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Developing supplier performance measures in a case organisation

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Bachelor of Business Administration

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<p>This thesis focuses on establishing appropriate supplier performance measures for a case company of the marine industry. Adequate approaches for determining supplier performance measures were identified as well as relevant concepts related to the subject.</p> <p>Competitive advantage can be gained from integrating procurement into company's strategy. Not only cost savings can be achieved but value can be added with well-integrated supply chains. (Gordon, 2008, pp.1-2). Supplier relation management (SRM) is therefore an important strategic function within an organisation in order to ensure efficient up-stream operations. The case company has most of its manufacturing outsourced. Procurement and SRM is however currently on low focus at the case company and has little strategic approach.</p> <p>Supplier relationship management (SRM) was identified as the most important concept related to establishing supplier performance measures. SRM has gained an important role in many organisations ensuring efficient up-stream operations. Establishing an efficient SRM system and strategy, which is aligned with the overall strategy of an organisation, has been determined as crucial for establishing appropriate supplier performance expectations and measures. The supplier performance expectations need to be communicated with the supplier in order to ensure realisation of the goal set for the SRM strategy. This was not executed at the case company.</p> <p>The methodology of the qualitative research was mainly semi structured interviews. Elements of action-based research were part of the research methodology as well. A workshop was organised with mainly procurement employees of the case company to test a solution proposal. It was found that supplier performance measures to be monitored at the case company are in the area of cost, time, quality and partnership based on the results of the analysis of the data gained from the interviews and workshop. These supplier performance measures support the realisation of the overall strategy and targets of the case company. The supplier performance measures were derived from the overall strategy of the case company and from the operational targets. The results of the research should function as a first step for continuous establishing and improving of a SRM system at the case company.</p>	
Keywords	Supplier performance, Key performance indicator, Purchasing, Procurement, Supplier Relation Management, Supply Chain Management

Contents

List of tables and figures

Glossary

1	Introduction	1
1.1	Company background	3
2	Research objectives and scope	4
2.1	Research design and methodology	5
3	Procurement function and the key concepts	6
3.1	Supplier Relationship Management	8
3.2	Challenges in SRM	9
4	Supplier Relationship Management	10
4.1	Determining strategically important suppliers	10
4.2	Importance of strategy to SRM	13
5	Supplier performance and evaluation	14
5.1	Supplier evaluation	14
5.2	Supplier performance expectations	16
5.2.1	Evaluation tools	18
5.3	Financial measures and Total Cost of Ownership	19
6	Research process	22
7	Data collection one and analysis of the current situation	27
7.1	Procurement processes and responsibilities	28
7.2	Procurement and SRM strategy	31
7.3	SRM system	33
7.3.1	Cost drivers in case company's procurement / SC	35
7.3.2	Supplier performance targets and measures	37
7.4	Summary of the current status	40

8	Preliminary proposal for supplier performance measures	41
9	Analysis of testing the preliminary proposal	47
9.1	Feedback on the current situation	47
9.2	Feedback on supplier performance measures	49
9.3	Analysis of the supplier interviews – mirror view	52
10	Final solution proposal and further recommendations	55
10.1	Supplier performance area: cost	55
10.2	Supplier performance area: time	56
10.3	Supplier performance area: quality	59
10.4	Supplier performance area: partnership / cooperation	61
10.5	Suggestion for implementation of the proposal	62
10.5.1	Phase 1	65
10.5.2	Phase 2	66
10.5.3	Phase 3	67
11	Discussion and conclusions	68
11.1	Summary	68
11.2	Managerial implications	71
11.3	Evaluation of the research	72
11.4	Closing words	73
	References	74
	Appendices	
	Appendix 1. Interview questions - data collection 1	
	Appendix 2. Workshop presentation - data collection 2	
	Appendix 3. Interview questions for supplier interviews and SC manager (data collection 2)	
	Appendix 4. Framework used to develop supplier performance measures at the case company	
	Appendix 5. Preliminary solution proposal: supplier performance measures	

List of Tables

Table 1.	List of interviews (data collection 1)	23
Table 2.	Categorizing of information from data collection 1	24
Table 3.	List of workshop participants (data collection 2)	26
Table 4.	List of interviewees (supplier and SC manager - data collection 2)	27
Table 5.	Final solution proposal for supplier performance area cost	55
Table 6.	Final solution proposal for supplier performance area time	57
Table 7.	Final solution proposal for supplier performance area quality	60
Table 8.	Final solution proposal for supplier performance area partnership and cooperation	62
Table 9.	Suggestion for measures to be included into the supplier dashboard	65
Table 10.	Supplier performance measurement areas and the alignment to the company strategy	70

List of Figures

Figure 1.	Research design of the thesis	6
Figure 2.	Porter's value chain	7
Figure 3.	Kraljic's portfolio matrix	12
Figure 4.	Hierarchy of supplier performance expectations	17
Figure 5.	Deming's PDCA cycle	19
Figure 6.	The price/ cost iceberg - TCO	21
Figure 7.	Value Chain of the case company	28
Figure 8.	Procurement department at case company	30
Figure 9.	Attributes valued the supplier to have	37
Figure 10.	Supply chain between the case company and suppliers X and Y	53
Figure 11.	Suggested phases for implementing the proposal	63
Figure 12.	Deming's Plan-Do-Check-Act cycle	64

Glossary

BSC	Balanced Scorecard = evaluation tool to compare different suppliers by weighting different criteria according to the importance
CSR	Corporate Social Responsibility is a business area, where a company set guidelines and rules for its operations that improves society and environment instead of exploiting it. (Bailey et. al. ,2015, p.485)
ERP	Enterprise Resource Planning system manages and integrates important processes used by companies (Bailey et. al. ,2015, p.216)
JIT	Just in Time is a business model, where stock is minimized as much as possible by aligning raw material deliveries to the production schedule (Lyson and Farrington, 2012, pp.334-335)
KPI	Key Performance Indicator measure whether set targets are achieved (Lyson and Farrington, 2012, p.108)
OTD	On-Time Delivery is a KPI to measure delivery accuracy
QC	Quality Control is the process of a company to ensure and improve product quality (Lyson and Farrington, 2012, p.280)
ROI	Return on Investment is a performance measure in order to assess the efficiency of an investment (Dani, 2020, pp.147-148)
SC	Supply Chain - network between an organisation and its suppliers and other external partners in order to deliver the final product / service to the end customer
SCM	Supply Chain Management is the strategic management of the supplier networks (i.e. SC) and to ensure the efficiency of up- and downstream functions of the organisation

- TCO Total Cost of Ownership looks at the total costs involved with a purchase, i.e. it is the purchase price plus the costs of operation. (Bailey et. al., 2015, pp.25-26)
- VC Value Chain includes all functions and activities to create a product/ service for the targeted customer. The main concern is how each function of an organisation can add value for its targeted customer.

1 Introduction

Globalisation of supply chains (SC) and the reduction of supplier base at many companies in the past made SC more vulnerable for disruption. Dependency on suppliers increased due to a decrease in supplier base. Outsourcing and globalisation put another dimension of risk on the SC in terms of transport pit falls and quality issues. (Weele, 2018, pp. 56-59) Managers nowadays are therefore more and more concerned with mitigating those risk factors and focused on SC activities. Evidence for this trend is visible when looking at strategic roles at many companies, where Supply Chain Managers or Chief Procurement Officers (CPO) are nowadays not anymore unusual. (Gordon, 2008, pp. 1-2, pp. 7-8)

Companies have realized that competitive advantage can be gained from integrating Supplier Chain Management (SCM) and procurement into company's strategy. Not only cost savings can be achieved but value can be added with well-integrated SCs. (Gordon, 2008, pp. 1-2). Procurement plays an essential role in SCM and is the most important strategic post in the upstream functions of any company. Companies have realized that achieving an efficient integrated SC means that supplier performance needs to be monitored. Many companies have some sort of performance measurement in place but only a few are benefiting from it, often due to insufficient supplier relationship management (SRM). (Gordon, 2008, pp. 7-9)

Supplier relationship management is a very important topic in business and academics have published theories and frameworks regarding this subject. The problem, however, is that all theories, frameworks and best practices are not universally applicable since each company's SC is unique or the frameworks are too extensive and therefore too time- and cost-consuming for implementation for small and medium-sized companies. Similarities in operations between companies of the same industry might offer the possibility to utilise best practice approaches for establishing a SRM-system. Therefore benchmarking (i.e. investigating what other companies are measuring in terms of supplier performance) might be a good starting point but organisations need to align their SRM strategy with their needs and individual SC if the company really wants to exhaust

all possibilities and utilize all benefits arising from good and efficient SRM. (Gordon, 2008, pp. 7-9, 79-80)

It is most important to align the company's strategy and objectives to the procurement strategy in order to establish actions and measures for SRM. These goals must be communicated also to the suppliers, followed up by measuring their performance, and as a result, corrective actions need to be taken. These steps or actions can be seen as a closed cycle and will lead to constant adjustments and improvement. (Dani, 2020, p.145)

Weele (2018, pp.58-59) points out that managers need to find balance between cost, value and risk and need to strive for continuous improvement of the price-value ratio while minimizing the risk. The challenge, which is evident based on the literature as well, is not only the alignment of company's strategy but also setting appropriate targets for the suppliers. It is also problematic to establish the correct measures and find tools in order to retrieve data needed for evaluation.

The research focused on SRM and determining appropriate supplier performance measures for the case company. The researcher had a special interest in developing supplier performance measures at the case company since the researcher worked at the case company for already six months before starting this research. The researcher had already an understanding of the complexity of the case company's situation before the thesis process due to the experience as an employee at the case company and took therefore the role of an internal researcher. The researcher realised the necessity for improvement in the research area.

The case company had realized that benefits can be gained from monitoring supplier performance. The researcher was asked by the top management of the case company to improve SRM by establishing appropriate supplier performance measures. Those measures should be visualised in form of a supplier performance dashboard later. The researcher investigated development frameworks for determining appropriate supplier performance measures at the case company. The researcher concluded that the overall strategy of the case company had to be considered when establishing the appropriate supplier performance measures. The benchmarking approach was therefore not

beneficial since the strategy of the case company is unique and benchmarking might have led to measure wrong supplier performance KPIs. Supplier performance areas of cost, time, quality and partnership were determined as final solution to this research utilising academic development approaches.

1.1 Company background

The case company is a provider of waste management systems for the marine, offshore and building industries. They also provide solutions for integrated water management as well as corrosion protection systems and they operate worldwide. The case company is the only provider of whole systems in its field of business and has its own in-house product development, which is its competitive advantage. (case company webpage, 2019)

The market on which the case company is operating is highly influenced by regulatory bodies, such as the International Maritime Organization, which stipulates environmental emissions at seas globally. The case company provides solutions for reducing emissions at seas, such as waste management systems. The case company's customers are operating in marine, offshore and building industries. (case company's intranet, 2019)

The SC of the case company is both global and local and is divided into component and system deliveries. Component deliveries are usually sourced from third-party component suppliers. Systems are manufactured by technology or manufacturing partners. The case company has only a few own manufacturing and assembly sites. Majority of manufacturing is outsourced, which makes SCM strategically critical to case company's business. (case company's intranet, 2019)

The case company is in constant change due to change of management and other employees, new acquisition of companies and improvement in the way of working and of processes.

2 Research objectives and scope

The research objective of this thesis was to investigate the case company's current SRM (supplier relation management) situation. Followed by this, the other goal of the research was to determine appropriate and relevant supplier performance measures for the case company. The target of this research is to propose a solution for a supplier dashboard, which can be implemented later e.g. by utilising Qlik Sense (analytics data platform). It shall reveal development areas in supplier performance and shall enable strategic decision making in procurement.

The researcher studied relevant literature related to the topic and investigated the case company's current SRM situation. It was investigated what procurement or SRM strategy is formulated at the case company and if the strategy is aligned with the overall strategy of the case company. This is particularly important since the efficiency of a SRM system depends on the strategy it is based on, i.e. the procurement or SRM strategy. This study illustrated the complexity of establishing a SRM system and demonstrated the specific challenges in this matter for the case company.

The main research questions of this thesis were as follows:

- What needs to be considered generally when establishing supplier performance measures?
- What appropriate development approaches and frameworks can be utilised for establishing supplier performance measures at the case company?
- What are the appropriate measures for supplier performance and how should those be implemented at the case company?

The focus of this thesis is on making a proposal of appropriate supplier performance measures for the case company. The actual outcome in terms of savings and other benefits for the case company was not studied since that was not possible within the 3,5 months of the time available. The final outcome of this research was a proposal for the appropriate supplier performance measures in the case company and recommendations for further actions. An example of how a supplier dashboard could look like was also presented to the case company's management. Implementing the performance measures into a supplier dashboard in Qlik Sense was not part of this research. Benefits, cost savings and impacts of adding value, improving SRM and implementing the Supplier

Dashboard can be validated only after an appropriate time from the implementation phase of the results. Therefore, possible benefits were discussed in this thesis only from a theoretical point of view.

2.1 Research design and methodology

This thesis is based on qualitative research since it offered the best insight for this study. This research included also methodological elements from the action-based research since the purpose of this study was to produce a practical outcome increase learning inside the case organisation. (Saunders, Lewis and Thornhill (2016, pp. 189-193). Action-based research is based on evaluation and analysis of the practices at the case company and built on the data gained with the intent to improve those practices. A close collaboration between researcher and participants was crucial in this approach in order to solve an organisational problem. (Research Methodology, 2019)

The researcher was asked by the management of the case company to improve SRM by making a proposal of appropriate supplier performance measures. Those measures should be visualised in form of a supplier performance dashboard later. The role of an internal researcher posed threats on the outcome of the research and its reliability, since researcher's preconception and pre-assumptions could have prevented the researcher to explore fully all issues, which could enrich the data. Researcher's and participants' bias were possible threats to the reliability of the research as well. (Saunders, Lewis and Thornhill, 2016, pp.202-203 + 208-209)

Qualitative research enabled to explore the situation fully and gave the chance to look at the research questions from many different angles. Semi-structured interviews and a workshop was designed for the qualitative research. Semi-structured interviews gave the advantage of not restricting answers of the participants or limiting answers to certain pre-defined questions. The research design is illustrated in Figure 1. Each set of data from the different data collection phases was analysed and considered for the further steps of data collection. The research was therefore dynamic. The report is also structured according to the research design, i.e. the actions taken during the research. This should enable the reader to follow the research process.

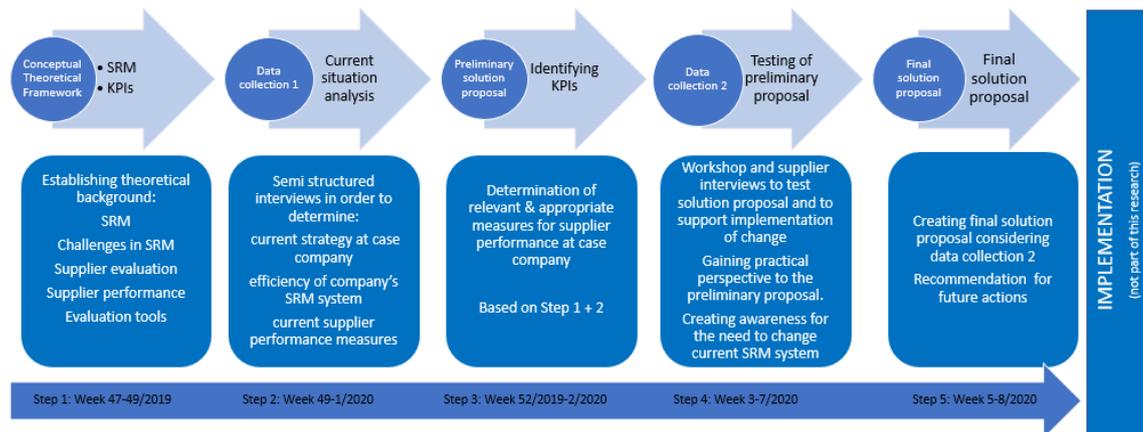


Figure 1. Research design of the thesis

The whole research took place between 15. November 2019 and 28. February 2020 and ended with a proposal of possible supplier performance measures along with recommendations for further actions to the top management of the case company. The short time available was therefore a crucial constraint throughout this research.

3 Procurement function and the key concepts

Many different opinions on what procurement, purchasing and sourcing mean are commonly spread among managers and even simultaneously used in the same context. Procurement is considered to be an umbrella function including all purchasing and sourcing functions as well as all activities required to deliver a product from supplier to the final destination. Managing external resources in the most efficient way in order to ensure operational functionality of the organisation is considered the main task of purchasing function. Sourcing tasks on the other hand, are to determine the best sources for the supplies needed in the organisation and to manage supplier contracts. (Weele, 2018, pp.2, 7-8, 391)

Bailey et. al. (2015, pp.44-46) uses the terms procurement and purchasing without distinguishing between the two. He emphasises, however, the development of purchasing function gaining a more strategic role in the management of companies during the 1990s. Also, Weele (2018, p.7) acknowledges the development of purchasing

and procurement from a primary supporting function, the task of which is to order supply, into a strategic function in an organisation's value chain (VC).

Michael Porter introduced the value chain model (illustrated in Figure 2) as a linear map and divided organisation's activities into primary and support activities in 1985. Each of the functions will add value (i.e. contribute) throughout the process of "producing" a product to the targeted customer to achieve competitive advantage. (Weele, 2008, pp. 56-59) Procurement does not belong in Porter's model to the primary activities. It is a support function to the primary activities.

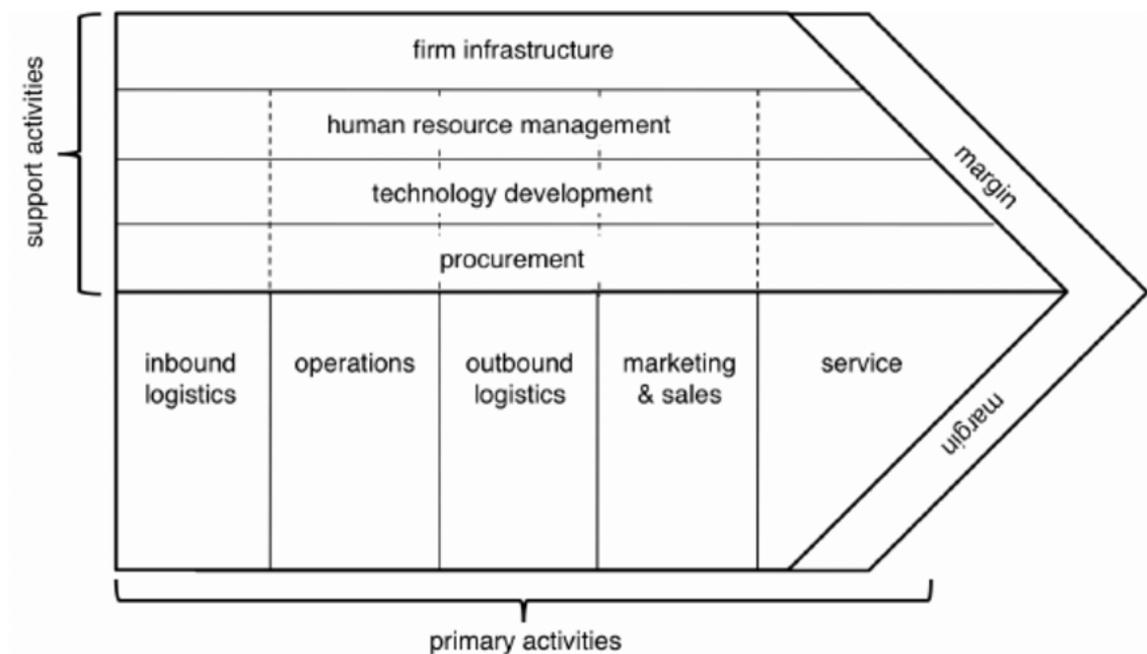


Figure 2. Porter's value chain (Lyson and Farrington, 2012, p.99)

Many organisations nowadays are concentrating on their core competences, which has led to an increase in outsourcing of non-core competences. Another development has been seen in the number of suppliers forming the supplier base of organisations. Organisations have exploited all possibilities of price reduction by increasing the volume. Another still ongoing trend is to seek competitive advantage from offshore sourcing due to lower labour costs in the developing countries. All the changes and trends have made the SC of many organisations more vulnerable. Increased lead times, communication issues with different cultures and quality problems and greater dependency on suppliers

are only a few risks threatening SC. Managers became aware of those risks and put more emphasis on procurement and purchasing. (Weele, 2018, pp. 56-59)

For the purpose of this thesis, procurement will be considered as a strategic overall function including purchasing and sourcing and with cross communication to other functions of an organisation.

3.1 Supplier Relationship Management

Managers' rethinking of that Supplier Relation Management is an area to concentrate on, is still an ongoing process. While some companies have already established a good SRM (supplier relationship management) system, others have ignored the necessity for it totally or have a poor SRM system in place. It is important to distinguish between the concept of SRM and SPM. SPM (supplier performance management) is according to Gordon (2008, pp.4-5) a process by which suppliers' performance is assessed, measured and monitored. This process enables management to be proactive, since risk and cost driver identification is possible when SPM is properly implemented. Risk mitigation and cost reduction are positive effects of a well-implemented SPM and can lead to a competitive advantage. (Gordon, 2008, pp.4-5)

A more appropriate view on SPM includes, next to the performance measurement, the communication part. In this extended view, SPM is a process of achieving a mutually benefiting supplier relationship. Effective communication and exchanging information are indicators of a well functional two-way-street of understanding. Suppliers' as well as organisations' long term prospects, are in focus and therefore long-term mutual relationships are sought after. SRM is another term used in the area of supplier performance and relationship management. SRM covers performance monitoring and relationship development and management. Supplier performance improvement activities are included in SRM as well. It (Gordon, pp. 4-5)

KPMG (2019) describes SRM in the article "Changing SRM in the digital age" as an organisational-wide evaluation of suppliers' capability and the management of the supplier interactions with the intent to develop a mutual beneficial relationship.

3.2 Challenges in SRM

Measuring supplier performance is still seen by many managers as a process of monitoring supplier performance by evaluating quantitative data only. They often concentrate on the most common KPIs, such as OTD (on-time delivery), price or quality. This might be due to the limited availability of data or due to the lack of strategic importance of procurement and SRM to organisation's strategy. A false or distorted picture of suppliers' performance can be the result of such an insufficient approach. (Gordon, 2008, pp. 79-83)

The act of buying supplies is often measured by its direct costs. This puts the purchase price into focus. Utilising inappropriate data or putting the focus on wrong KPIs might lead to supplier dissatisfaction and into skipping the opportunity for the supplier to add value to the organisation and therefore to increase customer satisfaction. (Gordon, 2008, pp.5-6, 73-77) Adding value to an organisation's VC should be in focus when building SRM system of an organisation and when sourcing for suppliers. (Weele, 2018, p.19)

A survey conducted by APQC (American Productivity and Quality Center) and SCMR (Supply Chain Management Review) revealed, that most of the 128 companies of the study see benefits from a SRM system in reducing risk and as increased supplier reliability as well as a way to streamline processes. However, they see difficulties in establishing and running a SRM system because of lacking of a clearly defined methodology and guided strategy. (Partida, 2019)

It might be difficult to determine what to measure for understanding supplier performance and how to obtain the data needed for that. Another challenge is to know the supplier base in order to distinguish between strategically important and unimportant suppliers. The chapters 4 and 5 deal with these problematics and investigate frameworks and approaches for solving those issues.

4 Supplier Relationship Management

A company can operate efficiently when up- and downstream functions operate properly and are adding value to the organisation. Upstream functions are all actions required to ensure the inflow of goods and services needed in order to operate efficiently. Purchasing those goods and services from suppliers is an important part in this area. An organisation needs to work together with good suppliers. According to Bailey et. al. (2015, p.251), a good supplier delivers on time, provides steady quality, offers fair prices, has a stable background and is responsive to the organisation's needs. The attributes mentioned are only a few from many, but questionable is, if all the attributes are equally important.

The goal of a sufficient SRM system is to establish mutual beneficial relationships with the suppliers. Companies can have a rather big supplier base ranging from hundreds to over thousands of suppliers. All suppliers are not equally important to an organisation and the organisation does not seek mutual beneficial partnerships with all its suppliers. A company needs therefore to determine, which suppliers are important to focus on and what to measure. The following chapters will address those issues from a theoretical point of view.

4.1 Determining strategically important suppliers

A company needs to determine which suppliers are important to the organisation and why. One approach is to analyse purchase spend. It is helpful to consider Pareto's 80/20 principle, which can be applied to spend analysis as well. Vilfredo Pareto's theory suggests that 80 per cent of the consequences derive from 20 per cent of the causes. This rule can be applied on spend analysis as well and states that generally 80 per cent of organisation's supply spend is with only 20 per cent of organisation's suppliers. (Baily et. al., 2015, p.19,198) According to a global survey of procurement functions by KPMG and cited in another article by KPMG (2019) it is stated, however, that the 80/20 rule applies only to few organisations. Weele (2018, p. 174) states that 20 per cent of all purchase items and suppliers will portray 80 % of the expenditure. Looking at the spend spread in the supplier base is a first step to determine important suppliers. (Weele, 2018, pp.174-175)

Different tools are derived from this rule for categorizing spend and identifying important suppliers. ABC analysis is one way to go about it. For determining the most important suppliers, an organisation needs to categorize its supplies by either spend, i.e. how much money is spent on items in comparison with whole expenditure, or by looking on the revenue created with those items. The latter option is used more in retail since the correlation is more direct from supply to sales. Manufacturing companies will probably use the spend perspective.

ABC analysis is a method of categorizing items into usually three classes (class A, B and C). Class A items are about 20 per cent of all items but accumulate to 80 per cent of the spend. Class B includes all 30 per cent of the items with 15 per cent impact on total expenditure. The last category C includes the remaining 50 per cent of the items but the impact on total supply spend is only 5 per cent. This tool helps to identify item or item categories with the greatest significance in spend volume and usage (i.e. how often those items are needed). Procurement departments can with this information investigate at least those suppliers, which are falling into the first category (i.e. class A items). (Lyson and Farrington, 2012, pp.313-314)

Another way of segmenting an organisation's supplier base is by using Kraljic's matrix. Peter Kraljic presented the first portfolio approach as an application for SCM. Kraljic's approach aims to identify the strategic importance of items or item categories by segmenting those in four quadrants. These quadrants are based on the financial impact and the risk for an organisation. (Lyson and Farrington, 2012, p.61) The Figure 3 illustrates Kraljic's matrix.

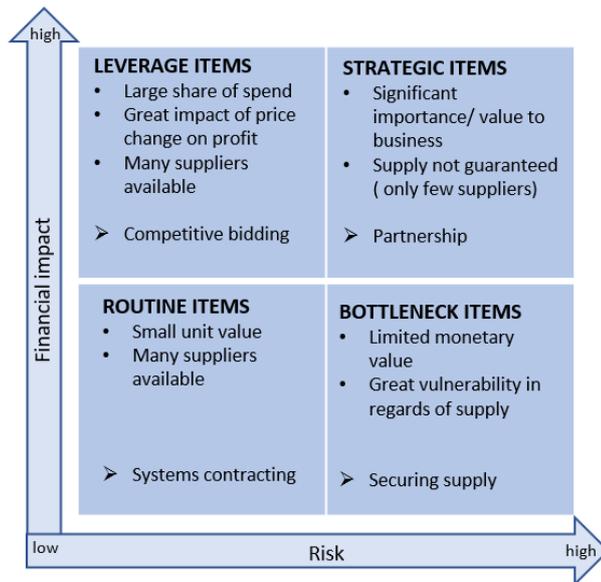


Figure 3. Kraljic's portfolio matrix (adapted from Weele, 2018, p.176).

The matrix also suggests different supplier relationships depending on the category. This matrix, also called portfolio, shall support managers to identify risk in their SC as well as potential value and shall lead to set strategies. (Gordon, 2008, p.60) Kraljic's matrix tool is one way of identifying on which supplier an organisation should concentrate and how.

Gordon (2008, p.60-64) points out that many segmentation matrixes, including Kraljic's portfolio, lack guidelines to help quantify the relevant factors and are very time consuming. Those matrixes might be also imprecise. He also indicates that a matrix approach might support a thought process and can create awareness for certain aspects. Gordon suggests a matrix approach with many dimensions. His suggestion separates different matrix segment to simplify a categorisation for management. Segments, such as supplier commitment or quality, can be exchanged or prioritized to each organisation's needs. Each segment has only to levels, e.g. low commitment/ high commitment for the example of supplier commitment.

Bailey et. al. (2015, pp.23-24) emphasise the importance of the mirror view. They suggest that organisations should look at the outcome of segmentation from supplier's perspective. As an example, an organisation might seek a partnership for strategic items with a certain supplier. This supplier, however, does not value a partnership with that

organisation, maybe due to the small proportion of turnover. This so-called supplier preferencing can be used as another step in identifying strategically important suppliers and the targeted depth of supplier relation.

Supplier segmentation is an important process in order to establish and implement a SRM system. It helps managers to define appropriate resource allocations and is a supporting process for determining the level of supply relationship.

4.2 Importance of strategy to SRM

Knowing the supplier base is one pillar in building a SRM system. The other pillar is knowing where the organisation wants to head, i.e. knowing the strategy. Dani (2020, p.145) expresses the importance of strategy to SRM and suggests that any SRM system should derive from a SC strategy. The organisational strategy, however, will be above all and guide the SC strategy, out of which the goals and objectives are formed. He claims that SRM system without a strategic approach might be misleading in SRM and wasting of resources.

Procurement and, for that matter, also SRM strategy and goals should be synchronized and aligned with the overall strategy, since it would otherwise not add value and work cross-purposes. (Gordon, 2008, p.27) As an example, a company's overall goal could be to increase customer satisfaction. SRM can have an influence on it by determining what customers value and what creates dissatisfaction for them. The procurement department needs to collaborate with marketing and sales in order to determine what the segmented customers value and what creates dissatisfaction. Increasing product quality or decreasing lead times are possible targets for procurement depending on the outcome of the collaboration with marketing and sales. Booth's (2010, pp.62-66) opinion on this matter takes it a step further by stating that an organisation should not expect its supplier to bother about their performance if there is no underlying strategy communicated. She suggests that strategy should be direction setting, shared openly within the organisation as well as with its partners (e.g. suppliers). Booth emphasizes that the strategy of each function (e.g. procurement or SRM strategy) should be aligned with the overall strategy of the organisation. She suggests that supplier should be viewed as an extended part of the enterprise from which the organisation can gain expertise. Including suppliers and

supplier relation into the strategy will add value to the organisation and supports a better understanding of both parties.

Gordon (2008, pp. 24-25) points out also that strategy needs to be aligned throughout the organisation. Especially SCM requires consideration of many internal and external functions, which emphasise the importance of alignment of the SRM strategy with other functions as well as with the overall strategy of the organisation. He suggests that supplier's own business model needs to be aligned with the organisation's overall strategy in order to ensure efficient operations. He uses the example of the business model JIT (just in time), which is common in manufacturing companies. The incapability of meeting the organisation's demands to deliver just in time could be indicated if supplier has no or a different business model conflicting with the business model of the organisation. Waste processes or other problems accruing during the daily processes could arise as a result of not aligned operating models which could add extra costs on the SC operations.

5 Supplier performance and evaluation

In the previous chapters it was pointed out that the depth of supplier relationships depends on the strategic importance of the supplier, which will also indicate what to measure. SRM goals and objectives are established by considering the overall strategy of the company and of procurement function. The company can derive important values and targets for procurement and SRM, which should be translated into supplier performance expectations.

5.1 Supplier evaluation

Supplier evaluation is one important part of the sourcing process. A properly carried out sourcing process lays out a good foundation for further SRM. Bailey et. al. (2015, pp.257-262) see supplier evaluation as an ongoing process of procurement.

Benton (2014, p.173) distinguishes two categories of supplier evaluation. One is process-based evaluation, for which the target is to eliminate non-value-added activities

in suppliers' manufacturing and operating processes. Performance-based evaluation of suppliers is based on their performance and is a more common approach in evaluating suppliers.

Supplier evaluation or vendor rating is used to monitor suppliers' performance conventionally measured in the area of quality, timing, service, price and quantity. (Bailey et. al., 2015, p.257) Lagging indicators are usually the base for monitoring those performance measures. Lagging indicators are often quantitative measures based on activities or actions of the past. (Gordon, 2008, p.81)

Bailey et. al. (2015, p.257) see a trend towards supplier relationship evaluation where supplier and buyer are working together to solve problems. This is beneficial for both parties. This argument is supported by Booth's (2010, pp.6-7) view that no company is an island. Booth explains that a company cannot afford anymore to control all components of the value chain, i.e. of company's customer value proposition. Companies need to utilize suppliers in a more appropriate way in order to gain value. Gordon (2008, p.81) sees a trend where more companies are looking into leading indicators when evaluating their suppliers. Customer complaints or customer satisfaction are typical leading indicators. These indicators are forward looking and shall drive the company's profitability.

Lyson and Farrington (2012, pp.367-372) state that supplier evaluation is a complex process which can eat up much of the sourcing time and could be costly due to the resources bound to it in the process. They suggest that suppliers should be evaluated by the aspects of finance, insurance, production or service capacity and capability, quality, health and safety, environmental management, historical performance and suppliers' contract compliance rate, supplier's organisational structure and resources, supplier's SRM system and second tier suppliers. Consideration of these aspects, when evaluating suppliers, helps to mitigate risk to the SC.

Risk mitigation is an important factor when assessing suppliers and their performance. Globalisation made risk management an important task for procurement management (Gordon, 2008, p.15). Risk factors can be categorised as unknown risk and known risk. Companies can have contingency plans in place so that they are prepared for known

risks (Dani, 2020, pp. 82-84). Companies want to make their SC as resilient as possible. One way of dealing with the risk mitigation in SC's is by knowing the SC, i.e. the supplier base, their performance and financial background. Looking for closer collaborations with strategically important suppliers can reduce risk as well. (Gordon, 2008, p.15) Increasing the knowledge about the own SC and supplier base can make SCs more resilient, since it reveals unknown risk factors. Knowing risk factors alone does not make a SC resilient. A strong risk management culture and strategies, which are in place, are also needed, since not all risk (known and unknown) can be eliminated or mitigated. SRM is therefore only one part of risk management. (Dani, 2020, pp.82-84)

Financial stability of a supplier is very important to consider in risk management, especially when a strategically close relationship and/ or single sourcing is intended. Supplier's balance sheets and income statements could be utilised to look for financial risk indicators, such as falling cash levels or profit margins. (Lyson and Farrington, 2012, pp.367-372)

Corporate social responsibility (CSR) is a rather new topic in procurement, since international press and social media made this area more transparent for the public. Many companies are nowadays judged by how they are operating and by their footprint on the environment. Topics such as child labour, CO2 emissions, preserving of the environment need to be considered in procurement as well when evaluating suppliers, since the company's reputation is at risk when ignoring CSR in their SC. (Weele, 2018, pp.16-17, pp. 374-375)

5.2 Supplier performance expectations

Lagging and quantitative KPIs are common measures when evaluating new suppliers and monitoring supplier performance but those are often set without considering any strategy or consideration of procurement targets. Weele (2018, p.302) gives a great example of how supplier performance targets are not sufficiently focused on because strategic procurement targets are not aligned with supplier performance targets. The example shows that procurement targets for the purchasers were only set on price reduction and did not consider quality improvement, which was the strategic goal of the organisation. The supplier quality was not improving because the strategic target for

improving quality was insufficiently translated into procurement targets. Setting performance targets for procurement and suppliers is therefore an important process, which need to be executed with due diligence (Dani, 2020, p.145).

Wrong targets can compromise strategic implementation and success of a SRM system as Weele's example demonstrated. Cross-functional needs and the organisational strategy has to be translated into a procurement strategy. SMART (Specific, Measurable, Achievable, Realistic, Timely) targets should be set for procurement out of which supplier performance targets are to be derived. Different tools and systems have been developed to support the process of target setting. As examples of such tools, Lean Six Sigma or Kaizen operation models are common among manufacturing industries, which shall enable quality improvements and innovation. These models combine the long-term waste reduction strategy and short-term improvement process. (Dani, 2020, pp.145-147)

Gordon (2008, p.83-87) suggests that supplier performance expectations should derive from the procurement strategy, which is derived from corporate goals and strategy. The development of the supplier performance expectations is illustrated in Figure 4.



Figure 4. Hierarchy of supplier performance expectations (adapted from Gordon, 2008, p.84)

The expectations should be appropriate to the supplier being measured, communicated with the supplier, as well as actionable and reachable. The expectations set should furthermore be measurable. (Gordon, 2008, pp. 83-85)

5.2.1 Evaluation tools

Surveys and questionnaires, as well as supplier audits are common evaluation methods. Carter's 10 Cs model helps during the evaluation and selection process. Suppliers should be evaluated on their capacity and consistency, i.e. reliability. Furthermore, should be investigated if the supplier has its own SC under control. Quality (Commitment to quality), price (Cost) and financial situation (Cash) as well as CSR (Corporate social responsibility) and communication (i.e. ICT) are elements of Carter's 10 Cs model to investigate as well when evaluating suppliers. (Bailey et. al., 2015, pp.262-264) Carter's 10 Cs evaluation themes are similar to the supplier evaluation aspects of Lyson and Farrington's suggestion, that were referred to in chapter 4.1.

Armstrong's performance measurement cycle is another tool. The cycle starts with Plan, continuing with Act and Track, and closing with Review. Reviewing is only sequenced as a singular task in the end of the cycle or timeframe, which might undermine reaching the target or set of goals since corrective action based on a review cannot be made during the cycle. Deming's Plan, Do, Check, Act (PDCA) cycle is a similar approach to Armstrong with the difference that the review part is second to last in the cycle which enables improvement during the process. (Dani, 2020, pp.145-146) Deming's PDCA cycle is illustrated in Figure 5.

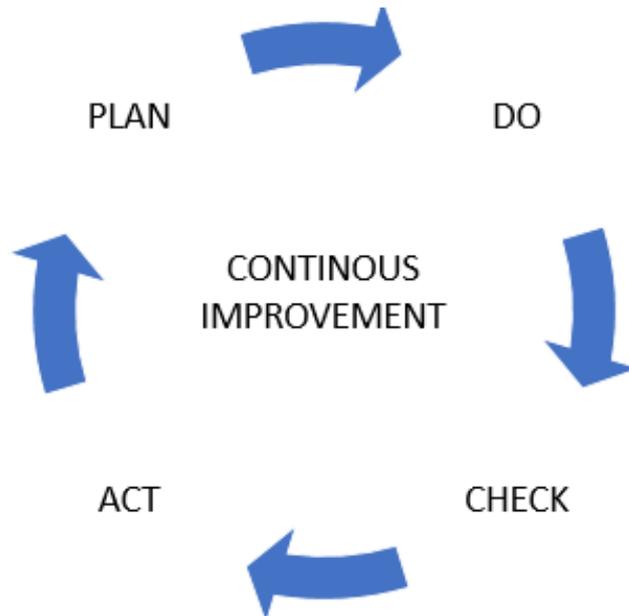


Figure 5. Deming's PDCA cycle (adapted from Dani, 2020, pp.145-146)

McKinsey's 7S model suggests that the seven internal elements (i.e. Strategy, Structure, Systems, Shared Values, Skills, Style, Staff) of an organisation need to be aligned and offers a comprehension on how those elements are connected. The Balanced scorecard approach gives an even more holistic view on performance measurement, since it includes the four aspects customer, internal, innovation and learning as well as financial to the view. (Dani, 2020, pp.146-147)

Setting KPI's for performance measurement utilizing a model or tool mentioned above are crucial for implementing an efficient SRM system (Dani, 2020, p.147). Gordon (2008, pp. 45-46) points out that performance areas need to be set according to the supplier segmentation and considering procurement strategy. Any company should furthermore be aware of certain financial and non-financial measures, which are illustrating the efficiency of SCM and therefore procurement and SRM. (Dani, 2020, p.147)

5.3 Financial measures and Total Cost of Ownership

Return on investment (ROI) is a significant financial measure, which indicates the level of operational efficiency of a company. ROI illustrates the ratio of profit to capital

employed. ROI can be improved by either increasing profit or minimizing the capital invested. (Dani, 2020, pp.147-148) Positive effects on profitability and therefore ROI are documented when improving procurement performance. Cost savings in procurement have a great impact on company's profitability. Procurement improvements will affect the profit by reducing procurement related costs as well as on the capital invested in e.g. to have a good stock management system. (Bailey et. al., 2015, pp.102-103, 198-199)

Cash flow is affected by the number of debtors as well as the agreed payment terms and will affect working capital ratios. Other financial measures linked to procurement, such as inventory turnover ratios and asset utilisation, need to be followed as well. (Dani, 2020, pp.147-148)

Cost reductions have a positive effect on ROI. Differentiation between price and cost is necessary to make in procurement. Price is only one element of procurement spend. Other costs could arise from e.g. quality issues, transport and inventory management. (Cousins et. al., 2008, pp.62-63) Gordon (2008, p.9-10) states that other cost drivers than purchase price are most likely to have a greater impact on ROI but are harder to identify. He points out that cost drivers are threatening the effectiveness of a company's SC and therefore might increase waste and reduce competitive advantage. Knowing and removing or minimizing cost drivers in the SC is therefore a necessary first step in implementing a more efficient SC. One example of understanding cost drivers is by looking at costs resulting from poor supplier quality. Costs related to defect supplies can lead to e.g. cost of dealing with customer complaints or even to the loss of future business. Also cost drivers arising from inspecting and testing the supplies to mend quality issues need to be considered.

Traditional procurement beliefs hold on to the idea that competition is an important condition in order to achieve the best price. This belief roots on the economic theory of supply and demand, i.e. price mechanism. Price of a certain product is determined by the quantity demanded in free market economies. The opposite, i.e. monopoly, was therefore viewed as disadvantage for the buyer for achieving economy of scales. Economies of scale has in today's business, especially in larger cooperation, no longer always a prime rank due to the fast-changing markets and demands. Advantage is not necessarily anymore sought by driving the purchase price down but rather by seeking

advantage from close supplier relationships. The aim of strategic cooperation with suppliers is to eliminate cost drivers. (Bailey et.al., 2015, pp.285-286)

This idea supports also the idea of total cost of ownership (TCO) when evaluating suppliers. TCO is an evaluation of all costs arising from a purchased product over its life-cycle. TCO includes the obvious part, purchase price, and all operational costs, e.g. costs in the areas of quality and flexibility, as well as delivery and other for the company relevant aspects. The Figure 6 illustrates the concept of TCO.



Figure 6. The price/ cost iceberg - TCO (Bailey et. al. 2015, p.26)

Price is therefore only one cost driver and other criteria need to be considered in strategic procurement. The concept of TCO can be utilised for the supplier selection process as well as a foundation for establishing supplier performance measures. The unit price (i.e. purchase price) is the most obvious aspect in evaluating the cost structure. Pricing terms, such as discounts, payment terms and exchange rates are worthwhile to consider as well. Long payment terms have a positive impact on the cash flow and therefore on the working capital. (Cousin et. al., 2015, pp.62-67)

Reducing stock quantities to a minimum is the goal of many organisations when reducing costs. Operation models based on JIT (just in time) are especially common among manufacturing companies in order to reduce warehousing costs. OTD (on-time delivery) is therefore in focus of many procurement departments and is usually measured as a percentage of the total delivery. (Cousin et. al., 2015, pp.62-67) Other criteria relating to delivery might be minimum order quantity, lead-time, cost of packing, customs fees and transportation costs. (Bailey et.al., 2015, pp.301-302)

The capability and willingness of a supplier to react to a change in demand is an important criterion as well. Inflexibility could pose penalties on the company and a disability to deliver to an increase in demand, can lead to unsatisfied customers and other costs in finding alternative solutions. (Cousin et. al., 2015, p.66)

A cross-functional information flow is necessary in order to discover TCO. The process of investigating the cost drivers might be time consuming and require resources. The TCO approach offers a holistic view on the actual cost and gives great opportunities to reduce cost in a sustainable way. (Bailey et.al., 2015, pp.300-304)

6 Research process

The research started by studying relevant literature about the topic with the intent to determine issues, variables and components related to the research questions as Saunders, Lewis and Thornhill (2016, p.570) suggest. A conceptual and theoretical framework was built in order to form the research structure and vision. The deductive approach enabled the researcher to develop a theory and test the theory during the process. The deductive approach helped furthermore to formulate the interview questions for the first data collection which were based on the literature review.

The interviews were semi-structured, having key questions outlined to guide through the data collection, and supported by consistent themes, which enabled better analysis while giving the interviewee the possibility to freely add and express relevant information about the topics. The intention of the first data collection was to discover the structure behind

the reality that characterise the events (Saunders, Lewis and Thornhill, 2016, p. 151), i.e. the first data collection revealed:

- How are the roles and responsibilities at the case company's Procurement department divided?
- What kind of procurement processes are in place?
- What is the current SRM system at the case company?
- How efficient is the case company's SRM system?
- What SRM / procurement strategy is in place? and
- How supplier performance is measured?

Twelve interviews with several employees mainly of the case company's procurement department were conducted for the first data collection from 2 December 2019 until 3 January 2020. Table 1 gives an overview of all conducted interviews of the first data collection.

Table 1. List of interviewees (data collection 1)

Data set no.	Source code	Management level	Department	Case company (C) / Supplier (S)	Duration	Date
1	C1	Specialist	Sourcing	C	75 min	2 Dec. 2019
2	C2	Specialist	Purchasing	C	102 min	3 Dec. 2019
3	C3	Specialist	Operations	C	87 min	9 Dec. 2019
4	C4	Mid-level	Supply Chain Operations	C	66 min	9 Dec. 2019
5	C5	Mid-level	Supply Chain Operations	C	48 min	12 Dec. 2019
6	C6	Low-level	Purchasing	C	101 min	13 Dec. 2019
7	C7	Specialist	Supplier Quality	C	57 min	13 Dec. 2019
7	C8	Specialist	Supplier Quality	C	57 min	13 Dec. 2019
8	C9	Specialist	Customer Support	C	63 min	20 Dec. 2019
9	C10	Specialist	Warranty	C	50 min	27 Dec. 2019
10	C11	Specialist	Purchasing	C	60 min	30 Dec. 2019
11	C12	Specialist	Purchasing	C	35 min	3 Jan. 2020

The table shows in which department each interviewee is operating as well as interviewee's level of management. Each interviewee was given a source code to maintain anonymity. The interview questions of the first data collection can be reviewed in Appendix 1. The interviews were partly recorded, and interview notes were compiled.

Source C3 was the only employee chosen for this data collection that has no direct supplier contact. The main reason for this interview was to gain insight to company's strategy and operational targets. All other employees are part of the SCM team and most of them of the procurement team.

The purpose of the first data collection was to discover what the situation at the case company is. It was investigated what happens at the case company's procurement department and how effective their processes are. The purpose of the first data collection was therefore exploratory as well as evaluative. (Saunders, Lewis and Thornhill, 2016, pp. 174-176) Reports and official information of the case company were investigated, which formed a picture of the situation together with the data gained from the interviews as well as from the researcher's own observation.

Twelve research areas were created (questions a-l) for the analysis of the data of the first data collection round. Table 2 gives an overview of those research areas, questions and interviewees which contributed the most for this research.

Table 2. Categorizing of information from data collection 1

Research areas		Interviewees
Procurement / SRM strategy / targets	a) What strategy exists?	C1-C6; C9-C10; C11-C12
	b) Is the strategy aligned with company strategy and targets?	mainly C3-C4
	c) How well are strategy and targets communicated vertically?	C1-C12
Knowledge supplier base + cost drivers	d) What knowledge about the supplier base exists?	C1-C12 (except C10)
	e) What is the level of TCO awareness?	

	f) What are the cost drivers in case company's SC?	
Values	g) What values/ attributes are appreciated in a supplier?	C1-C12 (except C10)
Supplier targets + communication of targets	h) Are performance targets set and communicated? i) What targets are set?	C1-C12 (except C10)
Supplier performance measurements	j) How is supplier performance measured and what is measured? k) How reliable is the data? l) What actions derive from supplier performance measurement?	C1-C12 (except C10)

The data obtained during the interviews were categorized according to this scheme in order to investigate the patterns. The goal was to evaluate the effectiveness of the case company's procurement and SRM system.

Approaches and framework based on literature review was utilised to establish the preliminary proposal for a solution. Those approaches and the framework were adapted to fit the special demands of the case company and to fit to the current situation. After this phase the solution proposal was tested in a workshop with seven participants, mainly from the case company's procurement department. The purpose of the workshop was to

- Validate the proposal
- Enrich the proposal with a practical view (practical restriction to proposal)
- Obtain further ideas, and
- Start implementing the change process in the mind of the employees.

The workshop was held on 24 January 2020 with a duration of three hours. It was planned to include other departments, such as sales and project management but invitations were declined due to time restriction. All participants of the second data collection are listed in Table 3.

Table 3. List of workshop participants (data collection 2)

Data set no.	Source code	Management level	Department	Case company (C) / Supplier (S)
12	C1	Specialist	Sourcing	C
12	C2	Specialist	Purchasing	C
12	C4	Mid-level	Supply Chain Operations	C
12	C6	Low-level	Procurement	C
12	C7	Specialist	Supply Chain Operations	C
12	C9	Specialist	Customer Support	C
12	C13	Specialist	Sourcing	C

The workshop was divided into three parts. The intention of part one and two was to create awareness of the current situation in the procurement department and to create the awareness for the need for change. The third part of the workshop was concentrating on supplier performance measures and KPIs. The goal was to obtain a practical view on the proposed measures and feedback to feasibility of the solution proposal. The workshop was recorded, and notes for further analysis were compiled. The workshop presentation can be reviewed in Appendix 2.

The supplier perspective was added by two interviews with the representatives of the case company's suppliers. These interviews gave a mirror view on the situation and helped testing the solution. An additional interview was held also with the Supply Chain Manager of the case company on 30 January 2020. He is responsible for those suppliers that were chosen for the interviews and gave also the buyer's view on the supplier-buyer relationship. The interviews with the suppliers were held on 14 February 2020. Table 4 shows the interviewees of this last data collection.

Table 4. List of interviewees (supplier and SC manager - data collection 2)

Data set no.	Source code	Management level	Department	Case company (C) / Supplier (S)	Duration	Date
14	C14	Specialist	SCM	C	75 min	30 Jan. 2020
15	S1	Specialist	Sales	S (supplier X)	35 min	14 Feb. 2020
16	S2	Top management	CEO	S (supplier Y)	39 min	14 Feb. 2020

Further interviews with other suppliers were not possible due to the short time available. The supplier interviews focused on their view on the supplier-buyer relationship with the case company and how the supplier evaluates its own performance. The interview questions for the supplier as well as for the buyer (i.e. case company's SC manager) are listed in Appendix 3. The interviews were partly recorded, and notes were compiled.

The preliminary solution proposal was adjusted according to the data gained from the workshop and the supplier interviews. An implementation proposal was established as well. The final solution proposal was presented along with recommendations to case company's top management.

7 Data collection one and analysis of the current situation

This chapter analyses the results of the data collection round one which was based on eleven interviews and researcher's own observation. The analysis of the current status in the case company is divided into three parts. First, the procurement process is illustrated and then it was looked into the procurement and SRM strategy of the case company. The last part was to investigate how efficient the case company's current SRM is. The researcher was to find patterns which determine the case company's strategic approach to SRM and what kind of SRM system the case company has at the moment.

7.1 Procurement processes and responsibilities

The case company has only a few manufacturing and assembly sites of their own. Most of the manufacturing is outsourced, which makes SCM a critical part of the case company's business. Porter suggests a linear map as a VC (value chain, as introduced in Chapter 2). Procurement is furthermore in Porter's model a support activity, which ensures the material flow for the manufacturing process. (Weele, 2018. pp.4-5) The complexity of processes between different functions in the case company as well as the importance of case company's SC led the researcher to adapt and modify Porter's VC model to describe the current status of the procurement function in the case company as illustrated in Figure 7. Procurement in case company's VC is in researcher's opinion a primary function, since the case company has most of the manufacturing outsourced. Procurement is therefore a crucial function to case company's operations.

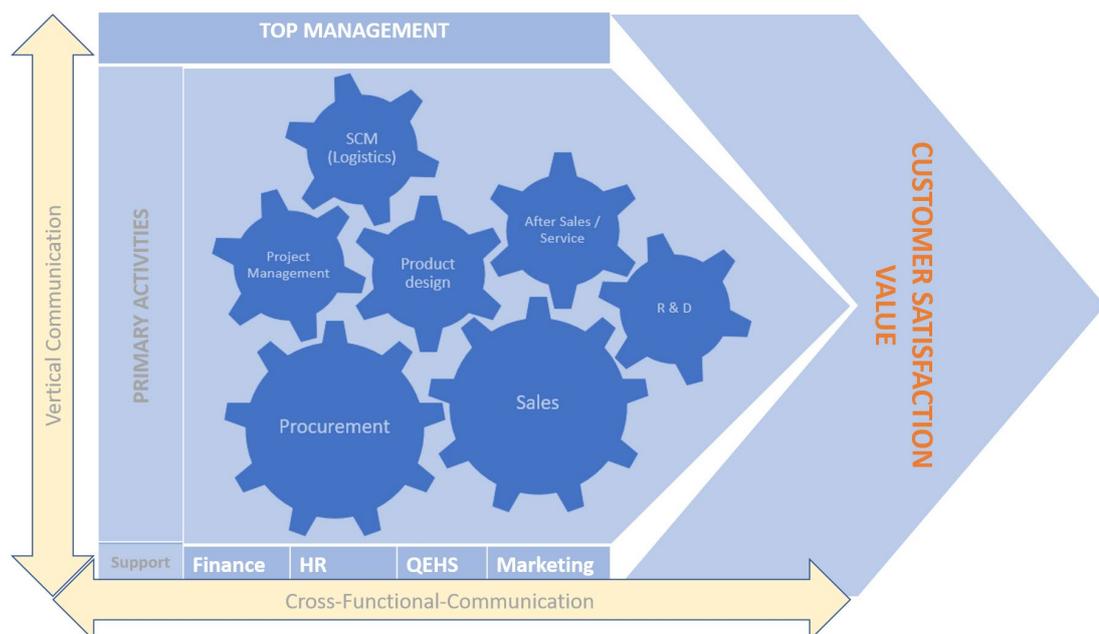


Figure 7. Value Chain of the case company (adapted from Porter's VC and modified)

Sourcing and purchasing of right components and end products are crucial to the case company's SC. Customer satisfaction requirements in terms of OTD and quality need to be fulfilled by procurement and SCM. Case company's business is very project-orientated and close collaboration between different functions is crucial in order to

succeed in each phase of the projects. Figure 7 highlights the importance of cross-functional processes and communication at the case company. Product design function needs to involve the procurement function already in the stages of project planning. The sales function needs to involve the procurement function to plan demand towards the suppliers in order to ensure OTD. Procurement needs to communicate any changes in delivery time with project management in order to ensure successful completion of the projects.

Porter's original linear map might be appropriate for manufacturing companies, but the complexity of the projects at the case company as well as the level of outsourcing requires a more dynamic view on Porter's VC. The researcher therefore adapted Porter's VC. The researcher views Procurement and SCM as primary activities as well as Sales and Project Management. R&D (Research and Development) and Product design are also core functions of the case company. All functions need to collaborate closely at any stage of the projects to ensure the success of the project, i.e. to add value for the customer and achieve competitive advantage. A linear view on case company's VC is there for not beneficial. Only great collaboration between all core functions of the case company and well established cross-functional processes enable the case company to achieve competitive advantage and add value for the customer in the process.

The SC of the case company is both global and local and the procurement department at the case company is organised and divided by the type of supplies and by process, which is shown in Figure 8.

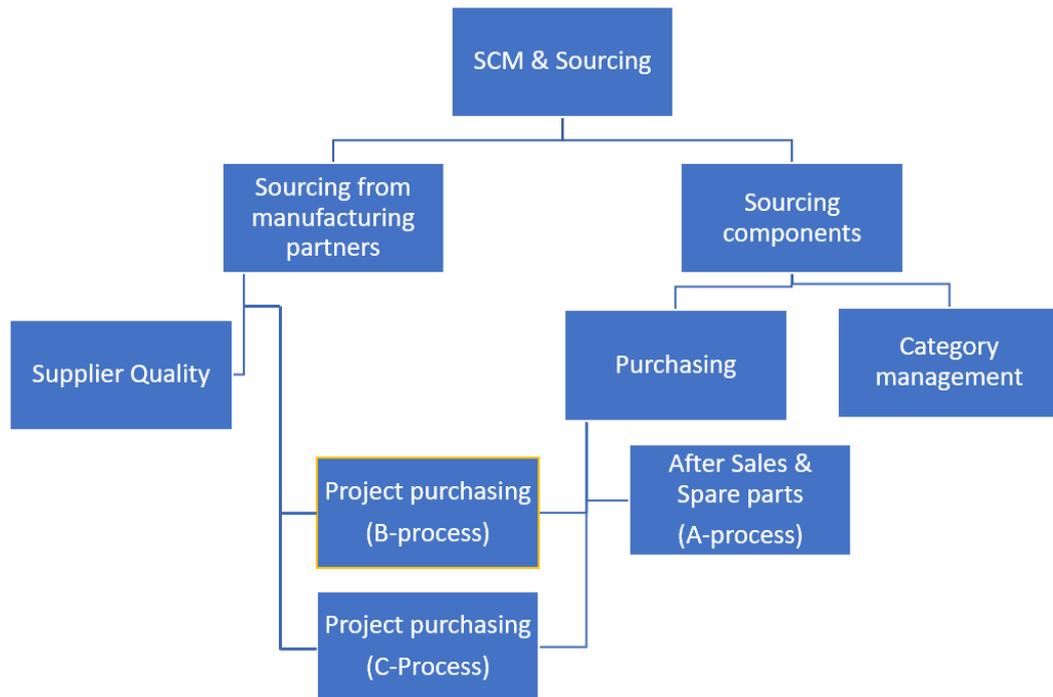


Figure 8. Procurement department at the case company

Sourcing is divided into two divisions, component sourcing and sourcing from manufacturing partners. Component sourcing includes all supplies, which can be bought “off shelf”, i.e. products that do not require any customising and are therefore immediately available. Customised supplies are sourced from manufacturing partners and belong to the second division. The customised supplies range from simple product adjustments to complex systems and machinery, which are especially engineered in-house and manufactured by the supplier for the case company. Assembly suppliers belong also to this category. Sourcing is responsible for the overall agreements with the suppliers. Sourcing negotiates prices and other terms with the suppliers. Responsibilities are not clear yet as the case company is in the middle of changing the work processes. The supplier quality function is part of the procurement department. This function oversees auditing of the case company’s manufacturing partners and ensuring the quality of supplies.

The purchasers place orders and follow those orders up. Purchasing is divided into three processes, A, B and C process. The A-process includes mainly purchasing of spare parts to the case company’s warehouse. Four purchasers are in charge of buying the spare

parts. The spare parts are categorised using an ABC analysis approach to identify slow- and fast-moving supplies, and to determine the appropriate replenishment cycle. The systems and machinery sold to the case company's customers have a very long life-cycle (ten years and longer). A-process purchasing is facing the problem of finding suitable spare parts for those systems due to obsolescence of spare parts because of the long life-cycle of the case company's systems.

The B-process on the other hand includes all purchasing of components and machines for projects. The supplies for this process require no or only little customisation, i.e. the products are therefore standardised. The project coordinators or procurement department are buying supplies for the B-process and overlooking the status of the purchase orders. Purchasing responsibilities are divided according to the suppliers. Technical requirements are already set, which results into pre-determination of the product and often also into pre-determination of the supplier. B-process purchasing can be defined as a purely buying function and is therefore non-strategic. The sales function informs the project coordinators in the early stage of bidding, which allows the case company to make forecasts to the suppliers.

C-process includes more complex projects having project managers as well as project assistants involved. The units for this process are very complex and customised. The procurement department is responsible for purchasing the supplies for this process as well as the end-product, i.e. the units. The purchase activities are divided according to the case company's portfolio, i.e. one purchaser oversees the buying of supplies for e.g. MBR units (Membrane Bioreactor) and vacuum systems while others are e.g. in charge of the supplies for wet and dry waste systems. The requirements of the items and units are already set by the product designer. Therefore, changes of the manufacturer or supplier are often not possible. Purchasing for C-process is an administrative function, which involves placing and overseeing purchase orders.

7.2 Procurement and SRM strategy

The interviews revealed that there is no procurement or SRM strategy in place at the case company when the research took place. Most of the interviewees are aware of the overall strategy of the case company and some of the specialists are also aware of the

common targets derived from the overall strategy of the case company. The overall strategy is communicated via Microsoft SharePoint, the Intranet platform of the case company. Every employee is responsible for keeping themselves updated.

The overall strategy of the case company for the next five years includes efficient operations, increased customer value and strong profitable growth. Targets set for profitability are growth in sales as well as improving EBITDA (Earnings before Interests, taxation, Depreciation and Amortization) and NWC (Net Working Capital). Synergies in sourcing and project execution, receptiveness and economy of scales and outstanding customer proximity amongst other targets are set for efficient operations. Targets for increased customer value are e.g. compliance with customer and legislation needs. (case company's SharePoint, 2019).

The level of awareness depended on the level of management of the interviewee in question. Middle management has a good understanding of the targets of the case company and is also informed by the top management. The implications for their work of the lower level of management and the specialist interviewed seem to be often unclear, i.e. they do not know what the overall targets mean for their function and what is expected from them. The answers of the interviewees to the questions regarding procurement and SRM strategy gave a revealing picture of how the communication of strategy is perceived

Specialist and lower management level:

"[...] the team is floating [...] nobody was told what important targets for procurement are [...]" (C6, 2019)

"[...] we are living moment by moment [...] there is no cross-functional communication [...]" (C8, 2019)

"[...] there is no Purchasing strategy communicated [...] a guideline is wished for my work [...]" (C2, 2019)

Middle management:

"[...] common targets have been communicated and should guide the everyday routine [...]" (C4, 2019)

"[...] The communication of the company strategy is via SharePoint [...] The top level has communicated the targets to the middle management. They are

responsible to communicate those with their team and what should be done. [...]"
(C3, 2019)

Improving supplier OTD (on time delivery) is a relatively new task for the procurement department. Each purchaser should follow up their purchase orders and update the information in the ERP system since mid-2019 in order to improve OTD and to discover possible delays as early as possible as well as to improve the data quality. The targets for OTD improvement set to the procurement team are, however, unclear to the purchasers. The purchasers communicate more with the suppliers and ask for order confirmation in order to improve OTD. Further actions that are required in order to improve OTD are not noticeable.

The improvement of payment terms given by the supplier are set to improve NWC. Each function within in the procurement department has several suppliers to negotiate with the suppliers longer credit days. The status of OTD improvements and negotiations about the payment terms are discussed in monthly meetings of the procurement team.

The data indicates that vertical communication (i.e. communication between top level management and middle management and the functions) is not well established and the specialists do not know or have only limited knowledge how they can contribute to realise the targets of the overall strategy. It seems furthermore that purchasing is a purely administrative function with very little strategic role. Purchasers are, according to their own information, only in charge of the act of buying, i.e. placing purchase orders and following those up. The procurement specialists seem to struggle with the everyday challenges by trying to keep the business running, i.e. by trying to fulfil customer's special requirements and are not bothered by strategy nor strategic approaches set for their function.

7.3 SRM system

After analysing the data collected during the first data collection round revealed that the case company works together with preferred suppliers and manufacturing partners for B- and C- processes. For many manufacturing partners and for some pump suppliers there are only a few or no alternative suppliers available. Furthermore, the benefit from

a possible change to another supplier, was questioned by some interviewees, since the risk deriving from an unknown supplier and changes in costs might outweigh the possible benefits. The purchasers are occasionally asking for quotations in B- and C-processes but usually the items (i.e. manufacturer) including the suppliers are set in the design and sales phase, which means that the purchasers do not have the freedom to choose between suppliers. The dependency on certain suppliers is therefore significant. Some of those suppliers are aware of the dependency. Others are as dependent on the case company as the case company is on them.

This phenomenon is described and analysed by Schmitz (Schweiger and Daft, 2016, pp.22, 28) in their research paper on buyer-supplier relationship which can lead to lock-in effects. A lock-in effect is described as a strong bond between buyer and supplier, which leads to the reluctance to change the supplier. Different factors indicate such a lock-in situation. The lack of alternative options or sources, increased switching costs deriving from relationship-specific investment (i.e. sunk costs) and asymmetric or symmetric dependency between supplier and buyer, as well as risk aversion might lead to such a lock-in situations, in which the buyer is reluctant to change the supplier. (Schmitz, Schweiger and Draft, 2016, pp. 22, 28)

The following statements given by the interviewees of the first data collection indicates that project purchasers (B- and C-process) are aware of the important and critical suppliers of their area.

“[...] I know the main five suppliers of my area. [...] I have a hung with some suppliers. [...] (C11, 2019)

“[...] I know a few suppliers quite well, but some only by name [...] I do not have the time to meet my suppliers. [...]” (C12, 2019)

“[...] Not everyone [purchaser] knows all suppliers, but the purchasers know the big and important suppliers for their units. [...]” (C6, 2019)

“[...] We know our suppliers very well. [...] A risk analysis was carried out and actions, such as meetings and audits are the result of it. [...]” (C4, 2019)

Based on the followig statements it seems that the knowledge is not pooled or it is only partly shared with other functions or within the procurement department.

“[...] The director of sourcing knows well which suppliers are important. [...]” (C1, 2019)

“[...] We have a list of preferred suppliers, but it is not shared. [...]” (C6, 2019)

“[...] Problematic suppliers are in purchasers’ mind. [...]” (C6, 2019)

“[...] A supplier risk analysis was established about two years ago, but I do not know where to find the result. [...]” (C12, 2019)

“[...] A supplier risk analysis was carried out recently, but results were not communicated. [...]” (C2, 2019)

A-process purchasers (i.e. buying of components and off-the-shelve-items) face the challenge of having a wide supplier base with about 600+ suppliers. Many of those suppliers have a very small impact on spend but they cannot be changed. The problem lies in poor technical documentation of the past projects and the long lifecycle of the units. The purchasers need to find the right supplier for very specific items and they are stuck with certain suppliers, which leads to a wide supplier base. This is due to the long lifecycle of the products the case company sells, which leads to the fact that certain components are obsolete at many suppliers and only available at few suppliers.

The knowledge of the supplier base is limited due to the wide supplier range. An ABC analysis helps A-process purchasers to identify fast-moving items in order to determine appropriate replenishment cycles and quantities. The ABC analysis was not used to identify strategically important suppliers or determine an appropriate supplier relationship strategy.

7.3.1 Cost drivers in case company’s procurement / SC

The awareness level of TCO among procurement department is analysed in this chapter. To study this, the interviewees were asked to name the major cost drivers in the case company’s procurement process.

According to the interviewees price is the most important factor in supplier negotiations. The payment terms are also in focus, as mentioned earlier. Other costs are not recognised or considered by most of the interviewees. Some participants notice other

cost drivers as well. However, it remains questionable, if those are considered in their decision making. The data gained through the interviews did not provide information in this matter.

Some manufacturers invoice mark ups or handling fees, which are often not considered in the selection process, since unit prices are in focus. This can lead to a higher end price for the unit bought. Some interviewees identify internal processes as the greatest cost drivers in procurement.

“[...] Changes made on unit technical requirements during manufacturing or units sold with too short lead time, end up in mark-up fees during the process as well as higher transport costs due to the lead time. [...]” (C12, 2020)

“[...] The biggest problems are not with our suppliers. The biggest troubles derive from internal processes, poor documentation and blurry responsibilities and structures as well as poor integration of bought companies. [...]” (C5, 2019)

“[...] Internal costs are another cost driver, when we fail to standardise. [...]” (C4, 2019)

The low awareness of TCO can be explained because of the lack of available data in order to identify cost drivers. The only way to compare suppliers is by their total spend, price and payment terms as well as by delivery accuracy. The following interview comments underpin this discovery.

“[...] There are no other significant costs than price. Transportation cost for example cannot be allocated, since suppliers can partly use our contracts with certain transport companies. [...]” (C2, 2019)

“[...] The real costs cannot be identified, e.g. specification of transport costs for purchase order by supplier, extra costs, such as fees are not separately reported. [...] Only price and payment terms are comparable. [...]” (C6, 2019)

“[...] TCO was discussed, but the intensity and how analytical the approach was, is questionable. [...] The cost drivers are unknown. [...]” (C1, 2019)

Middle management identified costs resulting from poor quality as a cost driver, but they think that available tools for identifying or analysing the data are poor. One of the operational goals is it to reduce warranty claims by 25 percent. Purchasers did not mention poor quality as a cost driver, which indicates that they are not aware of quality

issues and supplier performance. It indicates furthermore that the issue of poor quality is not communicated vertically in the procurement department.

7.3.2 Supplier performance targets and measures

The interviewees were asked to state what attribute they appreciate most from a supplier. The interviewees could give more than one answer but ranked their answers according to their own opinion on what is most important. The interviewees appreciate next to price and lead-time the ability to fulfil technical requirements at supplier as well as delivery accuracy. Figure 9 illustrates what attributes of performance criteria the interviewees appreciate the suppliers to have.

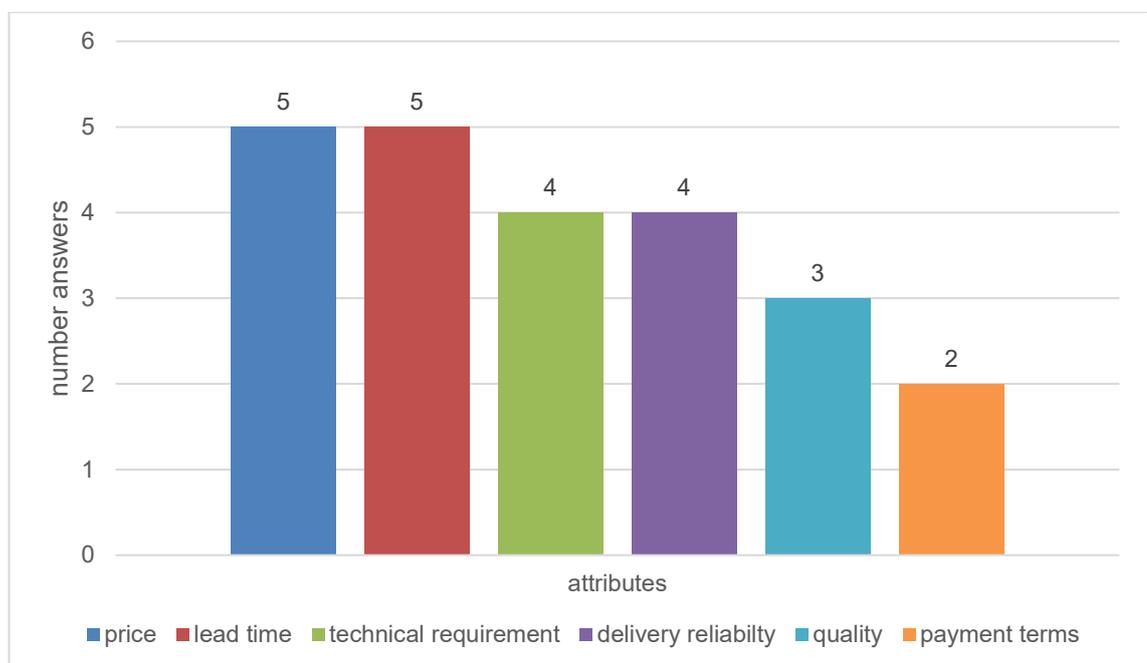


Figure 9. Attributes valued the supplier to have

Payment terms are the least appreciated even though payment terms are a focused target area. Quality seems to be only important for middle management (C4, C5) and for Sourcing (C1).

The lower management, as well as the procurement specialist (i.e. purchaser) are not aware if or what performance targets are set for suppliers. Internally the focus is on

improvement of OTD and payment terms. However, the implications of these or the targets are not set or communicated to the suppliers. Negotiations and meetings with suppliers are, according to middle management, used to discuss supplier performance but this is still not done to the extent that would be needed.

“[...] We are looking at OTD, but it is unclear how performance is measured for the manufacturing partners. [...]” (C2, 2019)

“[...] KPIs (Key Performance Indexes) are hard to identify and depend much on the manufacturer. [...]” (C5, 2019)

Supplier performance is traditionally not, or only little, measured according to the middle management. The supplier performance at the case company is measured as OTD (on time delivery) and by delivery accuracy. This means comparing discrepancy between the actual delivery time and the confirmed delivery date by the supplier. Furthermore, the credit days as well as total spend is reported.

“[...] Supplier performance is evaluated case by case or by project with audits. [...] We have established a BSC (Balanced Scorecard), but it is not implemented. [...]” (C8, 2019)

The manufacturing partners are audited for each project according to the department Supply Quality. Some pre-inspections are also carried out. The goal is to improve customer satisfaction with quality improvements. All units and systems sold go through a factory acceptance test (FAT), where the unit is tested on its function. The function Supply Quality concentrates their efforts on the manufacturing partners. Other component suppliers are not audited. Supply Quality has established a BSC (balanced score card) for the audits of case company’s manufacturing partners. Supply Quality are about to develop a supplier audit program, but it is not implemented yet nor the BSC due to lack of time.

Purchaser’s responsibilities for B- and C-processes are limited to placing and follow-up of purchase orders. Supplier selection is out of their control, since the product design functions as well as sales functions and project management functions decide in the early stages of the projects about the specifications of the sold products as well as the BOM (bill of materials) for the manufactured unit.

“[...] I am only placing and following purchase orders. [...] Historic supplier performance is not relevant, since I am stuck with the suppliers anyway. [...] We are trying to get the supplies on time in order to fulfil what was promised to the customer. [...]” (C9, 2019)

“[...] We do not have a structured way how to measure supplier performance. The focus is on price. [...] We follow OTD, but our negotiation power is poor, since we do not have alternative suppliers. [...]” (C6, 2019)

The requirements set in the early stages of project planning lead to an inability of the purchaser to change supplier or manufacturing partner. Supplier performance is therefore not relevant for purchasers' work, since they concentrate purely on order fulfilment with the constraints (i.e. lead time towards their customers) they face.

“[...] Bad suppliers cannot be changed, since our supplier base is fixed. [...] We do not have a database where supplier performance is available. The Purchasers have problematic suppliers and manufacturing partners in mind, but it is difficult to show to other relevant functions which are the bad suppliers, and which should be changed due to bad performance. [...]” (C6, 2019)

The purchasers noted that historical supplier performance is not considered when selecting the product (i.e. the items and suppliers/ manufacturers) in the early stages of the project. This is due to missing data available for comparison. Cross-functional communication is missing, or it is poor.

Actions to improve OTD and other internal actions are taken, but supplier performance is otherwise not or only little communicated with the supplier. Corrective actions with the supplier are not noticeable according to the information gained from the interviews of the first data collection.

“[...] We follow OTD by following better our purchase orders, we request confirmation to the orders placed and we update more the purchase orders in ERP. [...] That is what we are internally doing. Bottom line is that we try to improve purchaser – supplier communication. [...]” (C6, 2019)

“[...] Purchase order follow up is what we are doing to improve OTD. [...] OTD is discussed in our monthly team meetings. [...] Other actions towards the suppliers are not taken. [...]” (C2, 2019)

“[...] Supplier performance is not shared with the suppliers. [...] We had some discussion in meetings and audits. [...]” (C4, 2019)

“[...] We are trying to identify the causes for late deliveries of sales orders to our customers for the B-process. [...] We identified late supplier deliveries as root of the problem sometimes. [...] We are only collecting the data at the moment. [...]” (C9, 2019)

The reason for not sharing supplier performance related information with the suppliers might stem from unreliability of the data available and the low focus on that topic, which is further explained with the quotes of the interviewees.

“[...] The reliability of OTD data depends on the purchaser – how much time each purchaser has to update the purchase order in ERP. [...] The focus is, however, on OTD since mid-2019, which should lead to an improvement of the OTD data. [...]” (C11, 2019)

“[...] The confirmation dates of purchase orders are often not reliable, since purchasers do not always update the data into the ERP system. [...] This creates delays towards the customer. [...]” (C9, 2019)

“[...] OTD is difficult to measure, since goods are delivered often directly from our supplier to the customer. The reliability of OTD measures depends also on purchaser’s work. The data is not 100% reliable. [...] We have heavily worked on that matter. [...] Purchasers should update the purchase order better. [...] The data for deliveries to our warehouse 1 is pretty good and can be used as an indicator since most of the suppliers deliver also to our warehouse. [...]” (C4, 2019)

The data for the current supplier performance measures in terms of delivery accuracy seems to be unreliable due to the insufficient purchase order update of the purchasing function. However, actions for improvement have been taken already. The purchasers should update into the ERP system every purchase order with the confirmation date from the supplier as well as the changes to the confirmation date.

7.4 Summary of the current status

The following restrictions and obstacles were noticed for determining suitable measures during the analysis of the current status of procurement functions and SRM in the case company:

- The case company has no procurement or SRM strategy determined.
- SRM is on low focus at the case company.
- There is no strategic supplier segmentation established.

- Different processes and supplies might require different supplier relationship approaches.
- Data reliability is questionable, or data is not yet available.
- Supplier performance targets are not set, nor communicated to the suppliers.

The case company has only few own manufacturing sites. Most of manufacturing and assembling are outsourced. Case company's SC is therefore a crucial part in its success. The case company has not established any procurement or SRM strategy. Operational targets including also targets for procurement have been set by the top management. The lower management of procurement, as well as the procurement specialists are not aware of all their targets. It has not been determined what measures or supplier attributes are important for the supplier relationship.

Supplier performance targets are not set, or not communicated both internally within procurement department as well as with the suppliers. Vertical communication and communication with suppliers seem to be an issue, which requires improvement. Some suppliers are regarded as preferred suppliers and have frame agreements, but a strategic supplier relationship approach is not noticeable. The level of supplier relationship and a strategy for supplier relationship is not determined for most of the suppliers. This means that no categorisation such as e.g. Kraljic's matrix, has been carried out.

Procurement concentrates mostly on price and delivery time. The awareness of TCO is very low and leaves room for improvement. Middle management is aware of quality as a cost driver, but purchasers are not aware of it, which indicates that the information is not flowing vertically well enough. Furthermore are role and responsibilities within the procurement department not clearly divided, which create waste processes.

8 Preliminary proposal for supplier performance measures

This chapter investigates what supplier performance measures could be appropriate to follow for the case company based on the analysis done earlier.

The corporate goals and strategy are studied first in order to determine the supplier performance expectations. Gordon's hierarchy about the development of supplier performance expectations which was introduced in chapter 5.2, was utilised when developing a proposal of the supplier performance measures for the case company. Therefore, supplier performance expectations were derived directly from the operational targets set by the top-level management. Benchmarking was not used as a possible approach for determining supplier performance targets and measures since the case company has rather complex processes and a unique value proposal. Aligning the supplier performance targets and measures to the overall strategy of the case company was therefore more suitable approach.

The expectations set were general since a proper supplier segmentation is not carried out at the case company. The time available for the research and the scope of the thesis did not allow a segmentation of the case company's supplier base. The different processes (A, B, C) at the case company were as much as possible considered.

A performance-based evaluation of suppliers was selected for establishing supplier evaluation at the case company, which led to monitor mainly lagging performance indicators. The performance-based evaluation can be the first step in evaluating supplier performance. These performance results can lead to a process-based supplier evaluation in the future. The process-based supplier evaluation has many benefits since it looks at the leading indicators of supplier performance and enhances a close supplier relationship, which aims at long-term prosperity. The goal of a process-based evaluation is to eliminate waste activities in suppliers' manufacturing processes, which leads to improved operations. (Benton, 2014, p.173) However, considering the current stage of SRM at the case company, the missing strategic approach in procurement leads to a performance-based supplier evaluation at the case company.

Gordon (2008, p.81-83) suggests that supplier performance metrics should support the strategy of a company and the targets to be derived from that. Performance measures can be divided into quantitative data and qualitative data. Quantitative measures are often preferred by management, since they offer the illusion of reliability. Quantitative data can also be interpreted in different ways and therefore succumbs to subjectivity. The reliability of data depends also on the quality of data collection and input, as was

observed at the case company. Qualitative data can on the other hand, provides insight to root problems. Performance measures should be therefore a mix of qualitative and quantitative data and they should not only concentrate on lagging indicators, i.e. historic performance. The proposal for supplier performance measures is mostly based on quantitative data due to the availability of the data, but it includes also some qualitative measures.

The case company's corporate strategy and targets are set for five years but they are subject to yearly adjustments. The supplier performance measure areas like cost, time, quality and partnership were developed based on the corporate goals and operational targets at the case company. NWC, EBITDA, and quality are currently in focus at the case company next to procurement savings. The customers of the case company demand shorter lead times, which puts more pressure on the efficiency of case company's SC.

Appendix 4 illustrates how the supplier performance measures were derived from the strategy defined by top management. Targets for procurement and for the suppliers were set based on case company's strategy and operational goals. This proposal is based on on Gordon's (2008, p.84) hierarchy of supplier performance expectations and adapted and customised to the purpose of this research as well as to the situation of the case company. The supplier performance measures to be monitored at the case company are in the area of cost, time, quality and partnership.

COST

Procurement savings are one operational target at the case company. Measures in the area of costs are therefore necessary in order to evaluate the current situation and thus enable the case company to make decisions about cost savings. Appendix 5 shows all suggested measures for this supplier performance area.

The case company should measure how the supplier spend is divided into different non-material related costs in addition to spend per supplier, i.e. they should measure what other costs in form of fees and mark-ups are invoiced by the supplier. This should increase the TCO awareness at the case company and help to identify cost drivers in

case company's SC as well as to increase transparency in suppliers' cost structure. Analysing the spend structure contributes to the decision making in necessary supplier consolidation, which is also one operational target. Spend analysis can also be used as one part of categorising the case company's supplier base.

Payment terms (i.e. credit days) should be reported in order to provide data for comparison of suppliers. This can be used in negotiations. Payment terms are compared in order to improve NWC (net working capital) and liquidity at the case company. Savings shall indicate the success of actions taken in terms of procurement savings.

TIME

The supplier performance area time is one the most important areas to monitor since the supplier performance in terms of time influences a lot the customer satisfaction. OTD (on time delivery) is currently measured at the case company. Improving suppliers OTD will lead to an increased OTD rate towards case company's customers. Improvements are only possible if the root cause for late deliveries is reported. Measuring OTD as well as root causes for late delivery enables the case company to identify causes for troubles in their supplier base and implement corrective measures and actions.

Delivery accuracy is another measure in the area of time. It reveals the discrepancy in days when comparing the actual delivery date to the confirmed delivery date. Measuring OTD and delivery accuracy helps to identify cost drivers, since late as well as early deliveries create costs such as higher transport costs or they increase warehousing costs. Data for OTD and delivery accuracy is only as reliable as case company's purchasers update of purchase orders into the ERP system. Therefore, increasing data reliability should be in focus as well.

All performance measures in the area of time are illustrated in Appendix 5. Some measures could also fit into another area, but the researcher decided to categorise the measures to where they are the most insightful and beneficial.

The average lead-time of purchase orders (i.e. the time from placing the purchase order to order fulfilment) could support sales function and project management function in

estimations of lead time towards the customer during the planning and tender phase of projects. Breaking down the information to the product category level would offer even more clarity to this measure. The average lead-time for purchase orders is especially useful when evaluating case company's manufacturing partners and important component suppliers.

All manufacturing partners need to deliver FAT (factory acceptance test) in order to prove quality of the manufactured unit. Pre-FATs are required from the manufacturing partners prior to delivery. On time Pre-FATs indicate on time delivery as well as quality. Causes for late Pre-FATs should be monitored to provide a better understanding of the root cause and to provide decision making for improvement. Case company's project portal could be utilised for gaining the data needed.

The manufacturing system at the supplier is as important to look at as the system for the own processes. The suppliers should have a similar manufacturing approach as the buyer, which enables smooth and efficient processes. If a manufacturing company adopts Lean Six Sigma as a manufacturing system, then the supplier should have the same or very similar approach for its manufacturing or otherwise delays or increasing costs for stock keeping are inevitable to occur. The case company should therefore look at the efficiency of suppliers' manufacturing system and their internal cycle time in order to determine the alignment to processes of the case company. The data for those measures could be gained with help of audits and supplier surveys.

QUALITY

The cost of poor quality is one of the major cost drivers at the case company and therefore needs to be monitored. Many manufacturing companies measure suppliers by using the measure of defective parts per million. The case company has, however, most of their manufacturing outsourced and PPM is therefore not the appropriate measure for supplier quality performance. Warranty costs at the case company could be used as an indicator for supplier quality, since they reflect also the customer satisfaction. However, not all warranty cases are caused by poor supplier quality. Therefore, only the number of customer warranty cases with supplier being the root cause (i.e. manufacturing fault and pre-mature wearing) should be measured. The costs related to the warranty cases

related to supplier faults cannot be measured currently, since the data is not available yet. The data could be gathered utilising the case company's warranty management system JIRA as well as financial data. The data collection shall enable the case company to identify suppliers with quality issues. The volume delivered gives perspective to the data.

The warranty related costs are high at the case company. Claiming warranty towards the supplier turns out to be difficult due to the timeframe of certain projects. Warranty issues occur at the case company often after commissioning of the project. Commissioning is the closing phase of a project, where the sold and installed unit is tested according to the requirements of the customer. Commissioning might be from six months to one year after supplier has delivered its supplies depending on the project. This means that the supplier warranty time has already expired in some cases. The case company is therefore stuck with the costs related to warranty issues with the supplier being the root cause. Cost savings would be possible, if the case company can negotiate a longer warranty time with the relevant suppliers. Measuring supplier warranty time is therefore the first step in the negotiations. All measures and evaluation areas in the supplier performance area quality are listed in Appendix 5.

The case company should evaluate also at least its manufacturing partners as well as important component suppliers in the area of technical capability and suppliers' quality management system. Some of case company's customers have special requirements since the systems are built into naval ships or they are meant for offshore installations. Case company's supplier needs to fulfil those standards as well in order to enable the case company to deliver its units based on those special requirements. Audits and supplier surveys can be utilised to gather the needed data. The balanced scorecard method could be utilised in audits, which helps to objectify the subjective information gained during audits.

Especially the case company's manufacturing partners need to deliver different documents (e.g. data sheets, drawings, certificates and FAT reports). Missing documents will lead to an increase in costs later during the process (e.g. for after sales and service processes) as well as to customer dissatisfaction. The data is currently not available. For data collection, the project management system could be utilised.

Knowing its own SC is one element in risk reduction. The case company should therefore also look into the SC of its important suppliers. Audits help to identify risks in the SC and enable the case company to take corrective actions (e.g. sourcing for other suppliers) in order to create a more resilient SC.

PARTNERSHIP / COOPERATION

The supplier performance area of cooperation and partnership should be measured as well. The data available for this area, however, is rather subjective but indicates very well the depth of the supplier-buyer relationship. The measures are listed in Appendix 5.

Overall communication could be measured in form of scores for which internal surveys with case company's procurement department and supply chain managers could be the base for data of this area. The level of integration to case company's system and logistics related measures are important areas to measure as well. Suppliers would be scored against their current performance (e.g. implemented EDI system, consignment stock).

9 Analysis of testing the preliminary proposal

The results of the second data collection round and of the interviews to the the suppliers are analysed in this chapter. Information of the second data collection round was gathered in a workshop for representatives mainly of the procurement department on 24 February 2020. The analysis of data is split into two sections. Chapter 7.1 concentrates on how the participants of workshop received analysis of current status of procurement in the case company and where they saw room for improvements in terms of communication and processes. The chapter 7.2 focuses on supplier performance measures and the researcher is analysing whether the proposal for them is feasible. In the last chapter 7.3. the results of the supplier interviews are analysed.

9.1 Feedback on the current situation

The participants of the workshop were asked to reflect their own role in the procurement process and to determine where changes are necessary in order to develop their own

work and to improve their own work as well as the efficiency of procurement processes. All participants stated that the roles and responsibilities are not clearly set.

“[...] We don't know who is responsible for what, for example who is responsible for contracts, forecasts, etc. [...] It is not clear what Sourcing is doing and what Purchasing is doing. [...]” (C6, 2019)

The case company has different processes in place, which are set by Project Planning and sales to logistics and after sales functions. However, the participants' opinion was, that the processes are not always followed and that different locations (because of acquisitions) of the case company are not fully merged. They felt also that different processes are not in place, which creates communication problems and costs throughout the processes. Furthermore, some sub- processes for each function are missing, also for procurement.

It was also discovered during the workshop, that communication between the different functions and Procurement is poor, which can lead to misunderstandings and delays and ultimately to penalties from the customer or into higher transportation costs. This has also effects on customer satisfaction. Especially the communication between the sales function, product design function and procurement function is a key to a successful completion of projects and deliveries. The participants wish for the same way of procedures and unified processes, in all locations of the case company.

Most of the participants do not know their role in fulfilling the case company's strategy. This issue was already discussed and analysed in chapter 5.2.1. Furthermore, it was pointed out that information is not shared to everybody, e.g. Purchasers do not know, who are all the preferred suppliers.

“[...] We started paying more attention to target setting in 2019, but we do not have a culture for following up those targets. This should be implemented [...]” (C4, 2019)

“[...] Company strategy and goals are somehow communicated but what it means for the functions and how does the overall strategy affect the function is not communicated. [...] It is unclear what targets derive out of that for the daily work of the functions. [...]” (C6, 2019)

Another discussion related to communication flow revealed that the case company's suppliers often complain about missing or inaccurate forecasts. The manufacturing partners of the case company must often deal with delays from case company's side since the drawing required by the manufacturing is delivered late. That lateness might lead to delays through the whole SC and ultimately to delays towards the customer.

9.2 Feedback on supplier performance measures

During the second part of the workshop supplier performance measures and KPIs were discussed. The researcher introduced briefly her proposal for the supplier performance measures and asked the participants to evaluate the necessity and feasibility of each measure in regards of case company's current situation and future needs. The workshop participants worked in three groups; each group was assigned a certain performance area to discuss. The feedback of the participants is summarised next.

COST

Spend per supplier is currently measured, but other supplier related costs are not allocated or reported. The participants C1, C4 and C7 see the importance of examining other supplier or purchase related costs as well in order to get a better understanding of the real cost of purchasing. Spend and volume are according to source C4 important measures for supplier-buyer negotiations.

The source C4 points out that the cost development of each supplier should be monitored as well. However, the problem is that the customisation of the products makes it very difficult to measure the cost development. A pump supplier that supplies certain amount of standard pumps and a great amount of partly highly customised pumps, was presented as an example of this challenge. The prices for the customised pumps vary drastically, which leads to unreliable data in cost development. The case company has set targets for spend savings in different areas, but the results are not monitored.

According to the feedback received in the workshop, the payment terms payment terms in credit days should be furthermore monitored, since it is an important measure for improving the NWC (net working capital).

TIME

All measures in the area of time are according to the participants important. Participant C2 and C9 contributed most of the feedback. OTD (on time delivery) is an important measure but if the pre-Fat (factory acceptance test) is on time, it should not be measured for all suppliers. The ERP-system could be utilised for gathering the data, but the processes for purchase order handling and follow up should be standardised for all the case company's locations in order to increase data reliability.

OTD is currently measured as dispatch date plus transport time and is compared to the receiving date. The transport time is added because all purchase orders are made by using the delivery terms Ex works INCOTERMS 2020. This delivery term means that the buyer is responsible for organising and paying the transport from the agreed location (here from the supplier). Most of the suppliers organise, however, transport either to the warehouse of the case company or to another supplier of the case company on behalf of the case company. The case company arranges transport in all other cases including deliveries to the end customer.

It was discovered during the workshop, that measuring OTD this way does not reveal, if the supplier delivers on time because the dispatch date does not reflect the initial delivery date confirmed by the supplier. The purchaser changes the dispatch date in the ERP-system in case the supplier informs of any delays. The original confirmation of the supplier is entered into the ERP-system and should be the basis for OTD. The master data transport time behind each supplier of the ERP system is only an estimation and might be incorrect when the supplier is shipping the goods from another destination.

The participant C4 sees an increase in transport cost deriving from late information regarding readiness of purchase orders, as a big cost driver and wishes a way to resolve that problem.

QUALITY

Participants C13 and C6 contributed the most in the discussion about the supplier measurement area quality. Their opinion was that such measures as technical capability

of the supplier, supplier's sourcing and quality management (QM) systems should not be monitored because those are used as evaluation criteria for supplier selection in sourcing.

Supplier quality is currently not measured and utilising warranty data is a good starting point. The number of warranty cases caused by the supplier (e.g. manufacturing fault) as well as the related costs should be measured. Supplier defects should be added as a performance measure as well. Participant C4 suggests, that supplier deliveries should be checked on order fulfilment, appropriate packing as well as transport documentation (i.e. packing list). The reports and follow-up are not available but relevant data can be gathered utilising the ERP-system. Defects detected during Pre-FAT and FAT should also be monitored and reported. This would help to create a feedback loop in order to avoid outfalls and repeating mistakes.

Warranty time granted by the supplier is also important for the sales department . The transparency in that area would prevent great discrepancies between the warranty granted by the supplier and the warranty time the case company grants to their customers. The participant C4 stated that many suppliers have agreed to a warranty time up to three years.

Documentation is a big issue for the case company, since especially the after sales and service department rely on the data from the delivered projects. The documentation is furthermore also important for future projects. Drawings, data sheets, certificates and FAT reports are only a few of the necessary documents needed. Not all suppliers need to deliver those documents but for the manufacturing partners and for some component suppliers is the correctness of documentation a crucial measure. The case company has currently no data available to measure the correctness of documentation, but the project management program could be utilised for gathering the needed data.

PARTNERSHIP / COOPERATION

Overall communication should be measured according to the participants C1, C4 and C7 but response time to emails or requests is difficult to measure since it is very subjective.

The measure should also include how flexible and available the supplier reacts to the requests and changes made by the case company.

Measurements of logistics should also include a measure detecting whether all necessary documents (e.g. packing list, FAT report, etc.) were delivered by the supplier. Measurements of logistics should also be examined whether the supplier has an automatic order system available.

The supplier performance areas of “alignment and level of integration” should not be uniformly assessed since the capability for alignment e.g. with EDI connection depends on the size of the supplier.

9.3 Analysis of the supplier interviews – mirror view

The case company suggested two suppliers (interviewee S1 and S2) to be interviewed for this research. These interviews took place on 14th of February 2020. This chapter is based on data gained from these interviews as well as from an interview with the Supply Chain Manager in charge of the two suppliers (interviewee C14). That interview was held on 30th of January 2020.

Both suppliers (X and Y) are operating in the same industry and are specialists in plastic production. Both suppliers deliver products mainly required by one product area of the case company. They are delivering standard and customised products to the case company’s manufacturing partner or suppliers. They deliver also directly to the case company for the spare part sales (case company’s internal process A). The turnover, which is created by the case company of sales of supplier X’s products represents only about 2,3 % of the whole turnover of company X. Supplier Y is more dependent on the case company since about fifty percent of supplier Y’s turnover is generated by the case company. The supply chain (SC) between the case company and both suppliers is illustrated in Figure 10.

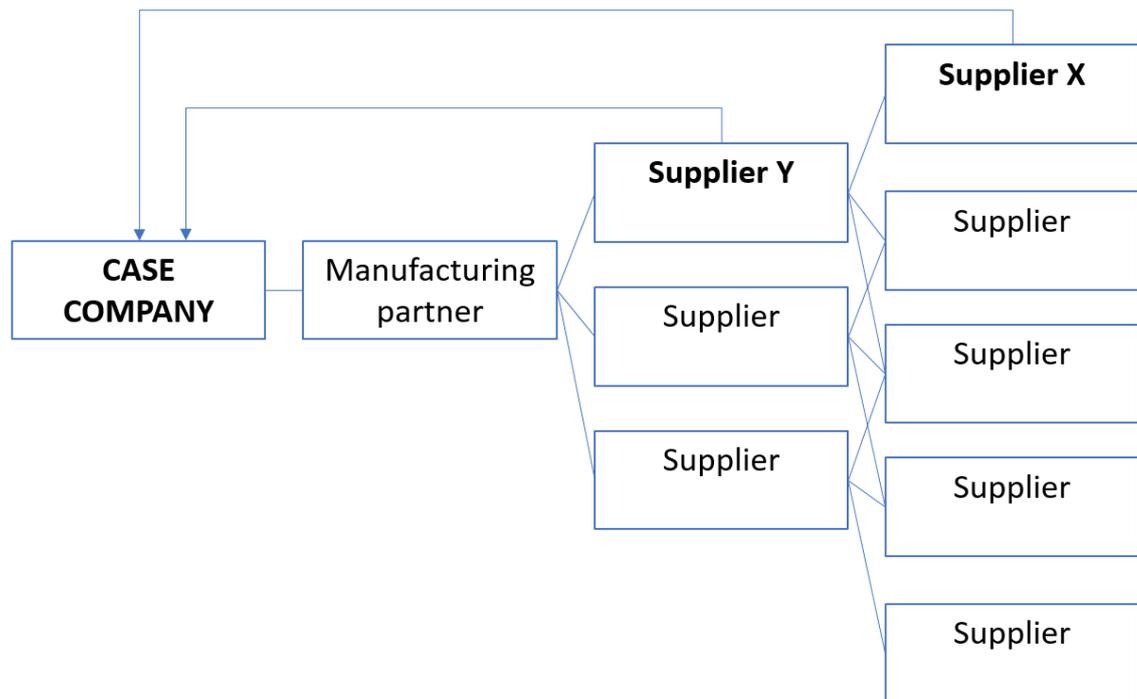


Figure 10. Supply chain between the case company and suppliers X and Y

Both suppliers are satisfied with the personal relationship with the case company. They emphasise open and good communication with the case company's representative (i.e. interviewee C14). Supplier Y, however, wishes, that the case company would take a more leading role within the SC, since they have some serious problems with the delivery accuracy of certain suppliers. The case company gives forecasts to the manufacturing partner and the 2nd and 3rd tier suppliers are involved in this SC. The orders from the manufacturing partners to supplier Y differ often from the ones by the suppliers and have too short lead-times.

Both suppliers evaluate their performance in the areas of quality and time to be good to excellent. They have an ISO-standardised quality management system and lean manufacturing system in place. According to the statements of the representative of supplier Y and interviewee C14, lower performance level of supplier Y in delivery accuracy roots back to certain sub-suppliers. The supplier Y has especially problems with one of its suppliers. This supplier delivers also directly to the case company. This supplier delivers specialised components to supplier Y that are needed for further manufacturing as well as in the case company for the sales of spare parts. The case

company has nominated this supplier as a partner during their sourcing process for certain products. The set-up time in the production would take a couple of months for another supplier if the case company would change to another supplier. Furthermore, the items are rather complicated and finding a new supplier might be challenging. Supplier Y is therefore dependent on this supplier causing problems in the SC. Supplier Y wishes that the case company supports the supplier Y in order to find solution for problems with the supplier in question. Supplier Y would like the case company to enable a more value-adding approach and more transparency in the SC, since many of the players within this SC are somehow connected to the case company. Supplier Y wishes also that the case company would lay out a long-term strategy for the SC and set targets towards the suppliers.

Supplier X and Y stated that the case company currently does not set or communicate any supplier performance targets. Both suppliers have gotten positive feedback for their supplier performance in the areas of time and quality. Other problems or issues are unknown. Both companies keep a safety stock for the case company in order to be able to deliver with short lead times that the case company often requests from them. Both companies would like to deepen the relationship with the case company. Supplier X would like to automatize processes more by e.g. having an automated forecasting process or an EDI connection. Supplier Y would like to deepen the relationship with more transparency within the SC and a more value-adding approach in the supplier relationship in order to eliminate waste processes within the SC. An EDI connection between the SC partners of the case company could also be imaginable. Supplier Y wishes for communication between all of case company's suppliers and partners.

The interviews revealed that supplier performance targets are not set nor communicated towards the suppliers. The daily operations are, however, running mostly smoothly and the forecast system that is implemented at the case company and communicated to the suppliers, is established and works usually well. The suppliers mentioned that a strategic approach of the case company is not noticeable to them.

10 Final solution proposal and further recommendations

The proposal for supplier performance measures presented earlier in this thesis was based on the analysis of the results of the first data collection round. This proposal was presented in a workshop for representatives mainly from the procurement department on 24 January 2020. The preliminary proposal was adjusted according to the feedback received during the workshop and two interviews with two suppliers. The adjustments made based on the received feedback are presented in this chapter as well as more detailed information on how the supplier performance measures should be assessed.

10.1 Supplier performance area: cost

All supplier performance measures of the area cost are presented in Table 5. The table gives an overview on what should be measured as well as how the measure can be monitored. The benefits for the case company are listed as well in the table.

Table 5. Final solution proposal for supplier performance area cost

KPI / MEASURE	How to measure	DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Spend	<ul style="list-style-type: none"> In amount- in € Data from at least 5 years back Broken down to monthly spend development Spend per supplier Broken down into item category per supplier Each category divided into levels of customisation if needed 	<ul style="list-style-type: none"> Spend data from Finance + ERP Item category / customization level from ERP 	<ul style="list-style-type: none"> Evaluation of supplier's importance Enables categorizing of suppliers Enables to determine appropriate supplier relationships + strategy 	ALL
Other costs (from supplier invoiced)	<ul style="list-style-type: none"> In amount- in € Data from at least 5 years back Broken down to monthly cost development Cost per supplier Broken down into cost category (e.g. mark up, handling fees, packing costs) Broken down into item category per supplier Each category divided into levels of customisation if needed 	<ul style="list-style-type: none"> Cost data from Finance Item category / customization level from ERP system 	<ul style="list-style-type: none"> Increase TCO awareness Identify cost drivers Enable decision making for cost saving actions 	ALL
Volume	<ul style="list-style-type: none"> Amount in pcs Data from at least 5 years back Broken down to monthly volume development Volume per supplier Broken down into item category per supplier Each category divided into levels of customisation if needed 	<ul style="list-style-type: none"> ERP system 	<ul style="list-style-type: none"> In perspective to Spend - Evaluation of supplier's importance 	ALL
Credit days (payment terms)	<ul style="list-style-type: none"> In credit days granted by supplier 	<ul style="list-style-type: none"> ERP system 	<ul style="list-style-type: none"> Enables comparison to other suppliers Indicator for the liquidity of the case company Increase NWC 	ALL
Savings compared in perspective to volume	<ul style="list-style-type: none"> In amount – in EUR Difference in spend when comparing similar time frames (e.g. one year compared to current year) 	<ul style="list-style-type: none"> Spend data from Finance + ERP 	<ul style="list-style-type: none"> Indicator of success of actions taken Increase EBITDA 	Mainly strategic important suppliers

The category spend should enable the case company to monitor the cost development of each supplier. The monitored performance data should be available on a monthly basis and at least for a current time and historical data from five years. The participant C4 pointed out in the workshop that monitoring the development of cost related to certain

suppliers is difficult because the items purchased are often customised and this results into differences in prices. Standard prices are only available and comparable for non-customised products. Manufacturing costs increase when there is less standardisation in place. This leads to an increase in the selling price as well. Therefore, the case company needs to categorise first the purchases (i.e. goods) into different products categories. Each category needs to be divided into three levels. Level-one-items are off-the-shelf products (i.e. standard products without any customisation). Items on level two are slightly customised and on level three they are highly customised. The case company's Product Design department should set the level of customisation. This information could be entered into the ERP-system when entering the item there. The case company has the possibility to monitor the spend and cost development of the supplier and break this information down to item categories and customisation level if needed. It will not give a hundred percent accurate picture, but trends are made more visible with this solution. In order to make the data comparable and measurable, the case company needs to compare the spend data with the volumes of purchases by the suppliers during the same time period with spend. This gives more perspective to the comparison. Looking at spend development enables the case company to monitor savings compared to similar time periods in the past.

10.2 Supplier performance area: time

On-time-delivery (OTD) should be measured as a percentage of all deliveries, i.e. it should compare the amount of deliveries on time to all deliveries made by the supplier. The case company needs to change the data that is utilized at the moment from the ERP-system for this measure. The correct way to measure OTD should be to use the formula: the confirmation date plus transport time versus the receiving date. This means that the confirmation date of the purchase order in the ERP system should be the basis for this measure.

The final solution for the supplier performance measures of the area of time is summarised in Table 6, which shows what should be measured and the benefits for the case company related to this measure. The table gives also instructions on how to measure the KPIs.

Table 6. Final solution proposal for supplier performance area time

KPI / MEASURE	How to measure	DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
OTD	<ul style="list-style-type: none"> Shows percentage of total deliveries of supplier measured which is punctual or delivered early Compared to first delivery date confirmed by supplier 	<ul style="list-style-type: none"> ERP system - confirmation date of purchase order (currently dispatch date = wrong) and reception date 	<ul style="list-style-type: none"> Improving delivery accuracy towards the customers Improving customer satisfaction > new and follow sales Eliminating waste processes stemming from late > costs savings (e.g. transport costs) 	All suppliers
Cause for late deliveries <ul style="list-style-type: none"> Intern Extern 	<ul style="list-style-type: none"> Percentage of total delays per supplier distinguished by reason for delay Internal causes <ul style="list-style-type: none"> Purchase order set with too short lead time Needed documentation delivered to supplier with too short lead time External causes <ul style="list-style-type: none"> Notification about readiness of goods too late send by supplier Too little manufacturing capacity Problems with subsuppliers / suppliers' SC 	<ul style="list-style-type: none"> ERP system Data gathering needs to be enabled and implemented 	<ul style="list-style-type: none"> Identify trouble shooters in supplier base Enables to define actions for improvement of case company's processes as well supplier processes and supplier performance 	All suppliers
Delivery accuracy	<ul style="list-style-type: none"> Average discrepancy in days Compared to first delivery date confirmed by supplier 	<ul style="list-style-type: none"> ERP system - confirmation date of purchase order (currently dispatch date = wrong) and reception date 	<ul style="list-style-type: none"> Improving customer satisfaction > new and follow sales Eliminating waste processes stemming from late or early deliveries > costs savings (e.g. warehousing costs) 	mainly suppliers delivering for C-process (i.e. delivering to case company's warehouse)
Average lead time	<ul style="list-style-type: none"> Time in days from placing a purchase order to purchase order fulfillment 	<ul style="list-style-type: none"> ERP system - order date of and reception date of purchase order 	<ul style="list-style-type: none"> Support of sales and project management for planning new projects, answering inquiries, estimating lead times towards customer > leads to increased delivery accuracy towards the customers and therefore to increased customer satisfaction 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Pre-FAT on time	<ul style="list-style-type: none"> Percentage of total pre-FAT required Compare initial set date for pre-FAT delivery to actual delivered pre-FAT 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be JIRA system or project tool 	<ul style="list-style-type: none"> Indicator for quality Indicator for OTD 	Manufacturing partners and supplier, where FAT is required
Reason for late pre-FAT	<ul style="list-style-type: none"> Percentage of total delays per supplier distinguished by reason for delay Internal causes <ul style="list-style-type: none"> Purchase order set with too short lead time Needed documentation delivered to supplier with too short lead time Pre-FAT too late booked External causes <ul style="list-style-type: none"> Notification about readiness of goods too late send by supplier Too little manufacturing capacity Problems with subsuppliers / suppliers' SC Resources for Pre-FAT not planned in Defaults discovered during pre-FAT should be monitored 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be JIRA system or project tool 	<ul style="list-style-type: none"> Identify trouble shooters in supplier base Enables to define actions for improvement of case company's processes as well supplier processes and supplier performance Avoiding pitfalls towards project delivery Eliminating repeating quality issues and mistakes 	Manufacturing partners and suppliers, where FAT is required
Suppliers' internal cycle time	<ul style="list-style-type: none"> Time in days from receiving the purchase order to fulfilling the order 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Indicator of supplier's efficiency Indicator for supplier's capability 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Supplier's Manufacturing system (e.g. Lean, Six Sigma)	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. Lean Six Sigma = 1; another pull system = 0; a push system = -1) 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or 	<ul style="list-style-type: none"> Indicator of supplier's efficiency Indicator for supplier's capability Indicator if supplier fits to case company's strategy and operating model 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

The case company has agreed the delivery term Ex works Incoterms 2020 with its suppliers. This creates difficulties in measuring OTD, since it is currently an estimate of the time pre for transport, which is the basis for the formula of monitoring OTD. Suppliers ship out from different manufacturing sites or warehouses of their logistic partners, which makes the estimates inaccurate. The case company could demand each supplier to provide a packing list or a notification when the goods are ready for dispatch to avoid this inaccuracy. This way the case company gets the exact information when the goods are ready. This date could be entered into the ERP-system and compared with the confirmation date given by the supplier. However, this will create more manual work for the purchaser, since the ordering process is mostly not automated. A solution could be also a joint e-mail box for the Procurement team where this kind of notifications are sent to by the supplier. The notifications could be automatically entered into the ERP-system

from this joint e-mail box. A proper IT- solution is needed for implementing this kind of change. This can be achieved only over a longer period of time.

Causes for delays are necessary to monitor in order to take corrective measures in the future. The researcher identified the following probable causes for delays:

- INTERNAL – purchase order is set with a lead time which is too short
- INTERNAL – documentation (e.g. drawings, specs) are delivered to the supplier with a lead time which is too short
- EXTERNAL – Notification about the readiness of the goods is sent too late by the supplier
- EXTERNAL – there is too little manufacturing capacity at the supplier
- EXTERNAL – there are problems with the 2nd tier suppliers of the supplier

The causes mentioned can be changed and extended according to case company's needs. Monitoring causes of late purchase orders requires the purchasers to retrieve the needed information from the supplier. This process should also be at least semi-automated.

The delivery accuracy should also be measured since not only late deliveries can create extra costs for the case company, but also early deliveries can e.g. increase warehousing costs. This measure should be presented as average discrepancy in days compared to the confirmation date.

The average lead-time, i.e. the average time (in days) from placing the purchase order to receiving the notification for readiness should be monitored. This measure helps sales and project management function in planning of new projects. For the procurement department this measure works for an indicator of performance when compared with OTD and causes of late deliveries. The average lead-time should be furthermore compared with the lead-time of the supplier which is entered in the master data of the ERP-system. The supplier's internal cycle-time should be compared with the average lead- time in order to identify discrepancy from supplier performance targets and from other suppliers of the same segment, and to identify room for improvement of the supplier performance. Audits and supplier surveys should be utilised in gaining the information needed.

On-time delivery of pre-factory acceptance test for purchase orders from manufacturing partners should be monitored as a percentage of all pre-FATs. Pre-FAT on time is an important measure since it is an indicator for OTD as well as for quality. Therefore, the causes for late pre-FAT need to be monitored as well. Possible reasons for late pre-FAT can be similar to the reasons for late deliveries (chapter 8.2) but are not limited just to those reasons. The defaults discovered during the pre-FAT should be monitored separately as well in order to avoid pitfalls and repetition of mistakes. The project management program could be utilised for extracting this information. A semi-automated process could be helpful in order to minimise manual work. A common email-box for the Procurement team for the pre-FATs and FATs could be utilised for entering the data automatically into the ERP-system or project management system.

10.3 Supplier performance area: quality

Measuring the costs of warranty cases caused by supplier (i.e. manufacturing default or early wearing) should be monitored as a first step to monitor supplier quality. The number of warranty cases with cause supplier should be put into perspective to the warranty costs as well as to volume (cost measurement) in order to give a better understanding of the quality a supplier deliveries. All warranty cases are currently divided into manufacturing fault (i.e. caused by supplier during manufacturing), premature wearing (i.e. too early end of usage of a product - before end of product's initial life cycle), user faults (e.g. because of wrong handling by customer), engineering faults (case company's fault e.g. because of wrong drawings) and other faults. The researcher advises to divide the root cause into further sub-groups. This should help the case company to identify the real problems behind quality issues and to enable them to take corrective actions. Additional sub-groups of warranty cases caused by the manufacturer could be e.g. faults in assembly and component quality problems. Also defects from pre-FAT (factory-acceptance test) and FAT should be monitored in order to measure supplier quality and to avoid pitfalls and repeating mistakes. Defects detected during pre-FAT and FAT could be documented either in the case company's warranty system JIRA or in the project management system.

The supplier performance measures of the area of quality suggested for the final proposal are listed in Table 7 along with guidance on how to monitor those KPIs and their advantages of measuring those.

Table 7. Final solution proposal for supplier performance area quality

KPI / MEASURE	How to measure	DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Warranty cases (cause supplier)	<ul style="list-style-type: none"> Number of warranty cases with cause <ul style="list-style-type: none"> Manufacturing fault <ul style="list-style-type: none"> Component quality issues Assembly problem Pre-mature wearing <ul style="list-style-type: none"> Component quality issues Wrong handling by customer (excluded from supplier performance measure) 	<ul style="list-style-type: none"> JIRA system 	<ul style="list-style-type: none"> Improving delivery accuracy towards the customers Improving customer satisfaction > new and follow sales Eliminating waste processes stemming from late > costs savings (e.g. transport costs) 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Costs related to warranty cases (causes supplier)	<ul style="list-style-type: none"> In amount- in € Broken down to monthly warranty cost development Warranty costs per supplier 	<ul style="list-style-type: none"> JIRA system Data gathering needs to be enabled and implemented 	<ul style="list-style-type: none"> Identify trouble shooters and cost drivers in supplier base Enables to define actions for improvement supplier performance Improving customer satisfaction from improved quality 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Warranty time granted by supplier	<ul style="list-style-type: none"> Warranty time granted by supplier in days 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Long warranty time granted by supplier enables costs savings in warranty Indicator for willingness of supplier to cooperate and share costs from bad quality Indicator for suppliers' flexibility 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Quality management system at supplier	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. according to ISO standards or exceeding those standards = 1; aligned to ISO-standards= 0,8; own QM system = 0,3; no QM system = 0) 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Indicator for quality 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Technical capability of supplier (naval/ offshore standards)	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. 1=excellent; 0,8=good; 0,5= moderate; 0,2=poor) 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Identification of non-quality / non-standard conform suppliers 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Sourcing system at supplier	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. excellent = 1; good = 0,8; moderate = 0,5; poor = 0,2) 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Indicator of how well is supplier's SC streamlined Risk identification/ minimisation in case company's SC 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Documentation required from supplier (e.g. FATs, certificates)	<ul style="list-style-type: none"> Number of cases distinguished as follow <ul style="list-style-type: none"> Documentation fully compliant (in full + on time) Failed submission (no documents delivered on time) Partly submission (some documents were missing at deadline) Project management needs to define latest when placing the purchase order what documents are needed and purchaser need to communicate those requirements incl. deadline to supplier 	<ul style="list-style-type: none"> Project management system/ ERP system Data gathering needs to be enabled and implemented 	<ul style="list-style-type: none"> Increased customer satisfaction by increased documentation delivery Increased customer satisfaction in after sales and service Cost reduction through eliminating waste processes from looking after documentation or retrieving information in after sales 	<ul style="list-style-type: none"> Where applicable: mainly Manufacturing partners and important component suppliers
Delivery quality	<ul style="list-style-type: none"> Number of cases with delivery quality issues categorised into <ul style="list-style-type: none"> Order fulfilment (partial delivery) Missing transport documentation Faulty packaging 	<ul style="list-style-type: none"> ERP system Data gathering needs to be enabled and implemented 	<ul style="list-style-type: none"> Cost reduction form reducing waste processes stemming from delivery quality issues 	<ul style="list-style-type: none"> Mainly for suppliers delivering to case company's warehouses

Incoming deliveries from suppliers should be checked against the following performance measures: order fulfilment, delivery of transport documentation and packaging as part of supplier quality performance measure. This would offer another important dimension to supplier performance in the area of quality, which can lead to reduction of internal process costs stemming from dealing with these quality problems.

Documentation was mentioned to have as a critical part in the case company's processes. Therefore, ensuring that all required documents are submitted by the supplier is crucial. The project management system could be utilised for measuring this performance measure. It should be measured how many products were delivered with submission of total documentation at completion of the purchase order line, partly submission or failed to submit any documents. Purchases orders for which documentation is not required should be marked in order to give a correct scope of this

measure. This performance measure enables the company to identify bottlenecks and to take corrective measures in order to increase customer satisfaction and decrease internal process costs.

The quality management system at the supplier as well as the supplier's technical capability and its sourcing system are important evaluation criteria for selecting a new supplier. These should be checked with help of audits and supplier surveys at least once a year in order to ensure even higher supplier performance. The researcher agrees with Bailey et. al. (2015, pp.257-262), that supplier evaluation is an on-going process of procurement. Supplier evaluation is furthermore an indicator to re-evaluate if the supplier is still a suitable partner for the case company.

10.4 Supplier performance area: partnership / cooperation

Overall communication can be measured only subjectively but it is anyway an important indicator for the depth supplier-buyer relationship. Annual internal surveys with all employees who have supplier contact could be utilised for acquire the needed information. The measure of overall communication should be divided into subsections in order to form a solid performance indicator. Subsections could be the response time to emails and purchase orders as well as flexibility and availability of the supplier to requests from the case company. Each sub-section should be assigned certain significance (i.e. weight) according to the importance of the sub-section. The survey participants should get the possibility to rate the suppliers according to a certain assessment scale (e.g. 1 = low performance to 10 = high performance). The results for each supplier should be weighted according to the amount of contact each survey participant has had with the supplier being evaluated.

The measurements called "logistics" and "level of integration" could be combined to on supplier performance criteria, which is shown in Table 8 along with the other supplier performance measurements of the area partnership and cooperation.

Table 8. Final solution proposal for supplier performance area partnership and cooperation

KPI / MEASURE	How to measure	DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Overall communication	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. excellent = 1; good = 0,8; moderate = 0,5; poor = 0,2) Divided into sub-categories Sub-categories assigned a certain significance [weighing] Sub-categories to be evaluate: <ul style="list-style-type: none"> Purchase order confirmation [e.g. 40 %] Response time to inquiries [e.g. 30%] Flexibility and availability (e.g. to changes in demand) [e.g. 30%] 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be internal yearly surveys with e.g. procurement and employees with supplier contact 	<ul style="list-style-type: none"> Indicator for cost reduction Indicator for depth of relationship Indicator for willingness to cooperate 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers Suppliers with high spend
Logistics & Level of integration	<ul style="list-style-type: none"> Determine a score on which base suppliers will be evaluated (e.g. excellent = 1; good = 0,8; moderate = 0,5; poor = 0,2) Divided into sub-categories Sub-categories assigned a certain significance [weighing] Sub-categories to be evaluate e.g.: <ul style="list-style-type: none"> Willingness to keep buffer stock [e.g. 30 %] Arranging transport on behalf of case company [e.g. 20%] EDI- connection / automated ordering system [e.g. 40%] 	<ul style="list-style-type: none"> Data gathering needs to be enabled and implemented Possible source could be audits, supplier meetings and/ or supplier surveys 	<ul style="list-style-type: none"> Indicator for cost reduction Indicator for depth of relationship Indicator for willingness to cooperate 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers Suppliers with high spend

The supplier performance measure called logistics and integration should investigate if an automatic order handling system is available at the supplier and if the supplier is willing to keep a buffer or consignment stock for the case company. It should also be found out whether the supplier has the capability and willingness to align with the case company e.g. via EDI connection. Supplier surveys and audits could be utilised to gain the necessary data. The different investigation areas, which are mentioned above, could be placed into a own sub-area of this supplier performance measure. Each sub-area should be assigned certain significance (i.e. weight) according to the importance of the sub-area. The auditor should get the possibility to rate the suppliers according to a certain assessment scale (e.g. 1 = low performance or no fulfilment to 10 = high performance or fulfilment). The weighted results for each supplier should be accumulated to give a result which can be compared with the results of other suppliers.

10.5 Suggestion for implementation of the proposal

The proposal suggested in the previous chapters for supplier performance measures suggested can be divided into three implementation phases. Several implementation phases are needed since SRM has currently low focus in the case company, there is not data available or it is not reliable and the strategic approach of the procurement department especially about SRM is narrow. Therefore a SRM system with appropriate supplier performance measures needs to be implemented gradually.

Each phase should include data collection for the following phases. The implementation phases are illustrated in Figure 11. The researcher suggests an implementation

timeframe of one to 1,5 years in total for all phases, but the timeframe depends on case company’s ability to allocate resources for the project.

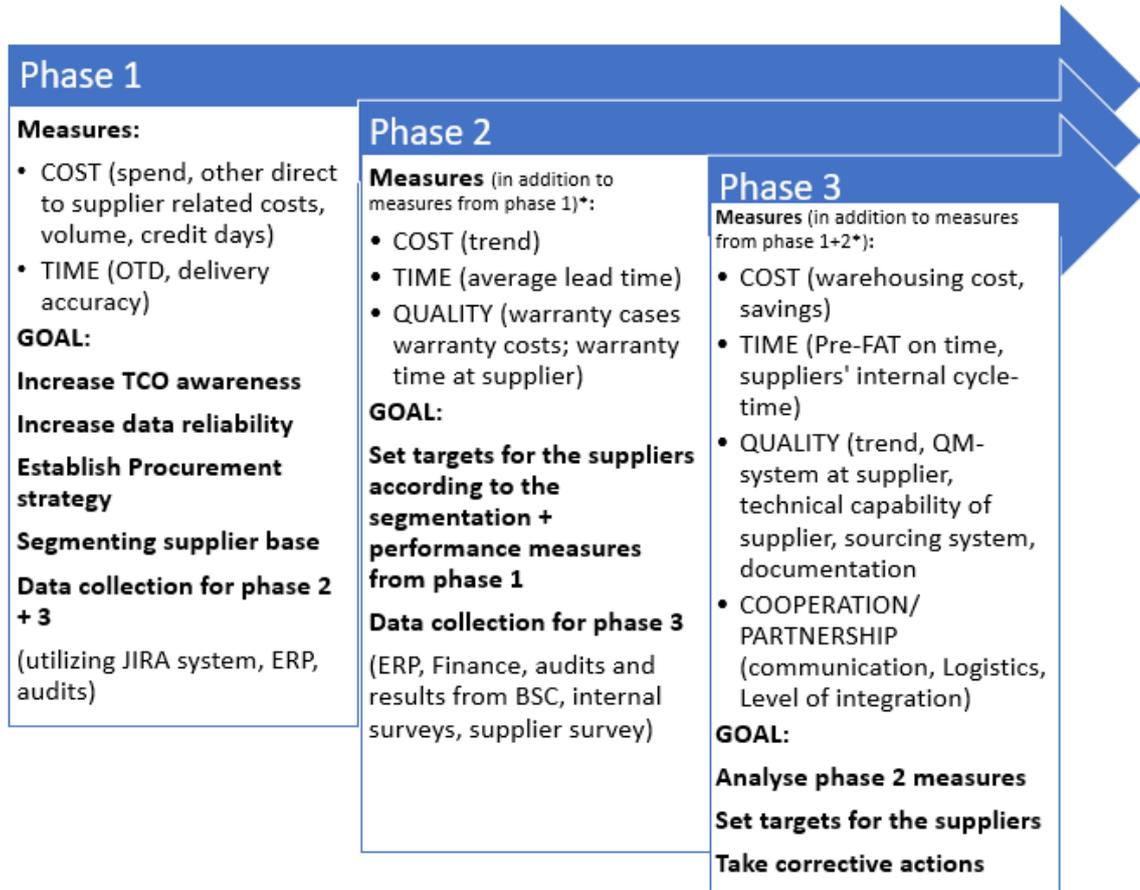


Figure 11. Suggested phases for implementing the proposal

Deming’s cycle approach for continuous improvement is illustrated in Figure 12 and should be applied for implementation. Deming’s approach is a tool for performance measurement. It enables the case company to adjust the plan and actions during the implementation process with the goal of continuous improvement. (Dani. 2020, p.145)

The validity of the current measures should be checked at the end of each phase, as well as the future measures. Supplier expectations need to be communicated internally as well as with the suppliers. In addition, corrective actions, developed from the results of previous supplier performance measures, need to be taken into account and communicated internally as well as externally.

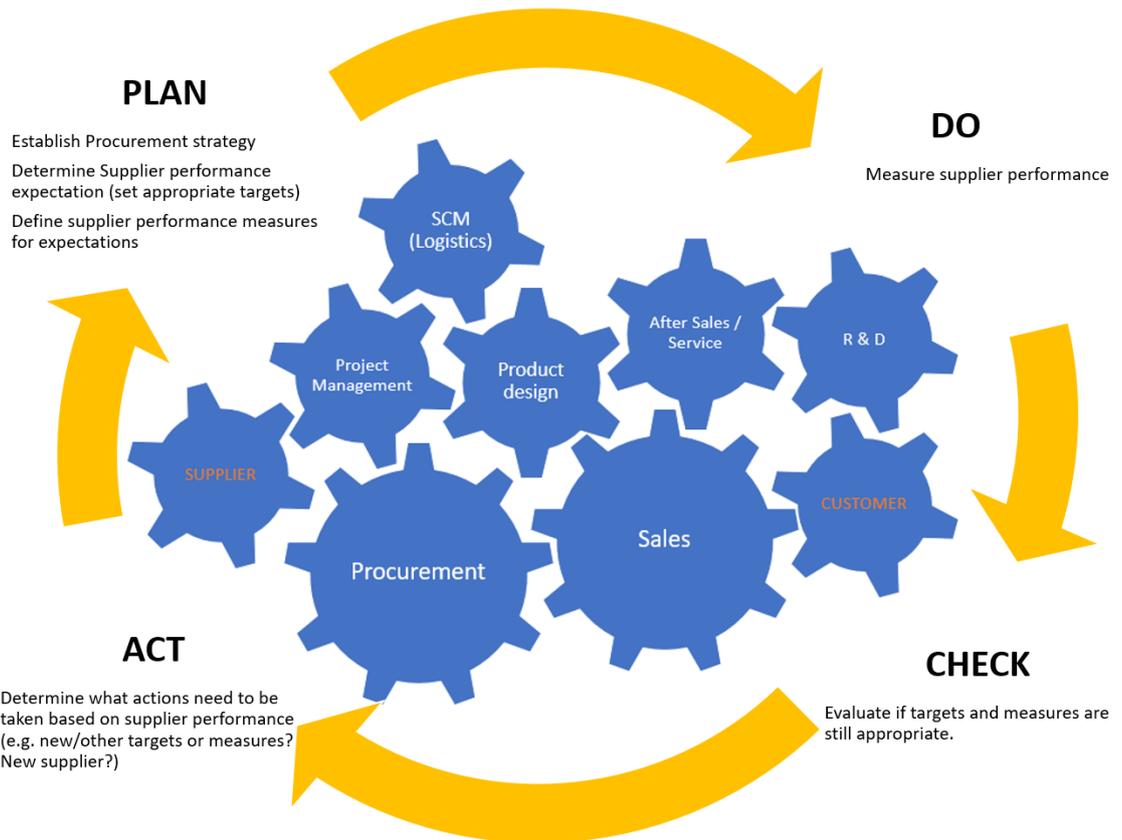


Figure 12. Deming's Plan-Do-Check-Act cycle (adapted from Dani, 2020, p.145)

Communication, vertically and horizontally as well as externally, was discovered as a critical area during the process of establishing a successful SRM, which is illustrated as intertwining gears in Figure 12. The researcher recommends that the case company improves their processes and communication during the implementation phases to support the actions taken for establishing a SRM and in order to eliminate waste processes. Each phase requires therefore communication about the supplier performance expectations and targets towards the supplier as well as internally towards the relevant functions of the case company (e.g. purchasing, supplier quality).

Table 9. Suggestion for measures to be included into the supplier dashboard

AREA	MEASURE / KPI
COST	<ul style="list-style-type: none"> • Spend and volume • Credit days (payment terms) • Savings
TIME	<ul style="list-style-type: none"> • OTD, delivery accuracy + cause for lateness • Average lead time • Pre-FAT OTD + cause for lateness • Suppliers' internal cycle time
QUALITY	<ul style="list-style-type: none"> • Warranty cases cause supplier + related cost • Warranty time at supplier • Documentation
Cooperation / Partnership	<ul style="list-style-type: none"> • Overall communication

All measures suggested are important in order to evaluate supplier performance. However, each measure needs to be constantly re-evaluated on its validity and purpose. Therefore, not all measures should be included into the supplier dashboard due to the complexity of the data. Table 9 above shows which measures included based on the researcher's view.

10.5.1 Phase 1

Phase 1 includes measures which increase TCO awareness internally. This should enable the case company to make decisions in terms of supplier consolidation and for procurement saving purposes. The data gained during this phase should enable the case company to segment their suppliers in a meaningful way, as well as to establish appropriate supplier relationship approaches depending on the segment. It would be beneficial for the case company to establish a procurement strategy and SRM system during this stage. Targets could be derived from such strategy and they could help to identify appropriate supplier performance targets and measures.

The intention of phase one is to create the smallest possible version of supplier performance measurements based on data and sources currently available in order to

identify if further investments in that matter are advisable. This approach is called Minimum Viable Product (MVP) (Plantenberg and Goldberg, 2019). The solution offered for phase one is the minimum requirement to address the most crucial goals and targets of the case company. Furthermore, the main goal of phase one is set to be the gathering of reliable data on which supplier performance targets for the next phase can be derived. This should be done in accordance to the strategy determined during the segmenting process. For this purpose the case company needs to create a BSC (balanced score card) for the audits and to increase auditing of its suppliers. Internal surveys should be prepared and conducted latest in phase two.

In the area of cost, spend (i.e. price) as well as other fees and costs invoiced by supplier should be measured. The volume gives the perspective to the spend measure. The credit days should also be reported so that it is possible to negotiate longer payment terms. This shall support the corporate goal to improve NWC (net working capital).

Time is the second area to measure in terms of supplier performance. Data for the KPIs delivery accuracy as well as OTD are available from case company's ERP system and can be utilised immediately. The case company needs to change data that is utilized currently from the ERP-system for this measure. The focus of this phase is to increase data reliability. Therefore, the case company needs to improve buyer processes and input as well as maintenance of the data in the ERP-system. Improving data quality at this stage enables the case company to set targets for phase two. Procurement needs to have measurable targets communicated to improve data quality. One target could be to reduce the percentage of non-confirmed purchase orders to a certain level. The case company should also consider improvement of certain processes in order to improve data quality and to reduce costs e.g. by reducing waste processes. Such an improvement could be realised by implementing a common email box for all B and C purchase order confirmations and delivery related emails. This way information can always be updated even during unexpected absence of employees.

10.5.2 Phase 2

Targets in the area of cost as well as time need to be set for the suppliers and the procurement team and should derive from performance measures of phase one with

consideration of the outcome of the supplier base segmentation and procurement strategy setting. The performance expectations should include more transparency in costs and a reduction of extra fees and mark ups. The case company needs to determine individual targets for each supplier, e.g. in terms of OTD. The targets should be measurable, appropriate to the individual supplier as well as actionable and attainable. The case company also need to consider what internally is required to support the targets set for the supplier. The targets need to be communicated to the relevant functions as well as to the supplier.

The average lead time measured in days should be added to support sales function and project management in planning the sales projects. The data of the ERP system should be reliable at this stage as a result of phase one and could be utilised further. The measurement area of quality will be added in phase two since cost of poor quality is one of the greatest cost drivers at the case company. The number of customer warranty cases with the supplier being the root cause, as well as the costs related to those warranty cases should be included at this stage. Also, warranty time at supplier shall be added to the performance measures of stage two.

The case company needs to start to gathering data for phase three latest at this stage. Internal as well as external surveys should be designed and carried out to support data collection for phase three. The function supplier quality needs to increase supplier audits and need to implement an evaluation system for the suppliers audited, e.g. a BSC (balanced scorecard).

10.5.3 Phase 3

Phase three includes setting performance targets based on the results of phase 2. The case company needs to re-evaluate targets and measures of the previous phases as well as the validity of phase three. Corrective actions need to be taken based on the re-evaluation. The case company needs to align the targets and measures according to the current situation and demands having company's strategy and goals in mind.

Phase three should enable the case company to measure supplier performance also in a qualitative way. The area of Cooperation and Partnership should be added to the

dashboard. All suggested measures should be implemented now, since data should be available from the previous phases. Audits and evaluation of suppliers utilising BSC should provide information about quality related as well as partnership related measures. Phase three shall enable the case company to re-evaluate its supplier base with the intention to determine if all suppliers are suitable and fit in the case company's future. Future steps could be implementing supplier performance measure in the area of sustainability (e.g. CSR), technology (e.g. research and development).

11 Discussion and conclusions

This chapter summarises the key findings of the research and lays out the implications for the management of the case company. Furthermore, the research is evaluated in terms of reliability and validity.

11.1 Summary

A company can operate efficiently when up- and downstream functions operate most efficiently and add value to the organisation. Cost savings can be achieved when procurement is integrated into company's overall strategy. Only when a company knows where to head, i.e. having a strategy in place, can value be added, and competitive advantage achieved. (Gordon, 2008, pp.1-2) Supplier relationship management (SRM) is therefore an important strategic function within an organisation in order to ensure efficient up-stream operations. The SRM strategy must be aligned with the overall strategy of the organisation to ensure value adding and its cross-functional purpose. (Booth, 2010, pp.62-66)

Supplier segmentation is an important process for establishing and implementing a SRM system. Kraljic's segmentation matrix is one way of segmenting the supplier base. Segmenting suppliers shall support determining the appropriate supplier relation strategy and identifying risk in the SC. Kraljic's model offers already strategic approaches according to the segmentation, which would be helpful, especially for the case company, since a SRM system or strategy is currently not in place. Segmenting the supplier base supports the determination of appropriate supplier performance

expectations and measures by the supplier segment and how supplier strategy is applied. Risk mitigation is in special focus of the supply chain managers, since SC has become more complex and vulnerable for disruption due to outsourcing and supplier consolidation. (Weele, 2018, pp.56-59) SRM helps to identify risk and to mitigate risk factors.

The case company has an overall strategy as well as a detailed operational strategy and goals established. A procurement strategy is missing and SRM is in low focus at the case company. Some approaches to identify and mitigate risk have been used by assessing subjectively risks of certain suppliers. A strategic approach in the way of operating with suppliers was not noticeable based on the interviews during this research. The management of the case company has however realised that benefits can be gained from a proper SRM system and asked the researcher to develop appropriate supplier performance measures.

The goal of this research was to determine appropriate supplier performance measures for the case company and to study important issues around that topic, as well as possible approaches for developing the supplier performance measures. Because the procurement and SRM strategy were missing, the researcher established supplier performance measures on the basis of the case company's overall strategy as well as its operational strategy and targets utilising Gordon's approach (i.e. hierarchy of supplier performance expectation). The researcher felt that a benchmarking approach was not appropriate since each company has its own individual strategy. The case company has a rather unique selling point and complex processes as well as a wide product portfolio, which would have made benchmarking very difficult or even impossible. A distorted picture of supplier performance and unnecessary data collection could have been the result of benchmarking. Gordon's approach was therefore the appropriate choice, since it could be adapted to the individual situation of the case company. Deming's PDCA cycle operated as the planning tool for establishing the implementation process and for determining appropriate supplier performance targets and measures. The goal of utilising the PDCA cycle is to enable continuous improvement and the PDCA cycle approach is therefore the better choice in comparison to the other approaches introduced in this research.

The researcher considered supplier performance targets supporting the overall and operational strategy of the case company as well as addressed issues discovered during the analysis phase of the data gathered with help of interviews, workshop and own observation. The supplier performance measures and targets were set in the areas of cost, time, quality and partnership. Each area of measures supports the goal of the overall or operational strategy. The supplier performance measures are therefore aligned with the overarching goals of the case company. Cost measurement enables the case company to increase TCO (total cost of ownership) awareness and leads to better decision making for costs savings. This will have a positive impact on the EBITDA of the case company. Cost analysis is a cornerstone for segmenting the supplier base and for looking into inventory processes.

Table 10 gives an overview of each measurement area and in perspective to the overall goals and strategy of the case company, i.e. it shows the alignment between targets and measures. The possible benefits deriving from measuring the supplier performance in these areas are mentioned as well.

Table 10. Supplier performance measurement areas and the alignment to the company strategy

Supplier performance measure area	Supported overall strategy /targets	Possible benefits
Cost (e.g. spend, volume, payment terms)	<ul style="list-style-type: none"> Procurement savings Economies of scale Improving EBITDA, NWC Supplier consolidation Decrease inventor level 	<ul style="list-style-type: none"> Increase TCO awareness Enables decision making for costs savings > improving of EBITDA Enables (partly) segmenting suppliers > enables decision making for supplier consolidation ABC-analysis possible, which enables to identify slow and fast movers > decrease of inventory level Analysis of payment terms supports payment terms negotiations
Time (OTD, internal cycle time)	<ul style="list-style-type: none"> Improving Sales OTD Procurement savings 	<ul style="list-style-type: none"> Improving customer satisfaction > new and follow sales Eliminating waste processes stemming from late or early deliveries > costs savings (e.g. transport costs)
Quality (Warranty costs, quality management system, documentation)	<ul style="list-style-type: none"> Improving quality (Procurement) Cost savings 	<ul style="list-style-type: none"> Improving customer satisfaction > new and follow sales Eliminating waste processes stemming from poor supplier quality > costs savings (e.g. for replacements)
Partnership (e.g. communication, logistics)	<ul style="list-style-type: none"> Improving Sales OTD Decreasing inventory level Procurement savings 	<ul style="list-style-type: none"> Reducing waste processes, i.e. costs through better information flow Increasing customer satisfaction through good information flow Buffer stock at supplier reduces inventory levels > cost savings

Measures suggested for the area of time support mainly improving the on-time delivery in sales and improvement of customer satisfaction. Quality measures support

improvement of the quality of the deliveries to the customer and improve therefore also customer satisfaction. The measures in the area of partnership are mainly leading indicators, which support more the insight on the quality of the supplier relationship affecting all the other supplier performance areas where measures are taken. The implementation of the solution proposal for supplier performance measures was suggested in three phases since data is partly not available or not reliable and SRM is currently on low focus at the case company.

11.2 Managerial implications

Hopefully the results of this research function as a starting point for establishing an efficient SRM system at the case company and the implications for the management are manifold since the maturity of the SRM system at the case company currently is rather low. The researcher suggests implementing the final solution proposal gradually.

The management should establish first a procurement strategy, which is aligned with the overall strategy of the case company as well as to the operational targets set. The management should furthermore establish a SRM strategy. The segmentation of the supplier base would be a logical second step for determining strategically important suppliers and setting appropriate supplier relationships approaches for the different supplier segments. Supplier performance expectation and measures should derive out of setting those strategies. Improving data reliability and gathering data for monitoring the supplier performance is important during the implementation of the final solution proposal.

Also, the procurement processes as well cross-functional processes need to be reviewed by the management. Those processes need to be refined, and when missing, established in order to ensure value-adding throughout the whole value chain, since unclear processes and missing communication were discovered to be an issue at the case company. Unclear responsibilities and processes might create costs and waste processes.

A cross-functional information flow is required in order to investigate all costs related to procurement (i.e. TCO). The suppliers should be viewed as an extended function to the

case company to add value to the customer. The processes between the case company and its suppliers need to be investigated and improved when necessary in order to eliminate waste processes and therefore costs. Supplier performance expectations and targets need to be set according to the solution proposal made by the researcher and communicated to the supplier. Procurement targets, i.e. targets for each procurement function should be set to ensure the success of the SRM strategy. The procurement targets should be aligned to the SRM and procurement strategy and connected to the supplier performance targets.

11.3 Evaluation of the research

The study provides information regarding SRM and establishing supplier performance measures. It furthermore offers an insight to the benefits of an efficient SRM system, including monitoring supplier performance, which makes the research relevant for other organisations. This research was carried out to enable organisational learning at the case company and to produce a practical outcome for the case company. The goal was to determine appropriate supplier performance measure for the case company and to investigate the current situation of case company's SRM system. The results of this research are very specific and customised to the situation of the case company, but other organisations can benefit from this research as well. The research process and design can be adapted to other organisations. The outcome (i.e. solution proposal) will however differ, since the researcher emphasises on the importance of considering the strategy of an organisation. The researcher has considered approaches for determining supplier performance measurements and for the implementation, which can be utilised by other organisation during the process. This research is especially useful for organisations where the maturity of SRM and procurement is low.

The researcher acknowledges that the study is difficult to repeat since the case company has ongoing changes in processes and way of working. Repeating the research in a different situation and to a different time might have impact on the outcome of the research. The repeatability is therefore a threat to this research.

The researcher had chosen a qualitative research design with elements from action-based research. The main approach for data collection was semi-structured interviews

and one workshop. The interviews and the workshop were partly recorded and notes for further analysis were compiled. The data collection chosen, and the methods for analysis of the data were appropriate for this research and supported assessing the situation and aspects being studied. The key questions established for the interviews supported the researcher to cover all relevant aspects to the research topic. The questions were established based on the assumptions that the researcher is without any prior knowledge of the situation at the case company in order to eliminate threats for the research from researcher's pre-assumption and preconception. The participants turned out to be very supportive and were eager for improvements in their functional area. Researcher's and participants' bias were therefore not a threat to the reliability of the research. One workshop was organised to validate the preliminary solution proposal. Two supplier interviews were held to add the perspective from the supplier. The workshop and supplier interviews increased the validity of the research. More workshops and supplier interviews would have been beneficial to enhance the validity even more but the short time available was a crucial constraint throughout this research.

11.4 Closing words

The supplier performance measures to be monitored at the case company are in the area of cost, time, quality and partnership and support the realisation of the overall strategy and targets of the case company. Possible benefits from monitoring those supplier performance measures are cost reduction, an increase in customer satisfaction and streamlining processes. Deming's PDCA cycle shall lay the foundation for further continuous improvement for case company's procurement and SRM system by re-evaluating periodically supplier performance measures. The researcher concludes that supplier performance expectations and measures need to be communicated internally with the relevant functions (e.g. procurement department) and more importantly with the suppliers in order to reach the targets set for the supplier performance expectations and in order to ensure improvements of SRM. The supplier performance measures suggested in this research shall be the starting point and are subject to change according to changes in the situation of the case company.

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Interview questions – data collection 1

PRE- QUESTION *(for all interviewees)*:

1. What are your responsibilities at case company?

INTERVIEW QUESTIONS

(internal with PROCUREMENT DEPARTMENT - interviewees: C1-C2; C4-C6; C11-C12):

2. How do you/ does the company derive value from the supplier relationship beyond price?
3. Has the company negotiated contracts with its suppliers?
 - a. Do you know whether company's suppliers are fully compliant with the contract terms?
4. Does the company/ you know how well the supplier base is performing?
 - a. How is performance measured now?
 - b. What is measured currently?
 - c. Why are those measurements taken?
 - d. How is the data for performance measuring gathered? (i.e. sources)
 - e. How accurate is the data?
 - f. What is the measurement frequency?
5. Are targets set for the suppliers in certain performance areas?
 - a. What target are those commonly?
 - b. Are the targets communicated and how are they communicated to the supplier?
6. What is the company doing with the performance data?
 - a. Is supplier performance shared with the supplier?
 - i. How is the feedback communicated?
 - ii. What actions are set for improving supplier performance?
7. Does the company know of all its suppliers?
8. Is the company aware of its most critical suppliers?
 - a. Who are those?
 - b. Why are they critical?
9. What are the company's greatest cost drivers in Procurement?

- a. Which suppliers are driving the most costs?
 - i. Why? / What are the cost drivers?
- 10. Does the company have quality problems, customer complaints, warranty returns?
 - a. What portion of it is caused by supplier?
 - b. How does the company intend to solve the quality issue?
- 11. Does the company have other difficulties with its suppliers or in Purchasing?
 - a. What is the nature of the problems?
 - b. What kind of corrective measures are in place?
- 12. Is the company aware of the types of risk lying in the supply base?
 - a. What are those risk factors?
 - b. Are there actions in place to mitigate the risk (factors)?
 - i. What are those actions?
- 13. Is there a procurement strategy in place?
 - a. What is company's procurement strategy?
 - b. Where does the strategy derive from?
 - c. What kind of targets are set/ derive from strategy?
 - d. How are those goals and alignment of strategy followed up?
 - i. What measurements are used to monitor the success of strategy/ targets set?
 - e. Is the Procurement strategy communicated to all Procurement functions?
 - i. What is communicated?
 - ii. Are targets set for the Purchasers?
- 14. How is the Procurement department organized?
 - a. Who negotiates supplier contracts?
 - b. Who is buying supplies?
 - c. What are the tasks of the Purchasers?
- 15. What is most important for the company when evaluating (new) suppliers?
- 16. What kind of sourcing process is in place?

INTERVIEW QUESTIONS (with interviewee C3):

- 2. Could you explain company's overall strategy to me?
 - a. What are the targets?
 - b. How are those measured?
 - c. With whom are targets and strategy shared/ communicated?

- d. How is this information communicated?
3. Has the company a separate strategy for operations?
 - a. What is the strategy?
 - b. What are the targets?
 - c. How are those measured?
 - d. With whom are targets and strategy shared/ communicated?
 - e. How is this information communicated?
4. Are you aware of any Procurement / SRM strategy?

INTERVIEW QUESTIONS (with interviewees C7-C8):

2. How do you ensure supplier quality?
3. How do you evaluate suppliers in terms of quality?
4. I have gained information that Supplier Quality established a BSC.
Could you please explain the categories you use to evaluate suppliers' performance?
 - a. How is the BSC implemented?
 - b. How is the data gained from the BSC gathered and analysed?
5. What kind of actions are taken as a result of the evaluation?
6. Do you communicate your results and findings with Procurement or with other functions?

INTERVIEW QUESTIONS (with interviewee C9):

2. Please explain the different processes (A, B, C) to me?
3. Do you have direct supplier contact?
 - a. Please define the contact

INTERVIEW QUESTIONS (with interviewee C10):

2. Please explain what the Warranty department is doing.
3. What are the root causes for the warranty issues?
4. Which root causes are directly supplier related?
5. Do you communicate to other functions (e.g. procurement) which suppliers create many Warranty issues?
6. Please define the cost of quality.
7. Is the case company taking corrective measures to reduce the cost of quality?
 - a. What are those actions?

8. How do you gather the data and how reliable is the data?
9. Do you have direct supplier contact?
 - a. Please define the contact.

Workshop presentation – data collection 2

1

PROJECT

- Create a Supplier Dashboard
 - Theoretical background
 - Situation analysis
 - What are we doing currently?
 - Determination of the needs (internal, external, cross-functional)
 - Establishing targets
 - Determining KPIs and measures to control target realisation
 - Build a demo of a supplier dashboard

2

PROGRAMM / SCHEDULE

3

TASK – current situation

- Work in pairs
- Think of your role(s) and responsibilities
 - Where are changes needed to improve your work?
 - What is positive and should remain as it is?

Duration 5 min + discussion

4

Situation analysis - PROCUREMENT

- Great expertise in each function
- Procurement / SRM strategy missing
- Vertical communication poor
 - Awareness of targets low
 - Change implementation not clear
- Horizontal communication
 - Between different function (sales/ product design -> Procurement)
 - Within functions (supplier knowledge is not pooled/ shared)
- SRM on low focus
- Supplier performance targets not set / not communicated
- Supplier performance data partly not reliable
- Supplier segmentation for the purpose of establishing/determining appropriate relationships not carried out
- Purchasing purely administrative function (i.e. only buying)
- A lot of manual work
- TCO awareness very low

5

Total Cost of Ownership

6



7



8



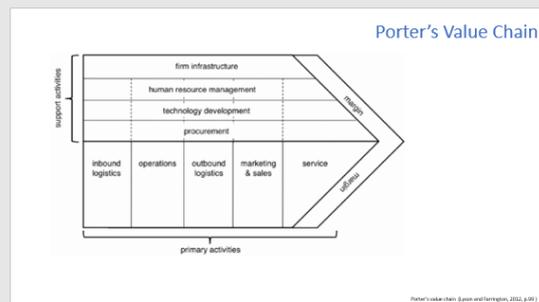
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TASK - communication

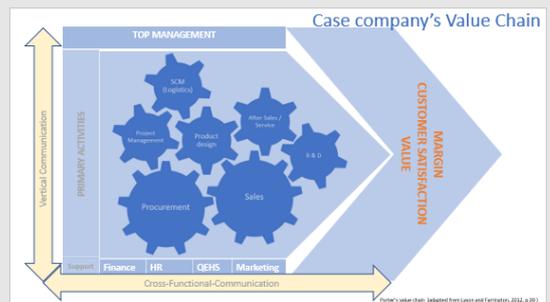
- Work in groups of 4-5 persons
- Think of the Supplier relation management in regards of communication and processes:
 - What communication would be needed from Top and Middle management to support Procurement and Procurement tasks?
 - Which departments need to communicate cross-functional to establish successful supplier relations and improve Procurement costs and processes?
 - What information is needed from those functions?
 - What processes need to be improved/ implemented?
 - Where do you identify extra costs arising from unclear processes and missing communication?
 - How important is the communication with the supplier and what should be communicated? Justify your answer(s).

Duration 10 min + discussion

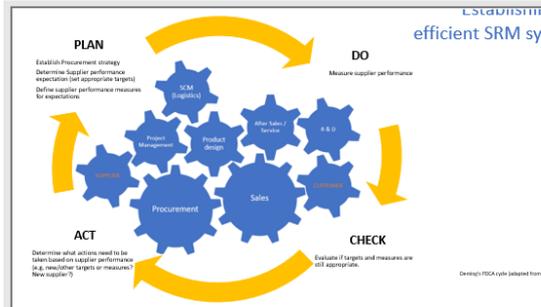
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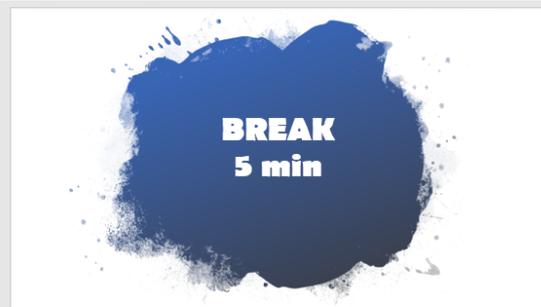
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12



13



14

SUPPLIER PERFORMANCE MEASURES

COST

- Spend
- Other direct to supplier related costs (e.g. fees)
- Volume
- Credit days

QUALITY

- Number of warranty cases with cause supplier
- Costs related to those warranty cases
- Warranty time at supplier
- Quality Management system at supplier
- Technical capability of supplier
- Sourcing system at supplier
- Documentation

TIME

- OTD (punctual/ before promised date)
- Delivery accuracy (discrepancy to promised date)
- Average lead time
- Pre-FAT on time
- Suppliers' internal cycle time

COOPERATION/ PARTNERSHIP

- Overall communication
- Logistics
- Alignment/ Level of integration

15

TASK – KPIs + performance measures

- Work in pairs
- Look into the measures/KPIs of the performance area you were given:
 - Justify if each measure is relevant for the case company.
 - Are all KPIs/measures equally important for every supplier? – Justify your answer.
 - How would you measure those KPIs? (e.g. in percentage of..., as score from an audit or survey)
 - What can be done with the measures? (i.e. actions resulting from the data gained)
 - For whom is the performance measure important? (consider also other functions + stakeholders)
 - What would be possible sources for each measure?

Duration 15 min + discussion

16

COST				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Spend	€	Qlik Sense/ Finance	<ul style="list-style-type: none"> Evaluation of supplier's importance Enables categorizing of suppliers Enables to determine appropriate supplier relationships + strategy 	ALL
Other costs (from supplier invoices)	€	Finance	<ul style="list-style-type: none"> Increase TCO awareness Identify cost drivers Enable decision making for cost saving actions 	ALL
Volume	pcs	ERP	<ul style="list-style-type: none"> In perspective to Spend - Evaluation of supplier's importance 	ALL
Credit days (payment terms)	days	ERP / Finance	<ul style="list-style-type: none"> Enables comparison to other suppliers Indicator for case company's liquidity Increase NWC 	ALL
Savings compared in perspective to volume	€	ERP/ Finance	<ul style="list-style-type: none"> Indicator of success of actions taken Increase EBITDA 	Mainly strategic important suppliers

17

Cooperation / Partnership				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Overall communication	Score	Internal survey	<ul style="list-style-type: none"> Indicator for cost reduction Indicator for depth of relationship 	<ul style="list-style-type: none"> Manufacturing partners
Logistics (e.g. willingness to keep buffer)	Score	Internal survey / audits - BSC	<ul style="list-style-type: none"> Indicator for willingness to cooperate 	<ul style="list-style-type: none"> Important component suppliers Suppliers with high spend
Alignment / Level of integration	Score	Internal survey / audits - BSC		<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

18

TIME				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
OTD (punctual/ or early)	% of total deliveries	ERP	<ul style="list-style-type: none"> Identify trouble shooters Establish actions for improvement Enable improvement of customer OTD > satisfaction Identify cost drivers (e.g. warehousing, transport costs from late/ early deliveries) 	ALL
Cause for late deliveries	% by cause	ERP	<ul style="list-style-type: none"> Identify causes for lateness (internal/ external) Define actions to improve own processes + set supplier targets for improvement Improve customer satisfaction (OTD) 	ALL
Delivery accuracy	Discrepancy in days (in line confirmed delivery date)	ERP	<ul style="list-style-type: none"> Identify cost drivers (e.g. warehousing, transport costs from late/ early deliveries) 	ALL
Average lead time	In days	ERP / Qlik Sense	<ul style="list-style-type: none"> Supports sales in terms of estimation of lead times (But needs to be broken down for supply categories) Indicator for improvement 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

19

TIME				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Pre-FAT on time	% of total	Utilizing Project tools?	<ul style="list-style-type: none"> Indicator for Quality Indicator for OTD (Pre-FAT on time > delivery also on time) 	Manufacturing partners (where FAT is required)
Reason for late Pre-FAT	% by cause	Utilizing Project tools?	<ul style="list-style-type: none"> Identify causes for lateness (internal/ external) Define actions to improve own processes + set supplier targets for improvement Improve customer satisfaction (OTD + Quality) 	Manufacturing partners (where FAT is required)
Suppliers' internal cycle time	days	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Indicator for suppliers' efficiency Indicator for suppliers' capability 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Supplier's Manufacturing system (e.g. Lean, Six Sigma)	Score	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Indicator if supplier fits to case company's strategy 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

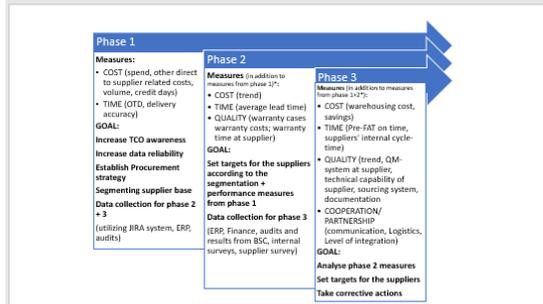
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QUALITY				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Warranty cases (cause supplier)	Amount (#)	JIRA	<ul style="list-style-type: none"> In perspective to area cost (i.e. total spent, volume) Identify problematic suppliers 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Costs related to Warranty cases (cause supplier)	€	JIRA / Finance	<ul style="list-style-type: none"> In perspective to area cost (i.e. total spent, volume) Increase of TCO awareness Identify costs drivers Identify problematic suppliers 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Warranty time at supplier	In days	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Long warranty time enables costs savings in Warranty and shows willingness to cooperate and to share costs of bad quality Indicator for suppliers' flexibility 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

21

QUALITY (continued)				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Quality Management system at supplier	Score	<ul style="list-style-type: none"> Audits / BSC Supplier surveys 	<ul style="list-style-type: none"> Indicator for quality 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Technical capability of supplier (Iswal/ Othbore standards)	Score	Audits / BSC	<ul style="list-style-type: none"> Identification of non-quality conform suppliers 	Where applicable
Sourcing system at supplier	Score	Audits / BSC	<ul style="list-style-type: none"> Decrease risk in SC 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Documentation	Score	Audits / BSC	<ul style="list-style-type: none"> Increase customer satisfaction in after sales Decrease internal process costs 	Where applicable

22



23



24

Interview questions for supplier interviews and SC manager (data collection 2)

PRE- QUESTION *(for all interviewees)*:

What are your responsibilities at your company?

INTERVIEW QUESTIONS *(internally with SC Manager - interviewee C14)*:

How do you evaluate the supplier performance of supplier X and supplier Y in the following areas?

- On time delivery + causes for late deliveries
- Quality + causes for defects
- Overall communication
- How well is the supplier aligned with the system of the case company?
- Is the supplier willing to keep a buffer stock for the case company?
- What is supplier's internal cycle time (i.e. manufacturing time)?
- What kind of manufacturing system is in place (e.g. Lean, Six Sigma)?
- What warranty time grants the supplier to the case company?
- How flexible is the supplier in terms of changes?

INTERVIEW QUESTIONS

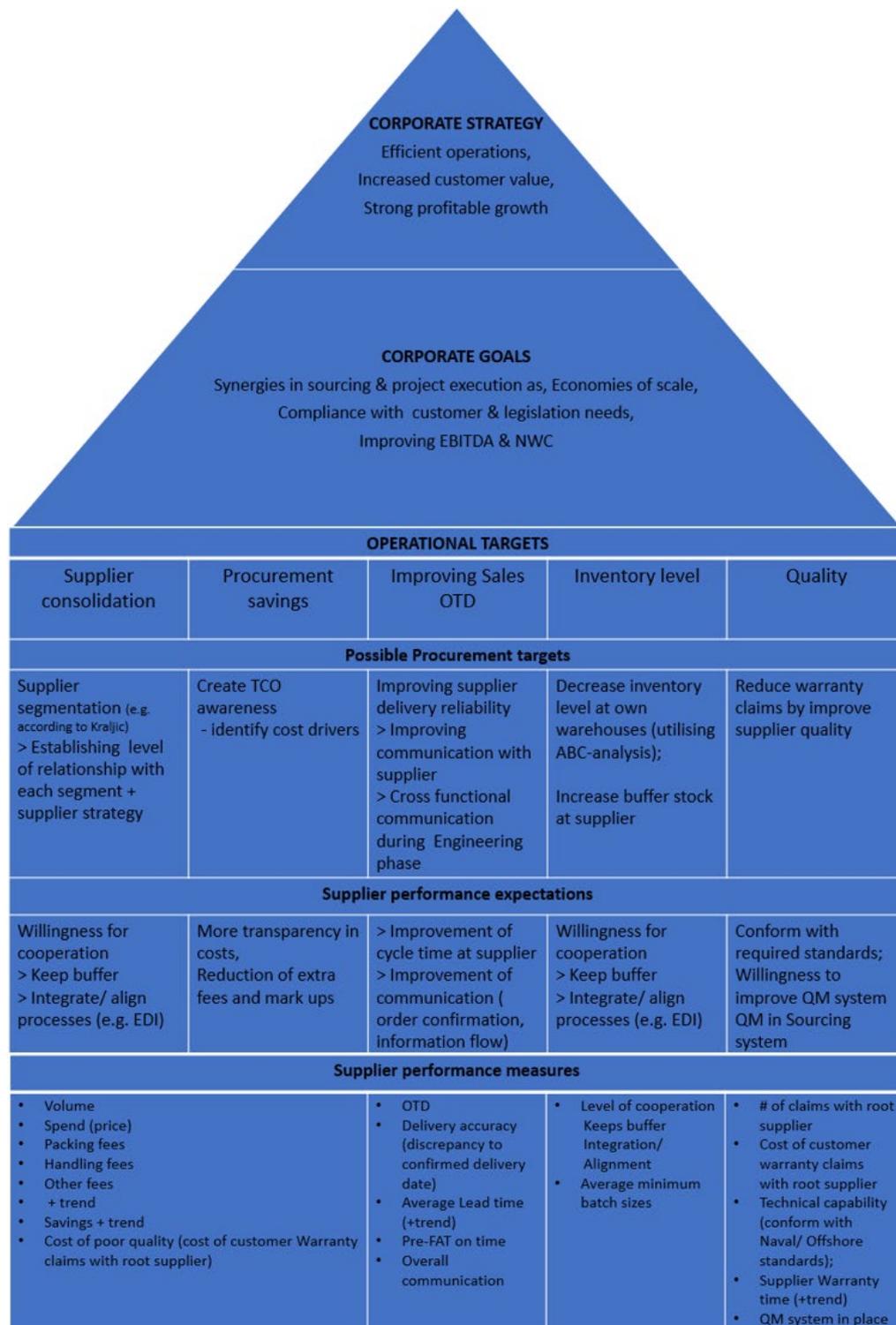
(with supplier X – interviewee S1 and supplier Y – interviewee S2):

1. How do you see the supplier-buyer relationship to the case company?
2. How would you describe the way of working / cooperation?
3. How would you like to improve the relationship?
4. Please tell me how your company is performing as a supplier for the case company in the following areas?

AREA	POOR	SATISFACTORY	GOOD	EXCELENT	Don't know
Time (OTD, Delivery accuracy)					
Quality					

5. Where do you see the root cause for low performance?
6. Are you aware of performance targets for your company set by the case company? Please name the targets.
7. How does the case company perceive your performance?
8. What manufacturing system does your company have in place?
9. What Quality management system does your company have in place?
10. Are you willing to keep buffer stock for the most common items for the case company X?
11. Would you like to deepen the relationship further, e.g. by aligning system with EDI?

Framework used to develop supplier performance measures at the case company



(adapted from Supplier performance expectations development hierarchy -Gordon, 2008, p.84- and applied to the case company)

Preliminary solution proposal: supplier performance measures

Supplier performance area: COST

COST				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Spend	€	Qlik Sense/ Finance	<ul style="list-style-type: none"> Evaluation of supplier's importance Enables categorizing of suppliers Enables to determine appropriate supplier relationships + strategy 	ALL
Other costs (from supplier invoiced)	€	Finance	<ul style="list-style-type: none"> Increase TCO awareness Identify cost drivers Enable decision making for cost saving actions 	ALL
Volume	pcs	ERP	<ul style="list-style-type: none"> In perspective to Spend - Evaluation of supplier's importance 	ALL
Credit days (payment terms)	days	ERP / Finance	<ul style="list-style-type: none"> Enables comparison to other suppliers Indicator for case company's liquidity Increase NWC 	ALL
Savings compared in perspective to volume	€	ERP/ Finance	<ul style="list-style-type: none"> Indicator of success of actions taken Increase EBITDA 	Mainly strategic important suppliers

Supplier performance area: TIME

TIME				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
OTD (punctual/ or early)	% of total deliveries	ERP	<ul style="list-style-type: none"> Identify trouble shooters Establish actions for improvement Enable improvement of customer OTD > satisfaction Identify cost drivers (e.g. warehousing, transport costs from late/ early deliveries) 	ALL
Cause for late deliveries	% by cause	ERP	<ul style="list-style-type: none"> Identify causes for lateness (internal/ external) Define actions to improve own processes + set supplier targets for improvement Improve customer satisfaction (OTD) 	ALL
Delivery accuracy	Discrepancy in days (to first confirmed delivery date)	ERP	<ul style="list-style-type: none"> Identify cost drivers (e.g. warehousing, transport costs from late/ early deliveries) 	ALL
Average lead time	In days	ERP / Qlik Sense	<ul style="list-style-type: none"> Supports Sales in terms of estimation of lead times (but needs to be broken down for supply categories) Indicator for improvement 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Pre-FAT on time	% of total	Utilizing Project tools?	<ul style="list-style-type: none"> Indicator for Quality Indicator for OTD (Pre-FAT on time > delivery also on time) 	Manufacturing partners (where FAT is required)
Reason for late Pre-FAT	% by cause	Utilizing Project tools?	<ul style="list-style-type: none"> Identify causes for lateness (internal/ external) Define actions to improve own processes + set supplier targets for improvement Improve customer satisfaction (OTD + Quality) 	Manufacturing partners (where FAT is required)
Suppliers' internal cycle time	days	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Indicator for suppliers' efficiency Indicator for suppliers' capability 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Supplier's Manufacturing system (e.g. Lean, Six Sigma)	Score	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Indicator if supplier fits to case company's strategy 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers

Supplier performance area: Quality

QUALITY				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Warranty cases (cause supplier)	Amount (#)	JIRA	<ul style="list-style-type: none"> In perspective to area cost (i.e. volume) Identify problematic suppliers 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Costs related to Warranty cases (cause supplier)	€	JIRA / Finance	<ul style="list-style-type: none"> In perspective to area cost (i.e. total spend, volume) Increase of TCO awareness Identify costs drivers Identify problematic suppliers 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Warranty time at supplier	In days	<ul style="list-style-type: none"> Audits + meetings supplier surveys 	<ul style="list-style-type: none"> Long warranty time enables costs savings in Warranty and shows willingness to cooperate and to share costs of bad quality Indicator for suppliers' flexibility 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Quality Management system at supplier	Score	<ul style="list-style-type: none"> Audits / BSC Supplier surveys 	<ul style="list-style-type: none"> Indicator for quality 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Technical capability of supplier (Naval/ Offshore standards)	Score	Audits / BSC	<ul style="list-style-type: none"> Identification of non-quality conform suppliers 	Where applicable
Sourcing system at supplier	Score	Audits / BSC	<ul style="list-style-type: none"> Decrease risk in SC 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers
Documentation	Score	Audits / BSC	<ul style="list-style-type: none"> Increase customer satisfaction in after sales Decrease internal process costs 	Where applicable

Supplier performance area: Quality

Cooperation / Partnership				
KPI / MEASURE		DATA SOURCE	REASONS/ BENEFITS	Which supplier to measure?
Overall communication	Score	<ul style="list-style-type: none"> Internal survey 	<ul style="list-style-type: none"> Indicator for cost reduction Indicator for depth of relationship Indicator for willingness to cooperate 	<ul style="list-style-type: none"> Manufacturing partners Important component suppliers Suppliers with high spend
Logistics (e.g. willingness to keep buffer)	Score	<ul style="list-style-type: none"> Internal survey audits - BSC 		
Alignment / Level of integration	Score	<ul style="list-style-type: none"> Internal survey audits - BSC 		