policy is also known by suppliers and internal customers.
5	Key performance indicators	What kind of KPI's (e.g. stock-out costs, service performance, inventory value) do you use for inventory management?	No KPI's in place.	Few key performance indicators in place, but not specifically selected based on their business impact.	Few most relevant key performance indicators selected based on their business impact and selected service strategy (e.g. quick response or cost efficient.)	Few most relevant KPI's chosen based on their business impact and service strategy and also regularly reviewed and cross-functionally agreed.