Maximizing Synergy at Volvo Group Truck Purchasing

Master's Thesis in the Master's Programme Supply Chain Management

ANN SHERYL JOSEPH
RAKESH RAJASHEKARA

Department of Technology Management and Economics
Division of Service Management and Logistics
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2018
Report No. E 2018-112

Maximizing Synergy at Volvo Group Truck Purchasing

ANN SHERYL JOSEPH
RAKESH RAJASHEKARA

Tutor, Chalmers: Gunnar Stefansson

Department of Technology Management and Economics
Division of Service Management and Logistics
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2018

Maximizing Synergy at Volvo Group Truck Purchasing

ANN SHERYL JOSEPH
RAKESH RAJASHEKARA

Master’s Thesis E 2018-112

Department of Technology Management and Economics
Division of Service Management and Logistics
Chalmers University of Technology
SE-412 96 Gothenburg, Sweden
Telephone: + 46 (0)31-772 1000

Chalmers Reproservice
Gothenburg, Sweden 2018

Acknowledgement

This thesis was conducted in collaboration with Chalmers University of Technology and Volvo Group Truck Purchasing, Gothenburg, Sweden. This thesis was conducted within the master's program Supply Chain Management. This project would not have been possible to conduct without the support of many people.

First of all, we would like to thank Benjamin Schreiber our thesis supervisor at Volvo Group Truck Purchasing, whose immense support and knowledge sharing attitude has played a key role formulating this thesis work. We would also like to extend our gratitude to Marc Delobelle the manager of Metal Tubes and Body in White purchasing team for constantly guiding us through the project. We also appreciate the entire Metal Purchasing team at GTP for providing us their constant support during the project.

Secondly, we would like to thank all the interviewees from the Engineering team, the Supplier Relation Manager and buyers from Volvo Group. Special thanks to all the suppliers who participated in the interviews.

Finally, we would like to extend our heartfelt gratitude to Gunnar Stefansson our supervisor at Chalmers University of Technology for providing his constant support and guidance throughout the project.

Gothenburg 2018

Ann Sheryl Joseph & Rakesh Rajashekara

Abstract

The study concerns the metal tube purchasing team within Volvo Group Truck Purchasing. Today, the metal tube team is trying to explore opportunities that can optimize the price. This study aims at formulating ideas that would optimize the part price by applying the concept of synergy. The effects of synergy are economies of scale, information and innovation. To achieve these effects four factors are considered and they are: performance measures, data management, total cost/benefit analysis and cross functional coordination and collaboration. Thus, study tries to apply these factors to generate opportunities to achieve synergy and thereby optimize part price.

Furthermore, the study focuses on four different areas within Volvo Group to explore the potential benefits of synergy; that is synergy 1) between different business units and truck brands 2) within purchasing organization 3) between buyers, suppliers and sub-suppliers and 4) between buyers, suppliers and engineers. To understand the current situation within the organization extensive data analysis was made by using the data available on the company's database. Further, semi-structured interviews were performed to collect data. To identify the opportunities within four areas mentioned above, Synergy Management Process by Daum, P (2012) was utilized. After analyzing and examining the data collected appropriate suggestions and potential opportunities to maximize synergy for the metal tube purchasing team within GTP are made at the end of this study.

Keywords: Synergy, purchasing, metal tube purchasing, economies of scale, economies of information, economies of innovation

Table of Contents

List of Figures

List of Tables

1. Introduction

In the past, purchasing was considered to be more of a clerical function trying to procure parts and services at the cheapest possible price (Gadde and Håkansson; 1994). But over years, organizations have realized that purchasing is one of the most important functions that can influence the overall business strategy. This shift of mindset has occurred because companies (mainly in the automotive industry) realized that 60% to 70% of the components that go onto any manufactured product are procured and this forms the majority of the company's total expense (Scannell et al; 2000). The purpose of every business strategy at functional level and/or company level is to maintain a sustainable competitive advantage (Carter and Narasimhan; 1996). One such strategy that has caught much attention in the business world is the concept of synergy. Some business economists and management consultants have even termed it as the 'Holy Grail' of business strategies (Faes et al; 2000). Many companies are working towards bringing in the concept of synergy in their business strategies at all functional levels including purchasing to realize competitive advantage and superior corporate performance over time. The case company under study, Volvo Group is also working towards the same purpose and is taking a step forward to maximize synergy and thereby optimize their supply chain further. The following section will give a brief on the case company and the research work.

1.1 Background

Volvo Group Truck Purchasing (GTP) is the purchasing entity at Volvo Group that is responsible for the purchase of direct and indirect materials and services for all the Truck Brands under Volvo Group. Apart from the 5 Truck Brand divisions the other business areas (business units) include Volvo Construction Equipment, Volvo Penta and Volvo Buses. Under Volvo GTP metal purchasing is a new department that works towards developing expertise on metal segments by creating strategies and implementing plans to optimize supply chain and reduce costs within metal purchasing. Currently metal purchasing is handled separately within the different business areas and Volvo Group overall is losing the benefits of purchasing the components under metal purchasing as one single entity. The purpose of the thesis work is to identify opportunities to establish synergy between Volvo GTP and purchasing functions of other Volvo business areas within metal purchasing. Moreover, the thesis will also look into the current practices within metal purchasing at GTP to find opportunities to maximize synergies in terms of economies of scale and information.

To understand the purpose and research questions of the thesis it is imperative to understand the organization structure of Volvo Group. Figure 1 shows the organization structure of Volvo Group.

It is clear from the organization structure that purchasing activities for truck business area is carried out by Group Truck Purchasing (GTP) and the purchasing activities for Volvo Buses, Volvo Construction Equipment and Volvo Penta are handled within each of these business areas separately. Further, GTP is divided into several purchasing organization that are responsible for continental purchases and handles suppliers located in the respective continents. For example, GTPN (Group Truck Purchasing North America) handles all purchases from all suppliers located within the North American continent. Similarly, GTPE (Group Truck Purchasing Europe) handles all purchases from all suppliers located within the European continent. The other continental truck purchasing organizations are GTPA (Asia Pacific), GTPS (South America), GTPJ (Japan). The purchasing organizations are further divided into Vehicle (components used to build cab, chassis etc., of the truck are classified here), Powertrain (components that go on the engine, transmission etc., of the truck are classified here), Supplier Quality & Development, Indirect Products & Services and Uptime & Adaptation Synergies (mainly aftermarket and customization of trucks) as shown in Figure 2. The Metal Tube Purchasing is a sub category under Metal Purchasing that is classified under 'Vehicle' as shown in Figure 3. The segments which are purchased under Metal Tube Purchasing are described in Table 1. Apart from identifying synergies between different business areas, there are possibilities to identify synergies across different purchasing organizations within GTP.

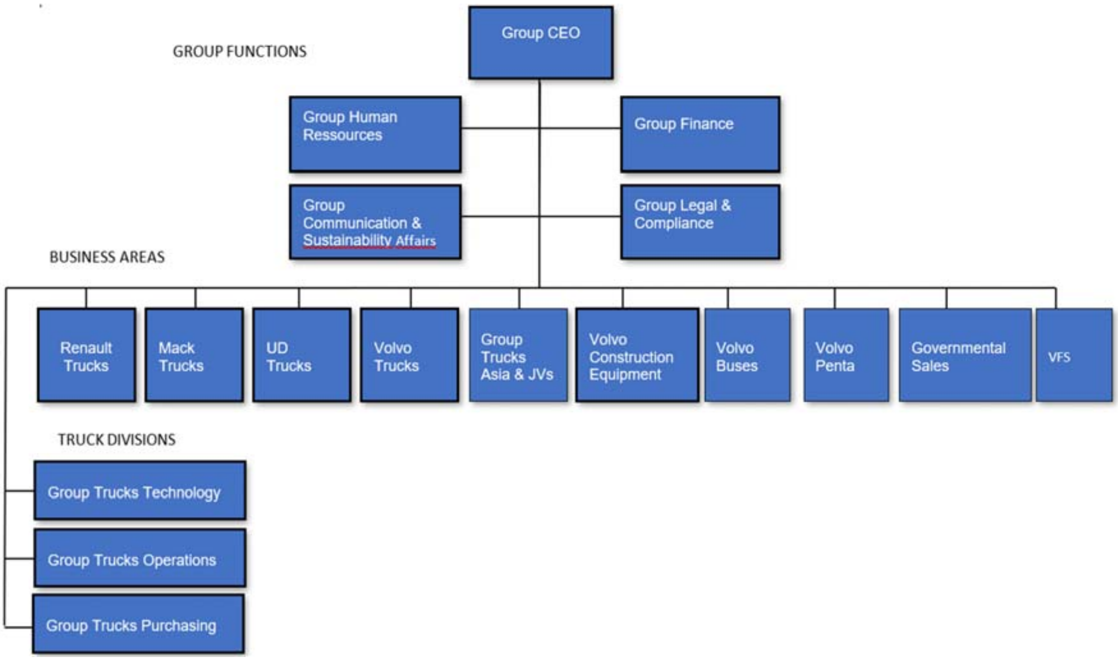

Figure 1: Organizational structure of Volvo Group

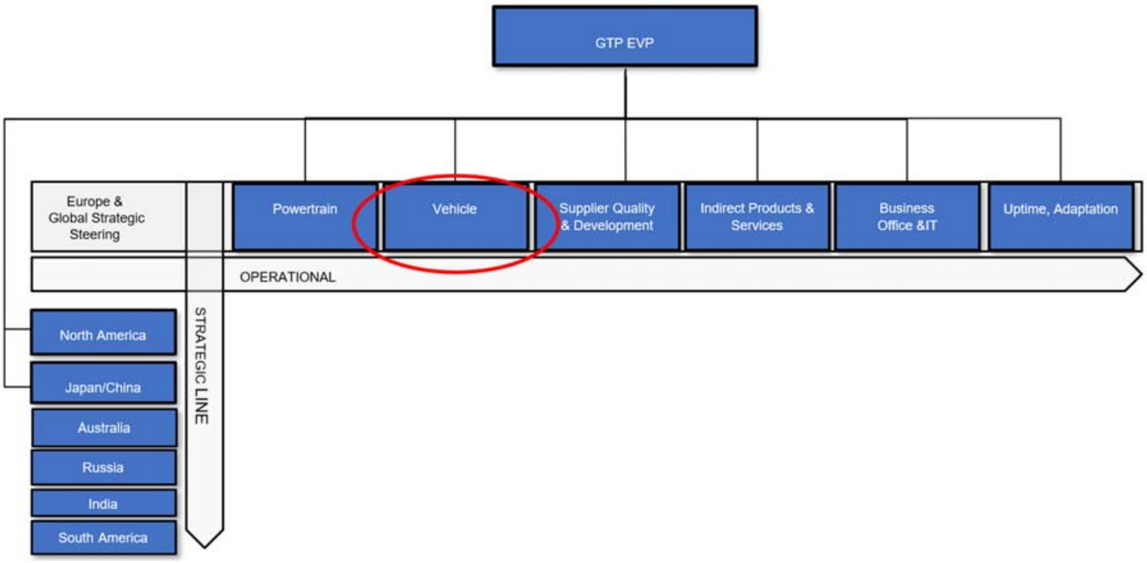

Figure 2: Organizational structure of GTP

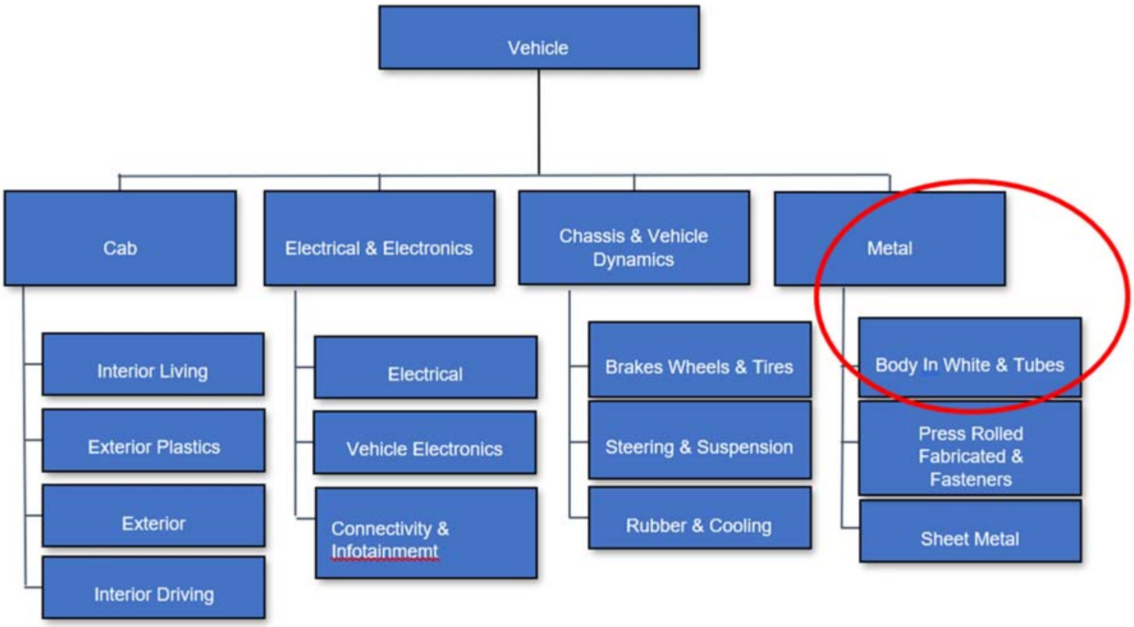

Figure 3: Organization structure of Vehicle Division

Table 1: Segment classification and description

Segment code	Segment name	Function
PFT10	Fluid Pipes	Transfer fluid from A to B without leakage avoiding pressure drop or back pressure. Example: Coolant pipe, oil pipe, air compressor pipe
PFT11	Rigid Exhaust Pipes	Transfer exhaust gases from the engine exhaust manifold to the environment going through the EATS (Engine After Treatment System) to comply with regulation
PFT20	Exhaust Gas Recirculation (EGR)/Oil Return Pipe (ORP)	EGR: Re-distribute part of the exhaust gases from the engine exhaust manifold to the engine air inlet to reduce after treatment needs and reduce the NOx quantity in the combustion chamber. ORP: Transfer the oil back after the Turbocharger outlet.
PFT21	Structural Pipe	Structural pipes have many functions. It could just be a bracket function to maintain or fix two elements together (Mudguard stay, Air deflectors...), but can also have a more elaborate use such as the ladder and the Grab handles that help the driver to enter in the truck. The tube can also be used as protective feature such as a battery box etc..
PFT22	Flexible Exhaust Pipe	Transfer the exhaust gases from the engine exhaust manifold to the environment going through the EATS (Engine After Treatment System) to comply with regulation. Flexible function to absorb engine vibration without leakage and back pressure.

Purchasing organization structure as such and the various subdivisions within the purchasing organization is inevitable for large organizations as Volvo Group. But, with it also comes the challenges of missing out on the opportunities to improve synergy and take advantage of the common goals to have better purchasing strategies. Currently, there is no clarity if the current suppliers of Truck Purchasing are also supplying to other Business Areas and if they share any common parts. Further, there is very minimal flow of information within the Truck Purchasing across different continents to identify better sourcing opportunities, thus the piece prices of parts not completely optimized. Moreover, the buyers themselves suspect that due to historic reasons certain parts that are made of steel tubes are not categorized under metal purchasing and are not benchmarked against the suppliers in the supply base of metal tube purchasing. Adding to this, lack of information of the tonnage and specification of steel tubes purchased is impeding the implementation of potential synergy ideas. Finally, inadequate data availability and information sharing across different functions and suppliers have also led to missing out on opportunities to maximize synergy in developing purchasing strategies. Thus, this thesis work tries to identify opportunities to improve synergy within metal tube purchasing by addressing these challenges.

1.2 Aim and Purpose

The aim of the thesis work is to identify potential opportunities to reduce part price of high spend components within Metal Tube Purchasing. The ideas for part price reductions are achieved using the concept of synergy within the purchasing function wherever applicable.

The purpose of the research work is to:

1. Identify and analyze the opportunities to develop synergy between different truck brands and business areas in terms of technology, information, suppliers etc.
2. Identify and analyze the opportunities to have synergy between buyers, suppliers and sub-suppliers to optimize part prices and/or strengthen business relationships
3. Identify and analyze supply network of tier 1 suppliers of metal tube parts
4. Identify opportunities to have synergy between engineering, buyers and suppliers to tap innovation ideas in metal tube technology and/or design etc.

1.3 Specification of issue under investigation

The research questions are developed keeping in mind two main areas - first, synergy across different business areas (RQ I, II) and the other synergy within Group Truck Purchasing (RQ III, IV, V and VI).

To fulfill the first purpose which is to identify opportunities to develop synergy between different business areas and truck brands, the following research questions were developed.

Research question I:

What purchasing strategy will maximize the advantage of procuring similar PNs from the same and/or different suppliers across different business areas?

Research question II:

What are the possible opportunities to maximize synergy for same PNs with part price differences within Truck Purchasing?

To fulfill the second purpose that is to identify opportunities for synergy between buyers, synergy between buyers, suppliers and sub suppliers the following research questions were formed.

Research question III:

What are the parts that could be classified under Metal Tube Purchasing to further maximize synergy and leverage benefits from current supply base?

Research question IV:

What are the opportunities to maximize synergy between the actors in the supply chain for metal tube purchasing?

Further the third purpose to optimize supply networks of tier 1 suppliers has led to the following research question

Research question V:

How can part price be optimized by optimizing the supply networks of tier 1 supplier in metal tube purchasing?

Finally, the last purpose was to identify synergy between buyers, suppliers and engineers which led to the following research question

Research question VI:

How can the current cross functional collaboration between technical and business side be improved?

Furthermore, the reach questions were developed along with the inputs from metal tube purchasing team to fit their requirements.

1.4 Limitations and delimitation

The focus on just one product group could be considered as one of the main limitations. This study only looks into purchase of metal tubes at Volvo GTP and so the recommendations provided may be applicable only to this product group and may not be generalized to other products and/or companies. Another point is, the data collected from the interviews is based on specific or unique relationships that the buyers, suppliers and engineers share, the data cannot be used to generalize the current situation across the entire purchasing organization.

The study focuses on part numbers that have high yearly volume and/or spend within the product group. This is because any potential ideas applied to these part numbers will result in better potential savings when compared to the ones with lower yearly volume and/or spend. This is the main delimitation of the thesis.

2 Methodology

The method proposed in this section is the process that is used to answer the research questions formulated for this thesis work. The basic structure of the method involves a thorough literature study, collection of empirical data through various sources and analysis followed by a conclusion. To support this process, a research design and research strategy is formed which acts as a solid framework.

2.1 Research Design

The research design is a guiding structure in executing a research method and the kind of research design employed will be dependent on the research questions (Bryman and Bell, 2003). The research questions mainly focus on metal purchasing and the recommendations will be based on the current situation at the case company, Volvo Group. The metal purchasing has a unique and complex functional and technical requirement with a constricted supply base. Therefore, it will be of importance to adapt the study to a contextual situation. Bryman and Bell (2003), state that case study is concerned with the complexity and nature of the case and the research involves intensive and detail analysis of the same (Bryman and Bell. 2003). Hence, considering the nature of metal purchasing and purpose of the thesis work, performing a case study implies to be a suitable research design.

2.2 Research Strategy

The study involves generation of theory/conclusion drawing general inferences based on empirical data and analysis, thus following an inductive approach. And according to Bryman and Bell, (2003), when a qualitative research strategy is applied along with the case study design, it induces an inductive approach. Therefore, this leads to an application of a qualitative research strategy. Qualitative strategy implies the application of various qualitative methods in data collection and analysis. Qualitative methods like participant observation and semi-structured interviewing are favoured in a case study research to conduct a detailed and intensive examination on the case (Bryman and Bell, 2003). For this case study, empirical data will be obtained through company's database and various semi-structured interviews. The position and the number of interviewees is described in the table 2.

Table 2: Interviewee description and count

Position of the Interviewee	Number of interviewees
Commodity buyer	2
Supplier - Key Account Manager	4
Design/Product Development Engineer	2
Supplier Relationship Management	1

The interviews were conducted with various internal and external actors to Volvo Group within steel tube purchasing. Referring to the table 2, the two commodity buyers belonged to the steel tube purchasing team who handled all the components/part numbers within the five tube segments (explained in detail in the following sections). The four suppliers were selected based on how strategic the suppliers are in terms of spend, technology etc. and also the kind of relationship the buyers and suppliers have had over the years (either rough or very cooperative relationships based on the buyers' description). Of the four suppliers that were interviewed, the commodity buyers handled two suppliers each. Further, the engineers that were interviewed were selected based on the products the suppliers delivered. Meaning, if an engineer worked with exhaust pipes, then the supplier who delivered exhaust pipes and the corresponding buyer were interviewed. Thus, creating a triadic relationship as depicted in the Figure 4 below.

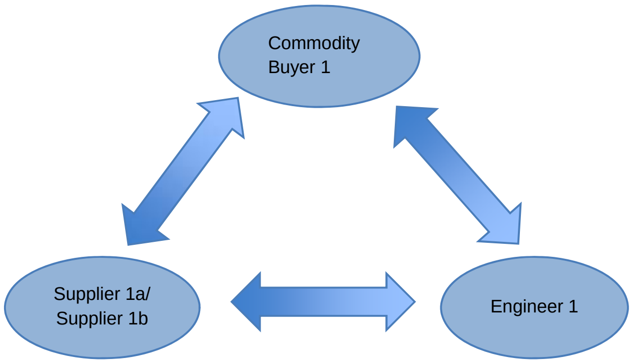

Figure 4: Triadic Relationship

Further, Supplier Relationship Manager (SRM) for one of the suppliers included in the study was interviewed to understand the kind of interaction and information exchange the SRM had with suppliers and buyers. These interviews were recorded and transcribed later for data analysis purposes.

Additionally, there were several meetings conducted with buyers from other business areas and continents, raw material standard and grades team, other engineers for support on other commodities, logistics team, supplier quality engineer etc. These meetings were not recorded, but were very important to collect, understand and use data required for the thesis work. The Appendix BB maps all the meetings conducted for the thesis work within Volvo Group.

Finally, all the data obtained through interviews and the database of the Volvo Group is further analyzed to fulfil the purpose of the study and answer the research questions. These research questions require a certain number of tasks to be performed to address them as shown in Figure 5. The tasks with respect to RQ I and II identifying high spend parts and further RQ I involves identifying functional and technical similarities. Further RQ II involves identifying same part numbers with price differences across different purchasing organizations within GTP. And then RQ III involves tasks to extract Bill of Materials for a high runner truck and further certain high spend parts which can be classified under Metal Tube Purchasing are identified. Further RQ IV and V involves identifying high spend suppliers. The next step in RQ IV was to identify metal tubes and classify them based on dimension, tonnage and material type. RQV includes tasks to map the supply network and find opportunities to optimize them further. Next RQ VI involves tasks of semi structured interviews with buyers, suppliers and engineers, further study and analyze the current situation to propose methods to improve cross functional collaboration.

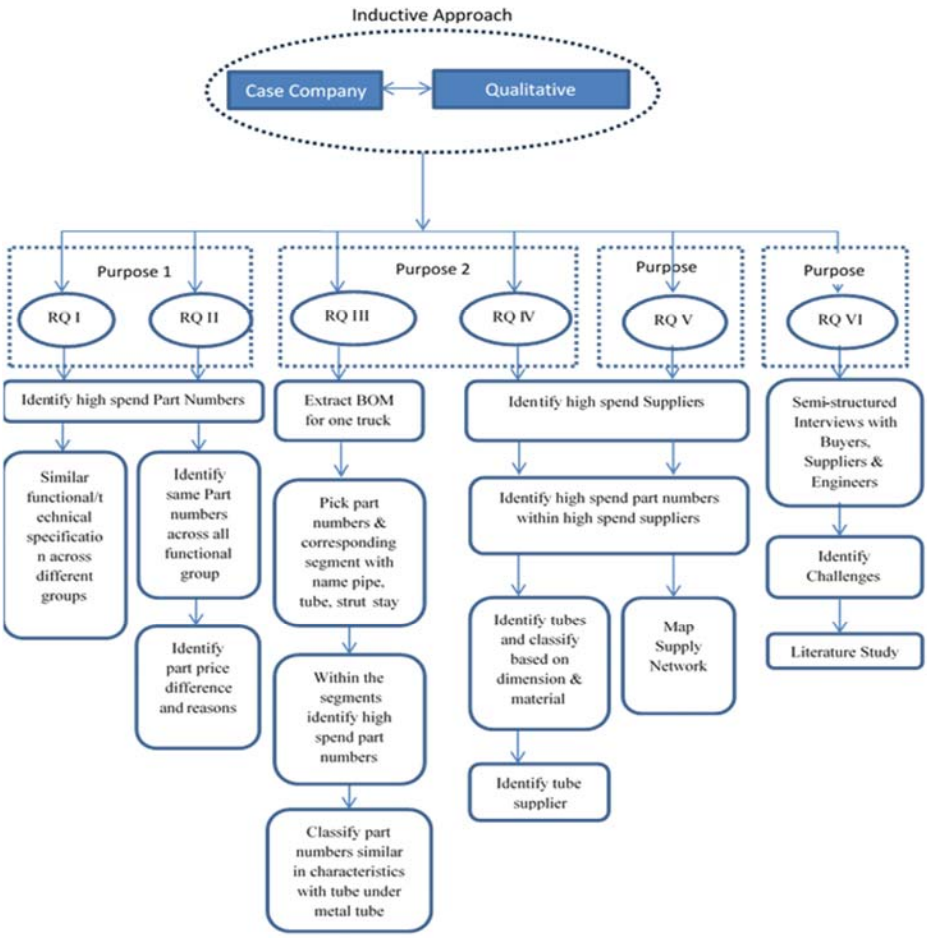

Figure 5: Tasks relating to each research question

2.3 Trustworthiness

Connelly (2016) refers trustworthiness to confidence in data, data interpretation and methods used in ensuring the quality of the study. The author also states four important criteria for confirming the trustworthiness of the research study and these are credibility, dependability, confirmability and transferability (Connelly, 2016). Credibility refers to data quality, dependability is how stable the data has been over time with changing conditions of the study. Conformability refers to consistency of the data obtained, and transferability is the degree to which the findings can be used in other studies or criteria (Connelly, 2016).

By using triangulation credibility and dependability in the study was supported. Triangulation is an objective to increase the data quality or confidence on the study by confirming the proposition with two or different independent measures (HEALE & FORBES, 2013). In this study, literature and interviews were used and compared to propose conclusions. The consistency of the data is confirmed by asking the same set of questions for all the interviewees. The interviews were recorded and transcribed to ensure conformability. Finally, the conclusions are based on the legitimate theories and data collected within the metal tube team. Therefore, the findings can be potentially adapted to other divisions of purchasing team. Also, Easterby-Smith et al. (2015) states that a complete transparency during the data collection is important. Therefore, a detailed transcription and an open communication regarding the process were done with the interviewees in the organization.

2.4 Ethics

Saunders et al. (2016) defines research ethics as behavioral standard which acts as a guide of conduct in conducting the research in relation to the research objects or those who are affected by it. (Bryman and Bell, 2003) state four important ethical factors: harm to participants, invasion of privacy, lack of informed consent and deception. Harm can be physical or mental harm, causing stress or affecting the participant’s possible employment in the future (ibid). Confidentiality and anonymity could be used prevent any harm following the openness from the participant (Bryman and Bell, 2003). Participants’ personal data has to be handled with care and in an appropriate way and is important for the researched to be transparent with the participants involved.

In this study, the purpose of the research was communicated well in advance. The participation of interviewees was voluntary, and they were free to cancel their participation any time and also could decide to not answer any particular questions. The interviews were recorded only with the permission of the participants and if they wished, they had the freedom to read/comment on the transcription without altering the main content of the interview. The participants have been held anonymous with their own preferences and the confidentiality has been handled accordingly. The research has been carried out with utmost respect towards participants, organizational values and information confidentiality

2.5 Research Process

To fulfil the purpose of the thesis and to further complete the tasks identified under each research question (refer Figure 6) a process was adopted. These identified tasks were carried out in four different phases of Synergy Management Process explained in an article by Daum P (2012). Synergy Management process has been explained by the author in terms of an overall corporate strategy. The synergy management process even though has been described for large mergers & acquisitions by the author Daum P (2012), this thesis aims to apply the same concept at much lower level starting from within the purchasing organization to different purchasing organizations of other business units within the group. Hence, Synergy Management Process (SMP) has been adapted from Daum, P (2012) to conduct the research. This framework provides a direction to solve the research questions. It involves four different phases in identifying and developing synergy within a company. The first phase is the definition phase which includes identification of synergetic potential which would add value to the whole corporation. Further, value in a business system is created with the interactions of subsystems which are based on variety of micro systems (staff members, resources or machines) (Cockerill, 1995).

The second phase involves planning phase and requires identifying strategic options for synergetic interaction (Daum, P (2012)). The author also states that any possible negative effects should also be considered in the planning phase in linking the individual units. In the planning phase, pareto principle is applied for the research questions wherever it is necessary. The main reason being to identify part numbers with high spend and has high impact in metal tube purchasing. According to Ronen, B, & Kozlovsky, (2007) 20% of the projects generate 80% of revenue and in a given bill of material 20% of part numbers account for 80% value. The third phase is the implementation phase, and, in this phase, communication plays a crucial role in creating synergies (Daum, P (2012)). Daum, P (2012) also speaks about the reward in achieving synergy goals i.e., joint incentives to make cooperation more likely. This works as a driving force in implementing synergies. The final phase is the control phase where verification is done to check the anticipated results. This is because, often positive synergistic effects do not turn out as anticipated as they are over clouded by unpredictable events (ibid). Table 3 explains different phases and actions involved specific to the study with respect to SMP.

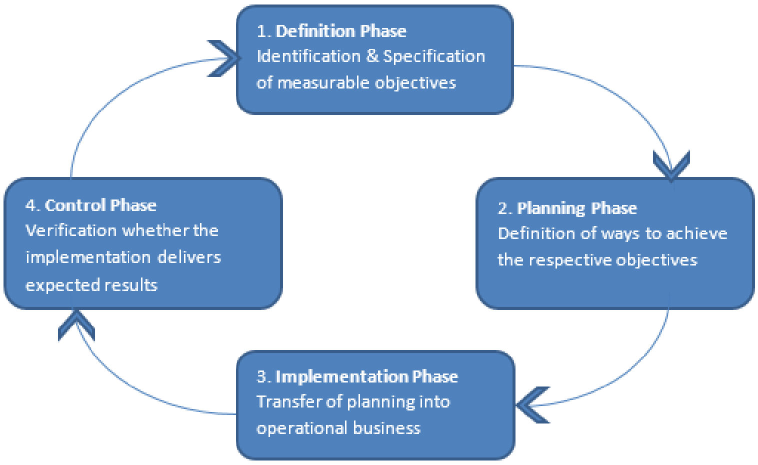

Figure 6: Synergy Management Process (Daum, P, 2012)

Table 3: Different phases and the actions involved within each phase

Phase within SMP	Actions Performed Specific to the Thesis Work within SMP Phases
Definition Phase	• Identified measurable objective - part price of high spend components in metal tube purchasing • Identified synergetic interaction potential to improve metal tube purchasing
Planning Phase	• Data collection & strategic options/solutions for synergetic interaction
Implementation phase	• Communicate between the business units • Communicate between buyers that purchase different segments • Communicate between buyers, suppliers and engineers
Control phase	• Verify Reduction in part price • Verify Increase in process efficiency in purchasing • Study what assumptions and possible future actions should be taken and predict possible risks and measures against the risks

3 Literature Review

A theoretical framework is presented in this chapter. The main aim of this chapter is to provide the reader an understanding about the factors involved in implementing synergy and the effects of implementation. The framework also provides credibility and trustworthiness for the analysis and results for the research within maximizing synergies and its effects.

3.1 Synergy: implementation and its effects

From the literature, it can be understood that synergy can lead to economies of scale (Kraljic, 1983) (Faes et al., 2000) (Smart, A. & Dudas, A, 2007), economies of information (Rozemeijer, 2000) (Quintens et al., 2006) (Trautmann et al; 2009), economies of innovation (Nix & Zacharia, 2014) (Pellizzoni et al., 2015) (Roberts, 1999). To achieve this synergy there are various possible means and some of the means utilized in this research work are performance measures (Saranga and Moser; 2010) (Cousins et al.; 2008), data management/information systems (Dewett and Jones, 2001) (Rozemeijer, 2000), functional coordination/cross functional integration (Dowlatshahi; 1992) (Foerstl et al.; 2013), total cost/benefit analysis (Cousins et al.; 2008). This theoretical framework gives an overview on synergy implementation and its effects and will be further used as a source for analysis. An illustration of this is shown in Figure 7 below.

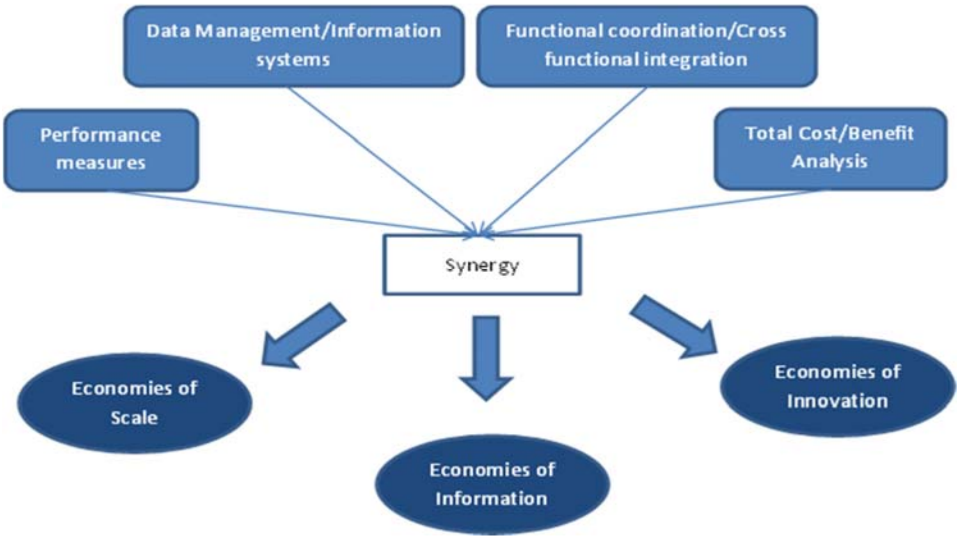

Figure 7: An illustration of theoretical framework in reference to the theory explaining the possible means (top) in implementing synergy and effects of implementation (bottom).

3.2 Concept of synergy in purchasing

Synergy is the coordination or interaction of two or more organizations or working units to produce a combined greater effect than the individual effects. It provides a competitive advantage by sharing resources, sharing best practices and aligning strategies across two or more units. Daum, P (2012), states that synergies do not develop themselves while it must be initiated in a professionally coordinated way. In business context, synergy is based on economies of scale where the costs are reduced across two interacting businesses by purchasing larger volumes. According to Faes et al. (2000) global purchasing synergies are divided into three categories economies of information, economies of process and economies of scale.

Smart, A. & Dudas, A (2007) explains a scenario of an airline industry in crisis and forced to cut costs. In order to do this company invested on a new supply chain management division to tap synergies by capturing benefits from coordination. According to Smart, A. & Dudas, A (2007) purchasing synergy is usually defined as pooled or pooling purchasing power. A logical step to implement synergy in purchasing is to coordinate the purchasing activities globally (ibid). Ensign (1998) states that sharing can lead to competitive advantage with certain preconditions. They are: 1) interactions between units which have a significant operating cost, 2) decrease in cost by running shared activities and 3) sharing has to support the differentiation by reducing differentiation costs or support the uniqueness in an activity.

3.3 Challenges in implementing synergy

Synergy implementation initially is a tough task as the unit managers have a high resistance (Faes et al, 2000). Further cross-business synergies act as an important part of a company's strategy, but traditional approaches lead to focusing on wrong opportunities (ibid). Another important aspect which a challenge in is implementing synergy is customization and responsiveness (ibid). Faes et al; (2000) explains a situation where a purchasing coordinator in a company stated that "people are too independent to understand positive side of the synergy". Shaver, J.M. (2006) explains that synergies usually create interdependencies and limit flexibility across business units. Porter (1985) explains three types of negative cost effects occurring due to synergies/sharing of resources; which are costs of coordination, costs of compromise & costs of inflexibility. However, Campbell and Goold (1998) argue that whole new way of thinking and application is required to avoid such failures. Daum, P (2012) explains that there are certain barriers blocking the synergetic interaction between the business units. One such barrier is performance related compensation to unit managers which limits their willingness to follow the overall objective.

3.4 Economies of scale

As the competition increases companies seek synergy across business units and opportunities for pooling negotiation is one the value-adding criteria in purchasing function (Faes et al. 2000). Volume is a company's bargaining chip and is very critical as economies of scale leads to competitive advantage (Kraljic, 1983). According to Trautmann et al (2009) to have a better or improved negotiation in the relevant supply market, adding up common requirements and aggregating the volume is the key. Standardized categories with minimal risk, similar in specifications and subjected to very few design changes are most suitable for pooling, thus increasing purchasing power. The two crucial factors in economies of scale are degree of volume aggregation and relevant supply market. Where the latter determines the supplier delivery capacity, price differences, currency fluctuations (Trautmann et al; 2009). Kraljic (1983), states that bundling leads to low overheads, specialized production and supply of high-quality parts, thus economies of scale. Davies et al. (1974) classifies purchasing items into four categories: raw material, machinery, components going into products and supplies not going into products. The authors state that, raw materials are or suitable for bundling activities as it is purchased in an organized market or from a small group of suppliers (Davies et al. 1974). Smart, A. & Dudas, A (2007) explain a case study where standardization of item specifications led to reduced supplier base and increased economies of scale by pooling.

3.5 Economies of information

A way to achieve a competitive advantage is by coordination between activities/units (Porter, 1985). Often purchasing department recieve incomplete information on company's business plan and also lack adequate operating information regarding demand variations with 3-6 +month horizon (Kraljic, 1983). The author states that a company must foster cross functional information flows and demands and encourage managers to supply information to purchasing information system. The capabilities in relation to purchasing are defined by the ability to assimilate and disseminate the information on suppliers and markets and building relationship (Quintens et al., 2006). The authors also state that a purchasing information system, enriching the purchasing staff with internationally experienced people and a global knowledge sharing system will benefit the purchasing staff within a company. Sharing of information efficiently across the globe and knowledge accumulation will lead to simplification of standardization, categorization and centralization of products (Quintens et al., 2006). Also, Rozemeijer (2000) states that pooling insights into function and process like purchasing strategies, access to world-class suppliers etc., will improve the results and Value is created by exchanging information from one set of people to other.

The need to leverage information and knowledge specific to purchasing situations across business units and purchasing organizations is crucial (Trautmann et al; 2009). The knowledge or information shared across the organization help the decision makers reduce the risk of uncertainty (Tushman and Nadler; 1978). The main two factors included in economies of information are purchasing complexity and supply risk (Trautmann et al; 2009). The complexity of purchasing is highly dependent on the type of product being purchased. If the product is completely new or if a product is highly customized, more information is required by the buyers resulting in increase in uncertainty (ibid). The external factors like the supplier availability, high price fluctuations, supplier power will also increase the uncertainty. Thus, there is a need for gathering more supply market information to procure products with desired quality, price and quantity.

3.6 Economies of innovation

Beath et al., (1987) explains two different kinds of innovation, product and process innovation. The former is about the possibility of differentiation of the existing product and the latter is about outward shift of an existing supply function leading to low variable costs in terms of producing a product. The returns of the innovation activities of a firm are determined by the reactions of its customers and competitors and hence the payoffs for all the actors within a market are interrelated. Innovation being a competitive factor, it has been analyzed that firms can extract some external knowledge and to have the innovation process extended beyond their boundaries by collaborative innovation approach (Pellizzoni et al., 2015). According to Nix & Zacharia (2014), collaboration has particularly become important as knowledge and capabilities are distributed in network economy. Kähkönen (2017), states that strategies driving integration value, total cost thinking, and ease of use leads to obsolescence of out dated products and produce or develop new products to offer to customers. A sustainable high profit is a result when a firm repeatedly introduces valuable innovations to meet customer demands and thus maintaining a high performance (Roberts, 1999). Soosay et al., (2008) recognized different kinds of supplier collaboration. Firstly, Supplier involvement, concerning supplier contribution in suggesting small changes in New Product Development (NPD) to developing a specific part of the product on behalf of the customer. Second, Supplier development, involving the activities undertaken by the customer/buying firm in developing the supplier's performance in terms of product, process etc., Finally, supplier integration, concerning coordination and knowledge sharing activities with the suppliers in terms of capabilities, process, and constraints lead to effective planning and forecasting (Soosay et al., 2008).

3.7 Performance Measures

Performance measures are defined as those indicators used by the management to measure, track, report and improve performances (Parmenter; 2007) of an individual, a team within the organization or the organization at large. In terms of purchasing and supply management firms are deeply rooted to the traditional performance measures that are driven by cost savings (Saranga and Moser; 2010). More specifically, common purchasing and supply management performance measures are cost, quality, delivery, flexibility (Cousins et al.; 2008). In the current competitive markets such performance measures are inevitable (Saranga and Moser; 2010) (Cousins et al.; 2008) even so, it is important to have performance measures that influence and encourage cross-functional collaboration (Cousins et al.; 2008). Cousins et al. (2008) emphasize that non-financial performance measures will help shift the focus from short term financial goals to medium and long-term goals. Further, Cousins et al. (2008) goes on to say that suitable non-financial performance measures are the reasons for successful financial performance in the long run. In this regard, identifying each other's important stakeholders and what kind of information they hold and how it could be put to use could become some of the steps towards such performance measures (ibid.). Performance measures that promote continuous improvement ideas are necessary in dynamic business environments. Therefore, developing performance measures that track the capability to innovate and learn are also imperative. For example, this can be measured in terms of how many improvements ideas have one suggested (ibid) or one's contribution to innovation (Foerstl et al.; 2013) etc. Rozemeijer (2000) further adds that to have an effective coordinated purchasing approach the performance measures should be built in a way that it is applicable across business units and functions and thus will improve purchasing synergy.

3.8 Data Management/Information Systems

Obviously, purchasing, production and logistics departments are the core of any supply chain and to have coordinated action between then continuous flow of updated information is important (Feger; 2011). And to have integrated information technology influences the level of collaboration across these functions (ibid). Assuming that most organizations have realised this requirement, in the pursuit of maximizing synergy it becomes necessary to check and understand the level of information flow within the functional setup and other actors (internal and external to the purchasing) that influence the purchasing function. One of the areas that companies should focus on to improve their purchasing synergy and trigger functional and cross functional collaboration is robust information and communication infrastructure (Rozemeijer; 2000). Kraljic (1983), stresses on the importance of information systems for continuous and consistent flow of information across all functions and effective use to realise price reduction or savings. According to the article by Dewett and Jones (2001) there are five important effects of robust information and data management systems on any organization and they are:

- it links employees within and across all functions
- it encodes and reverses information's it has collected or gained over time thus enabling an organization to expand its knowledge
- it enables an organization to improve its boundary spanning capabilities
- it provides improved information processing capabilities thus increasing efficiency
- it supports innovation and idea generation through improved collaboration and coordination across the organization.

These essentially are the basis for maximizing synergy and are supported by robust information system/data management systems.

3.9 Total Cost/Benefit Analysis

Any decision or synergistic actions proposed should be validated on a total cost approach or benefit analysis. Smart and Dudas (2007) emphasis on the fact that synergy may result in cost reduction, but it is important to consider the total cost the company will incur. The total cost is influenced by several factors like currency fluctuation, project cost, tendering cost, switching cost, logistics related cost etc. (Smart and Dudas; 2007). Any synergy initiatives should be based on transparency, analysis and alignment, and to achieve this companies often create a document called ‘business case’ (Cousins et al.; 2008). This is important for the organization to realize a greater positive effect rather than a just function optimizing its purchase cost.

3.10 Functional coordination and cross functional integration

Functional coordination can be defined as the sharing of information and management of same or common products and services and supplier base between all the purchasing organization within a company (Trent and Monczka; 2003). Whereas, cross functional integration can be defined as the collaboration between purchasing and other functions like engineering, design, production etc. (ibid).

Functional coordination and cross functional collaboration are considered to be the two most important strategies or elements in the development of purchasing and supply management (Axelsson, B et al; 2005). In the article by Foerstl et al. (2013) the authors have developed and supported four hypotheses in their study with regard to cross functional integration and function coordination. Of which two are relevant to this thesis and are: functional coordination has a positive effect on purchasing performance and so does cross functional integration. Further, purchasing function is defined as the ability of purchasing team to implement cost reductions, maintain quality, lead-time and contribute to innovation (ibid).

Functional coordination improves synergy potentials in the form of economies of scale, scope and process (Faes et al.; 2000). Moreover, the coordination activities will provide purchasing with an upper hand on price and quality and therefore purchasing should coordinate its activities wherever possible to improve results (Foerstl et al.; 2013). Rozemeijer (2000), stresses on the benefits of pooled negotiation power. By having amalgamated purchases different purchasing functions/units can enjoy better leverage over suppliers, reduce cost, improve quality of products bought Rozemeijer (2000).

Cross functional collaboration, especially with the engineering team will help in improving the involvement of suppliers in product development phase, in the identification of interchangeable parts, standardization and simplification of parts, fewer changes in process planning, easier manufacturable parts etc. (Dowlatshahi; 1992). All these leading to better purchasing performance (Foerstl et al.; 2013). One of the tools suggested by Dowlatshahi (1992), is Value Analysis (Value Engineering), which is an interfacing activity between engineering, buyers, suppliers and production, where the objective is to reduce costs at the very initial stage of the project through design simplification, part elimination, material substitution or process modification.

Further, the article by Foerstl et al. (2013) highlights the fact that the purchasing appraisal and goal settings will motivate the purchasing professionals to improve both functional coordination and cross functional integration. Such performance appraisal and goal setting will make the value of the purchasing function transparent and tangible to other stakeholders within the company (ibid). Moreover, such tracking of performance will also help uncover inefficiencies within the purchasing function (ibid).

Finally, the study conducted by Foerstl et al. (2013), suggests that functional coordination is more effective in terms of improving purchasing performance than cross functional integration. The reason being, functional coordination across all purchasing organization within a company is more advantageous for purchasing performance by having coordinated supply base strategy and category management (ibid). Therefore, the focus should first be on developing better functional coordination and then cross functional integration (ibid). Moreover, such coordination activities will require the investment of more personal time, proper information system to collect, aggregate and share relevant information and therefore will also involve cost (ibid).

4 Synergy Management at Steel Tube Purchasing Volvo GTP

This chapter involves four different phases as explained earlier, Definition, Planning, Implementation and Control phase. These phases are described based on each research questions mentioned earlier. Definition phase mainly involves defining the problem which is explained in the background and purpose. Planning phase involves presentation of empirical data with respect to the problem. Implementation phase is the analysis phase and control phase refer to the discussion where recommendations on successful implementation and the risks involved are described.

4.1 Definition phase

Meetings and discussions with the metal tube purchasing helped in identifying and defining problem statements that could be solved with the concept of synergy. The main quantifiable objective was to obtain reduced part price by synergizing or collaborating with other business areas, buyers, suppliers and engineers. To make this possible, the current level of interactions between these actors was to be studied. Thus, this phase helped the development of six research questions stated in the section 1.4.

4.2 Purchasing strategy to maximize the advantage of procuring similar PNs

This chapter identifies the opportunities where synergy can be implemented between different business area. Further, a purchasing strategy is proposed to maximize this advantage and procure similar part numbers across different business areas to obtain the benefits.

4.2.1 Planning phase

To develop plans to address the research questions extensive data collection was required. After which the data was studied and analyzed to suggest solutions to the research questions. The following sections present the data collected and how the data is used to draw up plans.

To answer the RQ I extensive data analysis on the parts under metal tube purchasing was done and this includes four important tasks. The initial task performed was the application of Pareto Principle to identify high spends parts. Among the many part numbers under the steel tube purchasing, it is important to identify those parts that will have greater impact in terms of potential savings or supply chain optimization when any changes are made. Spend, volume and supplier data of the part numbers were collected from Volvo’s internal purchasing system. The application of Pareto principle narrowed down those part numbers within metal tube purchasing was considered in the research work. These part numbers are further considered according to segment classification to identify which segments have the highest spend across different business areas. The segment which has the highest spend across all business areas was prioritized to continue with the next task. The second task involved comparing the part numbers similar in terms of design, technical and functional specifications within other business areas like Volvo Buses, Volvo Penta and Volvo Construction Equipment. The similarities were identified by accessing the design and specification documents of these parts from Volvo's internal database. Moreover, a conformability check was done by consulting the engineering department to confirm if there were any similarities between the identified part numbers. Secondly, a comparison of the supplier base of GTP and that of the other three business areas were made and this comparison helped identify common and/or other potential suppliers. Depending on the outcome of these activities a suitable purchasing strategy is suggested in the implementation phase.

To address RQ 1, data on part numbers from Volvo Trucks, Volvo Construction Equipment, Volvo Penta and Volvo Buses were collected by following the method described above. Except for Volvo Construction Equipment (VCE), all other business units use the same purchasing and material management system therefore, data collected was in the same format and had the same segment classification as that of Volvo Trucks. Whereas, for VCE, first, the data had to be brought down to the format that would enable comparison. Once this was done, the current year forecast spend of each of these Business Units were split into segment codes. The pie charts below represent the percentage spend of the five segments under steel tube purchasing within each business units.

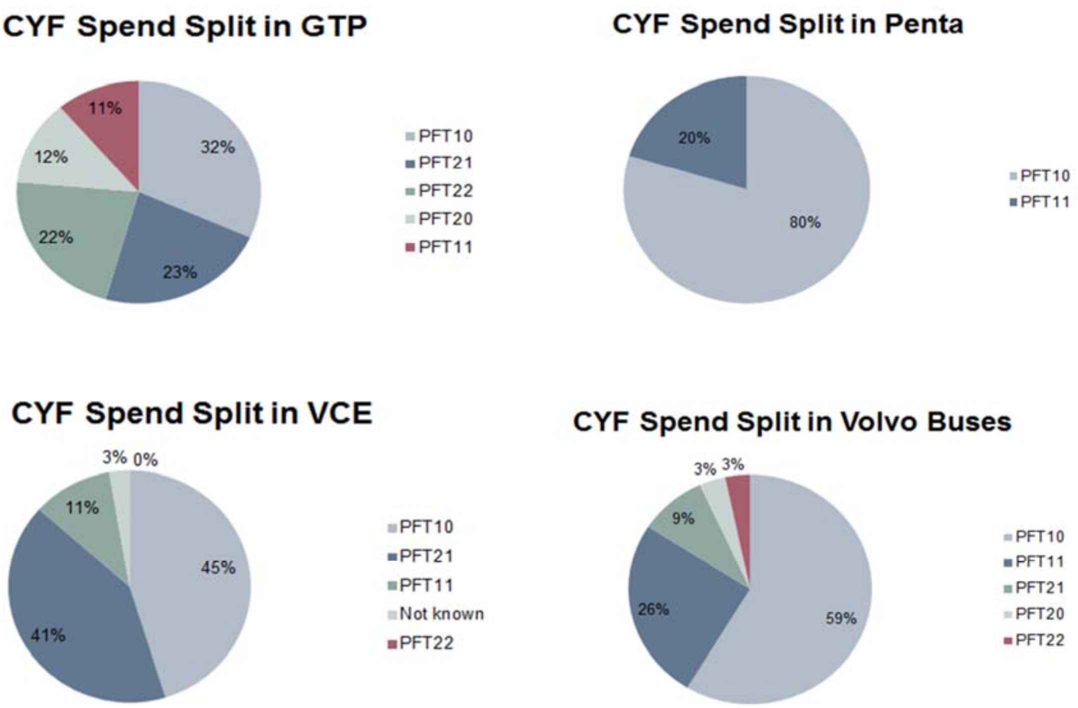

Figure 8: Spend and segment split with respect to business units

From the pie charts in Figure 8 it is evident that, in all the business units PF10 (fluid pipes) hold the major share of spend, followed by PFT21 (structural pipes) and PFT11 (rigid exhaust pipes). The part numbers within these segments of VCE, Penta and Buses were compared to GTP to identify commonalities in terms of material, design and function.

From this study it was clear that GTP, VBE and Penta shares almost the same supplier base. When the supplier base of VCE was compared to GTP, 3 new potential suppliers were identified and was never once used by GTP before. The table 4 below shows the identified suppliers and the segment of the part numbers they supply to VCE along with the spend split.

Table 4: Supplier business split

Supplier Name	**Segment Code**	**Spend Split**	**Presence in GTP Supplier Base**
Omega	PFT10	60%	Not present
Psi	PFT10	22%	Not present
Chi	PFT10	15%	Present with very minimal business

The table indicates that Volvo GTP is unaware of the existence of the supplier called Omega with whom VCE has a major share of business.

4.2.2 Implementation phase

The major finding for RQ 1 was the presence of unknown suppliers with large spend in other business units. This information was hidden or undiscovered until the exercise under RQ 1 (planning phase) was performed. The main reason is information sharing. After identifying the potential suppliers, the next step the respective buyers of the segment can do is to contact the VCE buyers associated with the supplier Omega and together study the part numbers purchased by VCE from Omega. GTP buyers can then send in a request for quotation (RFQ) for the potential high spend part numbers within their portfolio. The information obtained from the quotation can be used to benchmark the existing suppliers within GTP's base. In case the supplier Omega, turns out to be potentially good at pricing without compromising on quality, then GTP can launch a renegotiation activity with the current suppliers to avoid the cost of switching which may affect the final benefit according to total cost approach (Smart and Dudas; 2007). If the current supplier is not aligning with the market price and if supplier Omega still turns out to be cheaper, even with the switching cost then a supplier switch may be performed to enjoy pooled purchasing benefit across both VCE and GTP (Smart and Dudas; 2007). Additionally, when new projects are created within this segment of steel tubes, supplier Omega should be included in the RFQ process and once again leverage the benefit of pooled purchasing power.

4.2.3 Control phase

Once the contact with supplier Omega is established and they prove to have a cheaper market price, the logistical flexibility must also be analyzed, and a total cost approach has to be carried on having an overall positive effect for the organization (Smart and Dudas; 2007). Further a better information flow has to be created with Omega and appropriate supplier development plans have to be organized to overcome the initial challenges with the supplier. The relationship with the supplier can be taken up in steps, initially starting with supplier involvement, then supplier development and finally integrating with the supplier (Soosay et al., 2008) depending on the supplier's performance in quality, cost and delivery aspects.

4.3 Opportunities to maximize synergy within GTP

This chapter mainly involves a study within Group Truck Purchasing identifying part price differences. Further with the data obtained the possible opportunities to maximize synergy within Group Truck Purchasing are analyzed and proposed.

4.3.1 Planning phase

To answer RQ II, a study was conducted across different purchasing organization within Truck purchasing. The part numbers were extracted from the company's database. Further pareto principle was applied to identify high spend part numbers in all segments and across all functional group (GTPS, GTPN etc.,). These identified part numbers across all functional group are investigated, for price differences and reasons for the difference. The results of these steps are further explained below.

From the Volvo database, part numbers within the five segments with 80% of the total spend for GTP were compared against the same part numbers that were bought in North America, South America, Russia and Asia. The comparison mainly focused on part price, corresponding current year forecast (CYF) quantity and suppliers. By doing this activity it was observed that there were 6 part numbers (PN1, PN2… PN6) with potential to be investigated further as the price differences ranged from about 22% to 65%. Another interesting point that was noted in these cases was the presence of repetitive suppliers. For example, Kappa supplied PN1 to GTP Europe at piece price of 699,46 SEK with a current year forecast quantity of 6727 pieces (refer table 5). The same part number PN1 is also supplied by Epsilon SA to GTP South America at piece price of 546,49 SEK with a current forecast quantity of 230 pieces. This combination of Kappa and Epsilon SA prevails in 4 out of 6 cases and thus has a higher potential for savings and/or investigation (refer table 5).

Table 5: Part Price differences

Part Number	Segment	POrg	Suppliers	CYF Qty	Price/Unit	Price Diff.	% Diff.	Potential Savings
PN1	PFT11	GTP	Kappa	6 727	699,46 kr	152,96 SEK	22%	1 MSEK
		GTPS	Epsilon South America	230	546,49 kr			
PN2	PFT10	GTP	Alpha	1 644	692,01 kr	214,31 SEK	30%	0,35 MSEK
		GTPS	Tech South America	142	477,70 kr			
PN3	PFT11	GTP	Kappa	1 814	582,82 kr	120,12 SEK	20%	0,2 MSEK
		GTPS	Epsilon South America	16	462,70 kr			
PN4	PFT11	GTP	Nu	2 619	315,50 kr	103,33 SEK	32%	0,27 MSEK
		GTPR	Beta Russia	720	212,16 kr			
PN5	PFT11	GTP	Kappa	235	1 483,68 kr	941,58 SEK	63%	0,22 MSEK
		GTPS	Epsilon South America	22	542,10 kr			
PN6	PFT11	GTP	Kappa	78	1 641,12 kr	1068,58 SEK	65%	0,08 MSEK
		GTPS	Epsilon South America	10	572,55 kr			

Buyers were contacted to understand the reasons for such variations. The obvious reasons were inflation in the two continents/countries where the components are produced, local steel prices, and labor and facility chargers. Even, with these factors in mind the gap that ranges from 22% to 65% were not sufficiently supported. Thus, the next logical step is to approach the current suppliers in Europe to further understand the reasons for such gaps and take up negotiations to lower the gap in price difference. Should the negotiations fail, and then the next step would be to identify the opportunities to ship the products from South American and Russian suppliers, of course keeping in mind the total cost approach.

4.3.2 Implementation phase

The first step in this phase should be to contact the European suppliers for the part numbers presented in table 5. This is required to understand the reason behind the part price differences and to lead commercial negotiation with these suppliers to reduce the gap in prices. In parallel, the buyers in Europe should initiate communication with buyers from other continents and through this channel, request for information/quotation from the non-European suppliers for the part numbers presented in table 5 with the current year forecast quantities required by the European plants. As the current quantities purchased by the other purchasing organizations are lower, by adding quantities required by the European plants should further decrease the piece price due to economies of scale (Trautmann et al (2009) (Kraljic; 1983). Therefore, if the negotiations with the European suppliers fail to yield any results, the parts should be purchased from other favorable continents/countries. Either way, the purchasing KPI of reducing the part price will be achieved. But an important factor to consider is the logistic cost and other added costs that may occur if the parts are purchased from other continents (Smart and Dudas; 2007). Thus, a total cost approach should be adopted. Even, with this in place, good results may be achieved since the part price gap is already ranging from 22% to 65%. With the Volvo Logistics team's help, it was identified that the shipping of the identified part numbers from South America to European plants would cost 13.5% more on the existing part price, which is still well within the existing price gap.

One of the reasons why such cases appear and are hard to identify is because of how the purchasing organization is structured. Moreover, proactive monitoring of prices of same part numbers across continents (or purchasing organizations) is required along with effective flow of information on prices and suppliers. To identify such cases, meetings at regular intervals should be scheduled to improve and utilize economies of information, scale, scope and process wherever applicable (Faes et al.; 2000). Another aspect to keep in mind is the combined effort buyers from both the continents would put in to make this case a success. Therefore, the suitable performance measures should be built to make this combined effort visible across the organization that will motivate both the buyers to work towards such activities (Cousins et al.; 2008) (Foerstl et al.; 2013).

4.3.3 Control phase

For RQ II, once the supplier is proven to be cost efficient compared to the European supplier and has the capacity to supply for both European and non-European plants, then a logistics flow is created, and the supply terms are negotiated. But considering an overseas supply, delivery is still an issue because of the time required for transportation. Therefore, a proper planning has to be done and the flow has to be controlled based on the plan to overcome late delivery issues. There are also issues packaging considering long distance transportation. Therefore, the packing design has to be durable so that the product is easier to handle between different modes of transportation and parts within are carefully delivered without any damages/defects. Another issue that the firm can face is the capacity issue due to long lead delivery lead times. Therefore, optimum inventory levels have to be maintained to overcome this issue. To manage these issues a proper channel for information flow has to be created with the buyers in different continents, supplier, logistic team and the product users as Feger; (2011) states a continuous flow of updated information is important.

4.4 Parts that could be classified under Metal Tube Purchasing

In this chapter the focus is mainly to identify the parts that are not currently segmented under Metal Tube segments but have the potential to be classified under Metal Tubes. The study focuses on collected data and analyzing with respect to synergy leveraging the benefits from current supply base.

4.4.1 Planning phase

A truck is built using thousands of parts and so will it involve thousands of part numbers. By looking from steel tube purchasing point of view, there are supposedly a lot of steel tube parts that are classified under other segment codes that are currently not within steel tube purchasing. Thus, losing the leverage of having a common supplier base.

Parts or part numbers are classified under segment codes based on their functions. Currently there are five segment codes under steel tube purchasing and they are explained in the table 1.

It becomes necessary to understand the functions of part numbers within these segment codes in order to identify part numbers that are currently not classified into these segments but could fit into one of these segments and have potential reduction in part price by leveraging the advantages of using the existing supply base for steel pipes.

To identify such part numbers, the Material Cost Evaluation team was contacted to collect a bill of material (BOM) for one of the high runner trucks (high runner truck implies larger volume of parts purchased, therefore significant impact on the potentials). The BOM had 4080 different part numbers from various segments. The first step was to filter out all the part numbers that were already under the five steel tube segments. After this, part number descriptions were checked for words like pipes, tubes, stays, bars, struts and hose and then their respective segment codes were separated from the rest. At this stage of the process there were 20 segment codes that need further check to identify potential part numbers. Here, again the Pareto Principle was applied to reduce the number of parts to be checked within each of these segments. At the end of this process 7 part numbers belonging to three segments were identified that could fit into one of these five segments. Moreover, there were parts with an assembly of steel tube and rubber hoses or steel tube and brackets. These parts had to be scrutinized further to check if the added value was on the steel tube or the rubber or brackets. To understand where the added value of the part lies, further discussions were held with respective buyers regarding the process, tools etc. required to manufacture the part. Finally, three parts were identified out of this process that could be potentially moved to PFT10 and PFT21 segments and further benchmark the current price against the existing steel pipe supplier base.

Another interesting case that was found in this study was that sometimes, parts like air deflectors mainly made of plastic are logically segmented under plastic purchasing. But these parts are also assemblies of plastic deflector and steel pipes for structural support. Since, the steel pipes come as an assembly to Volvo plants, they are hidden and unnoticed. Further investigation made it clear that the plastic suppliers themselves purchased these steel pipes from other suppliers outside the steel supplier base. In such cases, it becomes important to scrutinize the cost breakdown of such assemblies and once again benchmark the price of these steel pipes against the existing supplier base. Four such parts were identified at the end of this study.

4.4.2 Implementation phase

Steel tubes parts (purely steel with no plastics or rubber) that are currently under other segments should be moved to the right segment under steel tube purchasing after checking if there were any reasons as to why they are under the current segment. For, these buyers from steel purchasing should communicate and coordinate with the buyers of those identified part numbers. The next step should be to identify opportunities for part price reduction by sending RFQ to the suppliers within steel purchasing. These reductions would owe to economies of scale and scope (Trautmann et al (2009) (Kraljic; 1983). If potentials exist, then supplier switch should take place, keeping in mind the total cost approach (Smart and Dudas; 2007). In case, the quotation is higher than the current price then, similar parts as those identified should be benchmarked with the new suppliers (of the part numbers under another segment). Thus, opening a room for negotiation with suppliers in the current base.

For those part numbers that are an assembly which have difficulties in being separated (due to investments in tooling, current ease for assembling etc.) as steel tubes and plastics or rubber parts should be further investigated with cost breakdown from the current tier 1 supplier and compare it to the price of the suppliers in steel purchasing supply base. (Some of the suppliers from the current supply base are also capable of producing a combination of steel and rubber and can be used to benchmark prices for such parts). If potential exists, then make that supplier the tier 2 to the plastic or rubber suppliers, once again creating pooled purchasing scenario (Smart and Dudas; 2007).

To identify and optimize such cases and leverage benefits out of economies of scale and scope buyers from other segments who identify such parts that do not belong to their segments should voluntarily reach out to the buyers of the appropriate segments. This shows, lack of information sharing. By understanding and leveraging every buyer’s knowledge on each of their portfolio would result in economies of information (Trautmann et al; 2009) and ultimately result in better part prices. To promote such behaviour within the purchasing organization, the efforts put in by both the buyers should be made visible (Cousins et al.; 2008) (Foerstl et al.; 2013).

4.4.3 Control phase

When the part numbers are switched across segments with the motive of having a right part under right segment, it is still an addition of part numbers under the buyer’s portfolio. Therefore, the buyer should have the complete knowledge about the function of the part and the necessary technical details for the production. This would help to overcome challenges with the quality issues due to changing the supplier or introducing new part to the current supplier base from buyer's portfolio. If the volume of the part number is too large, there are situations where the changed supplier might struggle with capacity issues. Therefore, the buyer has to understand the capability and capacity of the supplier beforehand and plan the supplier switch accordingly. If still the supplier faces with the capacity issues, the buyer/case company has to support the supplier to overcome the issue through supplier support and development programs (Nix & Zacharia, 2014).

4.5 Opportunities to maximize synergy between the actors in Supply Chain

The study in this chapter mainly focuses on identifying the opportunities to maximize synergy between the actors in supply chain. This main focus of this study is to collect data on the current suppliers of metal tube purchasing and analyze the possibilities to synergize between the actors in supply chain to obtain benefits from the final part price reduction.

4.5.1 Planning phase

The motive behind research question 4 is to find opportunities to reduce piece price by having a common raw material supplier (in this case steel tube) for most of Volvo's tier 1 suppliers within the steel pipe segments. Currently with metal purchasing, there are suppliers who provide steel rolls to Volvo plants and are also capable of producing steel tubes. The idea here is to increase economies of scale and scope by directing as many tier 1 suppliers of steel tubes as possible to one or two steel roll/steel mill suppliers to have the same reduced price for raw material. This activity would also remove any hidden intermediary in the supply chain that is currently adding no value but only overhead charges to the part price. To proceed with this case, large amount of data was collected and compiled and is explained in detail below.

By applying Pareto principle to the entire portfolio of metal tube purchasing for European continent it was found out that twelve suppliers account to 80% of the total spend for the current year (Figure 9). Therefore, further data collection and analysis were performed only for these twelve suppliers. Moreover, each of these suppliers on an average supply about 128part numbers/components, therefore it was necessary to consider only those part numbers which accounted for 80% of the total spend within each of these twelve suppliers. That being said, the entire study was conducted on a total of 214part numbers (separate components).

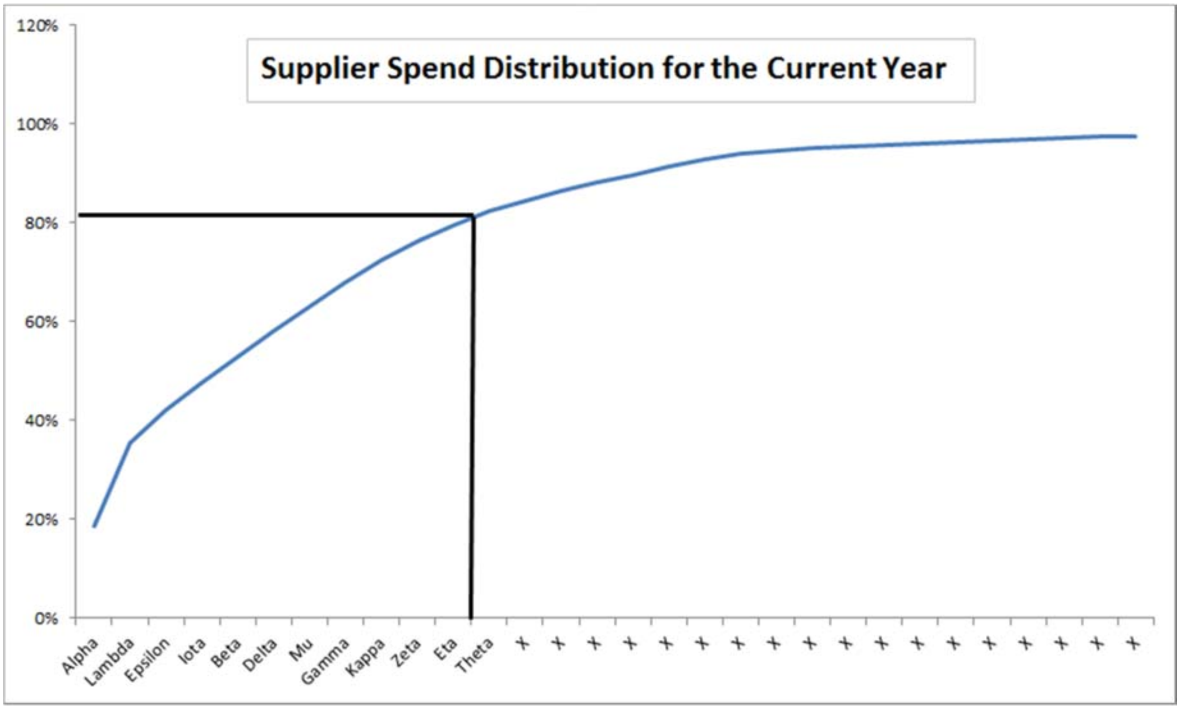

Figure 9: Spend curve with respect to suppliers

Next step in the data collection process involved mapping of correct weight and dimensions of steel pipes/tubes within each of the 214 identified part numbers. Most of these part numbers had many sub parts like brackets, flanges, nuts, screws, fittings etc. To find the exact weight of the steel tubes used in a part numbers, such sub parts had to be separated first and then extract the weight and quantity of pipes present in each part. This data multiplied with the current year forecast quantity gave the total tonnage of steel required for the current year for a single part number.

To map the dimensions of each pipe/tube structure was time consuming as not all these data were readily available on Volvo's system. Therefore, these constraints required us to review design specifications of parts to identify the dimensions of the same (mainly diameter and thickness). Also, the steel standard and grade for each of these part numbers was required for the study and this data was available on the technical specification documents. Moreover, to understand steel grade and standards better, a discussion with a standardization engineer was conducted. Since, all these data were scattered and not available at one stop, data collection involved for this research question was time consuming.

With all the data in place, a graph was plotted as shown in Figure 10 and 11 below. The graph represents the total tonnage of a particular type of steel standard and grade for a corresponding thickness and diameter. The variations in colors of the bars represent tonnage for a particular supplier. The alphabets on the X axis represent various steel tube standards and grades. The single digit numbers on the X axis represents the thickness of the metal tubes while the double and three-digit numbers represent the inner diameter of the tubes (both diameter and thickness are measured in millimeter). The Y axis represents the annual quantity of steel tubes purchased in tons.

One of the important criteria for this case to be a success and to have a stronger bargaining power with the steel mill suppliers was to have a minimum number of combinations in terms of steel grades & standards and dimensions and each of such unique combination should amount to at least 100 tons per year. Minimum number of combinations would also make the switch in supplier of raw material easier with fewer technical validations etc. Our findings showed that there were 89 unique combinations of diameter, thickness and material standard and grade. Of these 89 unique combinations, it was identified that 8 of such combination had further potential to investigate.

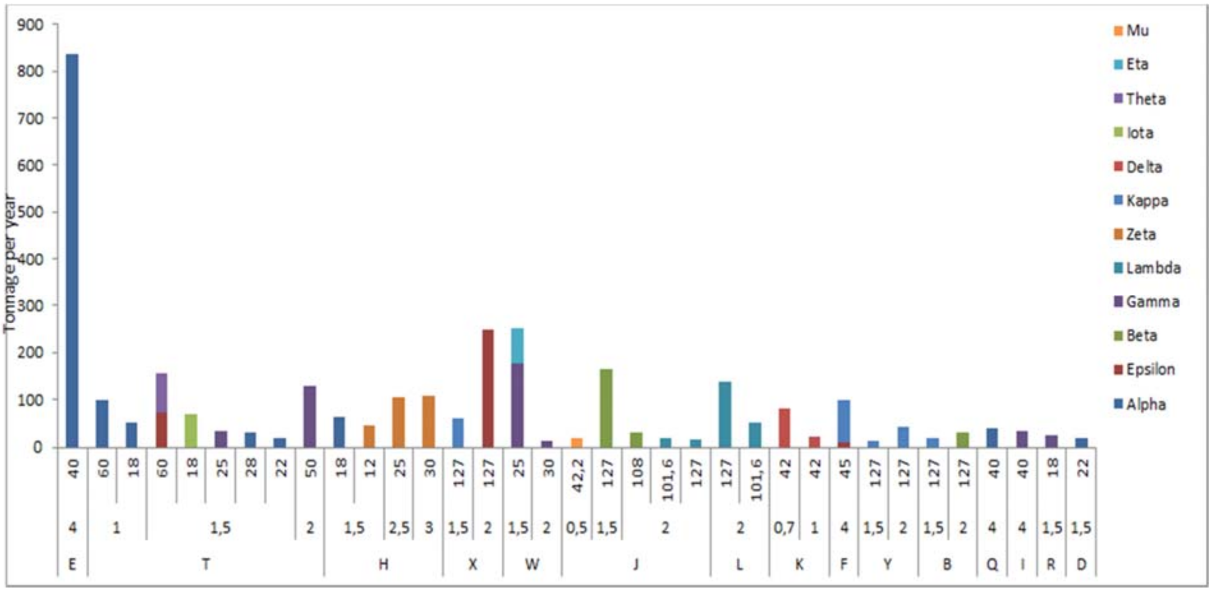

Figure 10: Tonnage of different steel grades bought from different suppliers

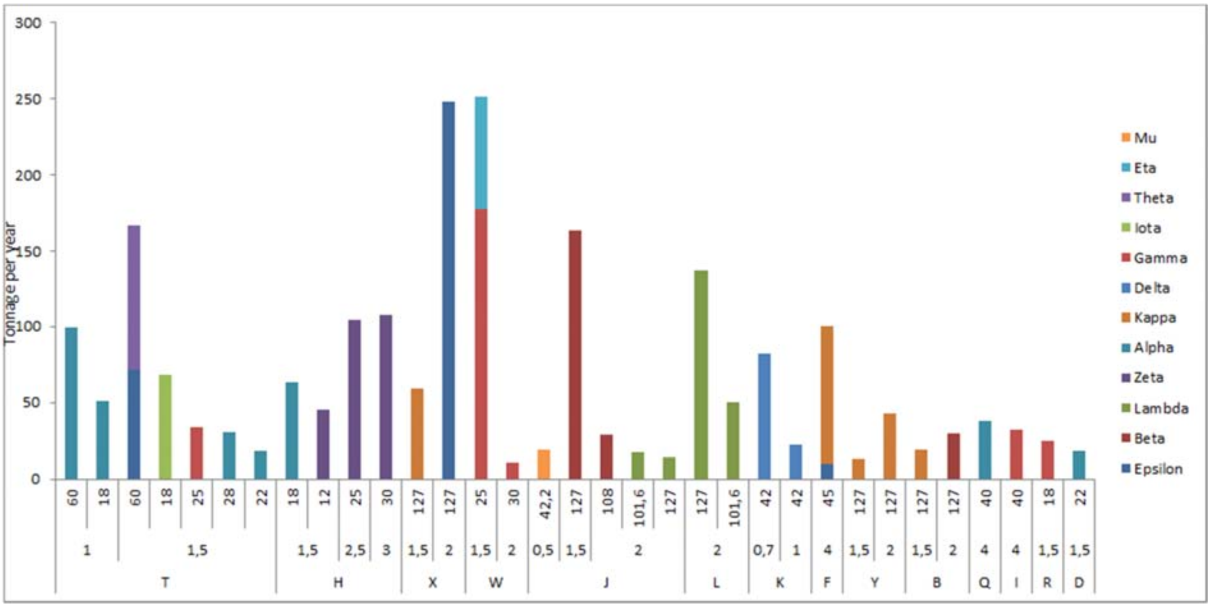

Figure 11: Tonnage of different steel grades bought from different suppliers (Zoomed in by excluding E)

To make the case even more feasible to implement, it was necessary to find out how many part numbers accounted for the total tonnage for each of the identified 8 combinations. The table 6 below is drawn to represent these findings.

Table 6: Description of number of number of parts and spend for the total tonnage of different steel grades

Steel Type	Thickness	Diameter	Suppliers	Number of PNs	CYF Spend (MSEK)	Tonnage
E	4	40	Alpha	4	27	838
T	1,5	60	Epsilon + Theta	2 + 3	5 + 12	71 + 96
H	2,5	25	Zeta	1	4	105
H	3	30	Zeta	1	3	108
X	2	127	Epsilon	4	10	220
W	1,5	25	Gamma + Eta	4 + 4	7 + 19	178 + 74
J	1,5	127	Beta	3	18	164
L	2	127	Lambda	2	13	138

In brief, for example, the steel type E (a particular steel standard and grade) with a diameter and thickness of 40mm and 4mm respectively amount to about 800 tons per year. The tonnage is split between 4part numbers and one supplier with a total current year forecast spend of 27 MSEK.

This means, if Volvo succeeds in finding a supplier to provide raw materials for these 4part numbers at competitive price then the case will be impacting 27 MSEK and the outcome of this switch of raw material supplier will result in comparatively better savings. Even bigger would be the potential to save if the raw material for all the identified part numbers is sourced from a common supplier.

4.5.2 Implementation phase

Davies et al. (1974), highlights that bundling activities of raw material can lead to economies of scale and so does the results of RQ IV. For this case, a comparison of current raw material price included in the part price and the price quoted by the steel mill/roll suppliers for the same raw material specifications should take place. Therefore, the first step here is to collect the cost breakdown from the suppliers of the 28 identified part numbers (refer table 6). In parallel, the buyers associated with steel mill/roll suppliers should be notified about the total tonnage and the specifications of steel grades and dimensions (diameter and thickness). These buyers should further send out RFQ to the suppliers of steel mill/rolls. If the quoted price is lower than the current price for raw materials, then communicate and coordinate with the tier 1 suppliers to have a smooth switch of raw material suppliers, once again having in mind the total cost approach (Smart and Dudas; 2007).

By having a common raw material supplier for the high spend and high-volume part numbers economies of scale is improved, and so will the part price reduce (Trautmann et al (2009) (Kraljic; 1983). Additionally, market knowledge on the raw material price can be shared between buyers to make further assessment of raw material price (Quintens et al., 2006) of other part numbers with tonnage lower than 100 tons. Thus, leveraging the advantages of economies of information (Trautmann et al; 2009). Once again, since more than one buyer from different portfolio are involved and share information from slightly different markets, such coordinated activities should be made visible through appropriate performance measures (Cousins et al.; 2008) (Foerstl et al.; 2013).

4.5.3 Control phase

Switching a raw material tier 2 supplier is a complex task. Because the tier 1 supplier has to build a relationship with the new tier 2 supplier and this takes time. This would initially lead to some delivery and quality issues sometimes. Therefore, the case company has to take measures to mend these issues by supporting the suppliers initially as it is familiar with both the suppliers.

4.6 Optimizing the supply networks of Tier 1 supplier

In this chapter the study mainly focuses on the optimization of supply networks leading to optimization of part price. This requires synergy between buyers and suppliers to understand the current supply network and identify the supply networks that can be optimized.

4.6.1 Planning phase

To answer RQ V, the material flow between Volvo and tier 1 supplier was mapped by collecting information through meeting and mails from the suppliers. This was done for only high spend part numbers within high spend suppliers identified by applying pareto principle or 80/20 rule.

All part numbers identified in empirical findings for RQ IV were used to collect data for RQ V. Most of the identified part numbers had one or more sub part numbers and some of these part numbers had be to be surface treated or painted before being assembled onto the truck. Therefore, an elaborate excel sheet was created to collect information on tier 1 suppliers, production location of parts, surface treatment and paint shop suppliers and their locations.

After weeks of extensive follow up, only ten out of twelve suppliers gave comprehensive data for the study of which two potential cases were identified. Before exploring the two cases, it becomes necessary to understand the Volvo Logistics Management Services rule where Volvo will pick up parts from locations that are within three days for transportation. When the suppliers are not located within this limit, then they need to have a warehouse from where they can transport within three days. With these details in background the two cases are presented further.

The two cases involve suppliers Lambda and Mu. Both supplier Lambda and supplier Mu has separate production locations at both Czech Republic and Germany. And the pick-up points for both Lambda and Mu are located in Germany. The pickup points at Germany are also used for parts that are produced in Czech Republic. This means that the parts produced at Czech Republic are first transported to Germany and then picked by Volvo Logistics to transport the parts to appropriate Volvo plants (refer Figure 12). For Lambda there are 54106 parts produced in Czech amounting to an annual spend of 36 MSEK and Mu has 29115 parts produced in Czech amounting to an annual spend of 13 MSEK. Initially, both for Lambda and Mu, all the parts were produced at Germany. Even though some parts were moved to Czech Republic, the pickup point setup still remained at Germany. A pictorial representation of the cases is Figure 12.

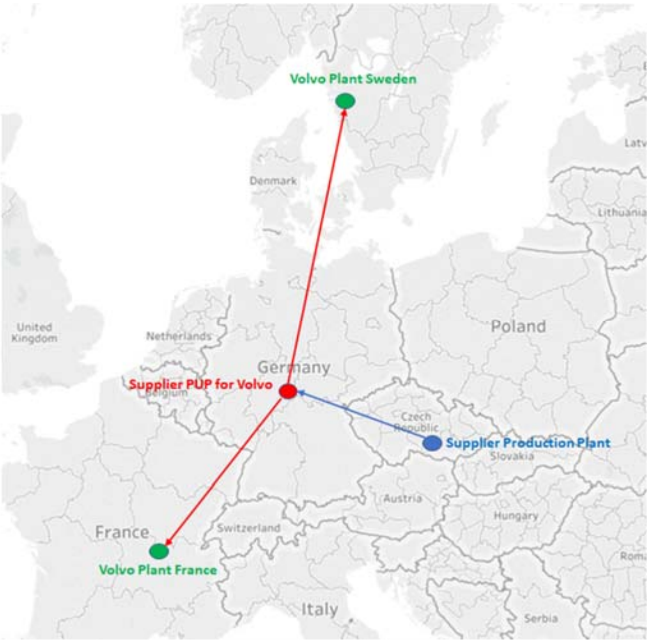

Figure 12: Current supply network scenario

Any external transportation that takes more than 72 hours is not in accordance with the Volvo Logistics Policy. The transportation time will not be affected drastically since, Czech Republic is within 72 hours for transportation to any Volvo plant within Europe.

Currently, there are 54106 number of parts with a current year forecast spends of 36 MSEK, that are transported from Czech Republic to Germany and then to Volvo Plants for supplier Lambda and 29115 parts with a forecast spend of 13 MSEK with the same setup for supplier Mu. In this current situation, the part price includes the following:

- Cost of carton boxes used for packing the parts for shipment between Czech Republic and Germany
- Cost of repacking activities at Germany (repacking into Volvo specific boxes - Volvo blue boxes)
- Cost of handling/warehousing at Germany
- Cost of transportation between Czech Republic and Germany
- Tied up capital/overheads at Germany

The proposal is to eliminate the costs listed above and thereby reducing the part price by eliminating the pick-up point at Germany for all the parts that are produced at Czech Republic.

4.6.2 Implementation phase

After identifying the two cases discussed in section 4.2.5, the next steps involve seeking comments and support from cross functional teams and the suppliers. First, a cost breakdown for all the identified parts should be collected from the suppliers to understand what percentage of the part price includes the following: Cost of carton boxes, Cost of repacking activities, Cost of handling/warehousing, Cost of transportation, Tied up capital/overheads.

The next step should be to contact the logistics team to give estimation on transport costs from Czech Republic to Volvo plants for the identified part numbers. With these data in place, a business case should be created to check the benefits of the proposal of pick up point change (Cousins et al.; 2008). The benefits should be transparent, and all the functions involved should be aligned with the proposal with a total cost mind-set (Smart and Dudas; 2007).

4.6.3 Control phase

The change in pick up point location involves logistical change for the case company. This might probably increase the transport distance and impact the delivery time schedules. Therefore, measures have to be taken in proper planning of inventory at production and delivery schedules. Cost breakdowns with price changes have to be updated frequently to understand the supply network and the added value for the part price. This information has to be stored and updated for future references and for making similar adaptations with different or same supplier (Feger; 2011).

4.7 Cross functional collaboration between technical and business side

This is a chapter which mainly focuses on synergy between buyer, suppliers and engineers. It involves understanding the current scenario, analyzing this scenario and proposing ideas to increase the cross functional collaboration and hence maximizing the synergy between buyers, suppliers and engineers.

4.7.1 Planning phase

To answer RQ VI an increased understanding of the current situation at case company on cross-functional collaboration is necessary. This information was collected through semi-structured interviews with employees from both technical (engineering) and business (purchasing) side of the case company. Additionally, four important suppliers were also interviewed to understand how much of the suppliers' technical knowledge is currently being used by engineering to have better competitive advantage in the market. This section is limited to and is concerned only with metal tube purchasing at GTP. This section is further divided into three main sub-sections, that were the focus of the interviews: Cross functional collaboration, Performance Measures and Data Management/Information Systems.

Cross Functional Collaboration

The data collected under this subsection is presented below in the perspective of the actors interviewed.

Buyers' Perspective

Today, buyer and engineers lack a common objective to meet. In the buyer's perspective the engineers design products in a way that products/components perform functionally and technically in the best possible way. On the contrary, the buyers tend to select suppliers first based on price and then on quality. When a new design is created, it is sent to the selected supplier and receive feedback from the supplier which is documented by the buyers. This feedback is then sent to engineers. The process is called Technical Review. The feedback generally includes how the design can be changed or adjusted to have better costs.

Most of the suppliers that are associated with Volvo GTP are in for a long-term relationship. It never has been in Volvo's strategy to work with suppliers on short term, even though such relationships may give room to create new agreements and price reductions. This is mainly because of the tedious supplier audits, supplier's selection processes, supplier induction to Volvo processes and Volvo's way of working.

In the buyer's perspective there is absolutely no synergy between them and suppliers. This is mainly because, both parties have extremely varied goals or objectives. Buyer's objective is 'price reduction' whereas the supplier's is the extreme opposite.

In terms of bringing the engineers and suppliers together to discuss material substitution or new technologies etc., there are no regular meeting scheduled. There is no official or formalized common ground where the three parties come together to discuss any improvement ideas. But at the engineering side, they are required to create a roadmap for the coming years and the buyers support these road maps by developing purchasing strategies. The strategies are created by collecting and understanding the data on the developed engineering road map. At this stage the buyers involve the suppliers to understand what ideas they are working on to check if Volvo engineering and suppliers can align on the same development activities. But, once again stressing on the fact that there are no regular meetings organized to check if other improvement ideas are viable or not.

Suppliers' Perspective

One of the interviewed suppliers feel that the response time from Volvo is long and believes that effective communication and collaboration is required to maximize synergy. The supplier stated that Volvo's engineering team should provide constructive reasons as to why a design or drawing cannot be changed instead of declining the remark with no feedback. All the four suppliers that were interviewed stated that most of the time they are asked to produce as per the design provided to them. And, all four of the suppliers voluntarily expressed that to have better coordination or synergy they would prefer to be involved in the design phase itself, to pitch in their ideas and their knowledge/experience in developing the product. One of the suppliers pointed out that involving suppliers in the initial design phase would even help reduce or have no tooling costs (as they can provide inputs to Volvo engineers to design in a way that already existing tools can be utilized).

The suppliers come in contact with the SQE and SDA etc. only during critical situation. But the supplier's logistics teams are in constant touch with the SRM. The suppliers have interaction with the engineers only after the business has been awarded to them. Sometimes, when the suppliers identify design change ideas to optimize part price or manufacturing process, only then they are in contact with the engineers to discuss the same. The suppliers also feel that sometimes, the innovative ideas they come up with are not implemented or has extremely heavy validation processes that it becomes difficult to implement such ideas. One of the suppliers made the following statement - "If I were a truck manufacturer then I would want to be able to implement new ideas faster than usual, in an effective way since it will be a competitive edge for me; of course, keeping in mind the necessary quality and risk factors involved. The old processes of how to attack new opportunities and new solutions have not changed much from yesterday to today".

Engineers' Perspective

In the engineers' perspective communication is the key for synergy between purchasing and them. To have all the required information from the start and to know each other is important. Engineers feel that it takes too long to get to know the buyers and it makes it even more difficult when there has been high turnover of buyers. Communication is made easy with time. One of the engineers mentioned that they do not have the time to work on ideas or discuss with the buyers about the product improvisation. Even if there are great ideas there is no budget and a project cannot be initiated. Also, the engineer mentioned that its natural for an engineer to have high margin in terms of cost and quality as to not to end up with quality issues and unhappy customers. So, it is natural to have differences with buyers in terms of cost. One of the engineers suggested that introducing some buffer hours in their work schedules to implement cost reduction ideas in collaboration with buyers would be more efficient way of allocating time and budget. Allocating some budget to implement cost improvement ideas would enable engineers to work in collaboration with both buyers and suppliers.

The suppliers are involved only in the review phase to receive any minor feedback from them to further improve design and cost.

Standardization/part simplification or new such ideas need resources and budgets which are the main constraints to implement such ideas. Quality issues are always given more importance and fixed immediately.

SRM's Perspective
SRMs maintain a document called action log for every supplier they are assigned to. These action logs contain information on operational logistic issues such as communication, EDI implementation, production and capacity (eventual production and capacity problems) etc. Only few buyers proactively approach SRMs asking them to share action log documentation.

Performance Measures
Supplier evaluations mainly take place on the following criteria:

- Quality (Q) - Measured in terms of parts per million
- Delivery (D) - A minimum of 98% delivery precision
- Cost (C) - Percentage reduction per year on total spend with the concerned buyer
- Relationship (R) - No specific measure criteria. Based on the unique relationship buyers have with their suppliers

In case of underperforming suppliers in terms of quality then Supplier Quality Engineers take the lead role in analyzing and fixing the issues. When it is delivery, then it is the Supplier Relationship Management that takes the lead role in helping the suppliers get back on track. Supplier Development Engineers (SDE) are approached if and only if a buyer identifies that the supplier needs help in developing their production systems, reducing wastes in their production/daily activities etc., based on his or her experience and knowledge on the supplier. Even though according to a buyer, 70% of innovative ideas come from suppliers, so far there has been no KPI to evaluate suppliers based on their capability to innovate or in terms of the number of improvement ideas they bring to Volvo as their customer. In summary, the suppliers are always and mainly evaluated on the cost savings they bring to Volvo. SRM, SDE, SQE etc., also focus only on underperforming suppliers.

Both buyers and engineers agree that even if ideas like standardization or simplification of parts or material substitutions are identified, there have been roadblocks in implementing such ideas. The major roadblock is lack of budget and resources. Further, complex and extremely long Volvo internal processes are also considered a roadblock. There are no performance measures for ideas generated through cross functional collaboration (mainly engineering and purchasing). Both, buyers and engineers expressed that to add more performance measures to the existing ones would be tedious.

In regard to functional coordination as well, there are no formal performance measures that make the efforts put in by buyers to improve functional coordination visible.

In the suppliers' perspective cost, improved market shares and emission regulations from authorities are drivers for them to innovate. One of the suppliers' made a strong comment that "95% of the time it is pricing that is given importance. Volvo will never care if we innovate or not, they want their products that they design, and we deliver on time. Not more not less". All of the suppliers mentioned that they are never evaluated based on their capability to innovate.

Data Management
The buyers interact with SRMs only during supplier crisis. No additional information that the SRM can provide about the suppliers are shared between SRM and buyers unless there has been a crisis with the suppliers. The buyers think that SRMs may have a lot of useful information and that the information is not shared with the buyers and neither do buyers ask for it. Most of the time, the action log documents are stored locally on SRMs storage drive.

The suppliers are never fully transparent with the buyers. The buyers state that the level of transparency from the suppliers totally depends on the relationship the buyers have built with the suppliers over the years. Every time, a new buyer is appointed, the relationship needs to be built from scratch and there has always been reluctance from the suppliers to share information fearing that it will be used against the suppliers.

Moreover, the data management systems or the methods used by Volvo to capture such data from the suppliers are very poor. When a buyer is replaced the data or information the buyer has is lost with him/her. There is no method or system where useful information on the supplier or supplier's supply chain is efficiently stored and managed. So much so that, cost breakdown of parts that were sourced by the previous buyer is unavailable to anyone in organization when the buyer leaves. Further, the SRMs, SDAs, SQEs etc., do not have the same contact as buyers do. This means, that employees working within these functions have practical information on the suppliers' supply chain, their tier 2, their production processes etc., which are never shared with the buyers. There is no systematic way of storing and managing such data that is available within the organization itself. Let alone, a system to manage and store such data, there are no meetings with buyers and employees from these functions where they could possibly share such information.

Some suppliers pointed out on the fact that, it has been difficult to implement innovative ideas or cost improvement ideas when there has been reorganizations or frequent change in buyers. Every time there has been a change the idea has to be restarted again with the new buyer.

4.7.2 Implementation phase

Performance Measures
From the data obtained it is understood that performance measures are key to understand, analyses and improve a firm's capability which also stated by Parmenter; (2007) where indicators are used to measure, track, report and improve performance of an individual or a team. But in terms of purchasing and supply management traditional performance measures are used and are driven by cost savings (Saranga and Moser; 2010). It is clear that the supplier

performance evaluation is mainly focused on financial performance and there are no formal performance measures in regard to functional coordination as well. On the contrary Cousins et al. (2008) state that non-financial performance measures focus on long term goals rather than focusing on short term goals and lead to successful financial performance in long run. Lack of budget and resources are considered as roadblocks in implementing ideas like standardization, part simplification or material substitution. This clearly states that there has been no performance measures or objectives which are common between technical and business side (engineering and purchasing). According to Quintens et al. (2006), sharing of information will lead to simplification of standardization. This is supported by Smart, A. & Dudas, A (2007) where they state that standardization of parts led to reduced supply base and increased economies of scale. Therefore, it is necessary to have a constant information sharing between engineers and buyers to improve the parts in terms of standardization and simplification. Ehrlenspiel et al. (2007) also talks about the importance of cost management with product developers. Therefore, certain common objectives or measures between engineers and purchasing will lead to a better overall performance of the organization.

Suppliers are not evaluated based on the capability to innovate. Even though 70% of the innovative ideas come from the supplier in current market, there are no KPIs to evaluate suppliers based on innovation. But, Cousins et al. (2008) argues that performance measures promoting continuous improvement ideas are necessary in dynamic business environments. The author also states that developing performance measures in tracking capability to innovate and learn are also imperative. This can be done by identifying one’s contribution to innovation or number of improvement ideas one has suggested. Also Nix & Zacharia (2014) explain the importance of collaboration with knowledge and capabilities being distributed in the network economy. (Roberts, 1999) supports this by explaining the importance of innovation to sustain high profit meeting the customer demands.

Data Management

Data management system to capture and store data from suppliers are very poor. On the other side suppliers are not fully transparent with the buyers and the transparency completely depends on the relationship between suppliers and buyers. Every time a new buyer is appointed everything should be built from scratch again as the information is lost with the replacement of the buyer. Therefore, sharing of information with new buyers and other stakeholders completely depends on the individual’s interest level. This is clearly observed from buyer’s interaction with SRM where the information is not exchanged efficiently between each other and interact only during crisis. However, Feger (2011), says that continuous flow of updated information is important between purchasing, production and logistics and having an integrated flow of information influences the level of collaboration between these functions. Kraljic (1983) states that organization has to foster cross functional information flow and demand and encourage managers to supply information to purchasing information system. It is observed that there is no systematic way of storing and managing data, as information about cost break down of parts sourced by previous buyer was not available. Also, it has been difficult for suppliers to deal with innovative ideas or cost improvement ideas when there is frequent change of buyers. Every stakeholders SRM, SQE, Buyer etc., have different contacts and different information about the supplier which can be utilized by information sharing and can be used in purchasing as a leverage. As Trautmann et al; (2009) says the need to leverage information and knowledge specific to purchasing situations across business units and purchasing organization is crucial. And with factors like supplier availability, high price fluctuations and supplier power increasing uncertainty, it is necessary to gather more supply market information to procure products with better quality, price and quantity (Trautmann et al; 2009).

Cross functional collaboration

Axelsson, B et al. (2005) states that functional coordination and cross functional collaboration are considered to be two most important strategies in developing purchasing and supply management. However, in the case company we find a few gaps in functional coordination and cross functional collaboration with lack of common objectives between engineering and purchasing side. This also the case between buyer and supplier objectives. It is clear and obvious that all these actors have different financial goals. However, these actors can further focus on having common non-financial objectives. As Cousins et al. (2008) states that non-financial measures help the organization to focus on long term goals. From Foerstl et al. (2013) it understood the importance of developing functional coordination and cross functional collaboration to improve purchasing performance. The author also state purchasing appraisals and goal settings would motivate the purchasing professionals to improve it. From the engineer's perspective it is clear that to achieve this communication is the key criteria required for collaboration. The suppliers also had the same suggestion where they state that response time from Volvo is long and effective communication and collaboration is required to maximize synergy.

From the buyer's perspective it is understood that there are no common or formalized meeting for all the three parties i.e., buyers, suppliers and engineers to discuss any improvement ideas. Dowlatshahi (1992) states in the view of purchasing, which needs to initiate cross functional collaboration especially with engineering team and this will lead to involvement of suppliers in the product development phase, standardization or simplification of parts, easy manufacturing, identifying interchangeable parts etc., The suppliers state that to have better coordination and synergy they would prefer to be involved in the development phase and add in their valuable experience and ideas in developing the product. They stated that this will also help reduce tooling costs. This is supported by Dowlatshahi (1992), Foerstl et al.; (2013) where they state that involving suppliers would lead to better purchasing performances. Engineers state that they do not have time to discuss product improvisation with buyers due to time and budget issues. Engineers look for high margins in terms of quality to not to end up with quality issues and unhappy customers but for buyer’s price becomes the priority. To counter this situation one of the tools suggested by Dowlatshahi (1992) is Value analysis, acting as an interfacing activity between buyers, engineers, suppliers and production with the objective being reduction of cost in the initial stages of product development through design simplification, part elimination, material substitution or process modification. And also, one of the engineers state that introducing some buffer hours in their work or allocating some budget to implement cost improvement ideas would enable engineers to work in collaboration with buyers and suppliers. This would lead to improving synergy potentials in form economies of scale, scope and process (Faes et al.; 2000).

4.7.3 Control phase

In terms of data management, the organization needs to find a way to secure the historic data collected by previous buyers or any other actors. Implementation of such systems will take time and cost. But to identify the right system and the right level of data that needs to be shared across various functions is the key here. And adding more performance measures to already existing long list has been stated as tedious. To avoid this, superficial KPIs can be used to begin with to promote cross functional collaboration. The outcomes of such KPIs has to be made visible to the entire organization and hence leading to synergy within the organization.

5 Conclusion

The purpose of the study was to find potential ideas to obtain reduction in part price of high spend components within metal tube purchasing with the concept of synergy. It was identified from previous literature studies that synergy would result in economies of scale, information and innovation. For this to be achieved and drive synergy consistently, four important factors were considered - performance measures, data management, total cost/benefit analysis and cross functional coordination and collaboration. The study focused mainly on four different areas to find synergy 1) between different business units and truck brands 2) within purchasing organization 3) between buyers, suppliers and sub-suppliers and 4) between buyers, suppliers and engineers.

From the study it was identified that there existed an opportunity for synergy between different business areas. Suppliers, producing similar components and had high spend were identified within other business areas. It has been identified that a strong communication network is required between the buyers to capture the opportunity between these business units and sustain it further in future. Finally, this leads to economies of scale and information by having common suppliers, global contracts, higher buying power and therefore optimized part price.

Also, from the study it was found that there were similar parts bought at varied prices across different purchasing organizations. To reduce the gap between the prices of similar/same parts purchased across the different purchasing organization, it was concluded that a strong communication and information sharing has to be promoted among the buyers procuring similar part numbers around the globe. This will lead to an optimal supply base with optimal part price for all the part numbers procured across the globe. In the process of creating synergy, even though the part price is less, there are possibilities which lead to high total cost considering logistics and transportation therefore, the study also concludes the importance of a total cost approach.

In addition, the study concludes that synergy is not only limited between purchasing organization or business unit, but also between different buyers within a single purchasing organization who are procuring different components. Information sharing about the strategies, about proper categorization of parts, information about supplier and technology will maximize synergy. In the study it was identified that there were various metal parts which were categorized under different segments leading to price differences for similar parts and therefore the information sharing between buyers of different categories would lead to better categorization and procurement of parts at better price by cutting short supply chain.

The study highlights the importance of information sharing across the buyers, suppliers and sub-suppliers. From the results it is observed that a huge potential exists in having a common raw material supplier for the parts with high tonnage from Tier 1 suppliers leading to reduction in part price. Therefore, a strong and constant communication network between raw material buyers, suppliers and metal tube buyers will lead to a sustainable synergy and procurement of parts with optimal price.

After analyzing the supply network two cases were found where the pickup point locations could be potentially changed to reduce the part prices by eliminating the identified non-value adding activities and associated costs. Further, a total cost approach has to be considered with all functions in line with the proposal. Similar such cases can be found in other commodities that Volvo buys hence optimizing the supply network and benefiting from the reduced part prices.

Further, it was identified that synergy between buyers, suppliers and engineers would lead to more innovative pathways and improve the organization's outcome with a long-term perspective. Having common non-financial measures across these actors would bring them together on a common platform in working towards optimal cost, better quality and innovative products for the market. This mainly requires sharing of information between the stakeholders, efficient data management system, so that the required data is accessible to everyone involved. This can be driven by having common performance measures between engineers, suppliers and buyers.

References

Axelsson, B., Rozemeijer, F. & Wynstra, F. 2005, "Exploring change issues in strategic sourcing", , pp. 15-31.

Bryman, A., Bell, E., Books24x7 (e-book collection) & Books24x7, I. 2003, Business research methods, Oxford University Press, Oxford;New York;.

Carter, J.R. & Narasimhan, R. 1996, "Is purchasing really strategic?", International Journal of Purchasing and Materials Management, vol. 32, no. 1, pp. 20.

Cockerill, S.K. 1995, "Unfolding systemic ideas", Executive Development, vol. 8, no. 4, pp. 4-8.

Cousins, P. M., Lamming, R., Lawson, B. & Squire, B. 2008. Strategic supply management: principles, theories and practice, Financial Times/Prentice Hall

Daum, P., Ebook Central (e-book collection) & ebrary, I. 2013; 2012, International synergy management: a strategic approach for raising efficiencies in the cross-border interaction process, 1st edn, Anchor Academic Pub, Hamburg.

DAVIS, H.L. & AL, E. 1974, CRITICAL FACTORS IN WORLDWIDE PURCHASING, Harvard Business Review, Boston.

Dowlatshahi, S. 1992, "Purchasing's Role in a Concurrent Engineering Environment", International Journal of Purchasing and Materials Management, vol. 28, no. 1, pp. 21-25.

Easterby-Smith, M., Thorpe, R. & Jackson, P. 2015, Management and business research, 5th edn, SAGE, London.

Ensign, P.C. 1998, "Interrelationships and horizontal strategy to achieve synergy and competitive advantage in the diversified firm", Management Decision, vol. 36, no. 10, pp. 657-668.

Feger, A.L.R. 2011, "Improving Internal Supply Chain Collaboration by Increasing Information-Processing Capacity: The Role of Enterprise Information Systems", International Journal of Enterprise Information Systems (IJEIS), vol. 7, no. 4, pp. 1-12.

Faes, W., Matthyssens, P. & Vandenbempt, K. 2000, "The Pursuit of Global Purchasing Synergy", Industrial Marketing Management, vol. 29, no. 6, pp. 539-553.

Foerstl, K., Hartmann, E., Wynstra, F. & Moser, R. 2013, "Cross-functional integration and functional coordination in purchasing and supply management: Antecedents and effects on purchasing and firm performance", International Journal of Operations & Production Management, vol. 33, no. 6, pp. 689-721.

Gadde, L. & Håkansson, H. 1994, "The changing role of purchasing: reconsidering three strategic issues", European Journal of Purchasing and Supply Management, vol. 1, no. 1, pp. 27-35

Grosfeld-Nir, A, Ronen, B, & Kozlovsky, N 2007, 'The Pareto managerial principle: when does it apply?', International Journal Of Production Research, 45, 10, pp. 2317-2325

Heale, R., & Forbes, D. (2013). Understanding triangulation in research. Evidence - Based Nursing, 16(4), 98.

Koellinger, P. 2008, "The relationship between technology, innovation, and firm performance—Empirical evidence from e-business in Europe", Research Policy, vol. 37, no. 8, pp. 1317-1328.

Kraljic, P. 1983, Purchasing must become supply management, Harvard Business School Press, Boston.

Kähkönen, A., Lintukangas, K., Ritala, P. & Hallikas, J. 2017, "Supplier collaboration practices: implications for focal firm innovation performance", European Business Review, vol. 29, no. 4, pp. 402-418.

W. Nix, N. & G. Zacharia, Z. 2014, "The impact of collaborative engagement on knowledge and performance gains in episodic collaborations", The International Journal of Logistics Management, vol. 25, no. 2, pp. 245-269.

Parmenter, D., Books24x7 (e-book collection) & Books24x7, I. 2007, Key performance indicators: developing, implementing, and using winning KPIs, 1st edn, John Wiley & Sons, Hoboken, N.J.

PELLIZZONI, E., BUGANZA, T. & COLOMBO, G. 2015, "MOTIVATION ORIENTATIONS IN INNOVATION CONTESTS: WHY PEOPLE PARTICIPATE", International Journal of Innovation Management, vol. 19, no. 4, pp. 1.

Quintens, L., Pauwels, P. & Matthyssens, P. 2006, "Global purchasing strategy: Conceptualization and measurement", Industrial Marketing Management, vol. 35, no. 7, pp. 881-891.

Rozemeijer, F. 2000, "How to manage corporate purchasing synergy in a decentralised company? Towards design rules for managing and organising purchasing synergy in decentralised companies", European Journal of Purchasing and Supply Management, vol. 6, no. 1, pp. 5-12.

Roberts, P.W. 1999, "Product Innovation, Product-Market Competition and Persistent Profitability in the U.S. Pharmaceutical Industry", Strategic Management Journal, vol. 20, no. 7, pp. 655-670.

Saranga, H. & Moser, R. 2010, "Performance evaluation of purchasing and supply management using value chain DEA approach", European Journal of Operational Research, vol. 207, no. 1, pp. 197-205.

Saunders, M., Lewis, P. & Thornhill, A. 2016, Research methods for business students, 7.th edn, Pearson Education, Harlow.

Scannell, T.V., Vickery, S.K. & Droge, C.L. 2000, "Upstream supply chain management and competitive performance in the automotive supply industry", Journal of Business Logistics, vol. 21, no. 1, pp. 23.

Smart, A. & Dudas, A. 2007, "Developing a decision-making framework for implementing purchasing synergy: a case study", International Journal of Physical Distribution & Logistics Management, vol. 37, no. 1, pp. 64-89

Trautmann, G., Bals, L. & Hartmann, E. 2009, "Global sourcing in integrated network structures: The case of hybrid purchasing organizations", Journal of International Management, vol. 15, no. 2, pp. 194-208.

Trent, R.J. & Monczka, R.M. 2003, "Understanding integrated global sourcing", International Journal of Physical Distribution & Logistics Management, vol. 33, no. 7, pp. 607-629.

Tushman, M.L. & Nadler, D.A. 1978, "Information Processing as an Integrating Concept in Organizational Design", The Academy of Management Review, vol. 3, no. 3, pp. 613-624.

Appendix: Interview Questions

General questions

1. Please give us a brief on your job profile.
2. Who are your stakeholders?
3. What is your idea of synergy between you and these stakeholders?

Questions to buyer

1. How would you define the relationship with the suppliers in your portfolio? Long term/strategic or short term?
2. What are the risks you have faced in having long term relationship with suppliers?
3. What are the risks you have faced in having short term relationship with suppliers?
4. What are the important criteria for selecting a supplier?
5. How flexible are your suppliers to handle product variants/variations?
6. What are the measures taken by Volvo to have strong and productive relationship with suppliers?
7. What are the criteria for measuring the relationship KPIs? Is there any structured way of evaluating this?
8. What are the steps taken by Volvo to help improve underperforming suppliers?
9. Does Volvo evaluate suppliers based on their capability to innovate? Are there any KPIs for suppliers in the area of innovation?
10. When the engineer designs a product and presents it to you as a buyer, what are the feedbacks you generally give and what do you think are the engineer's viewpoints in terms of material, design etc? What are your viewpoints on the same?
11. As a buyer what are the actions you take, or you can take to bridge the gap between the two perspectives?
12. Do you as a buyer suggest changes or revisions in the design specifications to improve the design? How well are these suggestions received?
13. Do you as a buyer identify interchangeable parts or initiate any part standardization and simplifications? How are these ideas received by the engineers?
14. Do you organise meetings with engineers and suppliers to identify new substitution for materials, technologies etc available in the market for parts that are already in production? How often do you have such interactions?
15. What are the roadblocks in implementing such ideas apart from constraints of budget for testing?
16. Have you heard of value analysis and its benefits in improving performance and cost?
17. In your performance evaluation are there any key performance index that track your efforts put into improving cross functional collaboration. For example, with engineers?
18. In your performance evaluation are there any key performance index that track your efforts put into improving functional coordination? (for buyers) For example identifying opportunities for other buyers located in other countries.'

Questions to suppliers

1. How many customers do you have? What percentage does Volvo represent overall? What is the annual consumption of steel in tonnage?
2. Do you have only truck manufacturers, or do you have a diverse customer base? If so what kind of other customers do you have?
3. What do you think is the most important factor that you as a supplier should exhibit consistently to have continued effective relationship with the buyer/customer?
4. What are your drivers for innovation?
5. Are the innovations you make made available to the entire market or are they made for specific customers?
6. If you innovate for a specific customer, then what are your expectations from the customer to sustain such a relationship?
7. Are these customer specific innovations later made available to the entire market?
8. Does Volvo evaluate you based on your capability to innovate? If yes, then what are they? If no, do you think it is required? Do you have any idea how this can be measured? Please be specific.
9. Do other customers evaluate on your "capability to innovate"? If yes, please explain. If no, do you think it can be implemented
10. What is currently Volvo not doing that other customers are doing which is beneficial for you as a supplier in terms of processes, product, contracts, communication & technology etc.?
11. Is your purchasing from Tier 2 influenced by customer requirements?
12. What are the recent measures taken by Volvo in collaboration with you to help you improve your performance?
13. How often do you meet with the engineers at the Volvo? Who initiates it either you or buyers?

Questions to Engineers

1. What are the important factors you consider while designing a new product in terms of material, cost, availability etc.?
2. When you design a product and present it to a buyer, what are the feedbacks you generally receive and what do you think are the buyer's viewpoints in terms of material, design etc.? What are your viewpoints on the same?
3. As an engineer what are the actions you take, or you can take to bridge the gap between the two perspectives?
4. How well do the buyers understand or know the parts under their portfolio? How well do they understand in terms of functional and technical requirements?
5. How often do the buyers come to you to suggest changes or revisions in the design specifications to improve the design?
6. Does purchasing (or buyers) help you identify interchangeable parts?
7. Do buyers initiate any part standardization and simplifications?
8. Do you think standardization or simplifications affect engineer's creativity?

9. Do interactions with buyers help you identify new substitution for materials, technologies etc. available in the market for parts that are already in production? How often do buyers come to you with such ideas?
10. What are the roadblocks in implementing such ideas apart from constraints of budget for testing?
11. Have you heard of value analysis and its benefits in improving performance and cost?
12. In your performance evaluation are there any key performance index that tracks your efforts put into improving cross functional collaboration. For example, with buyers/suppliers?
13. Do you have frequent interactions with suppliers for the components that you are responsible for?
14. Do you support suppliers to innovate new products/process or improve existing ones?