

MATERIAL PURCHASING MANAGEMENT IN DISTRIBUTION NETWORK BUSINESS

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ABSTRACT

This paper is based on the Master of Science Thesis made in first half of 2014. Thesis was made for Elenia Oy, Finland's second largest electricity distributor and one of the foregoing in the field of business. Master of Science Thesis was guided and approved in August 2014 by Technical University of Tampere, in the faculty of Computing and Electrical Engineering.

INTRODUCTION

In the last decade noticeable and long distribution outages around Finland have been caused by severe weather conditions. The outages have changed the public opinion and a more reliable electricity distribution is demanded. Lastly the Ministry of Employment and the Economy (TEM) has composed a new, more demanding law concerning of the electricity market, which came into the effect at 1.9.2013. The new law reduced allowed outage times caused by weather conditions to six hours in urban area and to 36 hours in rural area. The new requirements have to be fulfilled at the latest in 2028 and during that time it is estimated that 3,5 billion euros have to be used for the network investments.

These heavily increased investment levels are a driver for the more sophisticated management methods for material purchasing function. The objective of this study was to research and implement the key aspects of the modern material purchasing methods and practices based on the literature review and internal group studies. During the research process it came clear that special attention was needed on four different purchasing management areas: *material portfolio analysis, supplier selection, supplier performance evaluation and demand forecasting*. These aspects were selected because of the detected potential of efficiency improvement based on views and discussions with managers and colleagues. These four different areas will be presented in next chapters.

MATERIAL PURCHASING PORTFOLIO

Purchasing has become one of the most critical functions in today's organizations and the scope for different material and service purchases can be broad. Therefore purchasing portfolio models have been in great interests of researcher during the last decades and many different models have been presented. [1]

Originally the portfolio theory has its roots in financial investments, in a means of expected rate of return and balancing the risk.[2] First modern portfolio theory for investment purposes was developed and introduced by Markowitz in the early 1950. That model is generally seen as the origin of the portfolio theory. Although the Markowitz model is based on the financial investment, it has the same root idea with all different portfolio models after that: its main focus is to efficiently allocate limited resources for the most profitable actions. In a general way this problem is very relevant for purchasing management and the most famous purchasing portfolio model, called as a Kraljic [3] model, have a general objective to minimize a supply risks. [4]

It is stated by Bedley, et al. that the Kraljic's model is, although 30 years old, still valid and that many resent models published by other authors are not able to add any advance to the original model. Some authors have elaborated with Kraljic's work and focused on more advanced strategic recommendation, which can however be very useful supplements. Original model has also been criticised from the fact that the supplier side of the relationship is not taken into account and therefore authors such as Håkansson & Persson (2006) and Olsen & Ellram have focused for development of interdependencies and relationships between the purchaser and the supplier. [4]

The Kraljic's portfolio became famous when it was presented in the Purchasing conference in Copenhagen at 1983 by Peter Kraljic, who was at that time office director of McKinsey Company in Dusseldorf. Later on the conference paper was published by The Harvard Business Review with topic "Purchasing must become supply management". In the paper Kraljic proposed a four phase framework for analysing the supply strategy: 1. Classification, 2. Market analysis, 3. Strategic positioning and 4. Action plans.

The Kraljic model is the most famous from its 2x2 matrix (figure 1), which is used for visualising the results from the classification phase. Although the actual Kraljic model is consisted from four phases, the Kraljic matrix can be considered as a red line of portfolio analysis. However this matrix has been criticised from the fact that it doesn't give any consideration for supplier relationships. Therefore Olsen & Ellram (1997) have researched of different supplier relationships and their effect for the portfolio analysis. This is called as a

supplier relationship approach, where each supplier is reviewed based on its relative attractiveness and strength of relationship. The area of the circle (figure 1) reflects current allocation of resources to relationship management of each supplier. [5] The area of the circle could be also used for reflecting the total purchased volume of the supplier. [1]

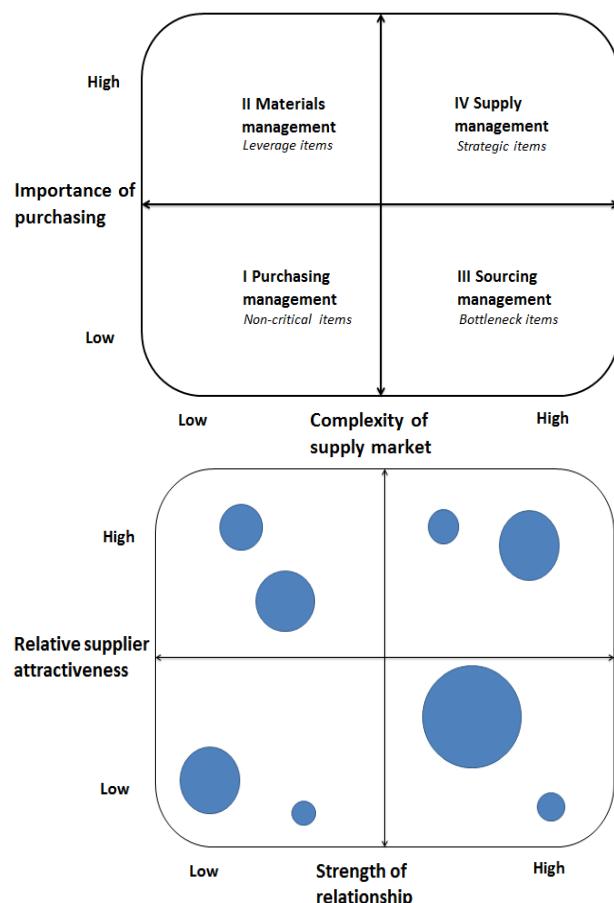


Figure 1, stages of purchasing management [3] and analysis of supplier relationships [5]

In this study the used method was a combination of the methods presented by Kraljic's and Olsen. The first matrix from the Kraljic's model was used because of its simplicity and therefore reliable results. However the Kraljic's model presented a relatively complex and insufficient method for the market analysis and therefore it was substituted by a method presented by Olsen, where supplier relationships were categorised in a similar matrix than the Kraljic's first matrix. The used matrix also visualised the situation, which helps to comprehend the real situation.

SUPPLIER SELECTION

The supplier selection has become more demanding tasks because of the increased investment levels are motivator for new suppliers to participate and also for search of new suppliers. As the amount of tenderers increases it becomes more challenging to make a right supplier selection, which is stated to be one of the most critical decisions in purchasing management. Supplier selection process is a complex multi criteria decision, where different selection criterions are hard to combine because of both quantitative and qualitative nature of the criterions. [6]

One of the first steps in the supplier selection process is to choose the right selection criterions. Correct selection criterions are a key to the success as it assures that suppliers are compared equally and with relevant success factors. After the studies of Roa, Ellram, Stamm and others, a professor from Leeds University, Constantine Katsikeas grouped criterions to more general conclusion on 2004, based on the literature reviews from the field of business. Criterions were: *competitive pricing, reliability, service and technological capability*. Although Katsikeas study was focused for the IT supplier selection, are these fundamental criterions which were also selected for this study. [7]

After the selection criterions are determined one question remains: how to compare each criterion between each other and against others suppliers? To do that a systematic method for criterion comparing is a much needed tool for archiving the desirable result. One widely used method among the researchers and supply managers is the advanced hierarchy process (AHP). The AHP is a robust multi-functional decision tool which is developed by Saaty in the 1970s [4]. It can be used in all decision making problems, there are examples like project selection, product formulation and microprocessor selections performed by AHP model. Even a place for a new city was once decided with AHP method [6].

The AHP is based on pairwise comparison in a hierarchy structure assembled from selection criterions and sub criterions of the decision problem. First step is to structure the decision hierarchy from the top to the down, when the goal is the uppermost part of the hierarchy and each lever is more detailed sub criterions down to the different alternatives.

After the correct criterions were selected the AHP selection method was further tested with good results. It was founded that the method performs well when quantitative and qualitative criterions are combined and the hierarchy process is a good tool for structuring the decision problem to more easily understandable. In the figure 2 a model created during this study is presented, including sub criterions, but alternatives are left out.

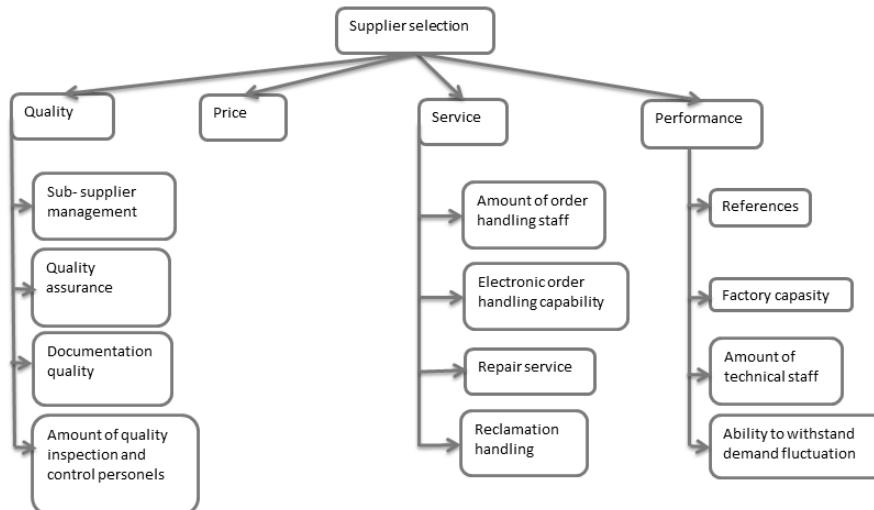


Figure 2, supplier selection hierarchy used in AHP process.

SUPPLIER PERFORMANCE EVALUATION

One of the key elements for creating and especially maintaining an effective supplier relationship is a supplier performance evaluation. Performance evaluation tools are necessary for confirming that suppliers are functioning as agreed and pointing out potential problems and aspects for possible efficiency improvements.

In the study the most used metrics were evaluated and the most valuable methods were selected. It came clear that one of the most usable models was presented by Beamon in a study of supply chain performance measurements. Beamon emphasised the importance of balanced measurement system which covers whole system performance. It was stated that the main weakness of typical performance metrics is that they are only focused to one or few aspect, for example to price. When the focus is in one part of the system the supplier will optimise its functions to serve only that measurement, which might cause severe harm for overall performance. [8]

To avoid these pitfalls Beamon present characteristics of an effective measurement system. These characteristics are presented in the table 1.

Table 1, characteristics of efficient measurement system [8]

Characteristic	Description
Inclusiveness	Measurement of all aspects
Universality	Allow for comparison under various operation conditions
Measurability	Used data is measurable
Consistency	Measures are consistent with organisations goals

Inclusiveness characteristic means that the whole system performance is measured, as already discussed. To fulfil this characteristic three categories were presented: *resource*, *output* and *flexibility*. Each of these categories is identified as a vital component of the supply chain success and at least one measurement should be used from each category. [8]

Resource category consists from different meters for resource usage. This can mean for example measures such as total cost or energy usage. Resources can be usually measured based on quantitative data, which is usually easily measurable. It is noted that the resource minimisation is often used as a general goal of the supply chain analysis with the cost of reduced flexibility. [8]

Output of the supplier could be understand in the most simplest as output from the supplier factory or turnover. Both of these measures are usually easily measurable from order handling system and therefore these are most used output measurement criterions. However output metric category also includes more complicated measures such as quality or customer satisfaction. [8]

Flexibility metrics measures how effectively system can withstand the market fluctuations and changes from manufacturers, suppliers and customer point of view. System has always some uncertainties and development needs, so the supplier's ability to respond to changes will give a major competitive advantage for flexible supply chain. If the supply chain flexibility is actively developed, it will increase variation withstand ability and variations can be handled more efficiently. However the drawback of the flexibility measurement is that there are rarely suitable data for flexibility measurement. [8]

To combine these measurements in a way that also fulfils universality, measurability and consistency characteristic the measurement system is a needed tool. One of the main criterions for measurement system is ability to combine quantitative and qualitative measurement, a characteristic which is fulfilled in Balanced Scoreboard (BSC). The BSC is a performance management tool which is based on structured report that can be used by managers to control and monitor the system. The BSC is developed from the late 1980s to the early 1990s and most popularly published, though not first, by Robert S. Kaplan in 1992 after a study made together with US management consultancy Nolan-Norton. [8]

The BSC was developed for combining the financial and non-financial measurement to the one single measurement report. The aim for combining the financial and non-financial, or so called soft factors, measurement was to create the measurement system that can be used for a long-term strategy development. Although the original BSC is well defined to be used as company's internal measurement tool, it is also usable tool for supplier evaluation. After the evaluation a scorecard was developed to fulfil needs of this case study. Developed scorecard can be seen in the table 2.

Each of these categories will be separately weighted based on management decision. Metrics are also individually evaluated based on pre-determined evaluation tables. Resources and output are based on available data meanwhile flexibility is more or less judgemental metrics, or in other words as soft metrics.

Table 2

Supplier scorecard	
Resources	
Additional costs	
Price trend	
Output	
OTD	
<i>On-Time Deliveries</i>	
SCAR	
<i>Amount of supplier corrective actions required</i>	
Flexibility	
Flexibility	
<i>Based on judgemental review</i>	
Development projects	

FORECASTING

Supply chains are always dependable for the upper level demand and the demand forecasts are a way to distribute the demand information to the suppliers before the actual purchasing order. The forecast allows suppliers to plan future actions and make needed decisions before it is too late to correspond on unexpected demand changes. Missing or inaccurate forecast will lead to resource shortages or excess through the supply chain which will eventually cause work disruptions and cost increases among the supply chain. The accurate forecast will help operation management along the supply chain and it is therefore forecast are an important part of supply chain management. [9]

Forecasting in a broad scope can mean different type of the forecasts, whereas the two main types are: forecast used for planning the system and forecast used for planning the use of the system. In the supply chain the last one is usually the case. [9] Demand forecasts will improve supplier's possibilities to the more precise production and logistics planning. One of the most famous and most researched phenomenon's which is caused by lack of communication is called as a bullwhip effect (BWE). Reducing of BWE can be made directly by implementing accurate and effective demand forecast, which will lead to the direct supplier cost savings. [10]

Quantitative forecast are typically divided for time-series and associative forecast. Time-series forecasts are based on available historical data and therefore predict the future demand from the history behaviour. Time-series forecasts are more widely used because of their easy implementing and relatively low system requirements, usually with fairly good results in the stable market. An associative (or causal) method relies on the factors which have causal effects on the demand. Such factors include changes for example in prices, weather or marketing campaign which can all be considered as causal demand factors. [11]

Time-series forecasting techniques are based on an assumption that the past behaviour could be projected to the future by analysing the underlying behaviour. One of the critical factors is to detect past behaviour patterns, which can be made by plotting the available data and visually examining the plot. Predictable patterns are *trend*, *seasonality* and *cycle*, meanwhile *irregular* and *random* variation are not predictable and should not be forecasted. [9]

After different patterns are visualised a correct forecast technique should be selected according to situation. The simplest method is call as a *naive* method, which means that that the past time-series data, for example from the last year, are presented as a forecast for the next year.

However, if more advanced forecasting methods are needed, an *averaging methods* or even more sophisticated *exponential smoothing methods* should be used. Averaging techniques are relatively simple to use without any software, meanwhile forecasting software is mandatory in most sophisticated exponential smoothing methods. In this study case product portfolio and markets are in a stable situation, where the most accurate model will be exponential smoothing technique. [11]

CONCLUSION

The goal of this thesis was to improve the knowledge of purchasing management and implement key aspects used by researchers and practitioners in the business branch. During the thesis project it comes clear that special attention was needed to four areas of purchasing: *purchasing portfolio analysis*, *supplier selection*, *supplier performance evaluation* and *demand forecasting*. As a result different models were presented and implemented to the use with good results.

Purchasing portfolio analysis was combined method presented by Kraljic and Olson. The advantage of this combination was to include supplier relationships model to the Kraljic's original first matrix.

The AHP method are presented to the supplier selection process as it combines efficiently both quantitative and qualitative factors and it is also robust tool with reliable structure. After the most performing suppliers are selected the supplier scorecard is needed for development the supplier's performance even further. To do that Beamon's studies main characteristic were implemented to the modified balanced scoreboard, which combines hard and soft performance factors to the one comparable measurement system.

The last studied supplier management tool that where identified was the demand forecast. Accurate demand forecasts helps suppliers to more efficient planning and also prevents possible stock outs. Preventing these will lead to the cost savings along the process and eventually to the direct contractual savings. To do that the exponential smoothing method was presented and implemented with good results. It can be stated that forecasting accuracy improved significantly from previous naive method.

As a conclusion of this study it can be said that it is was an interesting, thought demanding process. The broad scope of this thesis however complicated the process, but after all the goals was achieved with good results. However it has to be said that the material purchasing process is never ready and constant improvement will be needed in the future, but this study is a good starting point.

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