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Design of the Supplier Base in a Complex Automotive Manufacturing Environment

Master of Science Thesis in the Management and Economics of Innovation Programme

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Abstract

The subject studied in this study is costs related to introducing, maintaining and removing supplier relationships. The study extends beyond the evident visible costs, such as purchasing price, and aims to reveal and quantify the so called indirect or “hidden” costs in supplier relationships, i.e. ways to find and derive costs otherwise categorized as administrative costs to single supplier relationships. Few attempts of this character have previously been made, and when selecting a supplier and / or deciding whether to onboard a new supplier, the decision basis is often skewed towards the purchasing price. Albeit there are several studies on how to select suppliers with other factors than purchasing price as decision basis, this study attempts to complement existing academic research by developing an actual methodology for how to map and quantify costs in supplier relationships. Moreover, the Company that the study is conducted with will benefit from the study as the results are suggested to be applied in business cases to facilitate decision-making regarding introducing or removing suppliers.

To fulfill the purpose of the study, a single exploratory and inductive case study has been carried out at a manufacturing company operating in a specific segment of the automotive industry, henceforth referred to as Vidar, where interviews have served as the main source of information. The authors have mapped out relevant activities connected to introducing and maintaining a supplier relationship, and thereafter sought to estimate how much time or money each activity requires. For costs driven by time, or labor, the length of the activity has been sought to approximate by the authors. For other cost drivers, the authors have been given access to internal data and business cases to conduct approximate cost estimations.

The authors have found that Vidar has a comprehensive process to introduce and prepare suppliers for business with Vidar, and further that the process differs in time-consumption depending on whether the supplier already exists within Vidar and also on whether the supplier has any previous industry experience, if new to Vidar. The authors also found that major costs related to introducing and maintaining supplier relationships are labor and transportation costs. Actively removing a supplier does not appear to be a costly activity. Moreover, Vidar operates after an engineering-to-order logic due to the industry segment’s characteristics which in combination with short lead times due to the tender business and high degree of customer adaptations increase the complexity in the supplier base. As a consequence, reducing the number of suppliers is easier said than done for Vidar.

Keywords: *Supplier Base Design, Supplier Base Reduction, Purchasing, Supplier Base Cost Drivers, Supplier Base Complexity, Supplier Relationship Costs Mapping, Supplier Relationship Costs Quantification*

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Joakim Andersson

Fredrik Lövefors Daun

Contents

List of Figures

List of Definitions

Active Supplier. Supplier that Vidar currently conducts business with.

Advanced Product Quality Planning (APQP). Framework to develop and ensure the quality of products, particularly used in the automotive industry. Used by Vidar for quality assessment of key components.

Atlas. Vidar's transport planning system.

Complexity. The degree of varier elements and their interactions within a system.

Customer Adaptation (CA). Denomination for unique adjustments required by customers.

Engineer-to-Order (ETO). All manufacturing activities from design to assembly and even purchasing of required materials are related to a specific customer order. Production is usually multipurpose machinery, requiring highly skilled operators, for example larger customer-specific equipment and machines, vessels.

FRED. Vidar's warehouse management system.

Global Manufacturing (GM). Vidar division including (among others) the departments Logistics, Sales and Operations and Operations Excellence.

Purchasing System (PS). Vidar Group's purchasing system.

Key Component. Component that is either of high importance for the product structure or for the manufacturing process.

Logistics Department (LD). Vidar Group's internal logistics company. Also responsible for Vidar's standard packaging.

Labor. Cost driver calculated through multiplying the number hours spent on an activity with the hourly cost of personnel.

Agreement Management System (AMS). Data base for all supplier information.

Partner Management System (PM). Vidar Group's supplier register, contains supplier data such as legal information, addresses, bank details etc.

PLUPP. Vidar's MRP system.

Product Development Process (DVP). Process in which Vidar develops all new models or conducting updates of current models.

Production Part Approval Process (PPAP). Process to ensure the quality of a part before it is introduced to serial production.

Project & Operations Buyer (P&O Buyer). Role within Global Purchasing that is responsible for selection suppliers for customer adaptations and for the preparations for serial production, of a supplier that has been selected by the Sourcing Buyer.

Purchasing Segment. Vidar's definition of their purchasing categories.

Sourcing Buyer. Role within Global Purchasing that is responsible for a supplier base in a specific segment. The Sourcing Buyer is further responsible to establish supplier strategies and select suppliers for specific projects.

Supplier Network. All inter-connected companies that exist upstream to any one company in the value system.

Supplier Base. A portion of the supplier network that is actively managed by the focal company through contracts and purchasing of parts, materials and services.

Supplier Base Complexity. The degree of differentiation of the focal firm's suppliers, their overall number, and the degree to which they interrelate.

Total Cost of Ownership. Used to determine both the direct and indirect cost of a product, to gain a comprehensive understanding of the costs incurred on the business.

1 Introduction

This chapter aims to introduce the study topic and its context as well as the underlying problem definition. Moreover, the chapter describes the scope, delimitations and limitations as well as the report outline.

1.1 Phenomenon Studied

The subject studied in this study is costs related to introducing, maintaining and removing single supplier relationships. The study extends beyond the evident visible costs such as purchasing price, and aims to reveal and quantify the indirect costs, or so called ”hidden” costs, in supplier relationships. In other words, the study aims to identify and quantify specific activities otherwise categorized as e.g. administrative or overhead costs, and derive these costs to single supplier relationships. These indirect costs are more or less inevitable in every supplier relation. These costs consist of all extra activities imposed on a company by a specific supplier, such as order processing, relationship maintenance and issues in the daily business operations to mention a few. However, limited attempts have been made to investigate the magnitude of these costs.

In large organizations, or organizations in general for that matter, it is intuitive and easy to base the choice of a supplier on purchasing price to a large extent. This is often due to an inadequate comprehension of the magnitude of the indirect costs that a supplier relationship imposes on a company. Furthermore, it exists general knowledge of indirect cost drivers in academia (Gadde et al., 2010; Choi and Krause, 2006; Dubois, 2003), however few attempts have been made to quantify these costs or examine their relative impact on the company.

As there have been limited previous attempts to find, quantify and derive these costs to supplier relations, the subject is of interest to study. It is of interest for the business world to gain a comprehension of the magnitude of the indirect costs of a supplier relationship as material for decision basis, and it is further of interest for academia with an attempt to quantify the indirect costs that have previously only been categorized as overhead or administrative costs. Previous attempts to quantify specific administrative costs have been made through e.g. “Activity-Based Costing” (ABC), however ABC attempts to derive administrative costs to products, whereas this study aims to derive the costs to supplier relationships.

1.2 Empirical Context and Problem Definition

The Company, hereafter referred to as Vidar, is a subsidiary and independent division of Vidar Group. Vidar operates in a specific segment of the automotive industry and manufactures products that allows for a high degree of customer adaptations. Many of Vidar’s products are used by cities and municipalities, and Vidar’s product offering includes

both complete products and chassis for use with customers' own brands and surrounding services. The Company is headquartered in Northern Europe, but production and assembly facilities are spread throughout the world. In 2016, Vidar's revenue constituted around 10% of Vidar Group's total revenue (excluding financial services and reclassifications and eliminations) (Vidar Group, 2017). Besides Vidar, Vidar Group's portfolio companies operate within several segments of the automotive industry and connected industries, and the organization is illustrated below in figure 1.

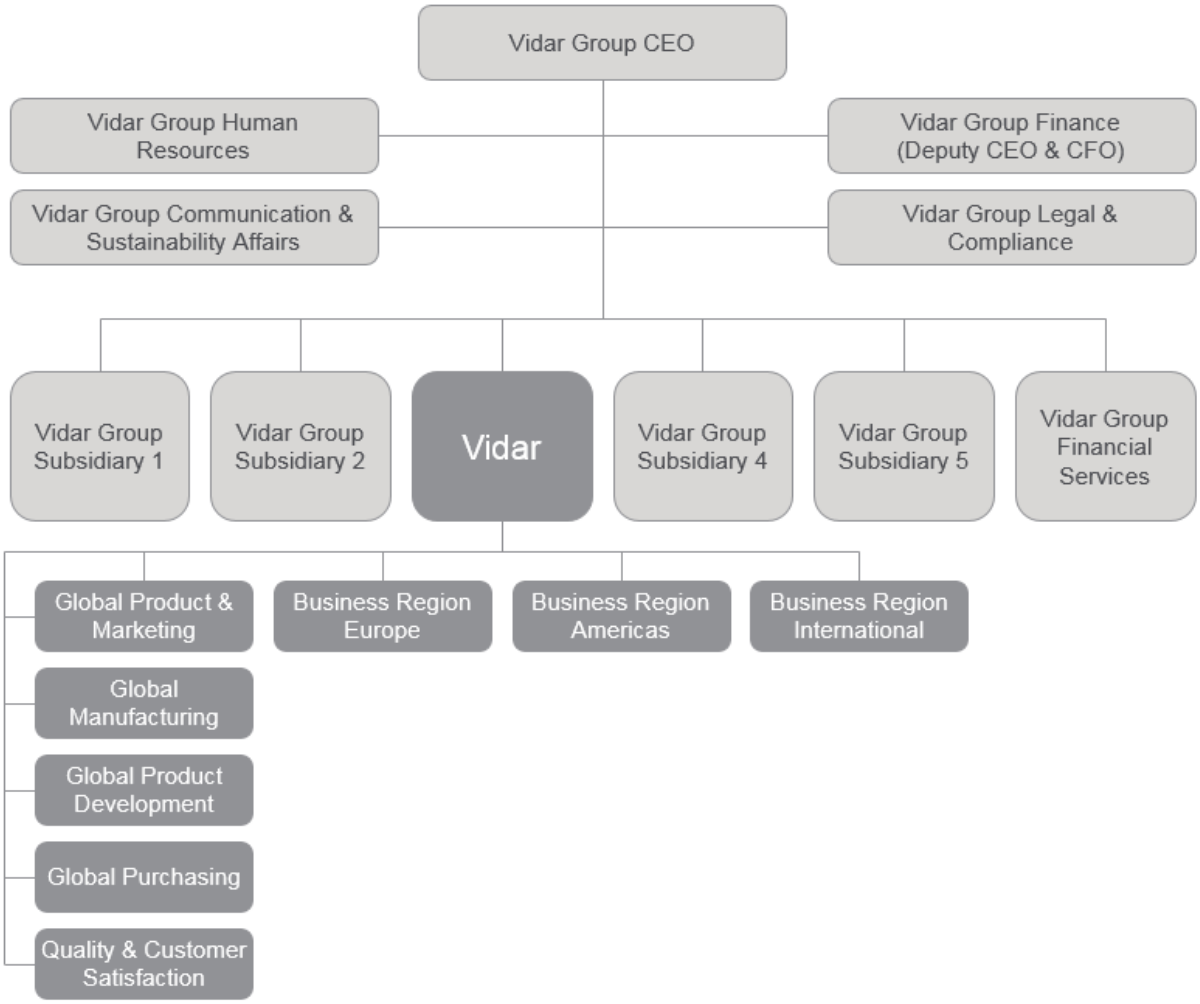

Figure 1. Vidar Group organization as of December 31, 2016 (Vidar Group, 2017)

Vidar has operating presence throughout the world and purchases direct material globally. Albeit the Company's relatively small size and that they only constitute around 10% of Vidar Group's total revenue, the legacy from Vidar Group's historical purchase in direct material has led to a high number of supplier relations. Adding the demand of high degree of configuration on Vidar's products, e.g. different requirements from the customers, increases the purchasing efforts and number of suppliers further compared to other portfolio companies within Vidar Group. Based on interviews with Vidar employees, Vidar experiences that a higher number of suppliers increases the complexity in maintaining the supplier base. Choi and Krause (2006) define complexity in a supplier base as how suppliers are varied and

interact with one another and argue that there are three key dimensions that drive supplier base complexity. These are the number of suppliers, the differentiation between suppliers in the supplier base and the interrelations between suppliers. Complexity in the supplier base tends to increase the transaction costs with suppliers but also affects the supply risk, supplier responsiveness and supplier innovation (Choi and Krause, 2006).

Moreover, Vidar has discussed potential costs of not having a certain supplier, e.g. access to certain technologies and networks or reduced quality and the strategic importance of different suppliers. Kraljic (1983) argues that each purchased part or product could be classified in one of the four following categories: strategic (high profit impact, high supply risk), bottleneck (low profit impact, high supply risk), leverage (high profit impact, low supply risk) and noncritical (low profit impact, low supply risk). In each category, the supplier characteristics may differ as well as the number of suppliers for each part or product.

Vidar's current supplier base and its size have resulted in that Vidar experiences issues deriving costs to suppliers, or groups of suppliers, and does currently not have any methods for evaluating when it may be appropriate to establish a new supplier relationship or the extent to which existing relationships should be maintained or terminated. In order for Vidar to make the right decisions it is important to better understand the costs for each supplier relationship; hence Vidar would benefit from identifying the cost driving elements in supplier relationships and developing a method for estimating the costs of a relationship and mitigating complexity in supplier relationships.

It is further of importance to state how Vidar defines a supplier. Intuitively, this may be obvious. However, given different corporate structures with one parent company incorporating many sales offices, manufacturing sites and shipping locations, how to define and count suppliers is not that intuitive. Vidar defines every manufacturing site as one supplier, i.e. one parent company can constitute several suppliers in Vidar's systems.

1.3 The Industry Characteristics

This specific segment of the automotive industry is dynamic in the sense that there exists no single product offering. Customers with diverse demands drive a high number of variants of Vidar's products. This dynamism results in a need for lots of specialized sourced parts and thereby complexity in the supplier base arises, due to the differing requirements. Compared to related industries, such as the automotive industry for personal transportation, this specific segment has lower volumes and higher degree of customer adaptations.

Vidar operates after an engineering-to-order logic (ETO) due to the dynamic nature of the industry segment and varying customer requirements. Weele's (2005) definition of ETO fits well with Vidar's operations: "All manufacturing activities from design to assembly and even purchasing of required materials are related to a specific customer order. Production is

usually multipurpose machinery, requiring highly skilled operators, for example larger customer-specific equipment and machines, vessels."

Moreover, the industry segment is dominated by tender business. The tenders lead to, according to interviews at Vidar, difficulties in conducting accurate forecasts, since historical data does not necessarily reflect future demand. Moreover, Vidar has experienced that the tender processes tend go on longer than initially intended and planned by customers, which sometimes results in that the tender process restarts without changing the delivery date. This results in less time for the winner of the tender to produce the product, i.e. it results in shorter lead times.

1.4 Theoretical Context and Previous Findings

This is not the first study aiming at analyzing purchasing and the supplier base at manufacturing companies or identifying and analyzing costs and complexity related to companies' supplier base. Already in the early 1980s, Kraljic (1983) claimed that purchasing must have a higher degree of strategic perspective and developed the "purchasing portfolio matrix" (the "Kraljic matrix") separating suppliers with respect to their strategic importance. Ellfram (1993) identified costs in the supplier base and in specific sources of transaction costs, e.g. order placement and preparation, transportation of goods, inspection, return of parts, follow-up and correction of orders. Cooper and Kaplan (1998) claimed that companies base decision on inadequate cost information, which rarely is recognized before losing competitiveness and market position. Thus, they introduced the activity-based costing allowing for more accurate cost control. In more recent times, Gadde et al. (2010) argued that a dominant share of companies' costs can be derived to the purchased goods and services and Choi and Krause (2006) discussed the complexity and its consequences within a supplier base. Moreover, Dubois (2003) discusses the effects from reducing the supplier base as well as indirect effects from the characteristics of relationships within a supplier network.

1.5 Purpose

The purpose of this study is to map and analyze factors in Vidar's supplier base that impact the supplier base design and the total cost of introducing, maintaining and removing one, or several, suppliers. Moreover, the study further aims to discuss and come up with innovative, outside-in solutions to mitigate supplier relationships and decrease the complexity.

1.5.1 Research Questions

1. What factors and cost drivers need to be considered when evaluating the supplier base of a company?
   Motivation: Gain a holistic understanding of what needs to be considered when designing a supplier base.

2. How does the impact of the identified factors and cost drivers differ, qualitatively and quantitatively, when (1) introducing a new supplier, (2) maintaining an existing supplier and (3) removing an existing supplier in a complex automotive manufacturing company?
   Motivation: Create quantitative material for decision basis when evaluating what supplier to select given a certain situation, or whether to consolidate purchases and terminate relationships, where the most important factors for the decision in question are highlighted.

3. How do the costs related to the number of suppliers affect the management of a supplier base at a complex manufacturing company?
   Motivation: Provide Vidar with suggestions for how the complexity in their supplier base can be effectively managed or mitigated.

1.6 Delimitations and Limitations

The expected outcome is a study and an elevation of the hidden cost drivers in Vidar's supplier base. The study focuses on Vidar's plant in northern Europe, henceforth "Manufacturing Site 1", and in east Europe, henceforth "Manufacturing Site 2", which allows the study to be conducted on a more detailed level rather than cover all plants on a high level. Albeit the focus on Vidar's plants in Europe, the developed method to map and derive costs in the supplier relationships is applicable and ready to implement in Vidar's other geographical areas.

The study will be used to create a business case for when it is appropriate to establish, maintain or remove a supplier in the supplier base. The result of this project will serve as supporting data for an overall cost saving project at Vidar. To serve the purpose, the study's scope has been refined and adjusted along the project and been narrowed down to permit a comprehensive analysis of selected parts rather than a broader and thus not as deep analysis.

General limitations and delimitations decided upon are presented in this chapter. Limitations and delimitations related to each category; the introduction, maintaining and removal of a supplier are, however, presented in the empirical finding since basic knowledge and understanding of Vidar's ways of working is necessary to understand the rationale behind some of the limitations and delimitations. The delimitations and limitations were developed and agreed upon with the tutors in an early phase of the study, but have been continuously evaluated and refined throughout the process.

The study is delimited to suppliers of raw materials i.e. suppliers of software, services etc. are excluded from the scope. The main reason to this is that one of the study's underlying

purposes is to facilitate business decisions regarding the supplier base of direct materials. Moreover, focus will be on suppliers of standard materials and not on suppliers of customer adaptation (CA) parts i.e. suppliers of customer-specific parts. The initial reason was that CA Suppliers are handled in a different way and have other requirements from Vidar and would thus increase the complexity of the study. However, the CA Suppliers are a major part of the supplier base, especially Manufacturing Site 2 (up to approximately 25 % of the total supplier base). Therefore, the CA Suppliers are qualitatively discussed in selected parts of the study to allow a more comprehensive analysis.

The level of analysis will be conducted on a supplier relationship level, i.e. number of articles and the volume sourced from the suppliers will not be in the primary scope, despite their importance. Having that said, the supplier characteristics and analysis are somewhat dependent and linked to the number of articles and volume and will thus be discussed and considered indirectly.

The study will discuss the business opportunities that may arise from adjusting the supplier base, however, the realization strategy of potential cost savings is not in scope, e.g. reallocation of personnel or tasks.

1.7 Report Outline

In the following section of the report, literature relevant for gaining a contextual understanding will be presented. The literature studied will be presented in an order of relevance for the study. In the section following the literature review, the methodology used for the study will be presented. After the methodology, the situational analysis and empirical findings will be presented. In this section, how Vidar operates and activities connected to supplier relationships will be outlined. From the situational analysis and empirical findings follows the analysis, in which the cost drivers connected to each activity as well as qualitative aspects of the findings are presented. Afterwards, a discussion concerning the findings and the complexity drivers will be presented, and following final section contains the authors' conclusions of the study.

2 Literature Review

In this chapter are literature and theories relevant for the study presented. The chapter aims at providing an overall understanding of the research field as well as providing valuable insight for the analysis.

2.1 Relationships in the Supplier Network

Axelsson and Håkansson (1984) argue that the supply side of a company and its strategic development can be separated into two strategic roles. Firstly, the development side that focuses on development of products and services by interacting with suppliers and secondly, the rationalization side.

Dubois (2003) focuses on the nature of supplier relationship and discusses the effects from reducing the supplier base as well as indirect effects from the characteristics of relationships within the entire supplier network. Dubois (2003) refers to most current theories on the topic and that these suggest a mix of high and low involvement with supplier which goes in line with Kraljic's (1983) idea of segmenting suppliers and relationships. Dubois (2003) continues to discuss that low involvement with suppliers usually is associated with dual sourcing and high involvement with single sourcing but also the consequences with each strategy. Low involvement with suppliers enable a company to reduce the purchasing price by having suppliers compete. There are however costs related to this strategy, e.g. costs for screening the market and the increased number of tenders needing to be evaluated. With a single sourcing strategy, a company can increase the supplier collaboration and reduce the number of suppliers, but not rarely is manufacturing companies' high degree of variety of purchasing needs resulting in a remained large supplier base.

In the case presented by Dubois (2003) the main cost driver in the supplier base was the number of suppliers and it was concluded that reducing the number of suppliers was a required first step to reduce costs in the supplier base. By selecting key suppliers in defined "commodity groups" and thus agree on a mutually collaboration, Dubois (2003) discusses the opportunity to get a supplier to adjust and broader their assortment, removing the need for additional suppliers.

2.2 Supplier Base Characteristics

The supplier network is all inter-connected companies that exist upstream to any one company in the value system and the supplier base is the portion of the supplier network that is actively managed by the focal company through contracts and purchasing of parts, materials and services. This section investigates the supplier base characteristics in more detail.

2.2.1 Costs in the Supplier Base

In today's business environment, companies' performance and efficiency are highly dependent on their supply side operations (Gadde et al., 2010). Gadde et al. (2010) continues with explaining that companies' increased focus on core activities, specialization and outsourcing are main drivers for the increased spend and efforts on purchasing activities. Gadde et al. (2010) argue that a dominant share of companies' costs can be derived to the purchased goods and services. The profitability is not only affected by the purchasing price though. Also, internal costs are affected from the need for a more developed and sophisticated interface with suppliers, e.g. more communication and interactions with suppliers.

The traditional process of purchasing can be separated into five phases given that the need of purchasing something is discovered: Defining what to purchase, identifying suppliers that can supply the good or service, calls for tender, evaluating and comparing of the tenders and then decide which suppliers to use (Gadde et al., 2010). Given that all requirements are met, the critical aspect when deciding which supplier to use is often the price (Gadde et al., 2010). However, price is not the only financial impact of purchasing, which is why the authors argue that a purchase is not an isolated buying decision and hence, other aspects should be considered. Below, the purchasing process model by Weele (2005) is presented in figure 2.

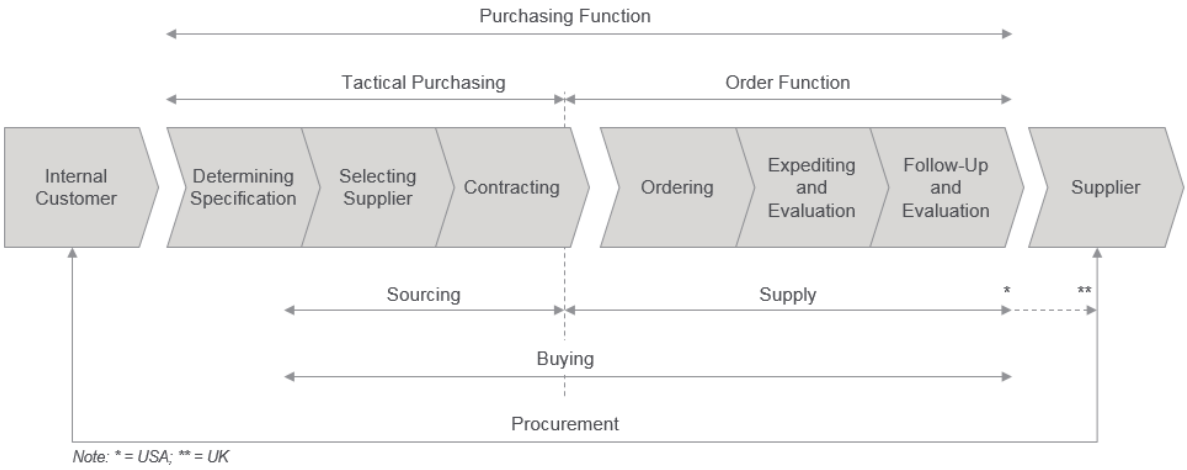

Figure 2. Weele's (2005) Purchasing Process Model

Costs related to purchasing and the supplier base can be separated into direct and indirect costs (Gadde et al., 2010). The direct, or "visible", cost is the price of the goods or services. The indirect, or "hidden", costs on the other hand, are costs that arise from making a purchase, illustrated with the iceberg principle in figure 3. Example of such hidden costs are production costs, goods handling costs, storage costs, capital costs, supplier handling costs, ordering handling costs, administrative and compliance costs, IT costs, screening and requirements control costs, development costs etc.

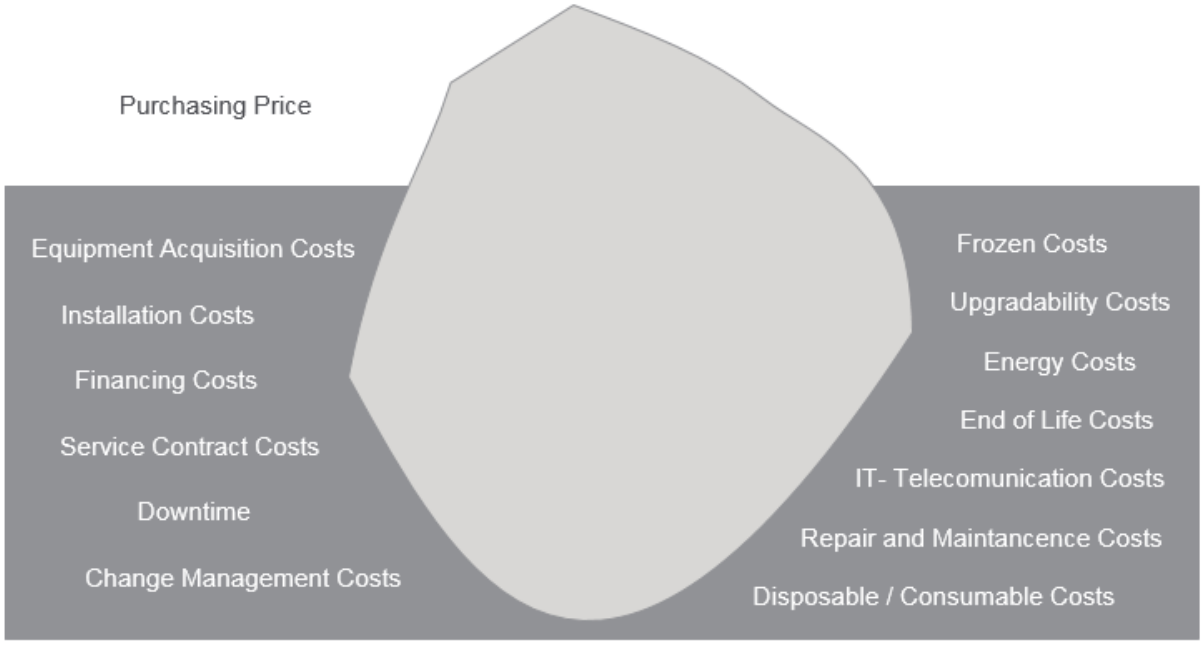

Figure 3. The Iceberg Principle

Choi and Krause (2006) discuss complexity within a supplier base, covered in a later section, and the transaction costs that arise of increased complexity. Transaction cost economics traditionally deals with the cost considerations involved in making outsourcing decisions. Here, transaction costs are regarded as the frictional costs imposed on the focal company from doing business with a certain supplier. Frictions arise from the focal company's interaction with suppliers as external entities to obtain the needed inflow of materials, parts and services to serve its customers. There exist many sources of frictions, e.g. identifying qualified suppliers, making sure they meet the standards, contracting with suppliers, monitoring suppliers and enforcing agreements (Choi and Krause, 2006).

Ellfram (1993) identified more specific sources of transaction costs, e.g. order placement and preparation, transportation of goods, inspection, return of parts, follow-up and correction of orders. Further frictional costs are incurred from developing and maintaining an exchange relationship, monitoring exchange behavior and guarding against opportunistic behavior in an exchange situation. The challenge for managers is here to minimize all these frictional costs incurred from the interface between a focal company and its supplier base (Choi and Krause, 2006). Choi and Krause (2006) also highlight transaction costs from "developing and maintaining an exchange relationship, monitoring exchange behaviors, and guarding against opportunism in an exchange situation".

2.2.2 Supplier Importance

Already in the early 1980s, Kraljic (1983) claimed that purchasing must have a higher degree of strategic perspective and developed the "purchasing portfolio matrix" (the "Kraljic matrix"). Kraljic (1983) argues that companies' supply strategy should depend upon two aspects: "(1) the strategic importance of purchasing in terms of the value added by product

line, the percentage of raw materials in total costs and their impact on profitability, and so on; and (2) the complexity of the supply market gauged by supply scarcity, pace of technology and / or materials substitution, entry barriers, logistic cost or complexity, and monopoly or oligopoly conditions". Please see figure 4 for stages of purchasing sophistication.

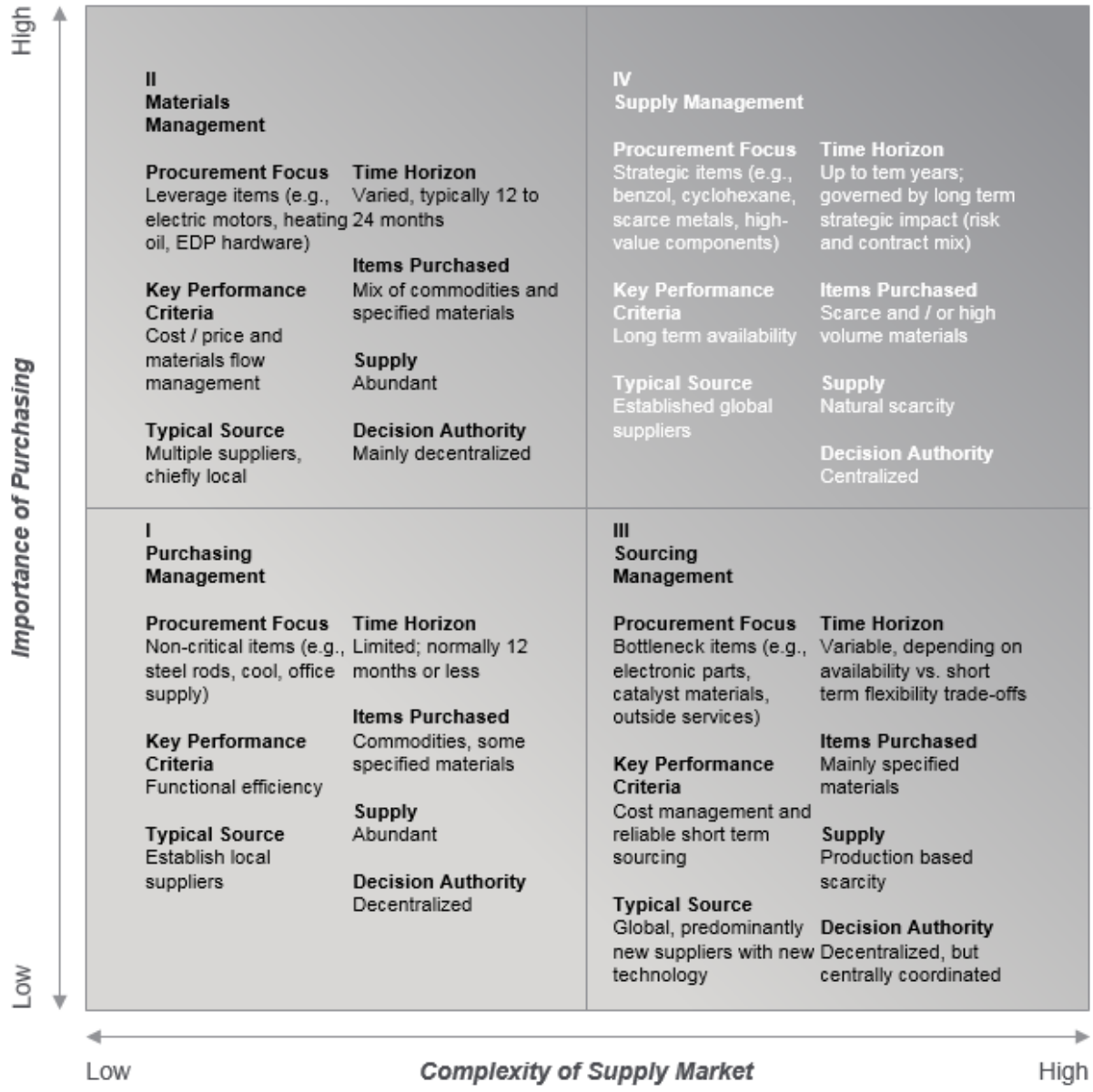

Figure 4. Stages of purchasing sophistication (Kraljic, 1983)

To facilitate the process of evaluating and assessing the companies' position in the matrix, Kraljic (1983) states five questions that companies should ask themselves. The questions are presented below:

1. Is the company making good use of opportunities for concerted action among different divisions and / or subsidiaries?

2. Can the company avoid anticipated supply bottlenecks and interruptions?
3. How much risk is acceptable?
4. What make-or-buy policies will give the best balance between cost and flexibility?
5. To what extent might cooperation with suppliers or even competitors strengthen long-term supplier relationships or capitalize on shared resources?

In order to shape the supply strategy, each product that is purchased needs to be classified, a market analysis needs to be conducted and the strategic positioning needs to be defined (Kraljic, 2005).

Classification. Each purchased part or product needs to be classified in one of the four following categories: strategic (high profit impact, high supply risk), bottleneck (low profit impact, high supply risk), leverage (high profit impact, low supply risk), and noncritical (low profit impact, low supply risk) (Kraljic, 1983). Both profit impact and supply risk can be defined in different ways. Kraljic (1983) exemplifies profit impact metrics such as "volume purchased", "percentage of total purchase cost" and "impact on product quality or business growth". Supply risk on the other hand, Kraljic (1983) describes in terms as "availability", "number of suppliers", "competitive demand", "make-or-buy opportunities" and "storage risks and substitution possibilities".

Market Analysis. With market analysis Kraljic (1983) emphasizes the importance of mapping the company's strengths as a customer and the suppliers' bargain power. Identifying potential suppliers, the supply market and the availability of the required purchasing items are key in the market analysis. Moreover, the company needs so evaluate the identified strength relative to the supplier strength. Typical criteria for evaluating company strengths and supplier strengths are illustrated below in figure 5, however these should be tailored for each industry and company.

	Supplier Strength	Company Strength
1	Market size vs. supplier capacity	Purchasing volume versus capacity of main units
2	Market growth vs. capacity growth	Demand growth vs. capacity growth
3	Capacity utilization or bottleneck risk	Capacity utilization of main units
4	Competitive structure	Market share vis-à-vis main competition
5	ROI and / or ROC	Profitability of main end products
6	Cost and price structure	Cost and price structure
7	Breakeven stability	Cost of non-delivery
8	Uniqueness of product and technological stability	Own production capability or integration depth
9	Entry barrier (capital and know-how requirements)	Entry cost for new sources for own production
10	Logistics situation	Logistics

Figure 5. Purchasing portfolio evaluation criteria (Kraljic, 1983)

Strategic Positioning. With the classification and the market analysis as base, the next step for the company is to strategic positioning each part in the purchasing portfolio matrix. From the purchasing portfolio matrix, the company can identify its strengths as well as weaknesses and develop the supply strategy from that. Weele (2005) refers to the purchasing portfolio matrix and define the classification as in figure 6, where one can find that Kraljic's (1983) two parameters to evaluate the supply strategy is taken in account i.e. (1) financial risk; and (2) supply risk.

Figure 6. Illustration of the Kraljic Matrix (Weele, 2005)

Weele (2005) describes the categories accordingly:

- **Strategic Products.** Products or parts in this quadrant are characterized by co-development between the company and supplier.

- **Leverage Products.** Products or parts in this quadrant are characterized by close relationship between the company and supplier i.e. early supplier involvement, but the product or part is developed by the company.
- **Routine Products.** No close relationship between supplier and company, the company request products or parts in this quadrant based on detailed specifications.
- **Bottleneck Products.** Products or parts in this quadrant are important from a manufacturing perspective and issues arise when the products or parts are missing, which is why several suppliers are usually used.

2.2.3 Supplier Responsiveness

Supplier responsiveness is viewed as the degree of promptness and accuracy of the supplier's response to the focal company's request for new items. Even though it may seem counterintuitive, competitive pressure on suppliers (i.e. when the focal company has many suppliers) does not play a critical role in supplier responsiveness. On the contrary, it is close relationships and open communication that leads to better supplier responsiveness (Choi and Krause, 2006). Consolidated purchased further results in more effective communication, which can better induce the suppliers to be more responsive to immediate needs.

2.2.4 Supply Risk

Managing the supply risk refers to minimizing events that might occur in procuring goods and services from suppliers that negatively impacts the focal company's ability to meet its customers' demands. Risk, in this regard, often arises due to structural arrangements or managerial decisions, whereas risk in the section of transaction costs comes from opportunistic behavior as an underlying behavioral assumption. Risk then arises from a situation in which the focal company is in a dependent position to certain suppliers, e.g. through a need of a technology possessed by a supplier, such that suppliers may have possibilities to escalate prices (Choi and Krause, 2006).

Weele (2005) discusses the additional work as well as the technical risk with testing and approving new materials and components. To reduce the technical risk, Weele (2005) argues that companies may end up sourcing from established suppliers due to previous positive experiences. Nevertheless, companies' try to source from more than one supplier in order to diversify and to negotiate. Issues may arise, however, when the company cannot send out brand or supplier specification but must ask for functional specification (Weele, 2005). One reason for such situations is patents, or rather the lack of patents. The issue is illustrated in figure 7.

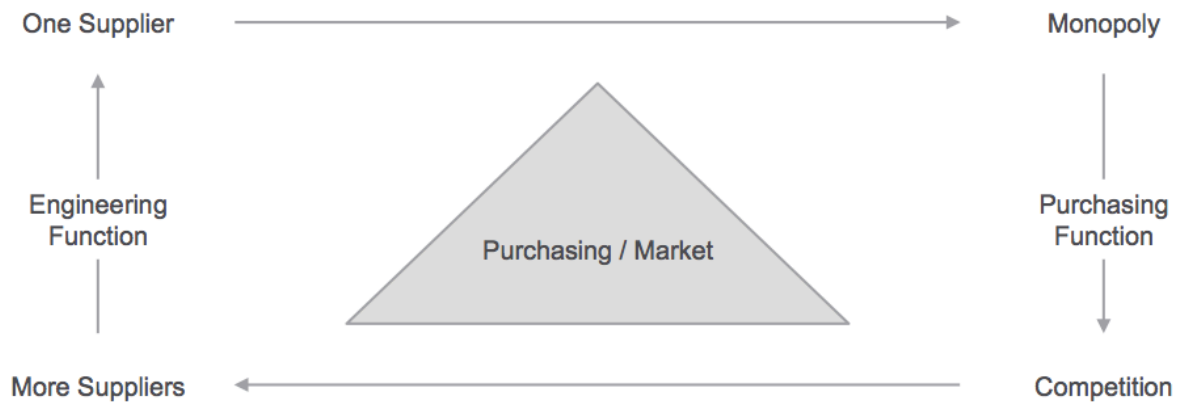

Figure 7. Relation between engineering and purchasing (Weele, 2005)

2.2.5 Complexity in the Supplier Base

The trend of outsourcing has increased the strategic importance of orchestrating and administering activities between the focal company and its supplier base (Choi and Krause, 2006). The importance of managing the supplier base correlates with the purchasing costs' percentage of product cost, i.e. it is more important to manage the supplier base when the purchasing cost is the bulk of the product cost. Choi and Krause (2006) suggest that complexity in the supplier base affects transaction costs with suppliers, supply risk, supplier responsiveness and supplier innovation.

Key Dimensions for Managing Supplier Base Complexity

Choi and Krause (2006) propose that there are three key dimensions that need to be managed to handle supplier base complexity. These are the number of suppliers, the differentiation between suppliers in the supplier base and the interrelations between suppliers, and will be further explained below.

Number of suppliers in a supplier base. The number of suppliers in a supplier base is defined as the current number of suppliers that have enduring business relations with the focal company. "Supplier base optimization", as often used in everyday speech, often only refers to reducing the number of suppliers in an attempt to reduce supplier base complexity. Using multiple suppliers for a single part increases the level of coordination needed to improve the efficiency of operations, which is why complexity in the supplier base increases with the number of suppliers. Fewer suppliers would on the contrary mean that the focal company can implement more efficient buyer-supplier interfaces, e.g. cost-effective inventory or order control, which would reduce the complexity (Choi and Krause, 2006).

Degree of differentiation amongst suppliers in the supplier base. The degree of differentiation is defined as degree of differences in organizational characteristics, such as organizational culture, operational practices (e.g. push vs. pull system), technical capabilities (e.g. if some lag, the focal company may need to invest more in supplier development), cross-border boundaries (e.g. language barriers), and geographical separation that exists

among suppliers in the supplier base. Activities between the focal company and its suppliers become easier to coordinate when suppliers are somewhat homogeneous in culture, work norms and closer to each other geographically (Chai and Krause, 2006).

The level of interrelationships between the suppliers. As Choi and Krause (2006) state, it is not unusual to find working relationships amongst suppliers in a supplier base. Suppliers are sometimes conducting business with one another, and these relationships are often unknown to the focal company. Companies in a supplier base can further compete for business with other suppliers in the supplier base. However, the interrelationships between suppliers may not only include exchange of goods, it is not unusual for exchange of information to take place as well. Limited information (e.g. predictable demand, competition's product features, production capacity etc.) can be obtained through market research, which is why some suppliers engage in collaborative supplier-supplier relations which yields a much richer flow of information. This can sometimes be beneficial to the focal company, e.g. if it implies better coordination, but it can also be harmful. If suppliers share information regarding bidding prices, or experiences with the focal company's pricing policies, the relationship is regarded as particularly harmful (Choi and Krause, 2006).

Four Key Areas of Managerial Involvement when it comes to Supplier Base Complexity

As previously introduced, Choi and Krause (2006) identify four areas of managerial focus that are affected by higher complexity in the supplier base. These are transaction costs, supply risk, supplier responsiveness and supplier innovation and will be further investigated now.

The challenge for managers regarding transaction costs is to minimize all these frictional costs incurred from the interface between a focal company and its supplier base (Choi and Krause, 2006). Choi and Krause (2006) suggest that supply risk has a quadratic relationship to supplier base complexity. Having too few suppliers is risky due to the impact of certain events, e.g. fire at a supplier's facilities or other devastating events. The focal company may further have less access to new technologies if it has too few suppliers. Having too many suppliers, on the other hand, is risky since it is harder for the focal company to control all suppliers, which may make deliveries more unreliable. Difficulties in coordination may further arise due to the interrelatedness, and suppliers may further be subject to increased demand fluctuations when supplying both other suppliers and the focal company. Information sharing amongst suppliers is another factor that increases supply risk (Choi and Krause, 2006).

Choi and Krause (2006) state that studies show that single sourcing led to higher responsiveness in the areas of e.g. design changes, coming from closer communications between the focal company and its suppliers. Single sourcing further correlated with buyer-supplier cooperation, also heightening supplier responsiveness. Thus, more suppliers and higher differentiation among suppliers are negatively correlated with supplier

responsiveness. Interrelatedness between suppliers further may hamper the focal company's possibilities to establish a relationship with a supplier, meaning that interrelatedness also has a negative correlation with supplier responsiveness. The number of suppliers has the strongest negative correlation with supplier responsiveness, followed by differentiation and lastly interrelatedness.

Supplier innovation refers to the focal company's possibility to tap into suppliers' creativity for product and process improvements. Interrelatedness may increase supplier innovation, arising from sharing of information, experiences and technical data etc. Choi and Krause (2006) state that autonomy is critical for innovation, thus the focal company must allow for a certain degree of autonomy in the supplier base. Furthermore, the number of autonomous actors, the differentiation among them and the interrelatedness between them should be high to create a fertile ground for supplier innovation. However, Choi and Krause (2006) also state that too much autonomy may lead to anarchy and disintegration of the coherent activities needed for supplier innovation to take place. Thus, a negative quadratic relationship is assumed between supplier base complexity and supplier innovation (Choi and Krause, 2006).

2.3 Activity-Based Costing

Cooper and Kaplan (1988) claim that companies base decision on inadequate cost information, which rarely is recognized before it is too late and eroding competitiveness and profitability is a fact. The underlying reason to the misleading information is that the cost base has changed over time but the traditional approaches to identify costs are maintained (Cooper and Kaplan, 1988). Cooper and Kaplan (1988) argue that the cost base has developed from mainly consisting of direct labor and materials to costs related to factory support operations, marketing, distribution, engineering, IT and corporate overhead. Thus, the authors introduced the activity-based costing approach allowing for more accurate cost control through considering all activities as supporting activities to produce and deliver products and services i.e. product or service costs. Having that said, Cooper and Kaplan (1988) do not imply that companies should replace current accounting system entirely but complement those with activity-based costing as an additional tool for making strategic decisions.

In manufacturing companies with higher degree of product variations the required support will increase and thus the costs compared to companies with lower degrees of variations (Cooper and Kaplan, 1988). The support activities are in most companies separated into categories e.g. production control, quality assurance, goods receiving etc. but when deriving the costs to products, the methodology is not sophisticated enough to accurately conclude the product costs e.g. still use direct labor as allocator or use percentage markups (Cooper and Kaplan, 1988). This results in that companies incorrectly estimate higher profits at high

degree of variation products and lower profits at low degree of variation products than what really is the case.

When initiating an activity-based costing approach the first step is to gather data on direct labor and material costs. The second step is to investigate how much indirect resources that a product will require, and when carrying out this step, one should follow the below three guild lines (Cooper and Kaplan, 1988):

1. Focus on expensive resources
2. Emphasize resources whose consumption varies significantly by product and product type; look for diversity
3. Focus on resources whose demand patterns are uncorrelated with traditional allocation measures like direct labor, processing time, and materials

The authors discuss whether all costs are possible to include in an activity-based cost approach and thus derive to products and conclude that two categories of costs are not applicable to distribute. First, costs related to excess capacity and second, costs related to research and development of new products should not be included.

2.4 Spend Analysis

Spend analysis is a process of organizing companies' historical procurement spend by suppliers, hierarchies, commodity alignment (Pandit and Marmanis, 2008). Pandit and Marmanis (2008) argues that spend analysis is "the starting point of strategic sourcing and creates the foundation for spend visibility, compliance, and control". The purpose of spend analysis can be separated into three areas. Firstly, spend analysis aims to identify a company's true spend. Secondly, spend analysis tries to discover strategic sourcing opportunities. This is mainly done through demand aggregation and supplier rationalization. Supplier base optimization / rationalization is defined as "focus of this effort is reduction in administrative and transaction costs and cost savings from concentrating greater purchasing volumes with fewer suppliers" (Choi and Krause, 2006). Thirdly and finally, spend analysis aims to reduce a company's spend which is done through improved compliance (vendor rebates, maverick spend, contract compliance, budget variance etc.) (Pandit and Marmanis, 2008).

By conducting spend analysis, companies are, according to Pandit and Marmanis (2008), able to reach savings in the range of 2 to 25% of the company's total spend. Spend analysis could for example identify suppliers where spending is unnecessary high and more preferred suppliers are available or commodities where supplier consolidation is possible. (Pandit and Marmanis, 2008). At a first glance, spend analysis could be viewed as a quick fix and easy to implement, however, Pandit and Marmanis (2008) highlights the challengers with spend analysis. Example of challenges is that companies' have different cost centers and general ledgers between divisions, which are not integrated and adjusted for purchasing, and in

combination with different reporting systems, this result in data that are not on a company level, not “cleaned” and not consolidated. The huge number of transactions and the need of a company wide mindset are other challenges in implementing spend analysis in a successful way.

2.5 Purchasing Category Management

There are several potential reasons for why companies engage in purchasing category management (PCM). Heikkilä et. al. (2016) find three main drivers for PCM which are direct cost savings from consolidated purchases, reduction of total cost of ownership and lastly business requirements and product / service structure, i.e. cross functional integration. The position of the focal company in the value chain and whether the company is a raw material producer or producer of more complex products and services appears to provide explanations for the differences in the formation of purchasing categories, their drivers and further for the use of mechanisms to integrate the purchasing and supply function and other parts of the organization.

2.5.1 Choice of Categories

“Category management” demands a classification into segments of third-party costs, which thereafter can be processed individually by cross functional teams with the purpose of identifying and implementing the optimal sourcing strategy for the category in question. In the process of classifying the categories, the third-party costs need to be segmented into different market-oriented areas (O’Brien, 2012).

All third-party costs cannot be affected though, e.g. taxes, government feed, rent, licenses etc. cannot be reduced or mitigated. However, it is important to know why one cannot affect that cost area before classifying it as impossible to affect, otherwise one might miss opportunities (O’Brien, 2012).

Classifying the costs is not an easy task. Fusions, mergers and acquisitions, integrated relations etc. often make it hard to obtain accurate information about spend to determine an appropriate breakdown of segments. Even if all data is available, it may be sub optimally broken down or segmented. The categories must further reflect the market orientation, i.e. how the market is organized (O’Brien, 2012).

2.5.2 The Three Foundations of Category Management

Category management rests upon three foundations, where all the three are important for realizing the full potential of category management. These are Strategic Sourcing, Handling of Markets and Driving Change and will be further explained below.

Strategic Sourcing. When it comes to strategy within purchasing, there are two distinct areas in need of strategy. Firstly, the purchasing function needs an overall strategy. This

must describe the long-term direction towards which the purchasing function is working, and its scope. The strategy must further be in line with the company's overall goals and the stakeholder's needs and expectations. The strategy must further match the purchasing functions resources and capabilities with goals of company and changes in the environment, external markets and optimal ways of working within sourcing (O'Brien, 2012).

Secondly, there needs to be strategies for the different spending-areas. Medium-term directions towards which the spend-areas are working, as well as scope and a definition of what, and how, the organization is buying. In the ideal case, this strategy will satisfy the organization and its customers' immediate and future needs, while matching them with current and future market conditions. The strategies of the spending areas should further be in line with the overall strategies and goals (O'Brien, 2012).

O'Brien (2012) describes some barriers to strategic sourcing. These include vertical silos, i.e. cooperation problems amongst different departments, the unpredictability of demand and market changes in the future, conflicts of interest within the organization, the traditional view of the purchasing department, lack of creativity and lastly an inability of getting things done.

Handling of Markets. This foundation is about understanding the market, how the focal company relates to the marked and what the markets structures of power looks like. This is especially important to understand in order to drive change, and to understand different types of interactions amongst market actors (O'Brien, 2012).

O'Brien further lists some barriers to understanding and handling the market. First of all, knowledge is power, i.e. markets change quickly, events globally may have an impact and change demand which results in a complex environment that is hard to understand. Furthermore, the focal company often only focuses on what's directly ahead of it and misses out on important events or information that is happening one or two stages away. Lastly, it is important to understand the balance of power. Who has the most power in a buyer-supplier relationship, and what effort would be required to change supplier? Understanding this dimension is crucial to drive change (O'Brien, 2012).

Driving Change. It doesn't matter how sophisticated or advanced one's strategy is, if one don't know how to implement it the right way. This is seldom something that the purchasing function can handle on its own, and requires a lot of cooperation and support from other departments (O'Brien, 2012).

The difference between working strategically and tactically lies mainly in the ability to drive change, i.e. the ability to work cross functional, do the project all the way through to implementation with high stubbornness. Purchasing often needs extra competences to drive

change in form of project managers, leadership and group-support and handling of internal communication such that the entire organization is informed and supportive (O'Brien, 2012).

The team responsible for driving the change should considered that humans have an inner resistance towards change. It requires tremendous energy and a huge effort to get people to let go of what they can and know, and feel comfortable with change. One must more or less create an inner sensation that change is necessary, in order for the change to be successful (O'Brien, 2012).

As with the previous foundations, O'Brien lists some barriers to change. The biggest barrier is the inner resistance of change within people, often driven by lacking engagement visible through e.g. resisting comments or avoiding behavior. Lack of managerial involvement and lack of an experienced need for change are further barriers. Insufficient resources to drive change are lastly another factor that prohibits change (O'Brien, 2012).

2.5.3 The Four Pillars

The three foundations of category management, previously explained in 2.5.2, provide a good idea of the challenges that exist within a certain category. However, to gain a more comprehensive picture of the possibilities offered by category management, O'Brien (2012) further lists four pillars that category management can rest upon. The pillars are based on practices that have provided empirical evidence of what is required to succeed with category management. The pillars are Innovative Thinking, Customer Focus, Cross Functional Teams, and Facts and Information and will be further explained below.

Innovative Thinking. Innovative thinking can be described as ideas that would provide a radical improvement compared to present achievements, i.e. ideas that would provide a fundamental change of state and change from present state to a new state, often carried out during a short period of time. It is not entirely uncommon that there may be a temporary dip in financial performance just before the change is completed, since large amounts of resources often are spent to prepare for and to execute the change (O'Brien, 2012).

Customer Focus. This demands the purchasing function to actively be engaged in customers and understand their needs, wishes, problems and businesses, and respond to them with a suitable sourcing strategy. The purchasing function has many customers, both internal and external. To illustrate, purchasing must consider the needs of engineering, production and logistics planning (i.e. internal customers) before changing suppliers, specifications etc. Understanding the needs of the business and the internal customers is key for strategic sourcing. However, it is important to stress that purchasing will likely not always be able to satisfy the needs of all internal customers, due to conflicts of interests. The key is to balance the trade-offs and understanding all the internal needs (O'Brien, 2012).

When it comes to external customers, it is often inappropriate for the purchasing function to communicate directly with the end customer. Instead, the contact with end customers will likely be through people working in e.g. marketing or sales (O'Brien, 2012).

Cross Functional Teams. O'Brien (2012) stresses the need for companies to work cross functional when working with category management. If projects are run solely by the purchasing function, it will most likely fail, especially if the project is particularly challenging.

Cross functional teams will ideally consist of representatives from relevant business units, with the category manager as the team leader. The manager must understand and be patient with the human factor – initially, the team will not work that well due to conflicts of interests and objectives, but after a while people will start seeing the benefits as their understanding of the necessity increases. The size of the team also matters. Is the team is too small, all relevant business units may not be represented or there may not be enough resources. On the contrary, if the team is too big it may be hard to manage and it may become hard to make progress and decisions (O'Brien, 2012).

For the team to be effective, team members must have sufficient knowledge about the products / services within the category, have enough time to spend on the project, have their superiors' support and be ambassadors for their business unit and drive communication between the team and the rest of the company. The team members must further be strong enough to resist any attempts to halt the progress made by members of their own business unit, if they know the project is important (O'Brien, 2012).

Facts and Information. Basing decisions on facts and information is probably the best way to avoid risks (e.g. bad investments, legal issues etc.). Before decisions are made, bosses and decision-makers thus want to accumulate as much information as possible to assure themselves that they are making the right decision. But that is not all, facts and information also constitute measures of pressure for change, e.g. one can exert pressure on people resisting change by using information / facts that speak to one's benefit (O'Brien, 2012).

Facts and information serves one final purpose, the obtaining of them helps people understand that their voices are heard in the preparation of a period of change. This may reduce their resistance to the change later on. It's easier to present ideas that are based on facts rather than guesses or intuition. The process of gathering information further takes place throughout the whole category management process (O'Brien, 2012).

3 Methodology

In this chapter, chosen methodology for the study and its parts is described. The methodology is characterized as exploratory and inductive, and aims to thoroughly investigate and answer defined research questions based on relevant literature. Moreover, this chapter aims to investigate potential pitfalls with the chosen methodology and how to overcome these.

3.1 The Case Study at Vidar

The study is of exploratory and inductive character, which provides the right conditions to draw more general conclusions based on the results. Eriksson and Wiedersheim-Paul (2008) argue that there are two methods to collect qualitative data: case studies and interviews. Consequently, both methods have been used in this study.

The study is a single case study. Conducting a case study is appropriate when examining a specific object with high degree of complexity (Yin, 2003). Furthermore, Yin (2003) argues that case studies are preferable when questions like "how" and "why" are answered, when the investigators have relatively low control over the system and when the system is difficult to study beyond its context. Since Vidar's supplier base, purchasing process and other relevant interdependent processes are in line with the above description, the report is based on a single case study conducted at Vidar's Manufacturing Site 1 and Manufacturing Site 2. The single case study also gave the authors the opportunity to spend time and effort on understanding Vidar's organization and how they are working. Consequently, the analysis and discussion could be conducted with a deeper understanding and be more comprehensive.

Albeit Vidar has manufacturing plants throughout the world, the study focuses on Vidar's Manufacturing Site 1 and Manufacturing Site 2 with the underlying purpose of being focused, reducing complexity and making the study manageable. Moreover, it is of interest to investigate both Manufacturing Site 1 and Manufacturing Site 2 in order to compare the ways of working at different geographic locations within Vidar. The decision to focus on Manufacturing Site 1 and Manufacturing Site 2 was made jointly by the authors and the tutors at Vidar.

Yin (2003) argues that the best strategy to avoid common pitfalls and thereby establish prerequisites for a comprehensive study is to perform a rigorous plan and design of the case study. The case study aims to link the project's data and conclusions with the initial research questions and purpose. Yin (2003) further explains that a case study usually consists of five parts:

1. Research questions
2. Potential work hypotheses
3. Analysis of different parts

4. Logic that links data with the research questions and purpose
5. Interpretation of results and analysis

Except for that the case study has not been using work hypothesis, it has been based on the above-mentioned parts. Initially, the purpose with the study was broadly formulated and allowed for adjustment and further development during the course of work. The research questions were defined to work as a tool to help answering the intended purpose of the study, albeit the purpose was not entirely defined. It is of great importance to prioritize time and energy on the research questions as these will lead and set the direction of the work (Yin, 2003).

The study's analysis is based on the conducted situation analysis and the empirical findings, which is of both qualitative and quantitative approach and collected through interviews and internal documents from Vidar. The qualitative part aims to facilitate the analysis and discussion and is suitable when the relationship between different factors in a company and the behavior of employees is complex and difficult to measure. The quantitative part on the other side, aims to estimate the mapped cost drivers in Vidar's supplier relationships.

3.2 The Work Structure

The following section provides a more detailed description of selected methodology for the two key parts of the study, which are identified as the literature review and the analysis. The focus of the following sections is on how each part was carried out and how the data was collected.

3.2.1 Literature Review

In the opening phase of the study, a literature review was conducted for the authors to create an overall understanding of the studied field and to be able to conduct a thorough situational analysis. Given the complex nature of supplier base analysis, there was no shortage of theory within the subject. The problem was rather to limit the literature to what really was relevant. Literature is a form of secondary data and it is therefore important to consider that the information may be angled or non-comprehensive for the studied areas (Björklund & Paulsson, 2012). In order to avoid these problems, the authors have tried to disseminate literature sources.

Topics of interest that are reviewed in the literature section are supply and supplier base management, design of supplier base, spend analyses, purchasing category management and supplier relationship management. Although the literature review was conducted in the opening phase of the study, literature was reviewed throughout the project in order to refine and use relevant theory that aligns with the findings and objectives.

3.2.2 Analysis

The analysis consists of the pre-study, empirical findings as well as the analysis. Moreover, the analysis generated a discussion and conclusion including recommendations.

Company Description

For the company description, a short pre-study was conducted based on secondary data as well as on primary data. It is of importance that different sources are used when conducting a case study to obtain a result as objective as possible. The secondary data consisted of Vidar's internal and public materials and reports, such as the quarterly and annual report and investor relations' presentations. Primary data for the company description was based on company visits at Vidar's purchasing office as well as at Manufacturing Site 1 and Manufacturing Site 2. At each visit selected representatives at Vidar presented their responsibilities and ways of working on a high level. During the first company visit and the kick-off for the project, a general description of Vidar as well as of Vidar Group was provided.

Situation Analysis and Empirical Findings

Initially, in order to investigate and evaluate the research questions, an analysis of Vidar's current ways of working with suppliers was conducted.

The purpose of the situation analysis was to understand how Vidar works with suppliers throughout the relationships' lifetime in order to identify possible cost driving elements. The situation analysis consisted of an identification of supplier base actors / stakeholders and known systems that impact the costs of a supplier relationship. For the situation analysis and empirical findings, secondary data has been collected through Vidar's internal materials and primary data has been collected through observations and interviews.

Internal Materials. The internal data consisted mainly of process maps and process presentations developed to facilitate Vidar's employees' work.

Observations. According to Björklund & Paulsson (2012), direct observations are a solid method for obtaining objective information. Direct observations can be carried out more or less formally (Yin, 2003). The most formal forms of observations could for example be conducted using protocols etc. whereas less formal observations may consist of company visits with visual inspections. During the project, the authors were stationed at the Global Purchasing and Global Manufacturing offices, and the authors visited Manufacturing Site 1 and Manufacturing Site 2 once respectively. Hence, direct observations were collected throughout the project. The observations were partly used to validate the data collected through Vidar's internal documents and the interviews. The observations were further used to map the processes, and to create a contextual understanding of the phenomenon.

Interviews. Eriksson and Wiedersheim-Paul (2008) argue that interviews are applicable when the purpose is to clarify and interact with what is being investigated and increase the flexibility, which is why interviews have been conducted in addition to the direct observations. The structure and characteristics of the interview may differ according to Björklund & Paulsson (2012). The interviews in this study were semi-structured, meaning that the questions asked covered a defined area, but the question sequence could be evaluated during the interview and, if appropriate, supplementary questions could be added depending on the interviewee's response (Björklund & Paulsson, 2012). For each interview a tailored questionnaire was developed. The interviews generally started with broad and open-ended questions and then more specific questions were asked as the interview proceeded. There were two underlying purposes with the interviews; firstly to get a contextual understanding, and secondly to gather quantitative data.

During the project 34 interviews varying between 30 and 120 minutes were held. The interviews were all individual and the majority of the interviews were face to face, but some were conducted through conference calls including video. One of the authors was responsible for asking questions and the other author was responsible for taking notes. In addition to the notes, selected interviews were recorded. All interviews were conducted with Vidar's employees that the authors and tutors found to be key stakeholders with valuable information for the project due to their expertise within the field as well as within Vidar's ways of working. Please find figure 8 with all interviews. Moreover, the interview questionnaires are to be found in appendix 1.

Interviewee Position	Number of Interviewees	Interview Length (min)	Contextual Understanding	Quantitative Data
Director Global Logistics and S&OP	1	60	✓	✗
Manager, Strategy & Business Development	1	60	✓	✗
Director, Global Manufacturing Strategies	1	60	✓	✗
Strategic Projects & Governance Manager	1	60	✓	✗
Global Supply Chain Development Manager	1	60	✓	✗
Purchasing Manager P&O, Sweden	1	60	✓	✗
VP P&O, Europe	1	30	✓	✗
Director Supply Chain Management & Logistics	1	60	✓	✗
Program Manager	1	30	✓	✓
Project Manager	1	30	✓	✗
Purchasing Development Manager	1	60	✓	✗
Manager Business Office	1	60	✓	✗
Chief Project Manager	1	60	✓	✗
Purchasing Developer	1	60	✓	✗
Manager & Finance Market Support Center, Manufacturing Site 1	1	60	✓	✗
Sourcing Buyer	5	60	✓	✓
P&O Buyer, Manufacturing Site 1	3	90	✓	✓
P&O Buyer, Manufacturing Site 2	3	90	✓	✓
Logistics, Manufacturing Site 1	1	120	✓	✓
Head of Material Planning, Manufacturing Site 2	1	120	✓	✓
Material Controller, Manufacturing Site 1	1	120	✓	✓
Material Controller and Senior Logistics Specialist, Manufacturing Site 2	1	60	✓	✓
Supply Quality Engineer (SQE)	1	60	✓	✓
Cost Engineer (CE)	1	60	✓	✓
Director, Transport Material Solutions	1	60	✓	✓
Agreement Administrator	1	60	✓	✓

Figure 8. List of interviews

Analysis

The analysis of the empirical findings consisted of three stages. First, mapping and identifying of cost drivers related to Vidar's supplier relationships. The drivers were divided into the three phases: 1) Introduction of Suppliers, 2) Maintenance of Suppliers and Removal of Suppliers. A tool developed by the authors facilitated the categorization of the cost drivers and factors. The tool also assisted in the discussion on whether different factors were in scope. The tool is a decision three and illustrated in figure 9.

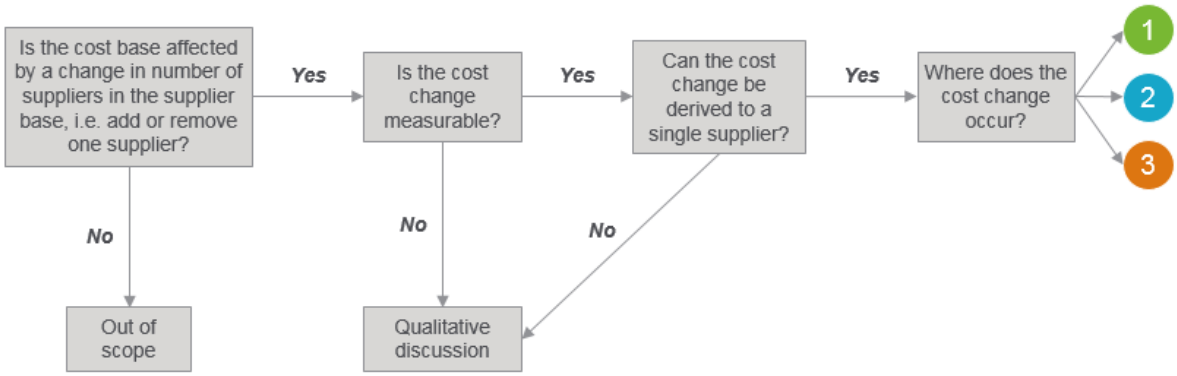

Figure 9. Cost classification tool

The second step of the analysis was to develop a model in which a cost interval for supplier relationships was calculated. Throughout the project an activity-based costing approach (Cooper and Kaplan, 1988) has been used but instead of deriving costs to a product, the costs have been derived to the suppliers. Please see figure 10 below for an illustration of how costs driven by working hours were calculated. Estimating transportation costs was a task deemed too complex given the time-scope of the thesis, which is why existing case studies were used to gain an approximate understanding of the costs incurred on the organization by a supplier from a logistics perspective.

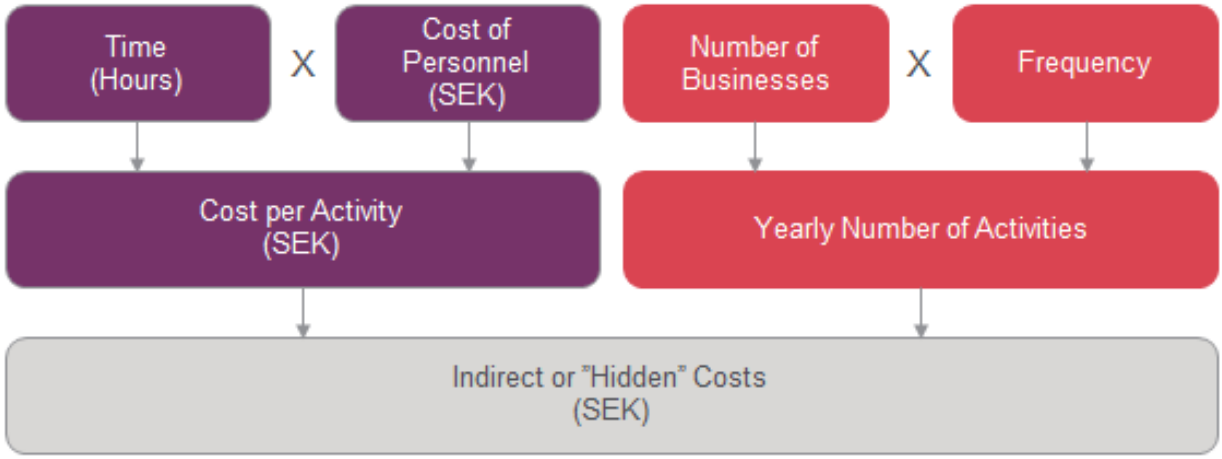

Figure 10. Calculation logic of indirect or "hidden" costs

Once the cost driving elements of a supplier relationship was identified, a blueprint for a supplier relationship was developed by the authors. Using the blueprint as a base, the authors could calculate the costs for engaging a new supplier, maintaining a supplier as well as removing a supplier with the model. Following the analysis and the estimation of cost related to the supplier relationships, conclusions were drawn to answer the purpose. Given the conclusions, recommendations were made regarding when it may be appropriate to engage a new supplier, and when it may be appropriate to mitigate a supplier relationship.

3.3 Validity and Reliability

With validity one refers to that the right things are investigated and registered, i.e. that what is being investigated and what is desired to be investigated corresponds with each other. Reliability refers to that the same results would be achieved in multiple surveys (Eriksson & Wiedersheim-Paul, 2008). In qualitative studies, Eriksson and Wiedersheim-Paul (2008) argue that the validity should be prioritized over reliability to ensure that the data collection reflects what will be investigated and hence the study questions and purpose.

To ensure the reliability of the data, the used sources have been reviewed throughout the project. Moreover, throughout the project, the authors have had a close collaboration and open dialogue with Vidar which has strengthened the internal validity. External validity refers to the extent to which the results of a study can be generalized and applied to other studies and cases. As this report aims to investigate Vidar's supplier base which is both complex and unique, the results can be assumed as specific for Vidar and not specifically externally valid. However, one could assume that the results could be of interest for peer organizations, which makes the results generalizable to some extent.

In addition to the interviewers' familiarity with Vidar's situation, control questions with known answers have been put in place to increase reliability. The relatively low number of interviews conducted is largely due to the fact that all responses to the control questions have been in line with each other. In order to further avoid irrelevant data, this has been sorted retrospectively based on the purpose and questions of the study.

4 Situation Analysis and Empirical Findings

This chapter covers the conducted situation analysis and the way Vidar works. In specific, the chapter discusses the findings regarding activities related to sourcing, selecting and preparing suppliers for business with Vidar, as well as activities to maintain the supplier relationships and activities related to actively remove suppliers. The chapter starts with a short overview of the entire process, followed by a deep-dive in the three parts which reflects how Vidar selects, maintains and removes supplier relationships.

4.1 Overview of Vidar's Sourcing and Supplier Relationship Process

Vidar uses segments in their procurement strategy, which is what O'Brien (2012) refers to as purchasing categories, to reduce and mitigate third-party costs incurred by transactions. Vidar has different ways of defining a segment, however two main strategies of defining segments have been identified. A first way that Vidar defines segments is through different product areas of the products, e.g. glass, metal parts, plastic parts and more complex modules. Then the buyer is responsible for the sourcing of all related parts to that particular area. A second way to define a segment is through the products' place in the Kraljic matrix, i.e. through what market behavior is required to procure the product. The procurement strategy is then either tilted towards a more strategic and collaborative relationship for items of strategic importance, or towards a more market-oriented behavior for items of less value and strategic importance. Thirdly, segments can also be created when the products in question requires specific technical knowledge about both the products and the manufacturing process. This is to ensure both the quality of the product and to mitigate supply risk through securing the supplier's manufacturing processes.

As described in the methodology, the situation analysis and empirical findings chapter is based on the conducted interviews as well as on internal materials such as process maps, instructions and internal presentation materials. Based on the findings, the costs related to supplier relationships are separated into three main categories with a number of sub-categories, illustrated in figure 11. As stated in the methodology, only costs that depend on a change of the number of suppliers are considered i.e. only the "delta costs" arising when adding or removing one or a number of suppliers are considered.

Figure 11. Overview of the supplier relationship process

Moreover, it is of importance to define what a supplier actually is and how Vidar keeps track on the number of suppliers. This is not as easy to answer as one may think since a typical supplier may have subsidiaries, be part of a larger corporate group, or have several sales offices (which are the entity that Vidar usually negotiates with). In addition, the suppliers often have several manufacturing sites (this is where Vidar actually buys the material and have daily communicate through EDI with), warehouses and shipping locations (from where the materials are transported). Vidar considers one manufacturing site as one supplier and thus this study also defines a supplier as a manufacturing site. Thus, the assumption that all manufacturing sites are onboarded, have separate agreements and the requirements are met is made. In reality, however, e.g. framework agreements are made on the parent company level. An example of a potential case of the supplier structure is illustrated below in figure 12 (in this case three suppliers).

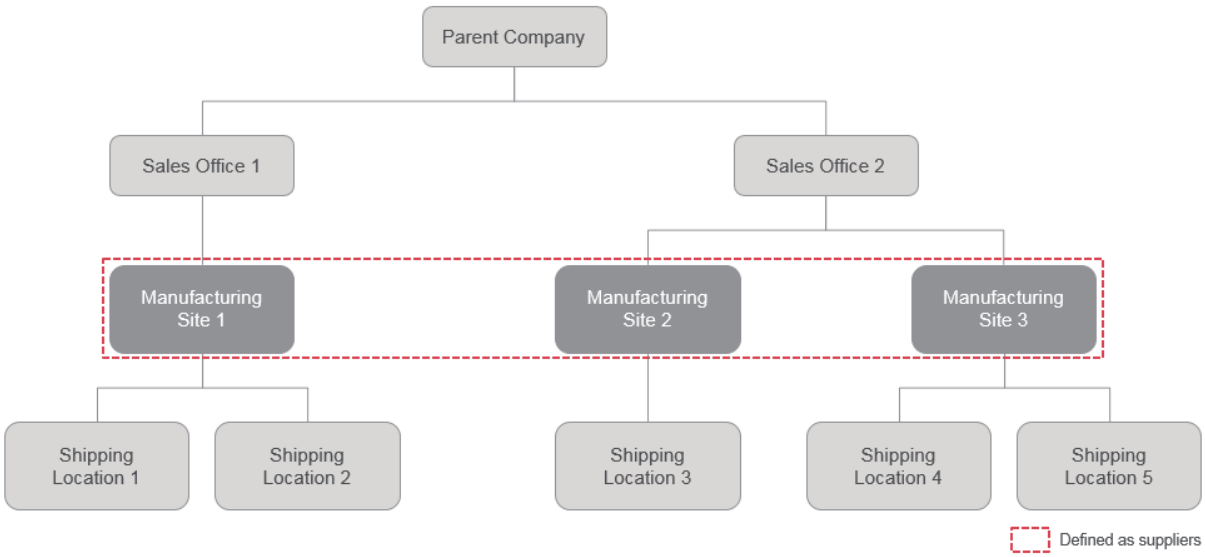

Figure 12. Example of a supplier and the supplier definition (three suppliers highlighted in red dotted line)

Albeit the main focus is on suppliers of standard materials (Standard Suppliers), it is of importance to understand the CA Suppliers' role. The CA Suppliers are not introduced and handled with the same formal processes as the Standard Suppliers, which has several consequences for the organization, according to the interviews. The next three sections will describe the formal process in which the Standard Suppliers are handled, but selected parts will also provide a brief description from the CA Suppliers' perspective.

4.2 Supplier Introduction

Standard Suppliers are introduced to Vidar Group either when needed in the serial productions phase, or during development projects, so-called DVPs. DVPs are for both new products as well as for small and big amendments to existing products. The part of the DVP that is relevant for this study is the "Select AP Supplier and Prepare for Serial Production" part where suppliers are chosen and introduced to Vidar, which is presented in figure 13. The selection part consists of two phases, the sourcing phase and the preparations phase.

During the sourcing phase, the responsibility of the project is under the Sourcing Buyer, whereas the responsibility is under the P&O Buyer during the preparations phase.

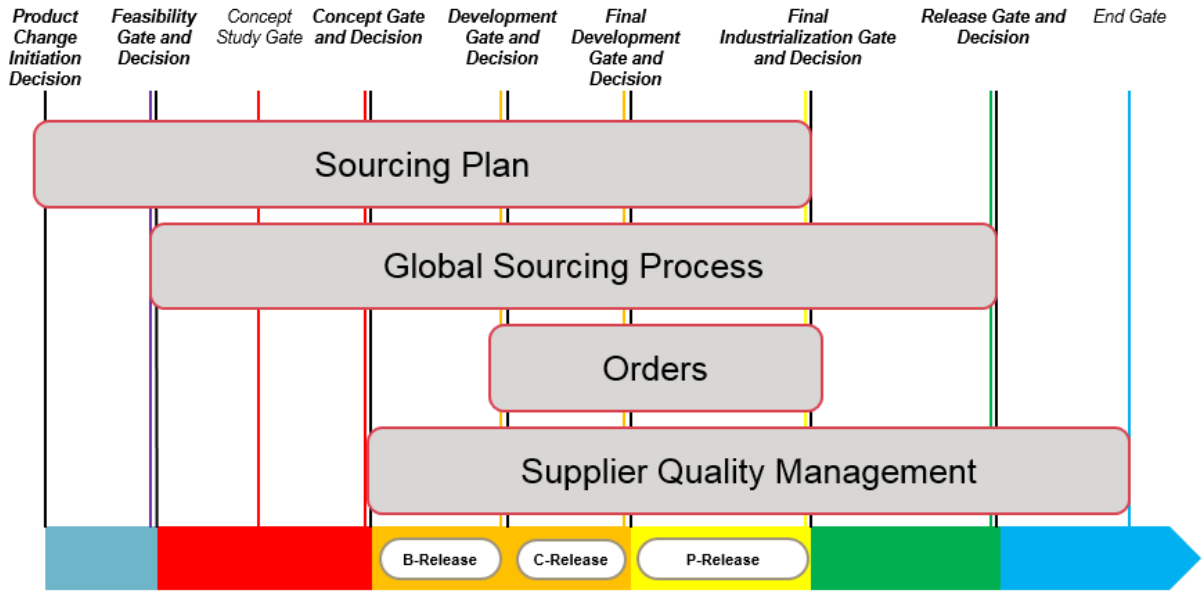

Figure 13. Overview of entire Global Sourcing Process, with deadlines and associated activities

Vidar has well-developed processes to select, onboard and prepare suppliers for the serial production. However, in addition to the formal processes, there are additional activities that must be carried out in order to start the collaboration. The scope of the "supplier introduction" phase in this study starts when the Sourcing Buyer gets involved in the process of starting to find suppliers for evaluation and gathering the requirements, to the point where the supplier has been chosen and all agreements have been signed. The focus here is on the work mainly conducted by the buyers, and the people supporting them in their work. The point is however, that the scope only includes work that is directly connected to a supplier in the introduction phase, i.e. work that is conducted by product development connected to a project where new suppliers are to be onboarded is considered out of scope. The rationale behind this is that the work is not directly affected by suppliers or by the number of suppliers i.e. the work must be conducted regardless.

4.2.1 Sourcing and Select AP Supplier

The supplier introduction phase starts with a process called "Source and Select AP Supplier", also known as the "Global Sourcing Process" within Vidar. This is the process of selecting what suppliers to consider, and how to choose between the options available and quotas received. The process including key stakeholders involved in each process is illustrated in figure 14, followed by a detailed description of each activity.

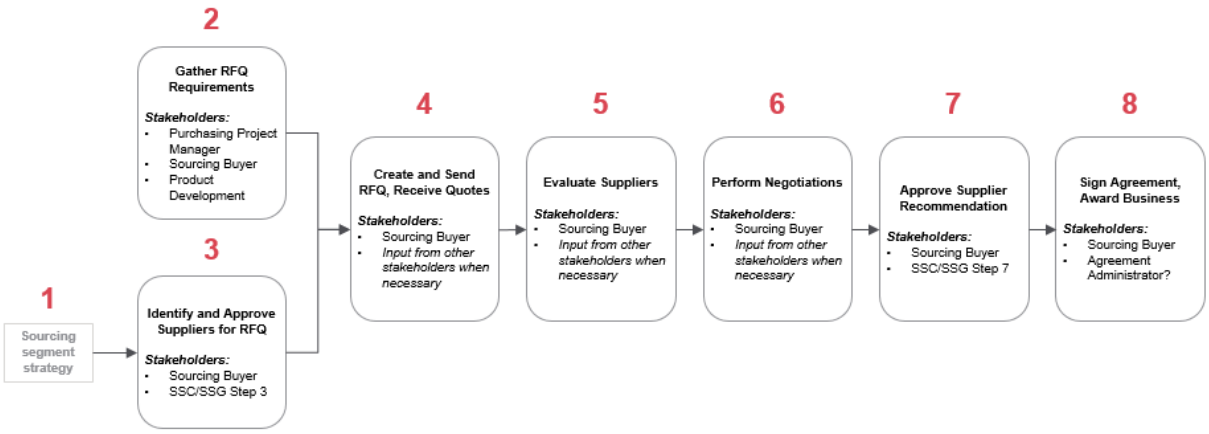

Figure 14. Vidar's "Source and Select AP Supplier" process including key stakeholders

Sourcing Segment Strategy

What first sets the scope in the sourcing process is the "Sourcing Segment Strategy". This is the overall strategy of the specific segment in question, and it sets the overall boundaries for what suppliers that are possible to consider and eventually select.

Gather RFQ Requirements

The second step of the sourcing process requires the Sourcing Buyer to contact all concerned stakeholders about their requirements before creating the request for quotation, or RFQ. The Sourcing Buyers have access to a pre-specified RFQ-template, where all requirements are listed. These requirements could be e.g. technical specification from Product Development, legal and regulatory frameworks, logistic demands from Global Logistics and aftermarket demands from the Logistics Department. Moreover, general requirements such as CSR and ISO requirements must be met by the potential suppliers.

Identify and Approve Suppliers for RFQ

Parallel to gathering the RFQ requirements, the Sourcing Buyer is also tasked with identifying what suppliers to send the RFQ to. The activity starts with an informal kick-off with all involved stakeholders from the sourcing team to inform about the sourcing case. If the approved segment strategy is available, the Sourcing Buyer should identify the segment strategy list i.e. pre-defined list of potential suppliers. Should the segment strategy not be available, the Sourcing Buyer will be tasked to identify other potential suppliers. Following the identification of potential suppliers, the agreement status and supplier performance of each supplier needs to be checked and included in the RFQ supplier list. Thereafter, the Sourcing Buyer has the responsibility to prepare and execute a presentation for the Sourcing Steering Group (SSG), or Sourcing Sub Committee (SSC) depending on the RFQ spend, where all sourcing team members and a manager from Strategic Sourcing are present (if SSG) alternative the Director of Strategic Purchasing (if SSC). The sourcing council is asked to provide input and raise concerns regarding what suppliers to proceed with. Before sending out the RFQs, all supplier information must be available and updates in all systems, e.g. Vidar Group's Partner Management System (PM).

Create and Send RFQ and Receive Quotas

The next step in the sourcing process is to put together an RFQ package that are to be sent to the suppliers in the approved RFQ supplier list agreed upon in the SSC meeting. This is done by bringing in all sourcing case information obtained in previous steps, to then create the package. Should any non-conformance in Supplier Performance or Agreement status have been identified in Step 3, requesting compliance must be a prerequisite for the supplier to be part of further sourcing activities. Thereafter, the RFQs are sent out via the Purchasing System (PS). A copy of the RFQ package should further be sent to a Cost Engineer with the purpose of making internal calculations regarding the approximate product cost.

Evaluate Suppliers

After sending out the RFQs, the suppliers considered are given a couple of weeks to create and send quotas to Vidar. Thereafter, it's time to make a first evaluation of the suppliers. In this first evaluation, the received quotations are compared to each other with respect to cost, requirement fulfillment and supplier performance, if available. All involved stakeholders are required to ensure that the supplier fulfills all their requirements. Following the first evaluation, a few suppliers are pre-selected for further negotiations, if appropriate. Their quotations will then be challenged, and an updated quotation will be requested.

Perform Negotiations

Based on the updated quotations received, the final negotiations with the suppliers will now be initiated. Should there have been any changes to the RFQ, updated cost objectives are required from the Cost Engineer as material for the negotiations. If the supplier further has made any changes to the agreement template, the legal counsel must be involved to approve the changes before the supplier signs the agreements. After the negotiations are completed, the Sourcing Buyer must ensure that the suppliers intended for nomination fulfills all requirements, and reach all the minimum requirements for supplier performance and has signed all the relevant documents.

Approve Supplier Recommendation

After having negotiated and nominated suppliers, as well as having received all the signed documents, the Sourcing Buyer shall prepare and present the nominated suppliers at the SSG or SSC 7 meeting, depending on the monetary spend amount. The Sourcing Buyer considers all aspect in the presentation e.g. purchasing price, geography, culture / relationship, historical performance if available etc. The purpose of the SSG / SSC 7 meeting is for all stakeholders (e.g. Sourcing Buyer, P&O Buyer, global logistic representatives, material controller, product developer etc.) to once again be able to raise their concerns, and receive approval for supplier nominations in the SSG / SSC 7 meeting.

However, interviews indicated that albeit all stakeholders are involved, the SSG / SSC 7 meeting seems to be more of a formality than an opportunity to discuss the supplier alternatives. This is strengthened by the fact that in most of the cases the Sourcing Buyers' recommended suppliers are approved, albeit issues from other stakeholders are raised. For example, instances have been observed where investments in e.g. tooling and prototyping have been made before the supplier is approved at the SSG / SSC 7 meeting. These costs then influenced the choice of supplier, as the costs would be incurred once again, should another supplier have been chosen. Another example of raised issue in the interviews is that the logistic costs are not emphasized enough since the rather common case that expensive "rushed deliveries" required due to production schedule changes are not taken into account in the evaluation. The logistic costs affect the profitability of each plant, although they have limited possibilities to affect these costs, as a supplier's location is dependent on the choice of supplier, a decision where the Sourcing Buyer has final say. The final example is that although price may not be the only KPI that buyers are measured after, it appears to be the most important one. Thus, it is not unreasonable to believe that price will be prioritized over other KPIs, such as low minimum order quantities (MOQs). Consequently, material controllers must adjust to the chosen MOQ and order accordingly, sometimes resulting in abundance of material and scrapping.

Sign Agreement and Award Business

Following supplier approval, Vidar's signature is required on all relevant documents, and then be uploaded to AMS and other platforms, if necessary. The agreement administrator is responsible for uploading all relevant documents.

The two main agreements to negotiate are the "Framework Agreement" and the "Price Agreement". According to the interviews with the Sourcing Buyers, the framework agreements are the most time-consuming agreement to negotiate and also one of the most time-consuming parts in the whole supplier introduction phase.

Sourcing and Selecting CA Suppliers

Vidar has a formal process for sourcing and selecting CA Suppliers, which is a "light" version of the process for Standard Suppliers. The difference between the Standard and CA sourcing process is that CA Suppliers do not go through the standard "Supplier Evaluation Method" by Vidar. This is however challenged in some interviews, where it is argued that the requirements are the same for all suppliers, or at least that Vidar should try to keep to the standard requirements and enforce those on all suppliers including CA Suppliers.

It is the P&O Buyers' responsibility to source and select CA Suppliers and not the Sourcing Buyers'. However, as per the interviews, the knowledge about the formal CA sourcing process is low and seldom followed. The result is that some P&O Buyers have developed their own strategies and processes to source and select CA Suppliers based on their own

interpretations on formal processes and of the requirements. Two main strategies to source and select strategies have been identified:

1. Avoid introducing new CA Suppliers as the time available in a project is not enough to onboard a new supplier
2. Introducing new CA Suppliers without conducting the steps described in the formal CA sourcing process

Both strategies are consequences of the limited time the P&O Buyers are given to source and select the CA Suppliers. As illustrated in figure 15 below, the limited time P&O Buyers have to source the material is a consequence of industry segment's characteristics, as well as the time needed to incorporate all the CA parts to the product structure after the tender has been won. In the best case, as presented in figure 15, the P&O Buyers have 4 weeks to source and purchase the CA parts before serial production is scheduled to start.

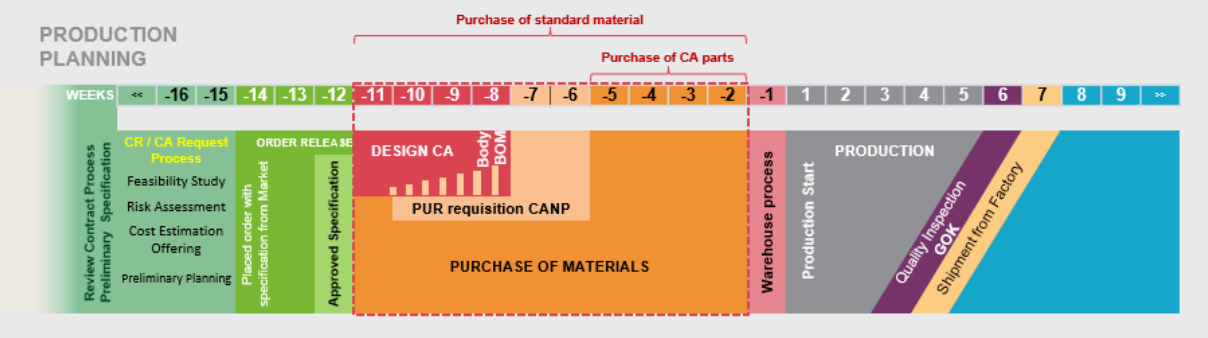

Figure 15. Production planning; design and purchasing of CA material highlighted in red dotted line

Another identified aspect of interest is that CA Suppliers may over time become Standard Suppliers as more customers require the part and volumes increase. Consequently, there is a "back door" for suppliers not needing to go through the DVP and thus there are potentially Standard Suppliers that are not meeting the requirements for being a Standard Supplier. The interviews have indicated on problems in production when CA Suppliers become Standard Suppliers e.g. capacity, quality, delivery etc. This is also, however, the case for Standard Suppliers where the introduction process is not conducted properly. Another aspect of this is that it is, again according to the interviews, worse if there are issues with Standard Suppliers since the standard parts in general are more integrated with other parts compared to CA parts. The CA parts are in larger extent isolated and thus not affect other parts or the assembly as much.

4.2.2 Hand Over 2

Between the "Source and Select AP Supplier" and "Prepare AP Supplier for Serial Production and Aftermarket", there is a handover of responsibility between the Sourcing and the P&O Buyer. This handover is in most cases "fluid", meaning that it takes place in increments, with continuous communication between the buyers. There is, however, a specific meeting

during which a specific list of pre-specified information and responsibility of the project is handed over from the Sourcing Buyer to the P&O Buyer. The list should include the following information (figure 16):

Hand Over 2 – From the Sourcing Buyer to the P&O Buyer:

- All Agreements signed / stored + up-to-date price list
- Co-signed timeplan
- Preliminary APQP timeplan
- RFQ Material
- GSP Material
- Important emails / minutes of meetings
- Business cards / Commercial presentation
- Steering committee material
- Quotation used as a base for agreement
- Supplier master data completed in Vidar systems (ISO certificate, CSR, Reach etc.)

Figure 16. Hand Over 2 checklist

4.2.3 Prepare AP Supplier for Serial Production and Aftermarket

After the supplier has been chosen and all agreements have been signed by both parties and uploaded into AMS, it's time to prepare the supplier for serial production. The process is illustrated in figure 17 below, and the activities are further explained in the following sections.

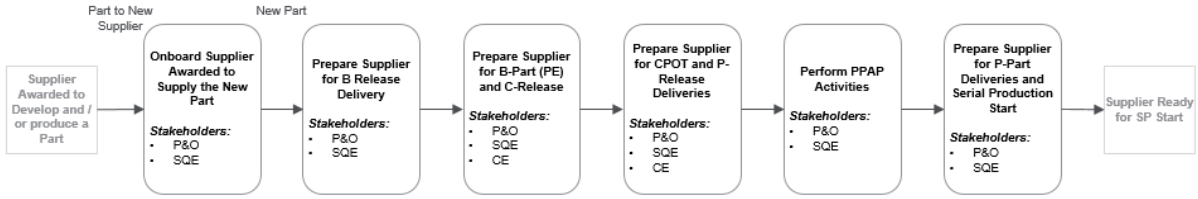

Figure 17. Vidar's "Prepare AP Supplier for Serial Production and Aftermarket" process, including key stakeholders

Onboard Supplier Awarded to Supply the New Part

In the process of onboarding the supplier to supply the new part, the P&O Buyer must first update the calculation request i.e. the quantity and timing for each part. Thereafter, the P&O Buyer sends request for a full-EDI to be integrated with the supplier. Thereafter, a review of the technical specifications (RTS) is conducted and communicated to the supplier. Following this, a kick-off with all involved stakeholders is conducted and the time plan is to be agreed upon with the supplier.

Prepare Supplier for B Release Delivery

In the preparations for B-release delivery, i.e. launch of latest update of the project, the P&O Buyer must once again conduct and communicate an RTS to the supplier and thereafter

place a development-cost order. Should there have been any changes to the technical specifications, these should be checked and re-calculated by the cost engineer.

Prepare Supplier for B-Part and C-Release

Before the B-part and C-release, the P&O Buyer further update and communicate the RTS to the supplier, and thereafter update the Calculation Request (CR). Thereafter, it's time to create a prototype order and update the Tooling Request, which also needs to be sent to the cost engineer. Should there have been any updates or changes, all involved stakeholders must be informed and the changes should be checked by the cost engineer. Lastly, the time plan should be followed up and agreed upon by internal stakeholders and the supplier.

Prepare Supplier for Conforming Part out of Tool and P-Release Deliveries

In these preparations, the work appears quite similar. Another update of the RTS needs to be made and communicated to the supplier, and the CR should be updated. Thereafter, the "tooling funding-request" should be updated and checked with the cost engineer. Following changes in costs then needs to be communicated to all stakeholders. Thereafter, the P&O Buyer places the tooling-, production material- and "Conforming Part out of Tool" (CPOT) order.

Perform Production Part Approval Process Activities

For the production part approval process (PPAP), once again, the RTS needs to be updated by the P&O Buyer and communicated to the supplier. Then, the P&O Buyer needs to change the "production material order" to the latest issue. Thereafter, the Supplier Quality Engineer (SQE) needs to perform an external process audit of the supplier's facilities as per Vidar's internal supplier evaluation model. According to the interviews, this activity only seems to take place for key components.

Prepare Suppliers for P-Part Deliveries and Serial Productions Start

In the preparations for the P-part deliveries and serial productions start, the P&O Buyer needs to first conduct a follow-up meeting with the supplier. Thereafter, all development costs need to be secured and the tooling costs need to be paid and the tools need to be labelled with Vidar's own label. The P&O Buyer must further secure that all agreements and amendments are signed and stored, and then update the forecasted price. After all this has been done, the P&O Buyer conducts a handover to "him / herself", as the project-phase ends and the operations-phase begins.

4.2.4 Setup of IT Systems

This section covers the activities and costs related to IT, and consists of costs related to adjustment of current systems, costs related to setup of new system connections, and finally costs related to testing and adjusting established setup. These will be further explained below.

Costs Related to Adjustment of Current Systems

When a supplier has been chosen and all agreements have been signed, they need to be added to AMS, which is done by the Agreement Administrator. When a new supplier then is brought into Vidar, the first thing that needs to be done is giving the supplier a PM-ID and status, which states what business is allowed with the supplier in question. PM is Vidar Group's supplier register and contains supplier data such as legal information, addresses, bank details etc. To give the supplier a PM-ID, it firsts needs to be added to PM, which is done by a central function in Vidar Group, which results in no direct costs for Vidar. The supplier further needs to be approved for access to the supplier portal, which is done by the Sourcing Buyer.

Cost Related to Setup and Adjustments of New System Connections

When a new supplier is brought into Vidar, several system-setups are required before serial production business can start. Firstly, Vidar aims at all their suppliers should have EDI, or at least web-EDI, through which messages regarding production schedules, material orders and forecasts can be automatically communicated to suppliers. The setup of EDI and web-EDI is currently outsourced by Vidar to an IT-consultancy firm, which then bills Vidar by an hourly basis.

The proportion of suppliers that do not have EDI connections is considerably higher at Manufacturing Site 2 compared to Manufacturing Site 1. At Manufacturing Site 2, only 42 % of suppliers have EDI connections. Regarding EDI coverage of part numbers and invoices, Manufacturing Site 2 has 89 % and 69 % coverage, respectively, whereas Manufacturing Site 1 almost has complete coverage in both areas. The main reason for this is again the higher proportion of CA Suppliers at Manufacturing Site 2. Since the CA parts may differ for each tender and consequently, the volumes sourced from each CA Suppliers are relatively low. Interviews have indicated that due to the low volumes, CA Suppliers do not consider Vidar as top priority and, in combination with no formal requirements from Vidar's side, rarely invest in setting up EDI.

Suppliers further need to be connected to Atlas, the transport management system used by Vidar. Through Atlas, suppliers can then book transport when they have planned their production and know when their goods are ready for collection. In the process of setting up Atlas, suppliers must add data, but the buyers are also responsible for filling in basic data as location etc.

From a factory perspective, there are also several systems that need to be manually setup before the supplier can be taken into business. PLUPP, the MRP system, will receive most of the information through its connection to PS, but some manual adjustments still need to be made. The same goes for FRED, the warehouse management system.

Following the setup of the new system connections, these need to be tested and sometimes adjusted before being able to put into practice. This is applicable to all systems; EDI, web-EDI, Atlas, and the factory specific systems – however the times needed to check and adjust the connections may vary.

4.3 Supplier Maintenance

After a supplier is chosen and has been prepared for serial production, it continues to ongoing business i.e. serial production. During this ongoing business-phase, several activities are needed to maintain and develop the relationship to keep business running smooth. Activities here include managing packaging material, transportation of material, goods reception and material handling at the manufacturing sites, invoice and payment processing as well as supplier relationship management activities. With respect to the purpose of the study, only costs and activities with a direct correlation to the number of suppliers will be considered.

4.3.1 Managing Packaging Material

Vidar places high emphasis that suppliers uses Vidar's Packaging Material. This is to increase handling efficiency at the own plants, and in storage facilities. It further used to heighten utilization-rate in transport and reduce the risk for damages.

Vidar manages its Packaging Material against suppliers in two ways: Either through "pull" or through "push". In the pull system, the supplier simply places an order for more packaging material when they are about to run out, whereas Vidar plans and executes the transport of the material. In the push-system, Vidar calculates approximately how much packaging material the supplier will need for e.g. the next 3 months and then plans and executes the transport.

With the same reasoning as for the EDI setup i.e. due to the low volumes resulting in that CA Suppliers do not consider Vidar as top priority, in combination with no formal requirements from Vidar's side on packaging, CA Suppliers often argue that using Vidar's packaging is too much work for too little value add.

4.3.2 Transport Material

An extra active supplier in Vidar's supplier base implies another pickup, or another new route in the transport network. Vidar's manages its transportation network through its "Logistics Department" (LD), which plans and executes collections from supplier plants. After the supplier has received a delivery schedule from Vidar and plans its production, the supplier then books transport through Atlas, for the goods to be picked up when ready. LD then plans the collection of the goods, and then either drives the goods strait to a Vidar

plant or through a "Vidar Managed Logistics Center" (VMLC) for repackaging and / or storage, and thereafter to the plant when necessary.

Should the supplier be an overseas supplier, the new route will further imply the setup of a new, or configuration of an existing, regional distribution hub to ensure shorter lead time to the plants. The hub can be either owned by Vidar, owned by a third party and managed by Vidar, or it can be both owned and managed by a third party, depending in the situation. The goods are usually transported by sea to the hub, in which the goods are then stored until called off by the factory.

4.3.3 Goods Reception and Material Handling

Further activities that have a connection, even if not linear, is the goods reception at the plants in the sense that more suppliers may result in more deliveries, which in turn consumes more time. It is not the "unloading" of the truck that will consume more time per se (since the volumes should be the same), but rather the time it takes to pull up the truck, open it, close it, and lastly driving away. These are all activities that are perfectly correlated with the number of deliveries.

4.3.4 Invoice and Payment Handling

The number of suppliers also has a connection to the number of invoice that need to be processed. Increasing the number of suppliers will likely result in more invoices for the finance department to process.

4.3.5 Supplier Relationship Management

Vidar has several activities, both scheduled and unscheduled, to maintain existing supplier relationships. These activities range from meetings to check up on progress on specific collaborations, checks to ensure quality and delivery precision and negotiations to sporadic activities as e.g. updating supplier contacts, financial information or addresses and communications in the daily operations. These activities are presented below.

Business Review Meetings

Sourcing Buyers have the responsibility to conduct so called Business Review Meetings (BRMs), which are continuous evaluations of supplier performance. These are conducted for suppliers that make up the top 80% of Vidar's spend, suppliers of strategic importance and / or for suppliers with issues. The meetings are conducted on a yearly basis.

Quality, Delivery, Cost and Relationship Meetings

These meetings are similar to the BRMs conducted by the Sourcing Buyer, with the difference the Quality, Delivery, Cost and Relationship meeting (QDCR) is conducted by the P&O Buyer at a lower strategic level. QDCRs are supposed to be conducted at suppliers with repeatedly bad performance or problems regarding quality, delivery, cost and relationship, which is evaluated and assessed through scorecards.

Certification Updates

The “supplier host”, i.e. the Sourcing Buyer for standard / variant parts and the P&O Buyer for CA parts, is responsible to check up on and update all certificates and agreements. This is done during certain time intervals depending on the document-type.

Information Updates

The supplier host is further responsible for updating all relevant supplier information, such as financials, contact persons and addresses. At least something per supplier needs to be changed every year.

Re-Negotiations

Even further responsibilities of the supplier host include re-negotiating prices with suppliers, given certain time intervals. This happens either when the existing price agreements terminates, when the supplier has been awarded with new business, or during a BRM.

Supplier Communications and Deviation Handling from the Plants’ Perspective

Communications with suppliers in the daily work that arises from issues is correlated to the number of suppliers, i.e. a higher number of suppliers result in higher workload. This, however, looks somewhat different in Manufacturing Site 1 and Manufacturing Site 2. The first difference between Manufacturing Site 1 and 2 is that Manufacturing Site 1 schedules production with a 15-day planning horizon, whereas Manufacturing Site 2 schedules the production with a 4-week planning horizon.

Two activities are mainly affected by the number of suppliers at Manufacturing Site 1. Firstly, the goods reception time is connected to the number of suppliers, as explained in previous sections. Secondly, it’s deviation handling. When something goes wrong, it’s more work for a material controller to communicate with e.g. six suppliers than with two.

At Manufacturing Site 2, four activities are affected by the number of suppliers. Goods reception is affected in the same sense as for Manufacturing Site 1, and the same goes for deviation handling. There are, however, more deviations at Manufacturing Site 2. This is due to the longer “frozen production time”, lower degree of automation and the higher proportion of CA Suppliers. Changes in the production schedule at Manufacturing Site 1 are communicated automatically to supplier through EDI, whereas selected suppliers lacking EDI have to be manually contacted at Manufacturing Site 2 to check whether the changes are acceptable. The third activity affected is the material planning. At Manufacturing Site 1, the MRP system takes care of the material planning automatically, whereas there are some manually interventions to the MRP system at Manufacturing Site 2, mostly connected to the short lead time and changes in production schedule. The number of suppliers then impacts how many different contacts the material planner needs to make when ordering material for

production. The fourth activity affected at Manufacturing Site 2 is the “speed-sourcing” that needs to be done for every new customer order. Whenever there’s a new article, or changes to an old one, P&O Buyers at Manufacturing Site 2 have to go through a “speed-sourcing” for every new article, and the workload here is correlated here to the number of suppliers. Again, interviews indicated that CA Suppliers, or the CA parts, drive the need of “speed-sourcing” since those are developed in a later stage in the process. Please see the figure 15 again for the short time available for sourcing CA parts.

4.4 Supplier Removal

In the termination of a supplier relationship, costs may arise from activities that are connected to the direct removal of a supplier. These are the actual activities taking place to remove the supplier, and the activities needed to ensure the future supply of the supplier’s parts.

4.4.1 Removing a Supplier

First, there are activities connected to remove a supplier, such as removal of supplier access to systems, information deletion etc. However, the interviews conducted by the authors indicate that these activities are not always carried out by the responsible buyer. Instead, the suppliers end up in an inactive state in the systems. An inactive supplier refers to a supplier that is in PM but no current business is conducted with them. Interviews have indicated that both Sourcing and P&O Buyers have different views on the inactive suppliers.

The general view among the buyers is that inactive suppliers don't bother too much but that they always require some time and energy because issues always seem to appear e.g. active suppliers are confused with inactive suppliers, updates and controls are required albeit the supplier is inactive and so on. Therefore, buyers would prefer the inactive suppliers to be removed from the system, i.e. PM. On the other hand, especially P&O Buyers responsible for segments with high degree of CA parts, some personnel see a value to have a big inactive supplier base with CA Suppliers to send out more quotas and thus easier source unique CA parts.

4.4.2 Future Supply of Parts

Secondly, the main workload in removing a supplier is derived to what happens to the supplier’s parts; either the parts are only required for the aftermarket and the responsibility of sourcing these parts will then be transformed to either the Aftermarket Purchasing department or a specific P&O Buyer with responsibility for aftermarket parts, depending on location. If the parts are still being in use, the supply will be transferred to another supplier. Should a supplier relationship be terminated, future supply of the part must be ensured by either awarding another supplier the business, or shift the responsibility of the supply to the Aftermarket Purchasing department or the aftermarket P&O Buyer. When choosing another supplier to supply the part, either an existing or a new supplier can be chosen. Should a new

supplier be rewarded with supplying the part, a similar process to “Prepare Supplier for Serial Production Business through APQP” will be initiated, and the costs are supposed be similar. Should an existing supplier be chosen, the process will be somewhat shorter and the costs will be lower.

If the product, for which the supplier in questions supplies one or several parts, is taken out of production, Vidar still must have access to parts for service for many years. The number of years varies, of course, depending of different legal settings, however 15 years is a somewhat common standard according to interviews with Vidar.

5 Analysis

The analysis section further examines what drives cost in Vidar's systems and ways of working, with basis in literature and analysis. The section follows a similar structure as the previous section, with an addition of a quantitative part and an ending section that qualitatively discusses the issues arising from a complex supplier base as well as how the number of suppliers affects the supplier base.

5.1 Overview of Vidar's Sourcing and Supplier Relationship Process

O'Brien (2012) states that category management demands a classification of third-party costs which thereafter can be processed, reduced and mitigated through the optimal sourcing strategy for the product in question. In line with the findings by the authors in section 4.1, it appears that Vidar has a well-developed long-term strategy for how they work with segments, or purchasing categories, as they have several strategies to define segments depending on the differing needs of the products. As stated by O'Brien (2012), a company working with purchasing category management needs both an overall sourcing strategy as well as specific strategies for the different segments, in line with how Vidar operates.

Furthermore, defining segments by product area facilitates the avoidance of issues with product structure as the buyer has a comprehensive overview of what parts will work together, and what parts will not. Segments defined through the strategic importance of the product helps reduce the transactional costs for products of higher strategic importance, whereas the product cost is reduced through transactional market behavior for easily accessible material. Segments defined by the knowledge-requirements of the buyer further helps reduce the risk of quality issues and supply risk, as Vidar can conduct a more rigorous review of both the product as well as the supplier's production processes.

5.2 Supplier Introduction

This study and the supplier introduction part will focus on the activities that drive costs when there is a new supplier introduced. Costs that will occur independent of the selection of suppliers will thus not be considered. Again, the scope will start after the Sourcing Segment Strategy, which is conducted to align and facilitate the sourcing decisions, to when a supplier is chosen and prepared to deliver to serial production. This means that the scope covers the Sourcing Buyer's responsibilities and the P&O Buyer's responsibilities until the serial production starts.

The supplier introduction phase consumes different amounts of resources, depending on whether the supplier has previously worked with Vidar, or Vidar Group, and whether the supplier has any experience of the automotive industry. What mainly drives work is then the need to thoroughly explain Vidar's demands and further assess if the supplier really is industrially capable. Thus, the workload intensity are categorized as follows:

- Suppliers new to Vidar, without industry experience

- Suppliers new to Vidar, with industry experience
- Suppliers new to Vidar, existing within Vidar Group
- Current suppliers to Vidar

An interesting aspect to add is Vidar's own maturity and how this affects the supplier relationship, more about this later.

5.2.1 The Sourcing and Select AP Supplier

Cost drivers related to the Sourcing and Select AP Supplier process are aligned with the frictional costs described by Choi and Krause (2006), e.g. identifying qualified suppliers, making sure they meet standards, monitoring suppliers, enforcing agreements etc. Before going through each step in the Sourcing and Select AP Supplier process and discuss the cost drivers, the process is again illustrated for a recap below in figure 18.

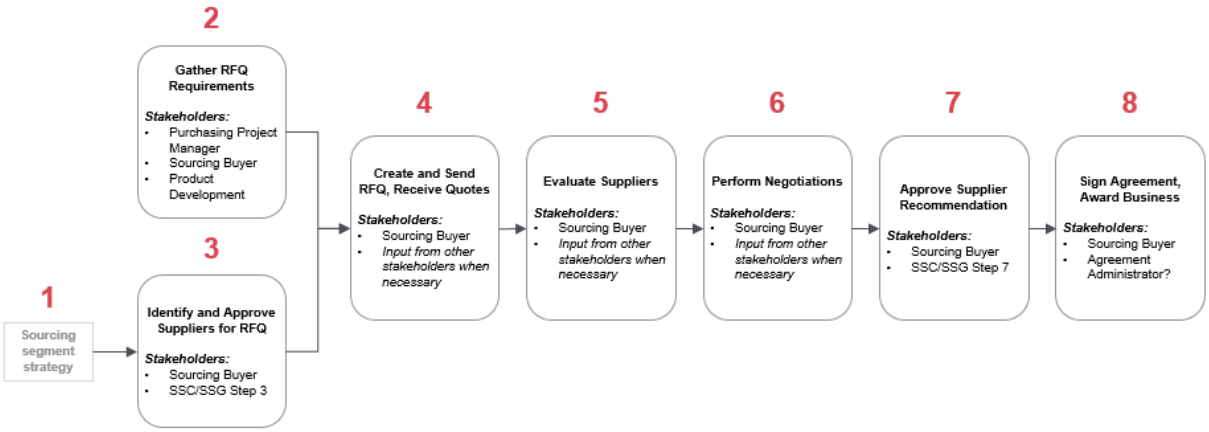

Figure 18. Vidar's "Source and Select AP Supplier" process, including key stakeholders

Gathering RFQ Requirements

The work in this phase is mostly driven by labor. The bulk of the work is made up of internal collaboration between product development, sourcing, the cost engineer, the legal department etc. to get in contact with the right people and gather all the requirements. The work is, however, not possible to derive to specific suppliers; it needs to be done independent of the number of suppliers and is thereby also independent of suppliers' previous experience.

Identify and Approve Suppliers for RFQ

The work of identifying and approving suppliers for RFQ is primarily made up of searching the existing supplier base for potential suppliers to use, and sometimes use external sources in the search of new suppliers when the existing supplier base is insufficient to satisfy the needs. Costs are thus driven by labor. The work here is connected to the number of existing suppliers, in the sense that the workload gets lower as the supplier base gets larger. Suppliers for new parts are further more likely to be found in the existing supplier base when it is large. The work is further somewhat segment-dependent, meaning that for some

segments there might be a predefined limitation on how many suppliers that are available, due to e.g. legal demands, technical knowledge, or intellectual property restrictions.

Create and Send RFQ and Receive Quotas

Costs are also driven by labor in this activity, characterized with lots of internal collaboration and communications with suppliers to ensure mutual understanding of the terms / demands. The work here is connected to the number of suppliers in the sense that the more suppliers that are evaluated, the more work needs to be done. The workload is further dependent on the study's categorization, as new suppliers, and / or without industry experience, demand significantly more time in explaining and ensuring mutual understanding of e.g. terms, demands and technical specifications.

Evaluate Suppliers

The work of evaluating suppliers mainly consists of internal collaboration and communication with suppliers. Costs are driven by labor. Like with the RFQs the workload is connected to the number of suppliers in the sense that the workload increases with the number of suppliers. The workload is further dependent on the study's categorization, in the sense that the quality assurance process needs to be more thorough with new suppliers, and / or with supplier without industry experience.

Perform Negotiations

When preparing for negotiations with suppliers, most of the work constitutes from communications with suppliers and the internal work of preparing. Costs are driven by labor. The workload may be connected to the study's categorization, in the sense that it is easier to negotiate with suppliers already within the Vidar Group, due to the bargaining power associated with consolidated purchases.

Approve Supplier Recommendation

As mentioned, suppliers are approved at the SSC / SSG 7 meeting, and the preparations consist mainly of internal collaborations. Costs are driven by labor, and there is no clear connection to the number of suppliers in the supplier base. There is further no clear connection to the categorization in the study.

However, as described in the empirical findings, in the SSC / SSG 7 meetings, interviews have showed instances where the decision is more or less already made, making the meeting rather a formality than an opportunity for all stakeholders to provide input. Issues raised in the empirical findings, e.g. that the tooling costs already are invested in for the supplier that was used for the prototype and that the investment would occur once more, should the supplier be changed. Should this issue not be confined to an isolated incident, could this be considered a lock-in effect for a supplier that was not properly selected. This goes in line with what Weele (2005) refer to as technical risk and that companies, Vidar in this case, end

up sourcing from established suppliers due to former positive experiences, albeit this is not necessarily the best one. However, it is important to state that the authors do not know the magnitude of the occurrence of these types of issues, however it remains an important area for future research.

Further empirical findings showed that some departments are measured after KPIs they have limited power to influence. To illustrate, the logistic costs affect the profitability of each manufacturing site. Should the SSG / SSC 7 meeting not be enough for the manufacturing site to communicate their needs or preferences, the logistic cost would be hard for the sites to influence once the supplier has been chosen. This would then be an example of when KPIs are not aligned with the area of responsibility of the department. As these are single observations, it would be bold to make statements regarding the magnitude of this issue, however it remains an interesting and important area for future research. Further findings regarding the KPIs is that price is not the only KPI for buyers, however it appears to be the most important one. Thus, it would not be unreasonable to believe that price will be prioritized over other KPIs, such as low minimum order quantities (MOQs). Consequently, material controllers must adjust to the chosen MOQ and order accordingly, sometimes resulting in abundance of material and scrapping.

Another aspect is the relationship aspect where Sourcing Buyers argue in line with Choi and Krause (2006) i.e. that close relationships and open communication will improve the supplier responsiveness, more effective communication and easier to handle the collaboration. However, this may sometimes be from the view of the Sourcing Buyers' and not from the plants perspective. The perspective of the people who will interact with the supplier on a daily basis, e.g. material controllers and P&O Buyers, may not be equally considered. Choi and Krause (2006) also discuss this by arguing that activities between the focal company and its suppliers become easier to coordinate when suppliers are somewhat homogeneous in culture, work norms and closer to each other geographically. The rationale behind the decision may thus be sound, however in practice the wrong perspective may influence the final decision too much.

Sign Agreement and Award Business

As previously described, the activities needed after the supplier selection are to get Vidar's signature on all documents and thereafter upload them into AMS. The cost drivers of these activities are labor, however there is no connection between the workload and either the study's categorization or the number of suppliers in the supplier base.

5.2.2 Hand Over 2

The handover of responsibility between the Sourcing and the P&O Buyer is again illustrated below in figure 19.

Hand Over 2 – From the Sourcing Buyer to the P&O Buyer:

- All Agreements signed / stored + up-to-date price list
- Co-signed timeplan
- Preliminary APQP timeplan
- RFQ Material
- GSP Material
- Important emails / minutes of meetings
- Business cards / Commercial presentation
- Steering committee material
- Quotation used as a base for agreement
- Supplier master data completed in Vidar systems (ISO certificate, CSR, Reach etc.)

Figure 19. Hand Over 2 checklist

The bulk of the work when preparing for the handover consists of internal collaboration in preparing the P&O Buyer, and ensuring all the relevant documents are in place before the handover takes place. Costs are driven by labor, which are not connected to the number of suppliers in the supplier base. The handover may be somewhat more complex, when the supplier lacks industry experience or when it is new to the Vidar Group.

5.2.3 Prepare AP Supplier for Serial Production and Aftermarket

The Prepare AP Supplier for Serial Production and Aftermarket process is again illustrated below in figure 20.

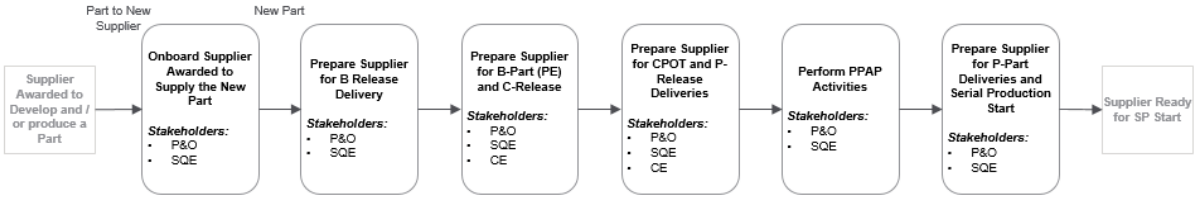

Figure 20. Vidar's "Prepare AP Supplier for Serial Production and Aftermarket" process, including key stakeholders

Most of the work in the preparation-phase consists of, like the sourcing phase, internal collaboration and communications with the supplier. Costs are also mainly driven by labor. However, the workload in practically all activities during this phase is connected to the study's categorization. Communication and collaboration with suppliers new to the Vidar Group, as well as suppliers without industry experience, consume a higher workload from Vidar's part. This holds true for all activities, ranging from onboarding the suppliers, preparing for all the release-gates and for all the activities connected to quality assurance. As stated earlier, PPAP is only conducted for a higher quality assurance, given the key components' higher importance for Vidar.

5.2.4 Setup and Adjustments of IT Systems

The costs of setting up the IT-systems are driven by labor, as it is the actual work of setting up and testing system connections and adjustments of existing systems that are considered from Vidar's perspective. Some of the systems, i.e. EDI and Atlas, have a clear connection to the study's categorization in the sense that new suppliers, or suppliers without industry experience, are more expensive and thereby more time-consuming to setup. The factory-specific systems, and adjustment of systems within the Vidar Group, does only appear to have a connection to the study's categorization if the supplier is already an existing supplier to Vidar, otherwise these systems will need to be setup and adjusted independent of whether the supplier is within the Vidar Group and has or hasn't any industry experience.

5.2.5 Limitations Related to Supplier Introduction

Supplier Involvement in Product Development (SIPD) projects are unique projects in which Vidar and selected suppliers collaborate to conduct special parts or products. SIPD projects are only carried out under specific circumstances and thus not appropriate to include in scope.

In the Product Development Process (DVP) the study covers the processes that Global Purchasing are responsible for, from where the Sourcing Buyers initiate the work until the product goes in to serial production. Other processes, e.g. Calculation Request (CR), Tool Requisition (ST) and New Part Requisition (NP), conducted by Global Manufacturing in the DVP process and the Product Development are equally important but the costs related to these processes are not possible to derive to one supplier, i.e. the work must be conducted independent of the suppliers. Consequently, these activities are out of scope.

A limitation of the supplier introduction phase is the difficulty associated with making clear definitions in the categorization made by the authors. While the biggest differences in labor appear to be between the categories, large differences in time-consumption may also occur within the categories. The same goes for differences within Vidar's segments (purchasing categories), i.e. the study has not managed to capture differences in time-consumption between segments.

5.3 Supplier Maintenance

All relevant activities and cost drivers that are connected to maintaining supplier relationships are presented based on the material and information flow.

5.3.1 Managing Packaging Material

As covered in the previous section, managing the packaging material is a necessary activity for maintaining supplier relations, at least with the suppliers that use Vidar's packaging material, which in Manufacturing Site 1 are almost all. Cost drivers of this activity are initially planning the transports of packaging material to the supplier, i.e. labor. Further cost drivers

are then the actual transportation to supplier plants and the number of transports, i.e. whether the supplier uses a push or a pull system. The transportation cost is further affected by the distance and utilization rate of the vessels. If new packaging material needs to be produced, further costs will be incurred for LD.

Albeit the workload related to the packaging material decreases for those CA Suppliers that do not use Vidar's packaging, other costs occur in due to the lack of Vidar's packaging. As described in the empirical findings, Manufacturing Site 2 experiences increased damages on goods when to Vidar's packaging is not used. This is because the material cannot be handled in the intended way at the goods reception. Furthermore, without Vidar's packaging material, the material cannot be stacked safely in the vessels, decreasing the utilization of the vessel and increasing the risk of damages during the transport.

5.3.2 Transport Material

Another supplier in the supplier base will further incur one extra collection site, or one extra route. If the supplier fits into the existing distribution network, i.e. only an extra collection is required, the costs incurred will be lower than for an entire new route. If the supplier does not fit into an existing distribution network, an extra route will be needed resulting in higher costs. The number of transports and the lengths of the transports are further drivers of costs, from a logistics perspective. Depending on geographical distance, there appears to be big differences whether the supplier comes from the Nordics, Europe or overseas. In the case of an overseas supplier, further costs will be incurred through negotiations and setups or configurations of regional distribution hubs to ensure shorter lead times. Even further cost drivers are the utilization of the vessels and the usage of Vidar's packaging material.

As described in the empirical findings, there are different views on the transport material and logistic costs and how to estimate these between the divisions. Pandit and Marmanis (2008) discuss challenges related to spend analysis, i.e. that different cost centers and general ledgers between divisions make it harder to have a company-wide perspective and derive costs to the root causes. Similar problems hamper Vidar since the Sourcing Buyers select suppliers and are "responsible" for the material costs, i.e. the plants are not responsible for material costs. On the other hand, the logistic costs are "put on the plants' financial statements" whereas they have limited possibility to influence them. Again, this empathizes the importance of having a company-wide perspective and work in cross functional teams.

5.3.3 Goods Reception and Material Handling

How the number of suppliers drives costs with a connection to goods reception, or material handling, is not entirely intuitive, as the material needed in production isn't dependent on the number of suppliers. The activities around the deliveries, however, drive costs. The cost drivers seem to have the same characters as for the transport, i.e. another supplier in the

supplier base that fits into the existing distribution network would incur one extra collection but would not have any greater impact on the goods reception. Another supplier that would require one extra route would however increase the goods reception workload since it would result in more deliveries and hence, the associated activities would incur further costs. However, worth mentioning is that this may not be a linear relationship due to the existence of regional distribution centers, where goods may be occasionally stored and repackaged onto other vessels.

The unloading of the goods may not result in further costs, but it is rather the time it takes to pull up the truck, open it, close it and drive away (i.e. the waiting time) that is connected to the number of suppliers and deliveries, and thus drives costs through labor. However, it is important to stress that it is the correlation between the number of suppliers and number of extra deliveries that is of interest to understand to quantify this parameter.

5.3.4 Invoice and Payment Handling

Invoice and payment handling drive costs in the sense that more suppliers will result in more invoices. The costs are incurred through more time needed to process the invoices, i.e. labor.

5.3.5 Supplier Relationship Management

The relationship management activities discussed under section 4.3.5 are mainly driving costs through labor, however some other different cost drivers occur depending on the activity. These will be discussed in the following sections.

BRM and QDCR Meetings

Both BRMs and QDCRs drive costs through labor, occurrence and number of suppliers. These usually take several days for the responsible buyer to prepare for, and another half a day to execute the actual meeting with the supplier. These are not conducted for every supplier, however, but are often limited to suppliers with high spend, suppliers with certain issues or suppliers of strategic importance. Choi and Krause (2006), argues that developing and maintaining an exchange relationship, monitoring exchange behavior and guarding against opportunistic behavior in an exchange situation all are costs related to the supplier relationships. The BRM and QDCR meetings are example of such costs.

Certification Updates

As stated, it is under the responsibility of the supplier host to ensure that all supplier certifications and agreements are up to date in Vidar's supplier information base. If they are not, the supplier host is further responsible to update the documents in question. Costs in this activity are driven by labor, which are further affected through the number of suppliers, number of certificates, how much time it takes to update a certificate and lastly, how often it needs to be done.

Information Updates

The supplier host is, as previously mentioned, further responsible to update information about suppliers when necessary. This can occur whenever the supplier has changed any information, but does not have the authority to change the information in Vidar's systems. This may happen when e.g. the company name, financial information or addresses are changed. Cost drivers in this activity are then the number of suppliers, time needed per update and how often updates are necessary.

Negotiations and Re-Negotiations

Another activity under the responsibility of the supplier host is re-negotiating price agreements with suppliers. This happens either when the price agreement runs out, which typically is after 3 years, when the supplier is awarded new business or during a BRM. Cost drivers in this activity is then the number of suppliers, the occurrence of negotiations, and the time needed to prepare for and conduct a negotiation.

Special Projects

Sometimes events occur, which triggers activities that need to be conducted for all suppliers. These may be updated CSRs that need to be communicated to all suppliers, e.g. material phase-outs in parts, updates on supplier requirements, or a renewal of Vidar's framework agreement. What drives cost here is then the number of suppliers, the occurrence of special projects, and the time needed per activity and supplier.

Supplier Communications and Deviations Handling

Much of the activity connected to suppliers from the plants' perspective is associated with deviation handling, and is done mostly by material controllers. The number of suppliers is in this case driving costs, in the sense that when deviations occur, several suppliers are likely to be involved in either the problem or the solution. The number of deviations and the time needed to solve the deviation are further cost drivers. The "speed-sourcing" that has been previously explained is also driving costs for the P&O Buyers at Manufacturing Site 2, in the sense that it consumes a considerable amount of time whenever there is a new customer order with many article generations. This issue is, however, mostly observed for CA parts, however it might be of further interest to investigate in which segments most generations of article numbers occur.

5.3.6 Limitations Related to Supplier Maintenance

When a current supplier to Vidar is in the supplier base, only processes and costs that can be derived to a change in the number of suppliers in the supplier base are taken in account and thus included in the scope. IT maintenance and regular updates are required but not included in the scope of two reasons: Firstly, albeit the amount of data is one driver of the maintenance and updates, today's systems utilize a neglectable data amount for each supplier (Magnusson, 2017) i.e. the number of suppliers is not a cost driver. Secondly, one

would not be able to realize the potential savings from maintenance or updates by reducing the number of suppliers in the system (Magnusson, 2017). So even though IT costs are of considerable magnitude, a change in the number of suppliers would most likely not affect the IT costs, which is why the IT system and the maintenance of it is considered out of scope for this study.

In relation to the inbound logistics there are two main delimitations. First, the planning and optimizing of transport network, which is conducted by LD, is neglected since this must be conducted independent of the number of suppliers. Furthermore, costs related to inventory are excluded since the parts must be kept in store independent of the number of suppliers. Further limitations have occurred in the approximation and estimation of the costs associated with managing Vidar's packaging material. As this cost is hard to model, the authors would have had to work with existing case studies or data form Vidar. However, there have been issues in collecting this data, which is why the cost of managing Vidar's packaging material has been neglected. It is, however, important to stress that Vidar Group currently has a global network supplying suppliers with Vidar's packaging material, which is why this issue does not appear to be of major importance. Furthermore, costs related to goods reception have also been neglected due to difficulties in obtaining data, which is considered a limitation for the study. However, this issue is considered to be of minor importance, as the study only focuses on the delta cost of having a supplier. Thus, only the time of pulling up, opening, closing and driving away with the truck would be considered per delivery, and not the time to unload the goods as that activity would occur independent on the number of suppliers.

An important aspect of suppliers and the number of suppliers are the manufacturing and warranty risk. However, quality issues and related cost are hard to quantify since the issues are occurrence driven and the costs are highly specific for each case i.e. it is difficult to estimate probabilities and generalize the impact. Thus, the manufacturing and warranty risk is a limitation but the time spent by the material controllers and others at the plants as well as by the P&O Buyers are captured in other parts of the study. Furthermore, the study covers ongoing processes to maintain and develop supplier relationships. Finally, the order creation process is out of scope since all parts must be ordered and are thus, according to interviews with buyers at Vidar, not driven by the number of suppliers.

5.4 Supplier Removal

In the empirical findings, the authors identified two potential cost drivers related to remove suppliers. First, costs connected to activities such as removal of supplier access to systems, information deletion etc. and secondly, cost connected to and derived from what happens to the supplier's parts.

5.4.1 Removing a Supplier

Costs related to this phase of removal of suppliers are mainly driven by labor. However, as described in the empirical findings, Vidar rarely carries out the activities as intended, e.g. removal of supplier access to systems, information deletion etc. Consequently, no costs from direct workload are reasonable to derive to the supplier. On the other hand, there are other aspects to consider.

Weele (2005) highlights issues that could arise when companies cannot send out brand or supplier specifications and thus must send out functional specifications. One could argue that not owning patents or developing and designing the parts in-house would increase the risks. Consequently, the complexity increase and thus the switching cost for changing and removing suppliers increases. With the same logic, one could argue that a higher degree of supplier integration is good as long as the company is able to invest and maintain the relationship, but once the supplier is removed the switching costs would likely be high.

5.4.2 Future Supply of Parts

The second cost category, cost connected to what happens to the supplier's parts, is driven by the number of suppliers and how many parts that are supplied. More specific, the cost driver is the time needed to prepare for and hand over the responsibility to the Aftermarket Purchasing department or the aftermarket P&O Buyer. Even though differences in how aftermarket parts are handled have been observed, the study has not investigated the operational or organizational impacts of the differing strategies at a deeper level. Thus, the area may be of interest for future research.

5.5 Cost Drivers Summary and a Quantitative Approach

In this section, a summary of the cost drivers and analysed quantitative data is presented. Throughout the project an activity-based costing approach (Cooper and Kaplan, 1988) has been used but instead of deriving costs to a product, the costs have been derived to suppliers. The output has been converted to relative size (where applicable), the highest cost is presented as 10 i.e. the Transport Material cost. The identified cost drivers as well as their relative cost are presented in figure 21.

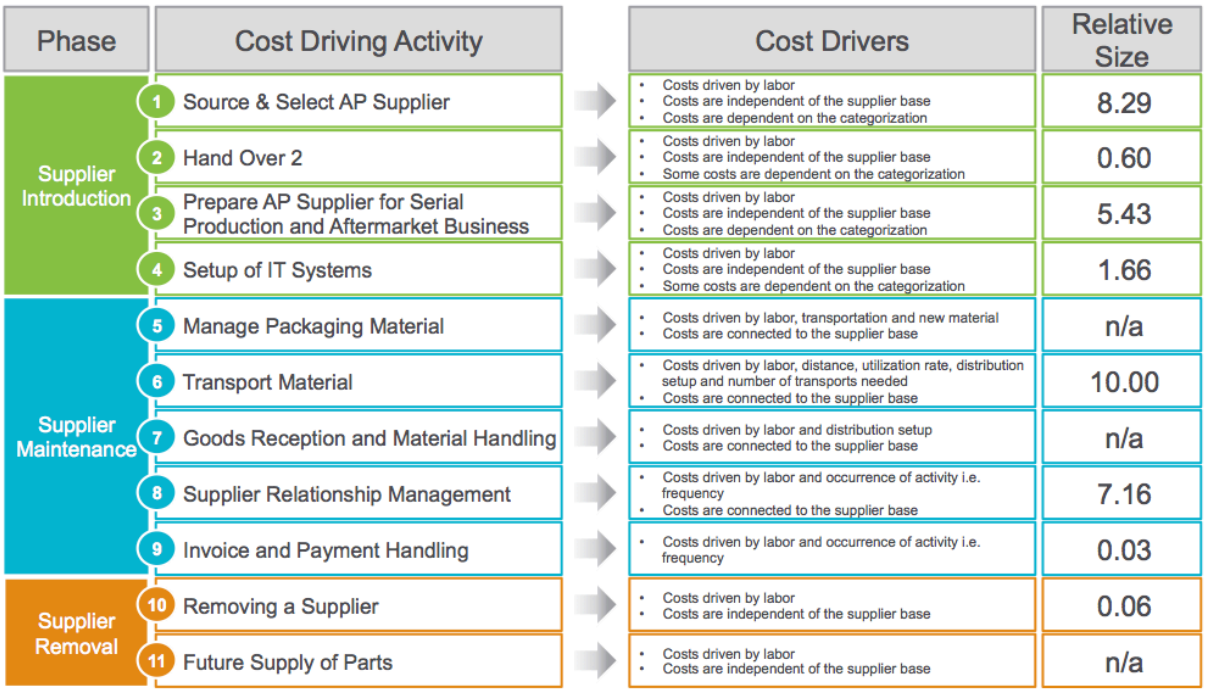

Figure 21. Summary of cost drivers and their relative cost

As Cooper and Kaplan (1988) argue; *"Activity-based costing is not designed to trigger automatic decisions. It is designed to provide more accurate information about production and support activities and product costs so that management can focus its attention on the products and processes with the most leverage for increasing profits. It helps managers make better decisions about product design, pricing, marketing, and mix, and encourages continual operating improvements".* Hence, the estimated costs aim at increase Vidar's own knowledge and give an idea of what "ball park" they are playing in regarding indirect costs related to supplier relationships.

5.6 Aspects to Consider on Number of Suppliers' Effects on the Supplier Base

As described in section 5.2-5.4, the number of suppliers has a direct impact on the costs related to the supplier base much due to the increased work required in introducing, maintaining and removing suppliers. However, the number of suppliers has further consequences, which are described in this section.

5.6.1 Business Advantage and Costs of Missed Opportunity

It is important to highlight that there may not be a linear relationship between time savings and the number of suppliers when talking about the importance of supplier removal. It is not unreasonable to argue that the time savings of going from e.g. four to three suppliers is greater than the savings of going from 24 to 23 suppliers. However, the biggest gain of reducing supplier may not be from time savings, but to an increased business advantage. Instead of doing the job half-done for many supplier, due to high workload and mandatory activities for a large supplier base, the job will be done very thorough for a selected few. Then, the company in question may start to see improvements through thoroughness and

efficiency. The buyers would then have more time for quality assurance, better continuous contact with suppliers and overall a better order in the supplier base. Issues can then be worked with proactively, instead of reactively.

A high workload from having many suppliers may further result in costs of missed opportunities. Time constraints for buyers will likely result in less or no time for re-negotiations of price agreements, or even writing price agreements in the first place, resulting in overpriced products for Vidar. Time constraints may further imply less time to perform reviews of suppliers, resulting in that only a select few will be reviewed when the need may in fact be greater. This, in turn, may lead to a higher supply risk from the supplier side. Furthermore, a reactive approach instead of a proactive approach to problems may prove costlier.

5.6.2 Manufacturing Complexity

Vidar continuously works for improving quality and the manufacturing excellence, however, issues will always occur. Vidar has a developed procedure to resolve production issues and although each situation is unique, one could measure time and money spend on a selected problem. Having that said, it is hard to assess probabilities of the occurrence of specific events that would result in e.g. a production stop. Furthermore, it would not be an easy task to derive the root cause to the problem and if it is a selected supplier's responsibility, i.e. derive costs in monetary terms from of having a supplier that causes problems would most likely be highly speculative. But for illustrative purpose, if one would assume that the probability that a supplier cause a production stop is equal for all suppliers in the supplier base, a higher number of suppliers would increase the probability for a production stop (given that the suppliers act independent of each other). The complexity further rises with the high number of CA Suppliers, in particular at Manufacturing Site 2. Given that they do not have to meet the same requirements and demands as Standard Suppliers, it would not be unreasonable to suspect that parts from CA Suppliers may have an increased risk of quality issues. However, given their limited impact on product structure, instances have been observed where issues caused by CA parts are isolated and do not often trigger a chain reaction of problems in the production. The same logic would hold true for the delivery. This reasoning is strengthened by the case presented by Dubois (2003) where the main cost driver in the supplier base was the number of suppliers. According to Vidar, the experience is in line with the case presented by Dubois (2003) and especially the handling of issues e.g. compensations, negotiation etc. is more complex with a higher number of suppliers.

Further complexity at Manufacturing Site 2 arises with every new customer order. Whenever there are article changes or new generations of article numbers, a sourcing process is triggered for the new parts. Having many suppliers then means that this sourcing process needs to be conducted for every supplier that supplies any of these "new" parts. Even if this parameter is hard to quantify, there is a clear gain in reducing the number of

sourcing processes needed for every new customer order. An easy way to solve this issue would be to investigate the segments in which there are the most article generations, examine how many suppliers there are in that segments and thereafter determine if consolidations of purchases are possible and / or necessary. Besides reducing the number of sourcing processes needed, further gains may result from the strengthened bargaining position Vidar gains with a higher purchasing volume, which in turn may result in lower purchasing prices and lower logistic costs.

5.6.3 Supplier Relationships and Learning

The number of suppliers also plays an important role in the relation and learning aspect. Dubois (2003) refers to that single sourcing strategy, which is in line with Vidar's strategy, usually is associated with high involvement with suppliers. A higher number of suppliers would thus increase the required time on interacting with their suppliers. In Vidar's case however, selected suppliers often based on Vidar's spend, are prioritized and thus close relationship and fruitful collaborations are established on the cost of some suppliers not being prioritized. This is somewhat in line with the argument made by Choi and Krasue (2006) that having a higher number of suppliers may in fact, though counterintuitive, result in lower supplier responsiveness. Having a better relationship with a select few will thus possibly result in a better quality of service, in terms of responsiveness, friendliness in communications, having the right contact persons and thereby a better overall relationship quality.

5.6.4 IT and Systems' Consequences

Having a large supplier base further causes complexity in Vidar's IT systems. Interviews with Vidar employees have indicated that an overwhelming number of suppliers in PM results in a slowdown of normal work tasks, since there are just are too many suppliers to sift through. Interviews have further showed that the high number of suppliers somewhat increases the possibility to make mistakes, and thereby also creating an additional need of time to correct it, from e.g. choosing the wrong supplier.

A high number of suppliers further makes it hard to keep order in the IT-systems. Buyers simply don't have the time to update suppliers' information, which in turn makes the supplier information base system less likely to be used, as the information sometime, or often, is not correct or up to date. This further slows down work tasks, as personnel may have to use additional resources to find the right information which also likely increases the probability to make mistakes.

5.6.5 Industry Maturity

As described earlier, it is convenient for Vidar to select and work with suppliers with industry experience, given that the suppliers to be selected are not current Vidar Group or Vidar suppliers. In addition to experience, maturity is of importance, which also includes Vidar's

maturity. A supplier's maturity may compensate for Vidar's immaturity in specific fields such as new technologies or ways of working i.e. organizational immaturity. Also basic support from mature suppliers such as asking follow-up questions to clarify or recognizing wrong order quantities are appreciated and convenient for Vidar.

5.6.6 Supplier Definition and Interfaces

One important aspect in relation to supplier characteristics is the company structure i.e. potential subsidiaries and different plants of the companies. One can discuss the definition of one supplier, and in this study a supplier is defined at the manufacturing site level as described in the empirical findings i.e. not parent company or the sales office where the negotiations are performed. However, this impacts the number of interfaces between Vidar and the supplier e.g. if a supplier delivers to three of Vidar's factories instead of one, or from three of its factories instead of one, it will drive costs (time) for every contact area (interface), through material planning, deviation handling, material handling / goods reception etc. An illustration of the phenomenon is presented below in figure 22.

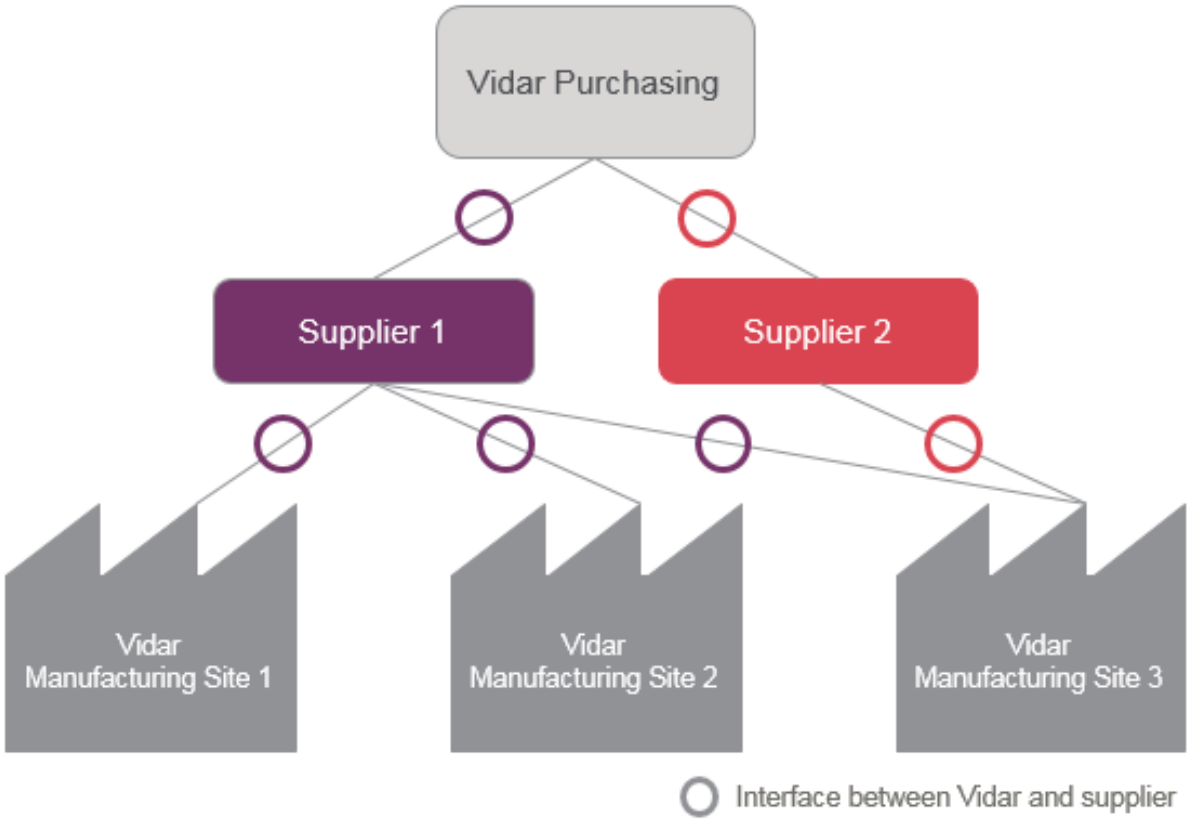

Figure 22. Supplier interfaces; Supplier 1 has four interfaces, whereas Supplier 2 has two

5.6.7 CA Suppliers' Impact on the Supplier Base

Since the CA Suppliers are handled differently, the cost drivers also differ. Additionally, since the proportion of CA Suppliers is considerably higher at Manufacturing Site 2, this is affecting the work at Manufacturing Site 2 to a large extent. Gadde and Håkansson (2001)

focus on three aspects when it comes to rationalize the supplier base; investigating what needs to be purchased, rationalization of costs related to logistic and rationalization of administrative activities. When it comes to the CA Suppliers and the CA parts, it is of great importance to investigate what needs to be purchased. As described in the empirical findings, each CA part is developed individually and sourced in limited time which increases the risk for complications and deviations that the P&O Buyer and material controller must manually handle. Hence, the administrative activities described by Gadde and Håkansson (2001) increase with the number of CA Suppliers. Also the costs related to the logistics are affected, e.g. since CA Suppliers do not use the Vidar packaging to the same extent as the Standard Suppliers, goods are not rarely damaged during transport.

Dubois (2003) discusses that low involvement with suppliers usually is associated with dual sourcing and high involvement with single sourcing but also the consequences with each strategy. Low involvement with suppliers enable a company to reduce the purchasing price by having suppliers compete, however there are costs related to this strategy. These include e.g. costs for screening the market and the increased number of tenders to process. Based on the empirical findings, there is thus a trade-off, an increased number of CA Suppliers increase the workload. On the other hand, having more CA Suppliers increase the probability to find a supplier that will be able to supply the specific part in the required time.

Vidar's single sourcing strategy indicates that Vidar is working in the right direction. Choi and Krause (2006) suggest that single sourcing leads to higher responsiveness in the areas of e.g. design changes, coming from closer communications between the focal company and its suppliers. Single sourcing is further correlated with buyer-supplier cooperation, which also heightens the supplier responsiveness.

Furthermore, Choi and Krause (2006) highlight the supply risk that arises from situations in which a company is in a dependent position to certain suppliers, e.g. through a need of a technology controlled by a supplier, such that suppliers may have possibilities to escalate prices. This is a potential risk for Vidar regarding the CA parts since Vidar is more dependent on the CA Suppliers than the other way around, due to low volumes but also that Vidar must procure the CA parts in a short period of time.

6 Discussion

This chapter aims to discuss and elaborate the analysis as well as adding perspective that will facilitate the concluding comments and recommendations.

6.1 Complexity Drivers

In addition to elevating hidden cost drivers in Vidar's ways of working with suppliers, the study has found several factors driving complexity in Vidar's organization. Since many of these complexity drivers have not been quantified in the same sense as the cost drivers, it is important to stress that the authors cannot make statements regarding the magnitude of these issues. The complexities have been categorized after where they occur, i.e. in supplier introduction, supplier maintenance or supplier removal, and will be more thoroughly explained and discussed in sections 6.1.1 – 6.1.3 below.

6.1.1 Complexity Drivers in the Supplier Introduction Phase

As stated in the analysis section, supplier inexperience or immaturity is a driver of complexity in the introduction phase. Suppliers without either industry experience or experience from working with Vidar drive time and workload for Vidar, since these suppliers often require more clarifications of e.g. legal and environmental demands, quality demands, logistics demands, and design capabilities, and a more thorough supplier evaluation to ensure industrial capability. Especially negotiations of purchasing conditions tend to be a big driver of workload and time during the introduction phase, as every requested change from the supplier needs to be internally checked and processed by Vidar's legal counsel. These are examples of the frictional costs incurred on the company when selecting suppliers, as mentioned by Choi & Krause (2006). Unlike experienced suppliers, inexperienced or immature suppliers further cannot compensate for immaturity from Vidar's part, as they have no experience or knowledge about Vidar's ways of working or common mistakes.

A second factor that drives complexity is the lack of formal requirements on CA Suppliers. There is a formal sourcing process for CA Suppliers, however it differs from the sourcing process for Standard Suppliers in the sense that the suppliers don't go through Vidar's standard supplier evaluation method. As stated in the empirical section, the buyers are not always aware or do not follow the formal sourcing process for CA Suppliers. This directly hampers Vidar's possibilities to ensure whether a CA Supplier is industrially capable, something that later may cause trouble for Vidar in the form of e.g. quality issues and delivery precision.

As stated in the empirical findings and the analysis, a possible third factor driving complexity may be investments made in tooling and prototyping. As instances have been observed where investments have been made before the sourcing decision has been made, the sourcing decision may be influenced and skewed as other suppliers then would be attributed with additional costs. Should this often be the case, the investments made in prototyping

and tooling would then be considered as lock-in effects with certain suppliers in the supplier selection process. While the authors do not know the magnitude of this issue, it is an interesting and important area for future research, and it is of interest to stress the importance of cross functional collaboration early in the process.

6.1.2 Complexity Drivers in the Supplier Maintenance Phase

The first thing driving complexity is the number of suppliers in the supplier base, as many activities and connections appears to be strongly correlated with the number of suppliers. Part of the explanation is all the CA Suppliers. P&O Buyers, especially at Manufacturing Site 2, spend much of their time "firefighting", i.e. solving problems that occur with suppliers. The workload is correlated with the numbers of suppliers, as keeping contact with more suppliers takes more time, which corresponds to Elfram's (1993) argument that maintaining more exchange relationships requires more time, due to the frictional costs incurred by maintaining more contacts. The operational results of these challenges are that buyers have less time to update the supplier information base, making it less useful, and further only dealing with problems reactively instead of proactively. As stated in section 5.6.1, the high workload may result in a lesser business advantage and costs of missed opportunities. Lack of time for buyers further means less time for quality follow-ups and relationship building. The buyers then further have less time to negotiate and write price agreements, heightening the risk of overpriced products. Vidar has issues handling this challenge, which is in line with the findings of Choi & Krause (2006), who state that that minimizing these frictional costs is a common challenge for corporations.

Further complexity arises due to the culture and location of the suppliers, or differentiation between suppliers as stated by Choi & Krause (2006). Sourcing Buyers work globally, yet they are looking at suppliers from their perspective, e.g. from Sweden. This may impact their decision in the sense that they want a supplier with which they can work with as little frictions as possible, i.e. with which they can have a relationship that is easy to maintain. Yet it may not be between the Sourcing Buyer and the supplier that the frictions occur, but between the P&O Buyer at Manufacturing Site 2 and the supplier, should the supplier supply material to Manufacturing Site 2. Even if the rationale behind the Sourcing Buyer's decision is sound, sub-optimizations may occur since it is not the Sourcing Buyer that will handle most of the communication. Understanding the differing internal needs is key to balance the trade-offs that may occur in such situations, as stated by O'Brien (2012).

In addition to the supplier introduction phase, suppliers that lack experience from either the industry or Vidar is another factor that increases the complexity in Vidar's supplier base. This supplier immaturity will most likely result in issues and firefighting in the beginning of the collaboration. However, suppliers with experience from either the industry or Vidar, i.e. mature suppliers, may on the other hand compensate for immaturity on Vidar's part, in the

sense that these suppliers can more easily recognize issues or deviations, e.g. wrong order quantities or delivery dates, made by Vidar before the problem escalates.

6.1.3 Complexity Drivers in the Supplier Removal Phase

When it comes to removing suppliers in the supplier base, complexity arises, or rather remains, since suppliers are not terminated. Such suppliers consume time and energy according to the empirical findings, since problems and updates always seem to arise. Although they are not used, this drives complexity in the supplier base in the sense that they may result in a slowdown of daily work tasks of the buyers. The only identified reason for when keeping inactive suppliers in the system could be of value is the CA Suppliers, since P&O Buyers then can find and use appropriate CA Suppliers easier.

6.2 Boundaries of Responsibility and Conflicts of Interest

Global Purchasing naturally strive for, among others, achieving a low purchasing price (price is one of the main KPI that buyers are evaluated on). As stated, a low purchasing price can often be achieved through compromising on MOQs, i.e. higher MOQs result in a lower purchasing price. Low purchasing prices can further be achieved through using overseas suppliers. The goal of the plants, on the other hand, is to reduce costs associated with logistics and warehousing. Low logistic costs are often effectively achieved through finding suppliers that fit into existing distribution networks and thereby consolidating collections and transportations. Distance is another factor with a big impact on the logistic costs. Further logistic costs include material handling and warehousing, both at the plants and in logistic centers, costs that are reduced when Vidar packaging is used. There are further issues connected to having overseas suppliers. As mentioned, overseas suppliers require regional distribution hubs to ensure shorter lead time. As Manufacturing Site 1 schedules the production on a 15-day planning horizon, the lead time needs to be less, something that overseas supplier seldom can achieve. Furthermore, there have been instances when there have been issues in the supply chain with overseas suppliers, i.e. the parts needed from the hub will not reach the plant in time for production, when the material controllers have been required to use flight transportation directly from the supplier plants. This have proven costly, both from Global Purchasing's but especially from a logistics' perspective.

The goals of these stakeholders are, however, somewhat contradictory. The goals are connected to different cost centers, which may not align with the stakeholders' areas of responsibility, resulting in sub-optimization and governance issues in line with the argument made by Pandit & Marmanis (2008). In other words, it appears departments are sometimes measured after KPIs they have limited possibility to influence. While overseas suppliers may provide a lower purchasing costs, they usually incur higher logistic costs due to e.g. longer shipping distance, tied up capital and longer lead times. High MOQs further results in a higher scrap risk and thereby drives cost. However, as buyers' main KPI is low purchasing price, it is not unreasonable to believe that low purchasing price is their main concern and that other factors may be neglected despite their impact on total cost. Even if there are

opportunities for representatives from the plant to provide input on the choice of supplier (e.g. during the SSC / SSG 3 and 7 meetings), Global Purchasing has final say in the choice of a supplier. Furthermore, it is not unusual that too much time and money has been invested in a certain supplier, due to e.g. tooling and prototype costs, such that a change of supplier would not be feasible. These conflicts of interests result, as mentioned, in a sub-optimal governance and a higher cost in the long-term. As stated by O'Brien (2012), a holistic understanding of the needs of the different stakeholders is needed to balance the trade-offs between differing internal needs to optimize the total cost of ownership. Worth mentioning is that in the process of selecting suppliers, landed cost, i.e. the logistic cost from the supplier's location to the manufacturing site, is normally considered.

6.3 Differences between Manufacturing Site 1 and 2 and CA Suppliers' Impacts

As stated in the empirical findings, there are several differences between Manufacturing Site 1 and 2. Firstly, the proportion of CA Suppliers at Manufacturing Site 2 is higher, since Manufacturing Site 2 manufactures the customer adapted parts, whereas Manufacturing Site 1 manufactures the standardized part of the product. Manufacturing Site 2 further has a smaller proportion of supplier that are connected to EDI or web-EDI than Manufacturing Site 1, since many CA Suppliers don't see the value of investing in EDI-connections given small and sporadic business encounters. Order handling and material planning are therefore more comprehensive and time-consuming at Manufacturing Site 2, since more orders must be processed manually. There are also more issues connected to order handling at Manufacturing Site 2, as orders and invoices are sometimes lost when EDI is not used.

Another impact of having many CA Suppliers at Manufacturing Site 2 is that fewer suppliers use Vidar's packaging material, resulting in more damages, warehousing issues, longer handling time at the material handling and lower utilization of transportation vessels. P&O Buyers at Manufacturing Site 2 are also more involved in fixing problems that occur at the plant, which may be a result of them being stationed closer to the production, i.e. on the same plant than the P&O Buyers in Sweden, where the P&O Buyers are separated from the production. Furthermore, there is a risk that CA Suppliers may cause more issues in the production than Standard Suppliers. This since CA Suppliers do not have to meet the same requirements and demands as Standard Suppliers. There are, however, instances where the magnitude of the issues caused by CA parts are experienced to be less problematic compared to issues caused by Standard parts, given the CA parts isolated impact on product structure. Thus, it is hard to assess the magnitude of this issue, however it is of importance for further investigation.

Lastly, the longer frozen time in the production planning at Manufacturing Site 2 drives workload for the material controllers. Every change in the production schedule within the frozen time must be manually checked with every supplier, as changes in delivery schedules may be necessary. This may result in additional purchasing costs as well as extra workload, there are 13 material controllers at Manufacturing Site 2 spending up to approximately 50%

of their working time on resolving these types of issues. According to interviews, it appears that the material controllers can resolve these issues at roughly the same pace as they occur.

6.4 The Industry Characteristics' and Number of Suppliers' Effects on Vidar

The industry segment's characteristics, e.g. the ETO and tender business, have a big impact on Vidar's operations and supplier base. The tender business and the uncertainties associated with it result in short lead times and a high degree of customer adaptations for Vidar. Vidar often needs to incorporate changes in the product structure shortly before production is planned. To shorten lead times and ensure accessibility of all necessary materials, Vidar needs a fairly large supplier base, especially for suppliers of CA parts. The reason for this is that Vidar does not always receive answers fast enough on their RFQs for necessary materials, and thereby cannot get access to the right material in time.

Finding the right number of CA Suppliers is easier said than done though. On the one hand, if Vidar has too few suppliers the buyers won't receive enough quotas to bring home the material needed for production in time. On the other hand, too many suppliers may result in too many quotas which in turn may be overwhelming for the buyers to process, given the time schedule. Keeping many suppliers will, however, also often result in low business turnover for each supplier, which lowers the incentives for the suppliers to incorporate EDI or Vidar's packaging material, resulting in issues such as missed orders and invoices, damages during transportation and lower utilization of transportation vessels as previously discussed. Another fact obstructing control over the number of CA Suppliers is the supposedly low barriers to adding them to Vidar's supplier base, due to lower requirements and demands from Vidar. On the other hand, this issue may be somewhat counterbalanced by the short lead times when a tender has been won, since there is often no time to onboard a new CA Supplier when sourcing material. Again, P&O Buyers are doing the best for each situation and as described the time allow for the two identified strategies in sourcing and selecting CA Suppliers:

1. Avoid introducing new CA Suppliers as the time available in a project is not enough to onboard a new supplier
2. Introducing new CA Suppliers without conducting the steps described in the formal CA sourcing process

Albeit the system appears to work (no outstanding complaints on issues regarding quality has been observed), one could argue that a communicated and aligned strategy or "light CA Supplier sourcing process" would facilitate the P&O Buyers work. Since this process already exists, it needs to be communicated and followed throughout the organization.

As stated, having many CA Suppliers also increases the workload for P&O Buyers when there are new orders, since all new articles that are generated with the order need to be sourced.

This sourcing process needs to be conducted for every supplier with which Vidar has agreed to purchase the new part from, independent of how many article numbers the supplier has. It is then somewhat self-explanatory that there is a higher workload for the buyer to conduct this sourcing process for many suppliers than for few, i.e. consolidation of purchases would be preferable here from P&O Buyers' perspective. As previously discussed, this also leads to issues being handled reactively instead of proactively, given the workload. Consolidating purchases with a "CA Supermarket" (a type of distributers of parts that Vidar consider as CA parts) would be a possible solution, given that both buyers and material controllers reduce the number of suppliers they need to keep in touch with. As suggested by Choi & Krause (2006), this solution may also heighten supplier responsiveness, in the sense that a higher business turnover increases the importance of Vidar's business with the supplier. However, the issue with short lead times will most likely also remain, given that the purchasing activities required to source all the material still needs to be conducted, just not by Vidar. All costs that are associated with these activities would then still likely be paid by Vidar in the form of a supplement charge, so the savings for Vidar would come in form of reduced work time solving issues and a heightened supplier responsiveness as described by Choi & Krause (2006). The reduced work time to solve issues, i.e. firefighting, may further lead to an increase in Vidar's business advantage, discussed in section 5.6.1. Even if there are no direct savings in working time, the work tasks that otherwise may be overlooked or neglected, e.g. negotiations, proactive work with quality, relationship maintenance etc., will be conducted more thoroughly and thereby increase the operational efficiency of Vidar, heightening both quality and delivery precision.

Contrary to CA Suppliers, Vidar has a comprehensive process to add Standard Suppliers to the system as described in the empirical section, and there is more work associated to maintaining an active Standard Supplier in the system. It is thus not unreasonable to believe that CA Suppliers will be added to Vidar's supplier base at a faster rate than Standard Suppliers. It thus appears that Vidar has too many CA Suppliers, resulting from a high degree of variations in product structures and low barriers to introduce CA Suppliers. Given the differing objective to retain CA and Standard Suppliers, it is not unreasonable to believe that there is a higher proportion of inactive CA Suppliers than Standard Suppliers in Vidar's supplier base. CA Suppliers may be necessary to keep in the system, whereas Standard Suppliers mostly appear to cause problems when inactive. However, the short lead times required by the tender business and the high degree of customer adaptation hampers the possibility to reduce the number of suppliers in Vidar's supplier base.

This chapter ends with figure 23, summarizing the key complexity drivers and the consequences for Vidar.

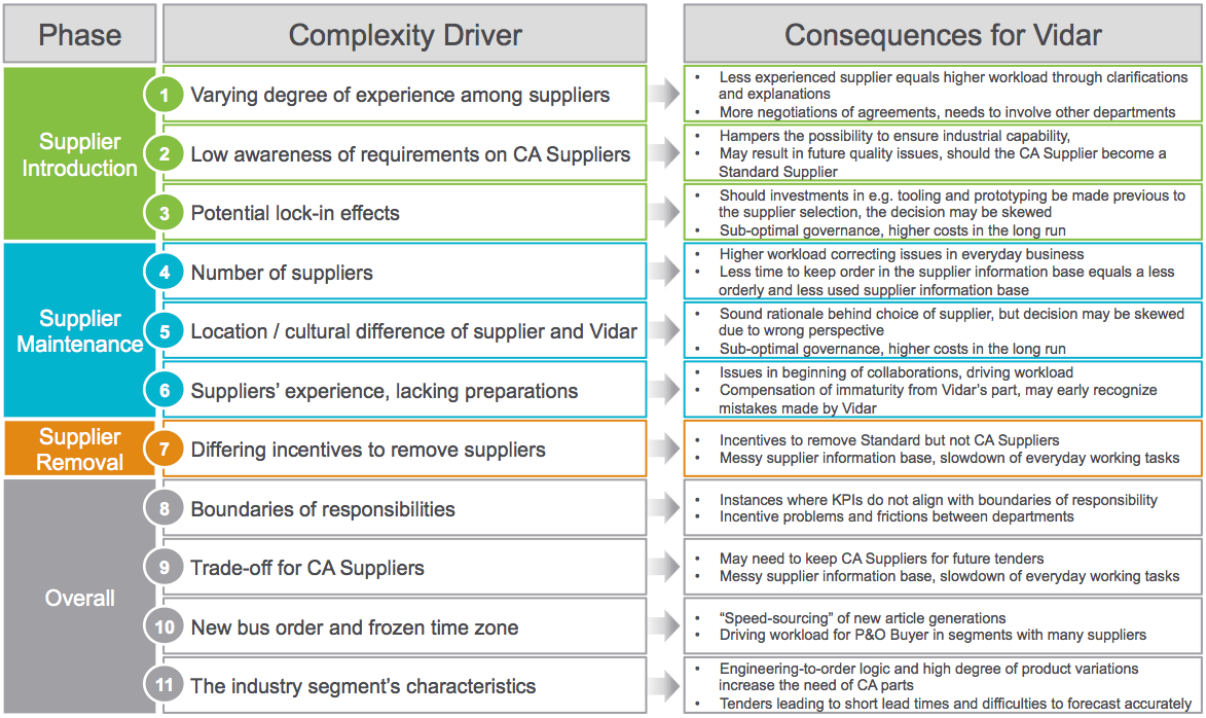

Figure 23. Summary of complexity drivers

7 Conclusions

This chapter is separated into three sections: summary of the discussion and concluding remarks, recommendations to Vidar and suggested initiatives to improve the supplier base and finally a further research section that discusses areas of interest to investigate further.

7.1 Summary

Vidar is good at Purchasing Category Management regarding the Standard Suppliers. Vidar has also come a long way regarding sourcing strategy and leverages a single sourcing strategy to increase responsiveness in the areas of e.g. design changes, coming from closer communications between Vidar and its suppliers. Single sourcing further correlates with buyer-supplier cooperation, also heightening supplier responsiveness. However, the CA Suppliers are hard to reduce, and as described, Choi and Krause (2006) claim that the number of suppliers has the strongest negative correlation with supplier responsiveness and Dubois (2003) claims that the main cost driver in a supplier base is the number of suppliers.

7.1.1 Cost Drivers

The cost drivers for supplier relationships and their relative cost are again presented in figure 24. In the Supplier Introduction phase, costs are mainly driven by labor. The work is mainly independent of the number of suppliers in the supplier base, however the workload during this phase has a clear connection to the categorization made by the authors. In the Supplier Maintenance phase, the authors make a distinction between the two main cost drivers. For the relationship maintenance activities, labor is the main cost driver. The workload is further directly dependent on the number of suppliers in the supplier base for practically all activities. The other main cost driver is logistic and transportation costs for both purchased goods and packaging material. These costs are further affected by distance, utilization of vessels, type of distribution setup and number of transportations made per year. Given that the costs in the introductory phase appear to be smaller and are non-recurring than the yearly cost of maintaining a supplier, savings could be achieved through consolidating suppliers. The main driver of cost in the Supplier Removal phase is labor, and the complexity to switch existing supply arrangement of the removed supplier's parts.

Phase		Cost Driving Activity	Cost Drivers	Relative Size
Supplier Introduction	1	Source & Select AP Supplier	• Costs driven by labor • Costs are independent of the supplier base • Costs are dependent on the categorization	8.29
	2	Hand Over 2	• Costs driven by labor • Costs are independent of the supplier base • Some costs are dependent on the categorization	0.60
	3	Prepare AP Supplier for Serial Production and Aftermarket Business	• Costs driven by labor • Costs are independent of the supplier base • Costs are dependent on the categorization	5.43
	4	Setup of IT Systems	• Costs driven by labor • Costs are independent of the supplier base • Some costs are dependent on the categorization	1.66
Supplier Maintenance	5	Manage Packaging Material	• Costs driven by labor, transportation and new material • Costs are connected to the supplier base	n/a
	6	Transport Material	• Costs driven by labor, distance, utilization rate, distribution setup and number of transports needed • Costs are connected to the supplier base	10.00
	7	Goods Reception and Material Handling	• Costs driven by labor and distribution setup • Costs are connected to the supplier base	n/a
	8	Supplier Relationship Management	• Costs driven by labor and occurrence of activity i.e. frequency • Costs are connected to the supplier base	7.16
	9	Invoice and Payment Handling	• Costs driven by labor and occurrence of activity i.e. frequency	0.03
Supplier Removal	10	Removing a Supplier	• Costs driven by labor • Costs are independent of the supplier base	0.06
	11	Future Supply of Parts	• Costs driven by labor • Costs are independent of the supplier base	n/a

Figure 24. Summary of cost drivers and their relative cost

7.1.2 Complexity Drivers

In figure 25, the biggest drivers of complexity in Vidar's organization are again presented. Complexity arising in the Supplier Introduction phase occurs from varying degree of experience among suppliers, lack of formal requirements on CA Suppliers and from potential lock-in effects in the sourcing process. Less experience of suppliers equals higher workload for the Sourcing Buyer in terms of more time spent on clarifications, explanations and negotiations of e.g. framework agreements. Lack of formal requirements on CA Suppliers hampers Vidar's possibilities to ensure the industrial capability of the supplier, which further may result in quality issues down the line, especially if the CA Supplier eventually becomes a Standard Supplier. Potential lock-in effects, as in the instance observed with tooling and prototyping investments, may skew the material for decision basis when a new supplier is to be selected. These complexities result in a varying workload that main strain the workforce, a higher amount of both operational and administrative issues and possibly higher long-term costs than necessary due to skewed material for decision basis when selecting suppliers.

Complexity in the Supplier Maintenance phase occurs from the number of suppliers, location and culture of suppliers as well as internal differences within Vidar and the supplier experience. A high number of suppliers result in buyers spending up to 50% of their working time solving issues related to everyday business, reducing the time available for their ordinary work tasks. It further results in less time to keep order in the supplier information base, which then becomes less orderly and less used. Further complexities that arise with the number of suppliers are the trade-off for the number of CA Suppliers and the increased workload for P&O Buyers associated with every new customer order. The supplier experience with Vidar further drives complexity in the sense that there will likely be more

issues in the beginning of the collaboration with new suppliers, and that experienced suppliers may compensate for immaturity on Vidar's side as they may recognize mistakes made by Vidar early. It thus appears that a reduction of the number of suppliers would facilitate the everyday work of both buyers and material controllers. Tools as the supplier information base would be less messy, and fewer suppliers would mean fewer issues in the everyday business. This would likely result in more time available to do the original work-tasks, heightening the before-mentioned business advantage while also lowering the costs of missed opportunities for Vidar.

In the Supplier Removal phase, complexity arises from the differing objectives to retain suppliers in the system even though they may not be used, resulting in an unorderly supplier information base.

Further complexity may arise for Vidar's organization because of unaligned KPIs and boundaries of responsibility of the departments. While the authors do not know the magnitude of this issue, it is important to stress the consequences if the issue is wide-spread. Should this be the case, there would likely be incentive problems and consequently frictions between the departments, hampering cross functional collaborations and heightening the total costs of operations. Other overall complexity drivers are the trade-off between keep and terminate CA Suppliers, the frozen time zone and the industry segment's characteristics.

Phase		Complexity Driver	Consequences for Vidar
Supplier Introduction	1	Varying degree of experience among suppliers	• Less experienced supplier equals higher workload through clarifications and explanations • More negotiations of agreements, needs to involve other departments
	2	Low awareness of requirements on CA Suppliers	• Hampers the possibility to ensure industrial capability, • May result in future quality issues, should the CA Supplier become a Standard Supplier
	3	Potential lock-in effects	• Should investments in e.g. tooling and prototyping be made previous to the supplier selection, the decision may be skewed • Sub-optimal governance, higher costs in the long run
Supplier Maintenance	4	Number of suppliers	• Higher workload correcting issues in everyday business • Less time to keep order in the supplier information base equals a less orderly and less used supplier information base
	5	Location / cultural difference of supplier and Vidar	• Sound rationale behind choice of supplier, but decision may be skewed due to wrong perspective • Sub-optimal governance, higher costs in the long run
	6	Suppliers' experience, lacking preparations	• Issues in beginning of collaborations, driving workload • Compensation of immaturity from Vidar's part, may early recognize mistakes made by Vidar
Supplier Removal	7	Differing incentives to remove suppliers	• Incentives to remove Standard but not CA Suppliers • Messy supplier information base, slowdown of everyday working tasks
Overall	8	Boundaries of responsibilities	• Instances where KPIs do not align with boundaries of responsibility • Incentive problems and frictions between departments
	9	Trade-off for CA Suppliers	• May need to keep CA Suppliers for future tenders • Messy supplier information base, slowdown of everyday working tasks
	10	New bus order and frozen time zone	• "Speed-sourcing" of new article generations • Driving workload for P&O Buyer in segments with many suppliers
	11	The industry segment's characteristics	• Engineering-to-order logic and high degree of product variations increase the need of CA parts • Tenders leading to short lead times and difficulties to forecast accurately

Figure 25. Summary of complexity drivers

7.1.3 Qualitative Aspects

As previously discussed, a lower number of suppliers may result in a business advantage for Vidar. Even though savings may not be achieved through workload, gains may occur in efficiency and thoroughness of the work. Buyers would then be able to work proactively with issues instead of reactively, possibly reducing quality issues and heightening the order in the supplier information base. More work time may further reduce the costs of missed opportunities, in the sense that buyers will have more time to negotiate prices and write price agreements, thus reducing the risk of overpriced products.

Closer collaborations with suppliers further provide more time for supplier evaluations and possibilities for more work on quality and supplier relationships. Better relationships may in turn resulting in a steeper learning curve for suppliers, possibly compensating for immaturity on Vidar's part in the long run. Vidar might then further receive a better quality of service and a better supplier responsiveness through maintaining the right contact persons.

As previously stated, there is complexity arising from the differences between Manufacturing Site 1 and 2. The material planning is automatic for Manufacturing Site 1, whereas it is partly manual for Manufacturing Site 2, driving workload for material controllers. Manufacturing Site 1 further has a higher proportion of suppliers using Vidar's packaging material, reducing damages made during transportation and material handling. Lastly, the planning horizon is shorter for Manufacturing Site 1 than for Manufacturing Site 2. Whereas most changes in the production are communicated automatically for Manufacturing Site 1, they must be checked manually for Manufacturing Site 2, driving both workload and extra costs from purchasing price and transports. Worth mentioning is that the main cause of this is the nature of the product that is manufactured. Customer adaptations of the product, which are manufactured at Manufacturing Site 2, are more complex and require both more parts and more knowledge. Thus, the high number of CA Suppliers at Manufacturing Site 2 is probably not the primary cause of Vidar's issues in itself, but rather a symptom of a greater issue in the organization, namely the allowance for the high degree of customer adaptations in the products.

7.2 Recommendations

Vidar wishes to mitigate the complexity in their supplier base, which could be achieved through reducing the number of suppliers. One way to reduce the number of suppliers, and thus the complexity, is to consolidating parts possible to source from one or fewer suppliers. This could be done through screening current and new suppliers that can offer more of Vidar's parts and consolidating those. Also, Dubois (2003) discuss the opportunity to selecting key suppliers in defined "commodity groups" and agree on a mutually collaboration, which in many cases results in that suppliers adjust and broader their assortment for the buying company and its needs. Further advantages of this solution may

be a higher bargaining power in negotiations and thus in turn lower purchasing prices, whereas consolidated purchases also may heighten the utilization rate in transports.

A “low hanging fruit” when it comes to removing suppliers in the supplier base, and thus reduce complexity is to terminate inactive Standard Suppliers in the supplier base, i.e. in PM, instead of keeping them. Standard Suppliers are thus to be terminated, or marked unavailable for business, when they are not used, whereas CA Suppliers could be left unaffected when not used. The rationale behind this is, as previously stated, that P&O Buyers need a certain number of CA Suppliers to be able to get the parts they need in time. In other words, Standard Suppliers mainly cause issues when they remain inactive in the system and should thus be terminated, whereas inactive CA Suppliers may have a certain value and should thus not be terminated immediately.

Removing inactive suppliers would reduce the complexity and facilitate the everyday work for buyers, however, selected interviews indicate that there is a value to keep the inactive suppliers to have more suppliers to evaluate when sourcing new parts (especially CA Suppliers as previously discussed). Therefore, Vidar should investigate what suppliers to reduce.

Moreover, since the CA Suppliers increase the complexity, one can argue that it is of importance that the Sales Department (and other departments as Product Development) understands the complexity and the operational consequences of customer adaptations for engineering, purchasing and manufacturing. From the interviews, it appears that allowing many customer adaptations increase the customer satisfaction, which in turn may increase the possibility to win tenders. However, Vidar’s organization might benefit if the Sales Department actively tried to reduce the number of customer adaptations already early in the selling process by explaining the benefits for the customers of selecting parts already included in a standard offering. The seller might then be able to suggest standard solutions of higher quality at a lower cost.

Another way to reduce the number of CA Suppliers is to use the mentioned CA Supermarkets. These reduce the number of interactions with suppliers for Vidar and increase the number of CA parts that are delivered with Vidar’s packaging material, given a consolidated purchase. However, this solution may not solve the underlying problems of lead times and forecasting. Using a CA Supermarket may even increase the issue with lead time, as another lead in the supply chain is added. Another potential issue with using a CA Supermarket is the scrap risk, which would most likely be a premium charge added to Vidar’s bill. Scrapping might occur should changes in volume occur too late, something that may result from product amendments late in the process. Given the many pros and cons for Vidar’s business, a CA Supermarket should be evaluated carefully by weighing the pros against the cons, preferably made by a cross functional team with representatives from every concerned department.

Vidar is further recommended to consider communicating the light sourcing process for CA Suppliers more clearly. Having a lighter sourcing process is appropriate considering the lower volume of orders and lesser importance for product structure and manufacturing, but Vidar should further consider adding another "CA to Standard" process, which makes a more thorough evaluation of the CA Supplier before it becomes a Standard Supplier, corresponding to the higher demands set on Standard Suppliers in the Global Sourcing Process. This would not only heighten the quality assurance of CA Suppliers, it may also further prevent CA Suppliers from becoming Standard Suppliers by going through the "back door", as previously explained.

Vidar is further recommended to consider reviewing the KPIs, incentives and boundaries of responsibility. As stated in the empirical findings, e.g. price appears to be the main concern for many buyers, resulting in that price will most likely be of the highest priority in negotiations, despite other factors' importance. It is important to state that for this change to occur, it would require significant management commitment to reducing the number of suppliers. However, with the limited quantification of the complexities caused by the number of suppliers, this decision would be very hard to make given the present situation. Furthermore, as instances have been observed where the logistics' and plants' perspectives may have been overlooked, e.g. in the case of early tooling investments, it might be of interest to consider even closer cross functional collaboration earlier in the sourcing process. The key recommendations are summarized below in figure 26.

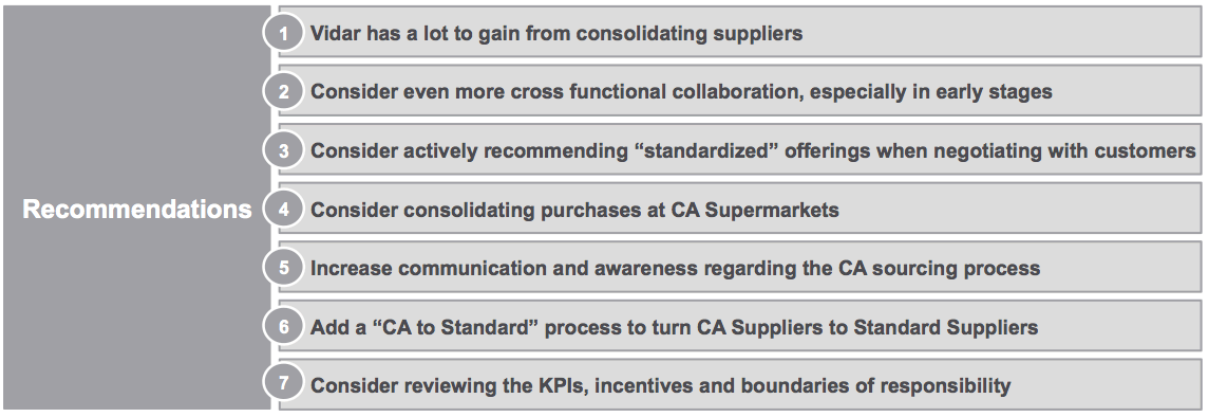

Figure 26. Key recommendations

7.3 Further Research

Albeit this study investigates the CA Suppliers, one would benefit from spend more time and dig deeper on this topic. Especially, an investigation of the customers and what drives (more than the obvious ones) the high degree of customer adaptations would be of value. One could ask if the CA parts, or allowing for customer adaptations, really is key to win tenders and how competitors consider customer adaptations. Also, it would be of value to investigate what segments the CA Suppliers are in and how these differ as well as investigate the proportion between active and inactive suppliers among the CA Suppliers.

Another interesting area to investigate further is how the volume affects the supplier relationships. The empirical findings indicate that Vidar prioritize their suppliers on spend to a large extent, which is partly driven by volume but also the prices. It would be of interest to understand the effects that the volumes drive.

As the authors of this study experienced issues in obtaining quantitative information regarding Material Handling and Goods Reception and Managing Packaging Material, it would be an interesting area for future research to examine the relative impact of these cost driving activities. Furthermore, it would be interesting to study transportation cases from Nordic and overseas suppliers to examine the relative cost impact of the suppliers' locations.

Finally, this study has covered the impact from the number of suppliers in Vidar's supplier base and partly the differentiation between suppliers in the supplier base. However, Choi and Krause (2006) also propose that the interrelations between suppliers influence the complexity in the supplier base. Hence, both the differentiation between suppliers and especially the interrelations between suppliers in Vidar's supplier base would be of interest to investigate further. An aspect mentioned by Choi and Krause (2006) that makes the interrelations between suppliers even more interesting to investigate is that it is not unusual to find working relationships amongst suppliers in a supplier base and that these relationships are often unknown to the company, which potentially could be the case for Vidar.

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Appendix 1 – Interview Questionnaires

INTERVIEW TEMPLATE SOURCING BUYER		
PHASE	**#**	**QUESTIONS**
	1	This is our understanding of the first part of the sourcing-phase, and how it is supposed to be, in theory [show process]. For simplicity, we will assume that this is how the work is conducted. Do you have any objections?
	2	How much time does it take to gather all the RFQ-requirements? (Technical specifications / regulations, logistic demands, aftermarket demands etc.) With respect to our categorization?
		How much time does it take to gather all general requirements? (ISO-certificates, blueprints etc.) With respect to our categorization?
	3	How much time does it take to identify and approve suppliers for RFQ (including confidentiality agreements)?
		Is there a connection between the workload and the number of suppliers? If so, how would you descibe and estimate the time for that connection?
		We have also come to understand that you have the SSC/SSG step 3 meeting, who participate in those meetings?
		Can you estimate the time for a typical SSC/SSG step 3 meeting?
	4	How much time does it take to create and send RFQs and receive quotas? Is there a big difference in workload with respect to our categorization? (Gather quotas, chase suppliers for information, etc.)
	5	How much time does it take to evaluate suppliers and quotas before the SSC/SSG-meeting? (Ask for time required for a supplier in every category)
	6	How much time does it take to negotiate Price Agreements and Framework Agreements with suppliers? (Ask for time requires to negotiate with a supplier in every category?)
	7	How much time does it take to approve the supplier recommendation? (Preparations before the SSC/SSG-meeting etc.)
		Is there a difference in time-spent, depending on our categorization?
		Who participate in the SSC/SSG step 7 meeting?
		Can you estimate the time for a typical SSC/SSG step 7 meeting?
	8	How much time does it take to get the agreements and terms signed? Is there a difference in workload, depending on our categorization?
	9	To our understanding, the majority of the workload is at the sourcing-buyer's desk in this phase. In other cases, other stakeholders have been mapped out. Is out 'map' coherent with your experiences? If there are more stakeholders that regularly take place, who are they and what activities do they participate in?
		How much help (time) do you get from the PSCO team (Purchasing Support Center) in India?
	10	Between the sourcing-phase and preparations before serial production there is a handover between the sourcing-buyer and the P&O-buyer. How long is the meeting at the handover? Does the time-spent vary, with respect to our categorization?
		Do you use the HOTO tool for the hand overs?
	11	Furthermore, we have come to understand that there is a full APQP if the supplier delivers 'Key Component', which impacts the workload of the SQE, PPM and P&O . Does it affect your work, in any way?
		If so, how?

		What activities are affected?
		Could you please estimate the time for these activities?
	12	Related to the IT-system, we've come to understand that the sourcing-buyers approve suppliers' access to the supplier portal. Is this correct?
		What suppliers are approved?
		What acitivities are required to approve access for a supplier?
		How much time would you say these activities take? Is there a difference, with respect to our categorization?
	13	To better understand your work, could you please tell us how many suppliers you are 'Supplier Host' for?
		How many people do you have contact with at each supplier?
	14	We've also come to understand that it is the responsibility of the sourcing-buyer to conduct so-called BRMs, which to oru understanding is maintenance of the relationship, with respect to capacity, risk etc.
		What kind of activities takes place at a BRM?
		Could you estimate the time for these activities?
		Is there a difference for how often it is done, or how much time it takes to do a BRM, depending on the supplier spend? If not, can you see any other appropriate categorization?
	15	We have also come to understand that you do so-called 'Special Projects', i.e. Events that triggers acitivities for 'all' suppliers. Approximately, how often does these type of events take place?
		CSR? Time per supplier?
		IMDS, i.e. Material phase-out? (Exv. chrome-6, led) Time per supplier?
		Other, new legal demands? Time per supplier?
		Re-negotiation of Volvo's purchasing terms & conditions? Time per supplier?
		Other?
		Could you estimate the time for these activities?
	16	We've also come to understand that 'Supplier Hosts' are responsible to re-negotiate prices, between given intervals of time. How often do you re-negotiate prices with a supplier?
		Who do you negotiate with? (E.g. Spend)
		What supplier don't you re-negotiate with? Why? Is there someone else conducting the negotiations on your behalf, then?
		What 'share' of your supplier base do you negotiate with?
		Can you estimate the time for how long a negotiation typically is?
	17	To our understanding, it is also the 'Supplier Host' that is responsible for controlling and updating all supplier certificates and agreements. How often are certificates and agreements updated?
		How often do you control that a supplier meets the 'Volvo-demands'?
		How much time does it take to control all certificates for a supplier, and update when necessary?
		How long time does it take to check that a supplier meets the 'Volvo-demands'?

INTERVIEW TEMPLATE P&O BUYER		
PHASE	**#**	**QUESTIONS**
	1	This is, to our understanding, what the first part of the sourcing phase looks like [show process map]. For simplicity, we will assume that this is how the work is carried out. Do you have any objections? Furthermore, we have come to understand that P&O-buyers participate with input on the steps 3, 6 and 7. Is this correct?
	2	What activities do you do, or what input do you provide in the process of identifying and approving suppliers for RFQ?
		How often are you asked to do this, for every sourcing-case or only chosen ones? If only for chosen ones, what are the criteria that needs to be met for you to get involved?
		How much time does this take? Any differences with respect to our categorization?
		Is there a connection here between the workload, and the number of suppliers? If so, how would you describe (and quantify) that connection?
	3	What activities do you do, or what input do you provide in the process of negotiating with suppliers in the sourcing-process?
		How often are you asked to do this, for every sourcing-case or only chosen ones? If only for chosen ones, what are the criteria that needs to be met for you to get involved?
		How much time does this take? Any differences with respect to our categorization?
	4	What activities do you do, or what input do you provide, in the work of preparing for and attending the SSG-meeting to approve recommended suppliers?
		How often are you asked to do this, for every sourcing-case or only chosen ones? If only for chosen ones, what are the criteria that needs to be met for you to get involved?
		How much time does this take? Any differences with respect to our categorization? (Preparations, actual SSG-meeting, etc.)
	5	Between the sourcing-phase and preparations before serial production there is a handover between the sourcing-buyer and the P&O-buyer. How long is the meeting at the handover? Does the time spent in the meeting vary, with respect to our categorization?
	6	How much time does it take to onboard a supplier? What is the difference in time-consumption with respect to our categorization?
	7	How much time does it take to prepare the supplier for a B-release? What's the difference in time-consumption with respect to our categorization?
	8	How much time does it take to prepare the supplier for a B-Part (PE) and C-release? What's the difference in time-consumption with respect to our categorization?
	9	How much time does it take to prepare the supplier for a CPOT and P-release? What's the difference in time-consumption with respect to our categorization?
	10	How much time does it take to prepare the supplier for PPAP? What's the difference in time-consumption with respect to our categorization?

	11	How much time does it take to prepare the supplier for P-part and serial production? What's the difference in time-consumption with respect to our categorization?
	12	For us to gain a better understanding of your work and your tasks, could you please tell us approximately how many suppliers you have contact with, or are responsible for, during a given year?
		How many people do you have contact with at each supplier? Does it differ? If so, please provide an approximate interval of number of contacts.
	13	To our understanding, it is the responsibility of the P&O-buyer to perform QDCR, including reviews, calculations and evaluations of risk and capacity, among other things, for a supplier. Is this correct?
		How often is a QDCR performed?
		What kind of activities takes place in a QDCR?
		Please estimate the time for these activities.
		Is there a difference between how often a QDCR is performed, depending on the supplier's spend? If not, can you see any appropriate categorization?
	14	We have also come to understand that 'Supplier hosts' are responsible for renegotiating article prices between given time intervals. Are P&O-buyers involved in negotiations with suppliers of standard parts, in any way? If so, how?
		Concerning the suppliers in your supplier base (CA), how often do you negotiate prices?
		Do you write framework- and price-agreements with your suppliers?
		How often do you negotiate frame-work agreements?
		What suppliers do you negotiate with?
		What suppliers do you not negotiate with? Why not?
		What share of your supplier base, approximately, do you not have time to negotiate with?
		Could you please estimate the time for "one negotiation"?
	15	We have further come to understand that you, as a P&O-buyer, are sometimes asked to help solve issues connected to factory issues / deviations with suppliers. What criteria need to be met in order for you to get involved?
		How often does this happen? Possible to estimate how often this takes place for a supplier?
		What are you required to do when you get involved in a typical supplier issue?
		How much time, approximately, do you spend on solving one of these typical issues?
		Does this happen for a specific type of supplier?
		Is there a difference in how often issues arise, depending on whether the supplier supplies CA or standard parts?
		Are there certain issues that arise more often with CA-suppliers?
		Are there certain issues that arise more often with standard-suppliers?
	16	Regarding the selection of CA-suppliers, we have come to understand that you have something of a 'fast-track' process for supplier selection. The questions 17-23 concerns this process, but can you start by explaining what steps you go through in the selection of CA suppliers?
		Do you go through any of the formal steps in the Global Sourcing Process? [show process]

		We've further come to understand that this process is triggered by generations of new article numbers or amendments of old ones. What other activities are triggered by amendments or generations of new article numbers?
		Are there other triggers for this process? If so, what are the triggers?
	17	How is the supplier chosen in this case; do you only choose old suppliers or do you also evaluate new ones?
		If new suppliers, how much time do you typically spend on choosing?
		How much time do you typically spend choosing an old supplier?
	18	How do you decide whether or not a supplier can be approved? Who are involved?
		How much time does this typically take?
		Does the time spent vary, depending on the supplier is new or old? Other factors?
	19	How long time does it take to prepare for the approval decision, and to actually make the decision?
		Does the time spent vary, depending on the supplier is new or old? Other factors?
	20	How much time do you spend negotiating with the chosen supplier? Price, ditributions arrangement, etc.
		How much time do you typically spend choosing an old supplier?
	21	What happens when a supplier is to be removed, i.e. What activities are you required to do? How much time does it take?

INTERVIEW TEMPLATE SQE		
PHASE	**#**	**QUESTIONS**
		Fråga om SEM
	1	This is, to our understanding, what the "Prepare AP Supplier for Serial Production and Aftermarket through APQP" looks like [show the process]. For simplicity, we will assume that this is how the work is carried out. Do you have any objections?
	2	How much time does it take to "onboard" a supplier with respect to our categorization?
	3	How much time does it take to prepare a supplier for the B-release with respect to our categorization?
	4	How much time does it take to prepare a supplier for the B-Part (PE) och C-release with respect to our categorization?
	5	How much time does it take to prepare a supplier for the CPOT och P-release with respect to our categorization?
	6	How much time does it take to prepare a supplier for PPAP with respect to our categorization?
	7	How much time does it take to prepare a supplier for the P-part and serial production with respect to our categorization?
	8	What other activities are SQE responsible for during the introduction of a new supplier phase?
	9	For us to gain a better understanding of your work and your tasks, could you please tell about your responsibilities during serial production and your connections / interactions with suppliers?
		How many people do you have contact with at each supplier?
	10	We have understood that SQE is involved in carrying out the BRM, which is review of a supplier including capacity, risk assessments etc., do you have any objections?
		What activties are carried out by SQE in a BRM?
		Could you please try to estime the time spent on each activity?
		Does the BRM itself or the frequenze of the BRM differ depending on the supplier characteristics? Or on the spend? Other relevant categorization?
	11	We have understood that SQE also is involved in carrying out the QDCRs, which includes calculation, evaluating and assessment of the supplier risk and capacity etc., do you have any objections?
		For what suppliers do you carry out QDCR?
		How often do you carry out the QDCR?
		What activties are carried out in a QDCR?
		Could you please try to estime the time spent on each activity?
		Does the QDCR itself or the frequenze of the QDCR differ depending on the supplier characteristics? Or on the spend? Other relevant categorization?
	12	We have understood that SQE also is involved in controlling and updating certificates, do you have any objections and how often do you conduct the updates?
		What are your responsibilities?
		How often is suppliers and that they reach the general Volvo requirements controlled?

	How much time does it take to controll one supplier's certificates, and if needed, update them?

INTERVIEW TEMPLATE CE		
PHASE	**#**	**QUESTIONS**
	1	This is, to our understanding, what the "Source and Select" and "Prepare AP Supplier for Serial Production and Aftermarket through APQP"-phases looks like [show the process]. For simplicity, we will assume that this is how the work is carried out. Furthermore, we have come to understand that CEs are provide input in the creation/sending of RFQs and negotiations with potential suppliers, then also at the preparation of a supplier for the B-Part (PE) och C-release and the preperation for the CPOT och P-release. Is this correct or do you have any objections?
	2	What activities do you do in the work of providing input on RFQs?
		How much time do you spend doing this for one sourcing case / for one supplier?
	3	During the negotiations, we have come to understand that you are tasked with providing input regarding costs, should there have been any changes in the RFQ. What activities are you tasked to do then?
		How much time do you spend doing this for one sourcing case / for one supplier?
	4	What activities do you do, or what input do you provide in the process of preparing a supplier for the B-Part (PE) och C-release?
		How often are you asked to do this (i.e. For all DVPs or only some)?
		How much time does this take? Any differences with respect to our categorization?
	5	What activities do you do, or what input do you provide in the process of preparing a supplier for the CPOT och P-release?
		How often are you asked to do this (i.e. For all DVPs or only some)?
		How much time does this take? Any differences with respect to our categorization?