

CHALMERS



Sales and Operations Planning Process Improvements

A Case Study of Volvo Truck Corporation

*Master of Science Thesis in the Master Degree Programme Supply Chain
Management*

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ABSTRACT

Sales and Operations Planning (S&OP) has gained increased recognition as volatile markets and complex supply chains increase the need for determining future actions and collaboration in the creation of sales and operations plans. Volvo Truck Corporation (VTC) has worked with simple S&OP principles since the beginning of the 1940s. VTC is experiencing gains from its S&OP but is at the same time uncertain of how to work in order to gain the most from its S&OP process. With this background, the purpose of this thesis was formulated to *assess how VTC can further improve its S&OP process given the company's S&OP context.*

The thesis was conducted as a case study at VTC's headquarters in Gothenburg. Three research questions (RQs) were formulated. RQ1 concerns identifying gaps between VTC's current S&OP process and how the S&OP process should be configured according to literature. RQ2 concerns which of the identified gaps that should be closed and in which order given VTC's S&OP context. After having answered the first two RQs, RQ3 was formulated to assess how scenario analysis can be incorporated into VTC's S&OP process. The data collection was carried out by a literature review, observations, internal and expert interviews, brainstorming, and by studying internal documents.

The results from this thesis are recommendations which summarize areas where VTC could make changes in order to improve its S&OP process, divided into four consecutive improvement rounds. It is concluded that there are 20 gaps between VTC's current S&OP process and the recommendations in literature where improvements are appropriate seeing VTC's S&OP context. These gaps concern the S&OP goal at VTC, available decision support, the planning parameters and structure of the process, the organization, and how the suppliers are considered and incorporated in the process. Using an S&OP maturity framework, VTC is classified as a Standard S&OP user within the five studied S&OP dimensions. However, the closure of the recommended gaps would result in VTC becoming a Proactive user in the majority of the dimensions. Concerning the four improvement rounds, VTC is recommended to start closing gaps which are considered prerequisites. Next, the focus should be on closing gaps in order to increase the S&OP maturity. In the last round, it is recommended to close gaps which, due to internal S&OP context reasons, cannot be closed immediately. Further, VTC is recommended to incorporate scenario analysis in three of the S&OP process steps and develop scenarios around its main sources of uncertainty as well as around its potential alternatives both on the demand and supply-side. How the scenario analysis should be carried out and the depth of the analysis are heavily dependent on VTC's S&OP context and maturity including, among others, the available supporting tools.

The theoretical and managerial contributions of this thesis lie foremost within the development of a general S&OP improvement model which provides guidelines on steps that are important to consider when improving an S&OP process. Furthermore, theoretical verifications and proposals are discussed and suggested. Moreover, some of the recommendations to VTC may be generalized and an even greater amount transferred to companies which share some of VTC's S&OP context.

Keywords: Sales and Operations Planning (S&OP), S&OP improvements, S&OP context, S&OP maturity, S&OP goal, Scenario analysis

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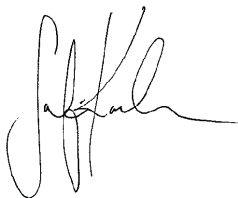
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Sofia Karlsson



Stina Sandin

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VOLVO TRUCKS ABBREVIATIONS

ATO	Asia Truck Operations
BA	Business Areas
BU	Business Units
CA	Customer Adaptation
CBU	Completely Built Up
CDD	Confirmed Delivery Date
CKD	Completely Knocked Down
EM	European Manufacturing
EML	European Manufacturing Logistics
EuD	European Division
GM	Global Manufacturing
GML	Global Manufacturing Logistics
HR	Human Resources
ID	International Division
IM	International Manufacturing
IML	International Manufacturing Logistics
OPT	Order Planning Tool
OtD	Order to Delivery
SAM	South American Manufacturing
SCM	Supply Chain Management
VLC	Volvo Logistics Corporation
VPT	Volvo Powertrain
VTC	Volvo Truck Corporation

1 INTRODUCTION

This chapter provides background, purpose, and identification of the problem to why this master thesis was conducted. Moreover, the research questions are stated and the delimitations presented as well as the disposition of the thesis.

This master thesis was conducted at Volvo Truck Corporation (VTC or Volvo Trucks) at the Headquarters (HQ) in Gothenburg, Sweden. The thesis aims at giving recommendations on how the company can improve its Sales and Operations Planning (S&OP) process in order to gain further benefits from S&OP.

1.1 THEORETICAL BACKGROUND

Companies have during the last years faced increasingly competitive markets within a dynamic economic environment where market and customer demand are changing rapidly. Within this new environment, companies are pressured to lower their costs whilst responding rapidly and accurately to customer requests. Meanwhile, trends such as globalization and outsourcing create increasingly complex supply chains and long lead times (Ventana Research 2006). In order to succeed with these challenges, a company must understand the capabilities and status of its supply chain (Singh 2009). The concept of Supply Chain Management (SCM) thus emerged as a response to these pressures and serves to integrate business processes along the supply chain and bring, previously non-coordinated, business units together (Feng et al 2008).

Alongside this supply chain integration, companies are reaching operational excellence by implementing among others lean production principles and marketing managers have concurrently increased their understanding of customer demand, preferences, and responses (Grimson & Pyke 2007). In conjunction with these initiatives, the concept of S&OP has gained increased recognition and has been put forward as the area within SCM that presents the most exciting possibilities for the future (Grimson & Pyke 2007). Singh (2009) expresses that, in order to compete and be able to respond to the marketplace, successful companies have realized that they need a structured process for creating realistic sales and operations plans. Companies have consequently turned their attention to S&OP which is a cross-functional long term planning process. S&OP counteracts the possibility for functional objectives to stand in the way for the long term strategy by the creation of an overall plan that all functions should aim towards. Hence, the development of S&OP is based in the need for determining future actions, both for sales and operations, since outsourcing, off-shoring and thus increased lead times make it hard to react to changes in the market as they happen (Ventana Research 2006). Thus, long-term planning is considered necessary in order to have sufficient time to change capacity when demand is either increasing or decreasing (Jonsson & Mattsson 2009). If the advance-planning time is too short, a company may lose opportunities on the market, or face poor utilization of resources and high inventories, depending on if there is an up or down turn on the market (Jonsson & Mattsson 2009).

The S&OP process is claimed to be an effective and inexpensive improvement mechanism but it does not provide easy answers and cannot take the place of good judgment (Sheldon 2006). What it instead provides is the increased chance of making the right decision in the

right time frame since it forces the right people to talk about the right areas of focus in a timely manner according to Sheldon (2006).

What moreover has been discussed by many authors (e.g. Tenhiälä 2011; Jonsson & Mattsson 2003; Berry & Hill 1992) is the problem of designing processes and systems in manufacturing planning and control (MPC), without linking them to the underlying conditions and the need of the specific company. Ivert and Jonsson (2010b) furthermore stress that the complexity of the S&OP context, the S&OP aim, and the maturity of the S&OP process affect the needs of the S&OP process. Thus, a contingency approach is necessary in S&OP so that the process is designed and structured to fit the studied company's experienced S&OP context.

S&OP was introduced to the industry in the late 1970s by the US business consultant Oliver Wight after lessons learned and experimentation in many companies (Sheldon 2006). From those early S&OP days organizations started to share experiences in organizations such as APICS, The Association for Operations Management¹, and the process thus started to evolve (Sheldon 2006). The S&OP process was later defined in 1987 as a business process with the goal of balancing supply and demand, as presented in Figure 1 (Sheldon, 2006). The traditional approach has however been extended in the literature over the years and S&OP is nowadays often described as including maximizing opportunity, minimizing risk, and making conscious trade-offs based on profitability (AMR Research 2009). Moreover, several maturity frameworks have recently been created for classifying S&OP users and these frameworks emphasize important dimensions to consider in S&OP. One of these frameworks is Grimson and Pyke's (2007) "Five-Stage Maturity Framework" which includes five dimensions, i.e. Meetings and Collaboration, Organization, Measurements, Information Technology, and S&OP Plan Integration.

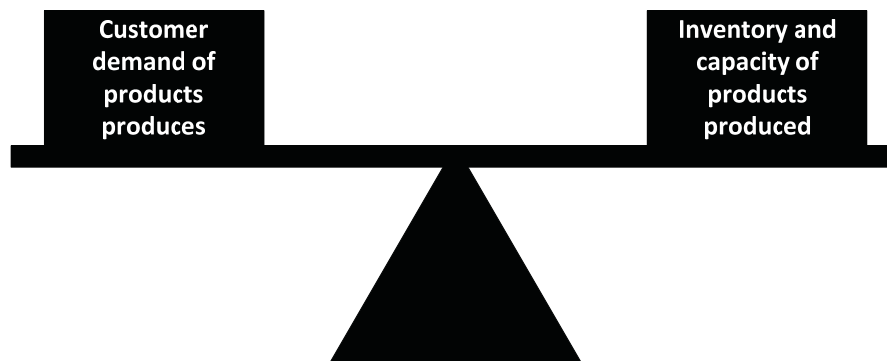


Figure 1. The balancing act between supply and demand (after Sheldon, 2006, p. 5).

There are many different views on the actual structure of the S&OP process, but the importance of having one is commonly agreed upon by practitioners, research organizations, and academia. S&OP was identified as the number two area of focus within SCM for companies in 2008 (Aberdeen Group 2008). Moreover, Sheldon (2006) argues that it is applicable for all kinds of business and that the S&OP methodology is one of the hottest topics in business today. The author emphasizes that all businesses that manage demand and synchronize resources, may them be manpower, capital, and/or machinery, can gain benefits from a robust S&OP process. This means that businesses ranging from manufacturing to

¹ <http://www.apics.org/default.htm>

banking and consultancies should use S&OP according to Sheldon (2006). Further, Sheldon (2006) claims that businesses of any size, with any type of manufacturing and inventory strategy, and on almost any market, can improve their decision making by using S&OP. The author makes a comparison of the fast-moving fashion industry and the slow-moving kitchen appliance industry. In the former, it is important to react quickly and get the new products out into the stores fast as demand is changing rapidly. In this market, not reacting quick enough leads to missed opportunities and large inventories, and thus risks must be minimized and demand and supply must be balanced to head in the same direction. On the other hand, slow-moving markets may be just as difficult, and in need of S&OP, as the competitive pressure can be tougher and with the low profit margins and high volumes just a couple of cents per unit make significant difference for profitability (Sheldon 2006).

The benefits of S&OP are many and AMR Research (2009) claims that a successful demand driven S&OP initiative can improve revenue from 2 to 5 percent, reduce inventories by 7 to 15 percent and improve the success of new product launch commercialization by 20 percent. Further, benefits include improved communications and shared goals leading to improved teamwork among the management from sales, operations, finance, customer service, and information technology, as well as increased customer service, stabilized production rates and improved material procurement (Sheldon 2006). However, Grimson and Pyke (2007) emphasize that the potential benefit, and what should be the explicit goal of S&OP, is profit optimization whilst other authors stress the benefit, and goal, of better reaching overall goals, independently of what these goals may be (Jonsson & Mattsson 2009).

According to Ivert and Jonsson (2010b), the more ambitious S&OP aim together with the increased complexity experienced by many companies result in that the S&OP process has become more difficult to handle. Furthermore, in the current economic climate, a company's context may change rapidly and frequently which result in a need for planning processes which take this new reality and its corresponding complexity and uncertainty into account (Chermack 2011). Therefore, it is stressed in the literature that scenario analysis has become an important piece in the S&OP puzzle (Schlegel & Murray 2010; AMR Research 2009; Baumann & Crum 2009). Thus, it is no longer enough to place all bets on only one plan but instead companies are recommended to try to execute the best option out of many possible scenarios and to get an increased understanding of the experienced uncertainty and the impact this may have on the business (Schlegel & Murray 2010; Muzumdar & Fontanella 2006). Thus, S&OP, with the support of technology and analyzing methods, increases a firm's ability to adapt to unplanned events (Ivert & Jonsson 2010a).

1.2 CORPORATE BACKGROUND – VOLVO TRUCKS²

VTC is part of AB Volvo, a Swedish manufacturer of heavy commercial vehicles and diesel engines. The Volvo Group has worked with simple S&OP principles since the beginning of the 1940s. During that time the company manufactured in big batches to stock and the meetings were called "Frame meetings" as they were used to create a "framework" on how much the company should build to inventory. The meetings took place two to four times per

² Information in this section obtained from Emil Jonsson, Manager, Dept. 27130, Program & Planning / Sales & Operations Planning, Volvo Truck Corporation, Interview 2011-01-27, if not otherwise stated.

year. As the Volvo Group was not a global organization at that time and only manufactured at a single plant in Gothenburg, the production plans for trucks, busses, and cars were made simultaneously. Since then, the process has been developed bit by bit and in the end of the 1970s VTC developed an S&OP process with monthly meetings. The development thereafter focused much on the tools for the process and the work moved from doing everything on paper to a “big-computer”-program to nowadays doing most of the work in Excel.

According to AMR Research (2009), the last economic downturn has been a compelling event for companies across industries which has driven them to transform and improve their S&OP in order to improve cash and better sense the market. VTC is one of these companies and the company has during the last years made some S&OP improvements. The focus of these improvements has been on the process rather than on the enabling technology and the improvements were mostly done in five areas. First, the key performance indicators (KPIs) were standardized. Previously, the company had different measurements on for example order intake creating confusion during the meetings. Second, the presentation material for the S&OP meetings was standardized to increase visibility and thus create a better basis for decision making. Third, the meeting structure was changed; the duration of the reconciliation meeting (the so called Program conference) was reduced from half a day to two hours and a Program proposal meeting was established. The latter increased the commercial units’ awareness of the numbers to expect during the Program conference. Fourth, VTC started to measure the effectiveness of its S&OP process and implemented the measures Program quality and Request quality. Fifth, VTC started to release the Program proposal live to the suppliers in order for them to get more time to react to increases and decreases in production.

According to Sheldon (2006), most people relate S&OP to larger companies even though, as stated above, it is applicable and should be used in businesses of all sizes. However, the belief is true in the sense that larger businesses, with global presence both concerning sales and manufacturing, normally experience greater challenges with managing its sales and operations (Sheldon 2006). Thus, since VTC nowadays is selling to a big part of the world and also have many manufacturing sites around the globe, this challenge is very applicable to the company. Thus, even though gaining benefits from S&OP, VTC experiences challenges and has gotten critique from the Volvo Group for how it manages the process. The critique has mainly circled the need for increased flexibility in the process in order to cope with the increasingly volatile market conditions that have been experienced through the latest up and downturns. Flexibility brings a new component to the S&OP process and VTC hence feels that new improvements may be necessary in order to accomplish a more efficient decision making. Furthermore, the development and improvements concerning S&OP in the company has been entirely internally managed and little emphasis has been put on theory or best-practice. VTC is therefore feeling that there may be gaps in how it is working and how the best S&OP users are working, leading to missed opportunities and increased risks. However, the discussed contingency approach to S&OP is also something VTC is considering. As discussed by Jonsson and Mattsson (2003), every planning environment is different and sometimes it is not suitable or even possible to use the most advanced methods.

Knowing the importance of S&OP for the Volvo Group and the increased pressures on the process, a couple of projects have been created within AB Volvo with the aim of harmonizing

the S&OP processes within the group. The Demand Council Project has initiated a common S&OP workshop within the group to understand the differences between how the different business areas within the group are working. Meanwhile, an Order to Delivery (OtD) systems investigation has also been initiated in order to understand the future demands on a potential common AB Volvo IT system in the Group's S&OP processes. In light of these other project, this thesis will focus on VTC's S&OP process and aims at giving recommendations on how the company can improve its S&OP process in order to gain further benefits from S&OP.

1.3 PROBLEM IDENTIFICATION

The importance of S&OP and the many benefits that can be gained from having a well established process have been stressed above. However, as discussed by Lapide (2004), many companies are not seeing the benefits they were expecting from their S&OP implementation. VTC is experiencing gains from S&OP but is at the same time experiencing new pressures on the process and is feeling uncertain on how it should be working to gain the most out of its S&OP process. The fact that all development of VTC's S&OP process has been performed internally has left the company unaware of what is recommended in the literature and how best-in-class companies are working. Since not knowing how it is currently performing leaves VTC tentative to what improvements should be done, this uncertainty is a problem for the company. Lapide (2005) emphasizes that in order to know how to improve, it is important to know where you currently are. Therefore, a foundation for any further improvements is to understand the current performance and next, how VTC's S&OP stand in relation to what is recommended in the literature. From such a comparison, gaps may be identified between how VTC currently is working with S&OP and what is stated in the literature. A gap has in this thesis been defined by the authors as:

A gap is where VTC's current S&OP process is not in alignment with the theoretical recommendations. Gaps may constitute of not working enough with one aspect but it may also be over-performing in another aspect.

The reason for including over-performing as a gap is because a potential process should use the company's resources as effectively and efficiently as possible. A match is consequently defined as working in line with the theoretical recommendations.

Concerning improving a company's S&OP process, Lapide (2004) discusses that even though companies spent more than \$12 billion in supply chain planning application software tools in the beginning of the 2000s they still do not gain the expected benefits, as mentioned above. There may be several reasons for this lack of benefits, but one may be linked to the contingency approach to MPC and S&OP which is mentioned above. Berry and Hill (1992) argue that many investments in MPC are inappropriate and become very costly since companies do not have a good understanding of the link between the market, the business, and the investments. The authors further describe the importance of linking systems to strategy and the need for each individual company to understand its own business and markets in order to choose appropriate process designs and investments in MPC systems. The issue of the lack of any general, one-fits-all, solution in MPC must thus be overcome by linking VTC's S&OP context to the identified gaps between literature and VTC's current way of working with S&OP. This is essential in order to avoid making inappropriate investments in

closing gaps which may not yield any further benefits for the company. Instead, the focus must be on gaps which, based on VTC's S&OP context, are important to close.

Regarding the lack of experienced benefits, Grimson and Pyke (2007) further state that, in general, S&OP is easy to understand but can be very hard to implement and the authors explain some of these challenges with the fact that S&OP requires corporations to change not only a business process, but also company culture. Further, it is suggested that it is important to implement S&OP in stages (Grimson & Pyke 2007). Thus, it is clear that to succeed with S&OP implementation and improvements it is important to understand which steps that are feasible and in which order they should be executed. Thus, a problem for VTC is that of knowing which steps that should be taken next in order to improve the process.

Implementing S&OP has been stated as a challenge for companies as it requires managers with very different incentives to work together (Grimson & Pyke 2007). Thus, improving the S&OP process at VTC is not solely about understanding *what* to change but also *how* it can, and should, be done in order to achieve the benefits of S&OP. Thus, an additional issue is to assess actions necessary to close gaps and how the changes can be incorporated into the S&OP process. In this thesis, this issue will be considered by assessing one identified gap further, i.e. the gap concerning incorporating scenario analysis in the S&OP process, whilst how to close the remaining gaps is left for VTC to investigate further. Due to the volatile and complex business environment, the importance of scenario analysis in the S&OP process is stressed in the literature (Schlegel & Murray 2010; AMR Research 2009; Baumann & Crum 2009). However, limited literature stresses how scenario analysis should be incorporated in the process and whether it is dependent on any certain context factors. Thus, there is problem of assessing how scenario analysis generally may be incorporated but especially how VTC may incorporate it in order to gain further benefits from its S&OP process.

1.4 PURPOSE

The purpose of this thesis is to assess how VTC can further improve its S&OP process given the company's S&OP context.

1.5 RESEARCH QUESTIONS

Based on the problem identification and the purpose, three research questions (RQ) were formulated and they are stated below. In descending order, the answer to each question creates a prerequisite in order to answer the following question.

RQ1. What are the gaps between VTC's current S&OP process and how the S&OP process should be configured according to literature?

RQ2. Given VTC's S&OP context, which of the identified gaps should be closed and in which order should they be closed?

*RQ3. How can the identified gap of limited scenario analysis in VTC's S&OP process be closed?*³

³ RQ3 was formulated to evaluate scenario analysis after the previous two RQs had been answered. The rationale for this is that the answer to RQ2 was a prerequisite for deciding upon what gap that should be investigated further by the authors. Refer to chapter 3 for further description of this process.

1.6 DELIMITATIONS

This thesis focuses on the S&OP process managed from VTC's HQ in Gothenburg and is thus delimited from the planning of the North American sales and operations as that is performed independently from the US. Moreover, the focus is on VTC's commercial divisions, namely the European (EuD) and International (ID) sales divisions. Thus, the thesis is moreover delimited from the Asian commercial division since it is part of Asia Truck Operations (ATO), a multi brand retail organization within AB Volvo, and not VTC. However, the belief is that the final conclusions may be generalized to apply to ATO as well.

This thesis is carried out as a pre-study for VTC's S&OP improvement project. Therefore, the thesis is delimited from the actual implementation project as well as from following-up the results of the implementation. Hence, the thesis will recommend areas for improvements but not how to implement the changes.

1.7 OVERVIEW OF THE MODEL OF ANALYSIS

In order to reach the purpose of this thesis, a model of analysis, structured around the three RQs, was created to describe the working process. This section provides a short overview of the model of analysis while a complete description can be found in the Methodology in chapter 3. In order to answer RQ1, a theoretical framework was developed and structured around four areas: S&OP definition and goals, S&OP planning parameters, S&OP process structure, and S&OP maturity. The Theoretical Framework was used to identify gaps between VTC's current way of working with S&OP and what is recommended in the literature. This gap identification was done mostly without taking the S&OP context into consideration. In order to answer RQ2, the authors analyzed which of the identified gaps from RQ1 that should be closed and in which order taking VTC's S&OP context into consideration. After having answered RQ1 and RQ2, it was decided upon which gap the authors should investigate further and consequently RQ3 was formulated.

1.8 DISPOSITION OF THE THESIS

This section presents how the thesis is structured and what can be found under each heading.

1 Introduction

This chapter aims at giving an understanding of the relevance of the thesis topic, S&OP, both from an academic and corporate perspective. Moreover, it aims at discussing the problem the thesis is addressing as well as purpose, research questions, and delimitations of the thesis.

2 Theoretical Framework

This chapter presents the relevant literature which includes descriptions of the S&OP context, definition and goals, the planning parameters, and the process. Moreover, an S&OP maturity framework is presented as well as literature within the framework dimensions. Last, literature within scenario analysis is presented.

3 Methodology

This chapter describes the methodology used to address the research questions and to reach the purpose of the thesis. The model of analysis as well as specific methods used for data collection are presented and argued for. The study's reliability and validity are also discussed.

4 Empirical Findings

This chapter describes VTC's S&OP context, its S&OP planning parameters and process as well as how VTC is working within the S&OP dimensions and thus presents the data collected from VTC. Further, data collected from expert interviews concerning scenario analysis is presented.

5 Analysis

This chapter analyzes the Empirical Findings against the Theoretical Framework and provides answers to the RQs. This chapter includes an assessment of VTC's S&OP complexity and S&OP maturity. Further, a gap identification of VTC's S&OP process against the Theoretical Framework is presented. Moreover, the chapter presents the analysis of the identified gaps including evaluation of which gaps that should be closed and in which order. The chapter ends with an analysis concerning how to incorporate scenario analysis in the S&OP process.

6 Discussion of Theoretical and Managerial Implications

This chapter discusses the contribution of this thesis in terms of theoretical and managerial implications. Key theoretical verifications and proposals are presented followed by a general S&OP improvement model developed from the model of analysis. The chapter ends with a discussion of the relevance of the results for other companies.

7 Recommendations to VTC

This chapter gives recommendations to VTC on how it can improve its S&OP process.

8 Conclusions

This chapter concludes upon the results from the thesis and the main theoretical and managerial implications and proposes fields for further study.

References and Attachments

1.9 READING INSTRUCTIONS

In order to for the readers of this thesis to gain an understanding of what chapters and sections that may be of interest for them, the following reading instructions are provided:

- ✓ Please refer to this introduction chapter as well as the discussion in chapter 6, the recommendations in chapter 7, and the conclusions in chapter 8 for an overview of the main results and contributions of this thesis. These chapters may serve as a starting point from where it is possible to refer to chapters you want to learn more about.
- ✓ If you are not well understood with the literature and theory behind S&OP and scenario analysis, please refer to the Theoretical Framework, chapter 2.
- ✓ If you are interested in getting a deep understanding of how VTC currently is working with S&OP, refer to the Empirical Findings, chapter 4.
- ✓ The extended answer to RQ1 may be found in section 5.3, Gap identification, whilst a summary of the answer may be found in section 5.4.1, Impact-Effort analysis of the identified gaps.
- ✓ Please refer to section 5.4.1, Impact-Effort analysis of the identified gaps, together with section 5.4.2, Four rounds of improvements, for the answer to RQ2.
- ✓ Please refer to section 5.5, Scenario analysis in Volvo Trucks' S&OP process, for the answer to RQ3.

2 THEORETICAL FRAMEWORK

This chapter describes the literature within the area of study. The main aim is to provide a theoretical foundation that can be used to analyze the current situation described in the Empirical Findings in chapter 4. The first sections of the chapter provides literature concerning S&OP context and complexity followed by S&OP definition and goals. Thereafter, S&OP planning parameters, S&OP process structure, and S&OP maturity frameworks are presented. The aim of the chapter is moreover to describe the literature within the area of scenario analysis.

2.1 S&OP CONTEXT AND COMPLEXITY

As aforementioned, a contingency approach is needed when studying S&OP as a firm's context may impact its S&OP usage. However, limited literature is found which describes what context factors that is important to consider when improving the S&OP process. Ivert and Jonsson (2010b) discuss the aspect of S&OP complexity which they define as “exhibited by the material flows, relationships, and information flows that arise within the organization (internal complexity), or via the connections with the organization's downstream and upstream partners (downstream and upstream complexity)”. The authors conclude that the complexity experienced by a company direct influence, amongst others, the S&OP aim as well as the use of decisions support systems in the S&OP process. Since the definition of S&OP complexity hence has been used earlier in order to connect a company's context to its S&OP usage it is considered a useful framework in order to structure the context affecting the S&OP. Thus, it will be used in order to describe VTC's S&OP context as expressed in RQ2. Important to emphasis is that apart from complexity aspects, other aspects within the context, and which may be considered belonging to the downstream, upstream, or internal context, will be described. The rationale is that the authors of this thesis consider there being context factors, not characterized as complexity, which affect how to improve an S&OP process.

Ivert and Jonsson's (2010b) definition of S&OP complexity is based on Bozarth's et al. (2009) definition of supply chain complexity. The latter definition states that supply chain complexity is the level of “detail complexity and dynamic complexity exhibited by products, processes, and relationships that make up a supply chain” (Bozarth et al. 2009 p.80). Detail complexity in this definition consists of the distinct number of components or parts that make up a system. Dynamic complexity, on the other hand, is the unpredictability of a system's response to a given set of inputs (Bozarth et al. 2009).

Based on Bozarth's et al. (2009) definition, internal S&OP complexity is “the level of detail and dynamic complexity found in the business units constituting an organization” (Ivert & Jonssons 2010b, p. 4). Thus, detail complexity increases with the size of the organization and the number and variety of the products. Within internal complexity, dynamic complexity increases with the number of breakdowns, rush orders, and manufacturing yield according to Ivert and Jonssons (2010b).

Downstream complexity is “the level of detail and dynamic complexity in the organization's downstream markets” (Ivert & Jonssons 2010b, p. 4). In this dimension, detail complexity increases with the number of customers and dynamic complexity increases with unpredictable demand (Ivert & Jonssons 2010b). Competitors are not defined as included in any of the three

complexity dimensions and the decision in this thesis is to consider the competitors as part of the downstream context

Upstream complexity is “the level of detail and dynamic complexity in the supply base of the organization” (Ivert & Jonssons 2010b, p. 4). Here, detail complexity increases with the number of suppliers as well as the amount of global sourcing since the latter results in complexity increasing factors such as import/export legislations and cultural differences according to Ivert and Jonssons (2010b). Dynamic complexity in this dimension increases with long and unreliable supply lead times (Ivert & Jonssons 2010b).

2.2 S&OP DEFINITION AND GOALS

As presented in the Theoretical background, the initial definition of S&OP described a business process aiming at balancing supply and demand. According to Feng et al. (2008) and Ventana Research (2006), this balancing act nowadays is extended and includes, at least in theory, balancing demand with all supply capabilities of production, distribution, procurement, and finance. Further, Ventana Research (2006) stresses that S&OP is a set of planning and decision-making processes which link operations to overall business goals as well as to operational- and financial planning. According to Baumann and Crum (2009), a central issue within S&OP thus is to transform the S&OP process from demand and supply balancing to a strategic process which integrates the entire business. The APICS definition of S&OP moreover includes that (Mansfield 2008, p.22):

[S&OP] is the definitive statement of the company’s plans for the near to intermediate term, covering a horizon sufficient to plan for resources and to support the annual business planning process. Executed properly, it links the strategic plans for the business with its execution and reviews performance measurements for continuous improvements.

The goal of S&OP, as presented in the literature, and as evident from the above, thus is to ensure alignment between the company’s operational plans and its business goals and strategies in order to reach the goals (Baumann & Crum 2009). Grimson and Pyke (2007) emphasize that the explicit goal of S&OP should be profit optimization through S&OP plan integration and thus stress profitability as the goal of S&OP. Jonsson and Mattsson (2009) on the other hand state that the business goals which S&OP affects include amongst others profitability goals and growth goals. Thus, whilst Grimson and Pyke (2007) clearly put forward profit optimization as the main goal with the S&OP process, other authors express that the goal for S&OP can, and should, vary depending on the overall business goals. It could be argued that the latter, broader view on business goals is more reasonable because every company has its own strategies and business goals and the S&OP process thus should be used to fulfill these goals. For example, strategies and business goals could change over time and the S&OP process should therefore also change focus in order to reach the business goals.

Moreover, important to understand is that competing functional objectives often can stand in the way of reaching overall objectives and this is among others true for the S&OP functions in a company whose objectives often does not align but constrain each other (Grimson & Pyke 2007). AMR Research (2009) moreover puts forward the issue of risk minimization and states that S&OP is about making conscious choices on the best scenarios to mitigate risk and

maximize opportunity. However, amongst practitioners in companies there is confusion about the goal of S&OP and there is significant diversity concerning what is actually considered the goal of S&OP according to Ventana Research (2006). Only 26 percent of the respondents in Ventana Research's (2006) survey agreed with academia on the relationship between S&OP and reaching business goals. Instead the respondents stressed goals of a more tactical character, including goals such as demand and supply matching (Ventana Research 2006).

Ivert and Jonsson (2010b) propose that the S&OP complexity influences the S&OP aim. The authors discuss that a complex S&OP process motivates an ambitious aim, similar to what is discussed above concerning the extended S&OP goal. Thus, if experiencing detail and/or dynamic complexity, simply having an aim of supply and demand balancing may be unjustified and result in fewer benefits. Detail complexity, to start with, where the S&OP process deals with several entities (internally, downstream and/or upstream), stimulates an aim which includes expanding outside the company borders and including, for example, suppliers in the S&OP process (Ivert & Jonsson 2010b). Similarly, dynamic complexity, where a company experiences uncertain demand and delivery times, motivates an aim of identifying and analyzing possible scenarios (Ivert & Jonsson 2010b).

2.3 S&OP PLANNING PARAMETERS

In order to achieve an effective and efficient S&OP process a company must first establish a number of planning parameters according to Jonsson and Mattsson (2009). These parameters are; the planning horizon, the planning frequency, the planning objects, the units of capacity, and the time fences used in planning. The parameters are not as explicitly stated by other authors, i.e. Aberdeen Group (2010), Baumann and Crum (2009), Singh (2009), Mansfield (2008), Grimson and Pyke (2007), Schorr (2007), and Lapide (2004/2005), but they are implicitly discussed and the following sections will thus include their insights as well.

Table 1 presents a summary of the theoretical recommendations presented in the sections below.

Table 1. Theoretical recommendations concerning how to set the S&OP planning parameters.

S&OP planning parameters	
	Theoretical recommendations
Planning horizon	1-2 years
	As long as the lead time for capacity changes
Planning frequency	Rolling monthly schedule
	Depending on market volatility
Planning objects	Low level of detail
	Aggregated product family level
	Products with similar characteristics within the group
Units of capacity	Low level of detail
	Total objects/tons per month
Time fences for change in plans	Percentages of how big changes that are allowed in different time horizons
	Depending on time taken to get access to material
	Depending on the lead time for capacity changes
	Depending on the flexibility of operations

2.3.1 PLANNING HORIZON

The planning horizon concerns how far into the future plans should be made (Jonsson & Mattsson 2009). There are differences in how long planning horizon that the academia recommends for S&OP. Grimson & Pyke (2007) state that S&OP generally creates plans for the upcoming 1 to 18 months whilst Schorr (2007a) states that the plans should cover the next 18 to 24 months. Yet other authors, i.e. Baumann and Crum (2009) and Bower (2005), have the opinion that the plans should cover at least the next two years. Jonsson and Mattsson (2009) state that the majority of companies use a planning horizon between one and two years while some companies plan for more than three years. Adding these opinions results in a recommendation concerning planning horizon somewhere in between one and two years.

The differences in what is recommended might however be referred back to the APICS definition of S&OP, as presented above and which stresses that the planning horizon should be “sufficient to plan for resources and to support the annual business planning process”. Similar views are expressed by Jonsson and Mattsson (2009) who state that the length of the planning horizon should relate to the time it takes to adapt available capacity in relation to existing market demand. Thus, the planning horizon should be as long as this lead time so that both opportunities on the market and the company’s resources can be fully exploited. Consequently the planning horizon will depend on a company’s unique context (Jonsson & Mattsson 2009). Moreover, as S&OP is strongly connected to the financial budgeting, the horizon should not be shorter than the budget horizon (Jonsson & Mattsson 2009).

2.3.2 PLANNING FREQUENCY

The meeting frequency and how often plans are revised vary between companies according to Grimson and Pyke (2007). However, most literature suggests a rolling monthly schedule (e.g. Singh 2009; Schorr 2007a; Lapidé 2004). Grimson and Pyke (2007), in contrast, put forward that many companies are moving towards a more frequent schedule than monthly meetings. The main opinion of the authors in this aspect is however that the frequency of the meetings is dependent on specific company characteristics such as how dynamic the market and production environments are.

2.3.3 PLANNING OBJECTS

Since S&OP refers to long-term and overall planning, the level of detail in the planning should be low with respect to the units of demand in the demand plan and to the production volumes in the supply plan (Jonsson & Mattsson 2009). The S&OP plans should therefore refer to an aggregated product family level (Jonsson & Mattsson 2009; Sing 2009; Grimson & Pyke 2007; Schorr 2007a). When deciding upon the product groups used in the plans, it is important that the products in the groups have similar demand behavior as well as similar resource requirements since demand and resource planning is aggregated (Jonsson & Mattsson 2009). There are also examples of when the S&OP process develops plans for stock-keeping-units but this seems to be the exception rather than the rule (Lapidé 2004/2005).

2.3.4 UNITS OF CAPACITY

The unit of capacity parameter refers to the level of detail that the capacity availability and requirements are specified in (Jonsson & Mattsson 2009). In the same sense as for the

planning objects, the level of detail should be low here as well (Jonsson & Mattsson 2009). Jonsson and Mattsson (2009) therefore recommend expressing the resource requirements in machine hours or man hours alternatively in the same unit as in the production plan, i.e. total objects per month or tons per month depending on the type of industry.

2.3.5 TIME FENCES FOR CHANGES IN PLANS

The last parameter concerns how far into the future the current production plan is tied to subsequent planning occasions and hence when, and how big, changes are allowed in the plan (Jonsson & Mattsson 2009). These time fences for when changes are allowed should depend on the time it takes to get access to material, make changes in capacity, as well as the flexibility of operations (Jonsson & Mattsson 2009). Jonsson and Mattsson (2009) suggest using simple rules such as time fences for when changes are allowed and percentages for how big changes that can be carried out. Bower (2005) also discusses this issue and put forward that S&OP leaders use self-imposed “blackouts” for adjustments in the current month plus two. These blackouts lead, according to the author, to improvements in the depth of horizon view as it forces these companies to focus on the long term.

2.4 S&OP PROCESS STRUCTURE

After having set the planning parameters, the next issue concerning the S&OP design is the process structure and what steps it should consist of. The structure of the S&OP process has been described by many authors (e.g. AMR Reserach 2009; Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007a) but there are differences in what the authors include and where the focus lies in the processes. Moreover, the structure of the process has evolved during the last two decades (AMR Research 2009). The different views on how to structure the S&OP process are also evident in the industry, where, even though a vast majority of companies have some kind of an S&OP process, few of them are alike (AMR Research 2009).

The traditional definition of S&OP, as defined above, has the goal to match supply and demand and with this goal the traditional structure of the process included four steps as presented by AMR Research (2009) and in Table 2. The process started with developing a demand forecast which then was balanced with supply. A consensus plan was then reached in a consensus meeting and thereafter the plan was published and thus the goal of supply and demand matching was met (AMR Research 2009). However, as discussed above, the goal with S&OP has moved to reaching overall goals and minimizing risks. The problem with the traditional process is that, even though it helps companies deliver the right product, at the right place, and at the right time, profitability and market potential is not considered and opportunities on the market are lost (AMR Research 2009). AMR Research (2009) therefore claims that the process has developed, to capture these new objectives, from the traditional four steps via a six-step process to today include nine steps as presented in Table 2.

Schorr (2007a) discusses that companies’ processes still often are limited to matching supply and demand and that the process still is treated more like a tactical process than a strategic process. The focus of these companies is still on better managing inventory, production and logistics, and important factors such as product development and finance are often still not considered as part of the process (Schorr 2007a). Likewise, important steps in the process

such as demand shaping, analyzing performance, developing scenarios, and analyzing gaps are often forgotten in the S&OP process according to Schorr (2007a).

Table 2. The evolution of S&OP processes according to AMR Research (2009, p. 3).

1990s	Early 2000s	Demand-driven leaders
1) Develop a demand forecast	1) Collect sales input	1) Collect sales and market input
2) Balance demand with supply	2) Develop a forecast	2) Develop a demand plan
3) Consensus meeting	3) Shape demand consensus refinement	3) Demand consensus refinement
4) Publish the plan	4) Develop a constrained supply plan	4) Shape demand based on what-if analysis on demand for supply
	5) Review and gain agreement through a consensus meeting	5) Develop a constrained plan by supply
	6) Publish the plan	6) Conduct a what-if analysis based on supply to determine trade-offs on the measurements and identify demand shaping opportunities
		7) Review and gain agreement through a consensus meeting
		8) Publish the constrained plan
		9) Measure and communicate the plan

Apart from AMR Research’s (2009) above mentioned nine-step process, many authors (e.g. Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007a,) still describe the process as containing five steps as presented in Table 3.

However, which steps that actually are included, and the content of each step, differ somewhat between the authors. Jonsson and Mattsson’s (2009) S&OP planning process is in many senses similar to the one presented by Grimson and Pyke (2007) even though the latter authors include “Measure the results and effectiveness of the S&OP process” as their final step. Schorr (2007a) on the other hand includes “Product management review” as the first step in his five-steps-model. What however are common between these descriptions are the inclusions of collecting demand data, creating a demand forecast followed by a preliminary delivery plan, a preliminary production plan where the delivery plan is constrained by the supply, and finally a consensus, or reconciliation, meeting where the two plans are adjusted and agreed upon. These steps are in broad terms the same as the four steps in the traditional approach as earlier discussed. However, what differs from the traditional approach is the depth of what is included in the steps and in many senses these processes include the same aspects within their five steps as is covered by AMR Research’s (2009) nine steps.

Table 3. The structure of the S&OP process (Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007a).

Jonsson and Mattsson (2009)	Grimson and Pyke (2007)	Schorr (2007a)
1) Forecast future demand	1) Create unconstrained demand forecast	1) Product management review
2) Produce preliminary delivery plan	2) Produce initial supply plan	2) Demand review
3) Produce preliminary production plan	3) Develop a final consensus operating plan	3) Supply review
4) Adapt delivery plan and production plan	4) Implement the plan	4) Integrated reconciliation meeting
5) Establish delivery plan and production plan	5) Measure process performance	5) Senior management review

Thus, no matter if designing a nine-step or five-step process there are important factors, or sub-processes, that should be included according to the authors in order to reach the overall goals. What the authors recommend to consider as part of a company's S&OP process will be discussed in the following five sections starting with Product management as discussed as the first step by Schorr (2007a) and ending with Publish, communicate, and measure the plan, as suggested as the last steps by many authors (e.g. AMR Research 2009; Jonsson & Mattsson 2009; Grimson & Pyke 2007). How the described processes fit into the five sections is illustrated in Table 4.

Table 4. Comparison of different S&OP process structures descriptions (AMR Research 2009; Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007).

	Product management review	Create the demand plan	Develop the supply plan	Reconciliation meeting	Publish, communicate and measure the plan
AMR Research (2009)		<ol style="list-style-type: none"> 1. Collect market and sales input 2. Develop a demand plan 3. Demand consensus refinement 4. Shape demand based on what-if analysis on demand for supply 	<ol style="list-style-type: none"> 5. Develop a constrained plan by supply 6. Conduct what-if analysis based on supply and identify demand shaping opportunities 	<ol style="list-style-type: none"> 7. Review and gain agreement through a consensus meeting 	<ol style="list-style-type: none"> 8. Publish the constrained plan 9. Measure and communicate the plan
Jonsson & Mattsson (2009)		<ol style="list-style-type: none"> 1. Forecast future demand 2. Produce preliminary delivery plan 	<ol style="list-style-type: none"> 3. Produce preliminary production plan 	<ol style="list-style-type: none"> 4. Adapt delivery plan and production plan 5. Establish delivery plan and production plan 	
Grimson & Pyke (2007)		<ol style="list-style-type: none"> 1. Create unconstrained demand forecast 	<ol style="list-style-type: none"> 2. Create initial supply plan 	<ol style="list-style-type: none"> 3. Develop a final consensus operating plan 	<ol style="list-style-type: none"> 4. Implement the plan 5. Measure process performance
Schorr (2007)	<ol style="list-style-type: none"> 1. Collect market and sales input 	<ol style="list-style-type: none"> 2. Demand review 	<ol style="list-style-type: none"> 3. Supply review 	<ol style="list-style-type: none"> 4. Integrated reconciliation meeting 5. Senior management review 	

2.4.1 PRODUCT MANAGEMENT REVIEW

Table 5 summarizes the main theoretical recommendations expressed in the section below.

Table 5. Theoretical recommendations for the Product management review S&OP process step

Theoretical recommendations
Product management review meeting as a first formal meeting in the S&OP process
Review of the product portfolio and other product activities
Output: new product plans, new activities plans and resources for implementing the plans, issues related to the plans, and assumptions and risks
Otherwise included in other steps when forecasting demand, investigating demand shaping possibilities and when discussing resource requirements

As presented above in Table 3, Schorr (2007a) includes a product management review as the first step in his five-step process. The review includes an assessment of the product portfolio including new product introductions, product improvements or repositioning, and end-of-life rationalization of old products (Schorr 2007b). Furthermore, other product activities affecting demand, supply, or financials are discussed as well as changes in process and technology (Schorr 2007a). These issues should, according to the author, be discussed in a product review meeting where attendees from R&D and product development as well as product managers and business unit managers make reviews, approve changes in schedules, and monitor performance. The output from the meeting and from this first step in the process is consequently new product plans, new activities plans and resources for implementing the plans, issues related to the plans, as well as all assumptions and risks. This output is then an input to other steps.

As presented above, Schorr (2007a) claims that product management often is left out of the S&OP process. According to the author, this may lead to understating revenue and capacity requirements and thus it is essential for senior management to consider the product portfolio. Ignoring product life cycle management in the S&OP process is moreover one of the most common threats to S&OP according to Bower (2005). The author therefore emphasizes including product life cycle management in a portfolio review which should take place in the beginning of the S&OP process.

Schorr (2007) and Bower (2005) are the only authors who explicitly include a product management review as a separate step of the S&OP process. However, other authors, such as Grimson and Pyke (2007), stress that information concerning product launches and product obsolescence are important in the forecasting of demand. AMR Research (2009) considers new product introductions in the fourth step as a way of analyzing possibilities for demand shaping and developing other forecast scenarios apart from the base-level forecast. Thus, the inclusion of product management in the S&OP process appears unanimous in the theory and mostly it is either presented as a separate first step or part of the first step together with forecasting and demand management.

2.4.2 CREATE THE DEMAND PLAN

Table 6 summarizes the main theoretical recommendations expressed in the section below.

Table 6. Theoretical recommendations for the Create the demand plan S&OP process step.

Theoretical recommendations
Collect sales and market input
Create unconstrained forecast (adjusted by planned marketing and promotional activities)
Use quantitative forecasting methods
Create a demand plan which refers to what the company wishes to sell and deliver in each period, i.e. with demand shaping considered
Include gap analysis, what-if analysis, and scenario analysis
Demand review meeting where the preliminary demand plan is set
Outcome: Unconstrained demand plan
Communicate the plan

Except from Schorr's (2007a) process and Bower's (2005) statements the other presented processes start with examining the demand-side of the business. What unifies the process descriptions is that the outcome of this demand review of the S&OP process is an unconstrained demand plan which defines how much the company plans to sell. Grimson and Pyke (2007) present this as one first step in the S&OP process which is similar to Schorr (2007) who also presents it as one step. In the latter process it is however the second step, following the product management review. Jonsson and Mattsson (2009) divide it into two steps; "forecast future demand" and "produce preliminary delivery plan" whilst AMR Research's (2009) process for demand-driven leaders divides the demand management into four steps.

The process leading up to the demand plan should start with forecasting future demand (AMR Research 2009; Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007). The first step in developing a forecast is collecting sales and market input according to AMR Research (2009) and here it is important to focus on competitive analysis, multi-tier value networks, and key customer purchasing behavior (AMR Research 2009). When having the input it is the marketing or sales department's role to build an unconstrained forecast using statistical analysis, i.e. quantitative forecasting methods, and/or management input (AMR Research 2009; Grimson & Pyke 2007). Schorr (2007c) moreover emphasizes that it is important to include the assumptions behind the forecast. In addition, when developing the forecasts, they should be adjusted by planned marketing and promotional activities (Jonsson & Mattsson 2009; Grimson & Pyke 2007).

After the forecast is developed, the next step is to produce the demand plan. In this step the targets for inventory levels or customer backlogs should be established according to Jonsson and Mattsson (2009). The difference between the forecast and the demand, or delivery plan, is that the forecast should only refer to what the market demands whilst the delivery plan refers to what the company wishes to sell and deliver in each period (Jonsson & Mattsson 2009). There may therefore be a difference if the forecast for example is considered too low in comparison to sales budgets and business plans and the company wants to close these gaps by additional demand shaping activities (Jonsson & Mattsson 2009).

The preliminary demand plan is decided upon during a meeting within the sales and marketing departments (Grimson & Pyke 2007; Schorr 2007c). Schorr (2007c) calls this the “demand review meeting” and the inputs to the meeting should be the business strategy, the forecast, customer plans, market intelligence, statistical projections, and the product management plans developed in the product management review. According to Schorr (2007c), the meeting should be owned by the head of sales or marketing and attended by sales, marketing, product management, the new product coordinator and the supply manager. During the meeting the inputs should be discussed and assumptions that the demand plan will be based on should be developed as well as there should be a review of performance metrics, developments, and changes in the plans from previous months (Schorr 2007c). The output of the meeting is the consensus, unconstrained, demand plan together with assumptions, reasons for changes, risks, and opportunities (Schorr 2007c).

Apart from developing this consensus demand plan, gap analysis, what-if analysis, and scenario analysis on demand are included in the most advanced processes, such as the nine-step process for demand-driven leaders presented by AMR Research (2009) and Schorr’s (2007a) five-step process. Schorr (2007c) states that gaps between the demand plan and the business plan should be identified and actions to close the gaps should be planned. AMR Research (2009) puts forward that scenario management is included in the best processes as a mean of reaching consensus around the plan as well as to create alternatives to the consensus plan. In AMR Research’s (2009) fourth step, “shape demand based on what-if analysis on demand for supply”, additional demand plans are created based on possibilities for demand shaping by using for example additional promotions, price management, and timing of new product introductions. These additional key scenarios should then be further evaluated in later steps of the S&OP process (AMR Research 2009). Baumann and Crum (2009) support this and stress that it is a myth that S&OP relies on one fixed demand plan or statistical forecast. In alignment with AMR Research, the authors state that demand shaping strategies together with scenarios should be evaluated.

Another important step in developing the demand plan is to communicate the plan details according to Schorr (2007c). The author stresses that the plan is the basis of the S&OP process and it should be communicated to, amongst others, supply that should make it and finance who should compare it to the business plan. Bower (2005) further states that it is important to communicate the unconstrained demand plan as it helps all functions to understand what the company could sell if the supply was unlimited. The demand plan can always be constrained when the supply situation has been further analyzed but management should be given the possibility to find solutions to the gaps (Bower 2005). The same gap between supply and demand may occur next year and thus it is important that supply planners assess their ability to deliver the demand plan and get the opportunity to provide more resources next time (Bower 2005).

2.4.3 DEVELOP THE SUPPLY PLAN

Table 7 summarizes the main theoretical recommendations expressed in the section below.

Table 7. Theoretical recommendations for the Develop the supply plan S&OP process step

Theoretical recommendations
Demand plan used as input as it is important that supply assesses its ability to supply the plan
Consider all aspects of supply
Evaluate the demand shaping scenarios, conduct what-if analysis based on supply, and develop supply scenarios
Analyze the gaps and the best alternatives for the company based on the overall goals
Supply review meeting
Output: Recommendations on valid supply plans, scenarios, and actions to close gaps

The next step in the S&OP process is to develop a supply plan. For Jonsson and Mattsson (2009), Grimson and Pyke (2007), and Schorr (2007d), this step is captured in one step of the process whilst AMR Research (2009) divides the supply assessment into two steps. The first of AMR Research's (2009) supply steps, namely the step to "develop a constrained plan by supply" is however similar to the previous authors "supply review" or "produce preliminary production plan" step.

In this step of the S&OP process, the demand plan previously created is used as an input in order to plan the volumes to be produced and delivered from production for each period during the planning horizon (Jonsson & Mattsson 2009). When producing the supply plan emphasis has to be put on the targets for, and current levels of, inventory or backlogs as the volumes that should be produced will depend on these levels (Schorr 2007d). The goal of this process is to analyze the best alternative for the company based on the overall goals (AMR Research 2009). A challenge is managing the potential trade-offs between maximizing customer service, minimizing inventory, and minimizing operating costs (Schorr 2007d). In order to analyze these issues all aspects of supply must be considered and therefore several functions must be involved in the supply review. Manufacturing needs to answer if there is enough internal capacity to produce the required supply plan, purchasing needs to answer if the suppliers have enough capacity, logistics needs to answer if there is enough logistics capacity and, in engineer-to-order companies, engineering needs to answer if there is enough capacity in its department (Schorr 2007d). However, returning to the trade-offs discussed above, the question is not simply about having enough capacity, but also about not having too much capacity since the latter leads to low capacity utilization and unnecessary costs.

In order to evaluate the supply-side's ability to support the demand plan, the supply review must identify supply constraints, demand shortfalls, and opportunities for capacity expansion (AMR Research 2009). In order to do so, inputs to the review are the overall business strategy, the manufacturing strategy, demonstrated internal and external performance, hedging strategies, improvement plans, seasonality plans, and flex capacity potentials (Schorr 2007d). These inputs together with the product portfolio plan and demand plan are used in the resource planning process in order to create the initial supply plan (Grimson & Pyke 2007). If there is not enough capacity to meet demand the demand plan is constrained and the supply plan adjusted (Jonsson & Mattsson 2009).

However, if there is a gap between supply and demand, the supply-side is expected to develop scenarios and how to shrink the gaps (Schorr 2007d). This scenario analysis should include profitability assessment of the different supply alternatives, issues with each alternative, and finally a recommendation on the preferred supply plan (Schorr 2007d). AMR Research (2009) goes one step further in its sixth process step, “Conduct a what-if analysis based on supply to determine trade-offs on the measurements and identify demand shaping opportunities”. This step includes an evaluation of the demand shaping scenarios previously presented in the demand planning (step four in AMR Research’s (2009) process for demand-driven leaders) in the same sense as the proposed demand plan is evaluated based on profitability, customer service, and so on. Constraints, demand shortfall, and capacity opportunities should moreover, in the same sense as above, be included for these supply scenarios.

A supply review meeting should be held, just as a demand review meeting was held in the previous step (Schorr 2007d). The meeting should be owned by the head of operations or similar department depending on organizational structure. The meeting aims at establishing valid supply plans, the above mentioned scenarios, as well as recommending actions to close identified gaps. Schorr (2007d) puts forward that it is a top-management decision to constrain demand or add capacity and thus the supply review should recommend actions but it is in the next stage of the S&OP process that a decision should be taken according to the author.

2.4.4 RECONCILIATION MEETING

Table 8 summarizes the main theoretical recommendations expressed in the section below.

Table 8. Theoretical recommendations for the Reconciliation meeting S&OP process step

Theoretical recommendations
Attended by managers from all involved functions
Objective is to reach a balance in supply and delivery plans in a way that reaches overall business and strategic goals
Includes evaluation of the preliminary demand and supply plans together with gaps and key scenarios, converted into monetary terms, against business plan, strategy, and performance metrics.
Include discussion of issues, consequences, risks, and opportunities
Include making decisions on capacity trade-offs
Executive reconciliation meeting or additional senior management review
Output: Final settlement on the plans by top-management

The next step in the S&OP process concerns the reconciliation, or consensus, meeting where managers from all involved functions, i.e. marketing, production, purchasing, logistics, and finance, formally meet to develop the final demand and supply plan for the upcoming planning periods (AMR Research 2009; Jonsson & Mattsson 2009; Grimson & Pyke 2007; Schorr 2007).

AMR Research’s (2009) and Grimson and Pyke’s (2007) descriptions of the reconciliation meeting step include the aim of reaching a balance in supply and delivery plans in a way that reaches overall business and strategic goals. During the meeting the preliminary demand and supply plans together with key scenarios should be presented and issues, consequences, risks, and opportunities discussed (AMR Research 2009). For S&OP leaders, this meeting includes reviewing the previously created demand and supply scenarios and making decisions around

pricing and capacity trade-offs according to AMR Research (2009). Furthermore, Schoemaker (1995) expresses that being able to see a wide range of possible future scenarios makes managers better positioned to deal with uncertainties and take advantage of them. The output of the step should be a decision on final delivery and supply plans for the upcoming planning periods (AMR Research 2009; Grimson & Pyke 2007).

Schorr (2007e) presents a somewhat different structure of the S&OP process and includes a fourth step which is the “integrated reconciliation meeting” where final plans are reconciled. The author thereafter presents a fifth step, the “senior management review”, where the formal decisions are taken. Jonsson and Mattsson’s (2009) last step in the process, i.e. “establish delivery plan and production plan” is in alignment with Schorr’s (2007e) and means that preliminary decisions taken at the reconciliation meeting are presented for the top-management group who settle the plans. Further, Schorr (2007) emphasizes the financial appraisal as an important part of the reconciliation review. The previously developed plans and scenarios need to be converted into monetary terms such as revenue, cash flow, and costs in order to see their affect on overall business goals. The goal, according to Schorr (2007e), should be to, on a monthly basis, forecast a full profit and loss statement for the planning horizon. After completing the financial appraisal, the next step is to review issues previously identified and evaluate the plans against business plan, strategy, and performance metrics. Thereafter, any gaps identified are reviewed, alternative solutions created and recommendations made. The process of reaching a recommendation includes an integrated reconciliation review meeting which should take place a couple of days after the supply review. The focus of this meeting is for the integrated reconciliation team to, with the input of issues, financial appraisal, and alternative scenarios, develop the final financial evaluation and gap analysis and reach a recommendation which is presented at the “senior management business review meeting”. The latter is the fifth step in Schorr’s (2008) S&OP process and it is where senior management with the help of the previous reviews and recommendation approve a plan and agree on actions that need to be taken (Schorr 2008).

Attendees to the senior management business review meeting should, according to Schorr (2008), be the executive management team with the president as the owner of the meeting. Other attendees are the people who have been responsible for previous steps in the process, and are there to make clarifications if necessary, such as new product manager/coordinator, the demand manager/coordinator, the supply manager/coordinator, finance manager/coordinator, and the S&OP manager/coordinator (Schorr 2008).

2.4.5 PUBLISH, COMMUNICATE, AND MEASURE THE PLAN

Table 9 summarizes the main theoretical recommendations expressed in the section below.

Table 9. Theoretical recommendations for the Publish, communicate, and measure the plan S&OP process step

Theoretical recommendations
Plans published and communicated to all involved parties
Measure results and effectiveness of the plans and the S&OP process

Some process descriptions finish the S&OP process at the previous step, e.g. Jonsson and Mattsson (2009) and Schorr (2007a), whilst other descriptions, such as those by AMR

Research (2009) and Grimson and Pyke (2007), include a final step of publish, communicate, and measure the plan. To implement the plan, it must be published and communicated to all involved parties such as operation, sales, and finance (AMR Research 2009). Furthermore, during the upcoming month the results and effectiveness of the plans and the S&OP process must be measured in order to learn for the next cycle (AMR Research 2009).

The measuring and learning finishes the process and it thereafter starts over from the beginning again. These five steps captures the common S&OP process but company experiences and how advanced they are in the different steps of the process varies widely and some issues are only covered by the most mature users (Grimson & Pyke 2007). This leads into the next section where S&OP users are classified according to their maturity level.

2.5 S&OP MATURITY

Lapide (2005) puts forward that maturity frameworks for classifying S&OP users are useful in a company's work of understanding how it is working today, where gaps exist compared to best-practices, and how its S&OP process could be improved. To do this classification there exists a number of S&OP maturity frameworks in the literature, e.g. Aberdeen Group (2010) presents the "S&OP Competitive Framework", Ventana Research (2006) proposes "The Ventana Research Maturity Model", Lapide (2005) presents a "Four-Stage S&OP Process Maturity Model", AMR Research⁴ (2009) proposes "The Maturity Model", and Grimson and Pyke (2007) present a "Five-Stage Maturity Framework". Interestingly, Ivert and Jonsson (2010b) propose that the S&OP maturity influences the S&OP aim. An ambitious aim is often a result of a mature process whilst the opposite does not hold true, namely that an ambitious aim per definition result in a mature process (Ivert & Jonsson 2010b).

The choice in this thesis has been to use Grimson and Pyke's (2007) "Five-Stage Maturity Framework". One rationale for this is that it is considered the most academic and reviewed as it has been published in *The International Journal of Logistics Management*. Grimson and Pyke's (2007) framework is moreover considered to be the most extensive. One reason for this is that Grimson and Pyke's (2010) framework is an extension of Lapide's (2005) and Aberdeen Group's (2010) frameworks. The main differences between these frameworks and Grimson and Pyke's (2007) framework, as well as the originalities with Grimson and Pyke's (2007) framework, according to the authors, are, first, that the latter explicitly points to profit optimization as the goal of S&OP and a future state, primarily to provide a vision for what can be accomplished. Second, another difference is that Grimson and Pyke's (2007) framework includes five stage. The authors have however not found any companies that have reached this fifth stage today but it is a desired state for the future. Another rationale for why that Grimson and Pyke's (2007) framework is considered the most extensive is that the other frameworks' S&OP dimensions fit into Grimson and Pyke's (2007) five S&OP dimensions. However, no other framework covers all of Grimson and Pyke's (2007) dimensions entirely. How the other studied frameworks fit into Grimson and Pyke's (2007) five S&OP dimensions is illustrated in Appendix 1. Further refer to Appendix 2 to Appendix 5 for an overview of each framework.

⁴ AMR Research is after an acquisition part of Gartner, Inc (<http://www.gartner.com/technology/about/amr-research-acquisition.jsp>).

Additionally, important in the choice of framework was the purpose of using a maturity framework, namely, as stressed by Lapidé (2005) above, to identify gaps and use it as input in the improvement process. The purpose of Grimson and Pyke's (2007) framework is to "help managers understand how effective their S&OP processes are and how to progress to mature stages" (Grimson & Pyke 2007, p. 329) and this is considered well in line with this thesis purpose of using a maturity framework. AMR Research's (2009), Aberdeen Group's (2010) and Ventana Research's (2006) frameworks are, for reasons explained in Appendix 2 to Appendix 5, not considered as useful to accomplish Lapidé's (2005) described purpose. Since Grimson and Pyke's (2007) framework furthermore incorporates many of Lapidé's (2005) thoughts, it is believed to be the most suitable for classifying a company and help in the improvement work. Grimson and Pyke's (2007) framework will therefore be presented further below.

The purpose of Grimson and Pyke's (2007) framework is, as mentioned before, to help companies evaluate their S&OP process and for them to become more mature and advanced users of S&OP. The presented framework is based on previous literature, company interviews and, as previously mentioned, Aberdeen Group's (2010) and Lapidé's (2005) frameworks.

Grimson and Pyke's (2007) framework consists of five S&OP dimensions. Three of the five dimensions; Meetings and Collaboration, Organization, and Measurements are primarily business processes. The other two, Information Technology and S&OP Plan Integration are information processes. These dimensions have been identified by Grimson and Pyke (2007) as important means to reach the goal of profit optimization through S&OP plan integration. The framework further uses a 1 to 5 ranking across the five dimensions. The ranking starts with a company that has no S&OP process and Stage 5 is proactive and what the ultimate company can achieve according to the authors. The five stages discussed by Grimson and Pyke (2007) are: Stage 1 - *No S&OP process*, Stage 2 - *Reactive*, Stage 3 - *Standard*, Stage 4 - *Advanced* and Stage 5 - *Proactive*. Table 10 shows Grimson and Pyke's (2007) framework and can thus be used to classify a company. However, for the purpose of this thesis and in order to get further understanding of what is best-practice according to academia, the dimensions will be described further below. The descriptions will hence include additional best practices as presented in the literature. Moreover, the other frameworks and their recommendations concerning the different dimensions will be presented in alignment with the framework mapping in Appendix 1.

Table 10. Grimson and Pyke's (2007) "Five-Stage Maturity Framework" can be used to classify an S&OP user's current process.

	Stage 1 No S&OP process	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	<ul style="list-style-type: none"> • Silo Culture • No meetings • No collaboration 	<ul style="list-style-type: none"> • Discussed at top level management meetings • Focus on financial goals 	<ul style="list-style-type: none"> • Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data 	<ul style="list-style-type: none"> • Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings 	<ul style="list-style-type: none"> • Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	<ul style="list-style-type: none"> • No S&OP organization 	<ul style="list-style-type: none"> • No formal S&OP function • Components of S&OP are in other positions 	<ul style="list-style-type: none"> • S&OP function is part of other position: Product Manager, Supply Chain Manager 	<ul style="list-style-type: none"> • Formal S&OP team • Executive participation 	<ul style="list-style-type: none"> • Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	<ul style="list-style-type: none"> • No measurements 	<ul style="list-style-type: none"> • Measure how well operations meets the sales 	<ul style="list-style-type: none"> • Stage 2 plus: Sales measured on forecast accuracy 	<ul style="list-style-type: none"> • Stage 3 plus: New Product Introduction • S&OP effectiveness 	<ul style="list-style-type: none"> • Stage 4 plus: Company profitability
Information Technology	<ul style="list-style-type: none"> • Individual managers keep own spreadsheets • No consolidation of information 	<ul style="list-style-type: none"> • Many spreadsheets • Some consolidation, but done manually 	<ul style="list-style-type: none"> • Centralized information • Revenue or operations planning software 	<ul style="list-style-type: none"> • Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench 	<ul style="list-style-type: none"> • Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	<ul style="list-style-type: none"> • No formal planning • Operations attempts to meet incoming orders 	<ul style="list-style-type: none"> • Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored 	<ul style="list-style-type: none"> • Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals 	<ul style="list-style-type: none"> • Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions 	<ul style="list-style-type: none"> • Seamless integration of plans • Process focuses on profit optimization for whole company

2.5.1 MEETINGS AND COLLABORATION

Table 11 summarizes the main theoretical recommendations concerning the Meetings and Collaboration dimension expressed in the section below. The recommendations have been grouped into three categories; Meeting structure, Meeting participants, and Collaboration.

Table 11. Theoretical recommendations for the Meetings and Collaboration dimension.

Theoretical recommendations	
Meeting structure	Routinely S&OP meetings with a given frequency, and structured meeting agendas
	Pre-meetings before the consensus meetings
	Event-driven meetings included in the process and supersede scheduled meetings
	Material presented in a format that is suitable for the senior executive team
	Formalized S&OP process
Meeting participants	Executive S&OP meetings
	Participants have authority to make decisions
Collaboration	Collaboration between sales and operations
	Incorporate a broad range of supplier capacity data and involve suppliers in parts of the meetings
	Incorporate a broad range of customer data and involve customers in parts of the meetings

Grimson and Pyke (2007) express that Meetings and Collaboration evaluates the effectiveness of the human component in S&OP. It measures the existence of S&OP meetings, the collaboration between sales and operations, if there are pre-meetings before the consensus meetings, if there are executive S&OP meetings, how formalized the S&OP process is, if customers and suppliers are part of the meeting, and if their capacities are considered (Grimson & Pyke 2007). The span goes from Stage 1 with no planning meetings and no collaboration. Next, in Stage 2, companies mainly discuss financial goals and do not integrate plans and there is still little collaboration. In Stage 3 additional aspects are included, as presented in Table 10, but also including that unresolved conflicts are addressed during the executive S&OP meetings in this stage. Further, for a company in Stage 3, it is discussed that pre-meetings lead up to a formal executive S&OP meeting where there is a focus on integrating supply and demand plans.

A broad range of customers and suppliers data is incorporated in Stage 4 and the suppliers and customers also participate in parts of the meetings (Grimson & Pyke 2007). Lapide (2004) and Ventana Research (2006) also discuss the importance on external inputs to the process from customers and suppliers and AMR Research (2009) mentions that having a focus on the channel is crucial for being an advanced S&OP user. Last, in Stage 5, all supply chain partners also get access to real-time internal and external data and there are event-driven meetings that supersede the scheduled ones (Grimson & Pyke 2007). The aspect of real-time internal and external data is neither something that is stressed by other authors nor is it further explained by Grimson and Pyke (2007). Since S&OP by definition concerns long-term planning and should be set apart from execution, where real-time data is essential, the issue of including real-time internal and external data in Stage 5 will be disregarded from here on.

Seven out of twelve factors Lapide (2004) presents as important to make an S&OP process successful can be related to the Meetings and Collaboration dimension. The importance of the meetings is also stated by Bower (2005) who presents “not understanding proper meeting

procedures” as one of twelve pitfalls in S&OP. Lapide (2004) and Ventana Research (2006) also emphasize the importance of routinely S&OP meetings with a given frequency and a structured meeting agenda. Furthermore, Ventana Reserach (2006) and Lapide (2004) express the importance of the pre-work to support input to the consensus meeting. Both demand and supply should have formal review meetings before the consensus meeting (Ventana Reseach 2006). Baumann and Crum (2009) also emphasize that it is the role of the middle management to make sure that the material is presented in a format that is suitable for the senior executive team.

An important aspect of S&OP is to reach consensus by decision making. Lapide (2004) and Bower (2005) emphasize the importance participants having the authority to make decisions. Lapide (2004) states that if it is difficult to get senior managers attendance, such as senior vice presidents and vice presidents, subordinate director-level managers should attend the meeting and have the authority to make decisions. Lapide (2004, p. 18) expresses that “there should be no option of going back to get executive-level approvals before decisions are made”.

According to AMR Research (2009), senior executive involvement is necessary for the S&OP consensus meeting to have the authority to make decisions. Senior executive involvement is further highlighted by many authors (e.g. Aberdeen Group 2010; AMR Research 2009; Baumann & Crum 2009; Grimson & Pyke 2007; Ventana Research 2006; Lapide 2004) as very important in order to succeed with S&OP.

2.5.2 ORGANIZATION

Table 12 summarizes the main theoretical recommendations expressed concerning the Organization dimension in this section. The recommendations have been grouped into three categories; Formality, Ownership and participation and S&OP anchored in the organization.

Table 12. Theoretical recommendations for the Organization dimension.

Theoretical recommendations	
Formality	Formal S&OP function and team
	S&OP team members whose job descriptions specify S&OP
Ownership and participation	Independent S&OP process owner
	The S&OP process should be facilitated by an S&OP coordinator
	Every step in the S&OP process should have different owners and coordinators
	Cross-functional S&OP team
	Executive level participation, sponsorship, and ownership
S&OP anchored in the organization	S&OP should be understood and respected in the organization
	Understanding that the S&OP process leads to a more “profitable outcome for the company”
	Formal training program about S&OP

Grimson and Pyke (2007) explain that the Organization dimension focuses on the corporate S&OP structure. It includes if there is a formal S&OP function, if it is the responsibility of other positions, if there is a formal S&OP team which job description specify S&OP, if there is executive level participation, and if S&OP is understood and respected in the organization. In Stage 1 there is no S&OP function in the company, not even as part of another function whilst in Stage 5 there is a formal S&OP team with executive level participation and S&OP is understood and respected by others in the organization and they understand that the S&OP

lead to a more profitable outcome for the company (Grimson & Pyke 2007).

Many authors discuss the importance of having a cross-functional S&OP team (AMR Research 2009; Baumann & Crum 2009; Grimson & Pyke 2007; Ventana Research 2006; Lapide 2004). AMR Research (2009) and Ventana Research (2006) recommends that companies should include executive management, finance, manufacturing, demand planning, supply planning, marketing, product engineering and design, and IT functions. All these functions should provide input to the S&OP process but not all of them have to attend the final consensus meeting (Ventana Research 2006). Lapide (2004) discusses the importance of active participation during the meetings and that each member has a role to play that contributes to the process. Furthermore, Aberdeen Group (2010) states that formal training programs in S&OP, processes, and technologies may be useful in order to increase the understanding for the process and its importance.

As previously mentioned in Meetings and Collaboration, it is important with executive involvement in the meetings. In the Organization dimension, the importance of including executives in the formal S&OP team is also emphasized. Aberdeen Group's (2010) framework emphasizes that best-in-class companies are more likely to have senior management lead the S&OP process. Further, Ventana Research (2006, p.6) found that finance and executive management involvement is the "second-most significant factor in achieving gains in revenue, profit, customer satisfaction, and forecast accuracy". In alignment with this, AMR Research stresses that most companies that have a mature S&OP process have executive sponsorship. However, AMR Reserach (2009) furthermore states that the need for executive sponsorship varies and the need for strong executive sponsorship grows stronger the larger the company is and the more complex the political environment is. Schorr (2007) states that that the S&OP process should be owned by top executives but the author moreover states that the different steps in the S&OP process should have different owners and meeting coordinators. For example, the owner of the demand review meeting should be the head of sales and marketing whilst the meeting should be facilitated by a demand manager or coordinator and similar recommendations are put forward for the supply review (Schorr 2007). It is important that the coordinator has a good understanding of the organization and a broad-based experience (Schorr 2007). Similarly, Aberdeen Group (2010) emphasizes the importance of clearly defining who is accountable for every part of the process.

Baumann and Crum (2009) state that the S&OP process should not be owned by the demand or supply function. Having the ownership at one of these functions is actually one of the most common reasons to why S&OP does not provide the expected benefits because sub-optimization often occurs (Baumann & Crum 2009). Bower (2005) further states that the S&OP leaders must be familiar with the demand and supply functions but the author moreover emphasizes that the S&OP leaders should not own the supply or demand planning.

2.5.3 MEASUREMENTS

Table 13 summarizes the main theoretical recommendations expressed concerning the Measurements dimension in this section. The recommendations have been grouped into three categories; S&OP goal measurements, Company performance, and S&OP process performance.

Table 13. Theoretical recommendations for the Measurements dimension.

Theoretical recommendations	
S&OP goal measurements	S&OP partially accountable for the profitability
	Measure company profitability and other financial metrics linked to the S&OP process
Company performance	Overall measurements: profitability perfect orders, revenue, and inventory
	Major strategic initiatives
	Key supply chain performance indicators
	Measure results of new product introductions
	Functional measurements
S&OP process performance	S&OP effectiveness measurements including feedback and suppliers and customers' evaluation
	Forecast accuracy for sales over time
	Improvements in delivery precision
	Use cross-functional measurements

The Measurement dimension refers to both company performance and S&OP process performance (Grimson & Pyke 2007). Included measures are forecast accuracy for sales, new product introductions, S&OP effectiveness, company profitability, and whether the company's profitability is linked to the S&OP process (Grimson & Pyke 2007). New product introduction measures are important as other operational measurements are not suited for the special situation of new product introductions according to the authors. Thus, it is important to also measure development cost, time to market, ramp-up time, and the number of successful introductions in the S&OP process (Grimson & Pyke 2007). S&OP effectiveness measurements should include 360 degree feedback where team members are provided feedback from their peers, supervisors and subordinates. Moreover, customers and suppliers should be asked to evaluate the process. Companies should also include functional measurements and an effective S&OP process should lead to improved forecast accuracy over time as well as to improvements in delivery precision (Grimson & Pyke 2007).

In Stage 1 of Grimson and Pyke's (2007) framework, companies only have standard financial accounting systems whilst Stage 5 companies have all above mentioned measurements and since the focus for Stage 5 companies is profitability, these companies also have profitability measures. Having the focus on profitability means that profitability is reported to the S&OP team who are partially accountable for it (Grimson & Pyke 2007).

The performance measurement dimension is widely discussed also in other frameworks and literature. According to Bower (2005), measurements are important for S&OP success and it is also important in the work of continuously improving the process. Likewise, in the performance measurement dimension in Aberdeen Group's (2010) framework, it is put forward as important for companies to measure the process and its results in order to improve its businesses. Moreover, amongst others AMR Research (2009), Ventana Research (2006),

Bower (2005), and Lapide (2004) give recommendations concerning which performance measurements a company should use in conjunction with its S&OP. Starting with Ventana Research (2006), it suggests meeting preparedness, attendance, action plan follow-up, efficiency of review meetings, and S&OP process improvements as key measurements of S&OP effectiveness. These metrics are considered close to the 360 degree feedback, as discussed above, and thus incorporated in that point in Table 13. When measuring the S&OP process, Lapide (2004) believes that demand forecast accuracy is the most important metric. Continuing, the five shared metrics that AMR Research (2009) found to be the most important are: forecast accuracy, perfect orders, revenue, profitability, and inventory. Last, Bower (2005) includes the following measures as important for the S&OP team: measurement of major strategic initiatives, forecast accuracy measures, critical market measures, new product forecast accuracy, major financial indicators and measures, and key supply chain performance indicators. Aberdeen Group (2010) also stresses the importance of linking financial metrics to the S&OP process and having the ability to provide mapping between operational supply chain metrics and financial metrics. Furthermore, Singh (2009) states that metrics should be compared with targets and that the metrics should be cross functional, for example is it better to show how inventory is related to the forecast instead of measure the two, forecast accuracy and inventory, separately.

2.5.4 INFORMATION TECHNOLOGY

Table 14 summarizes the main theoretical recommendations expressed concerning the Information Technology dimension in this section. The recommendations have been grouped into two categories; Information sharing and Functionality and software.

Table 14. Theoretical recommendations for the Information Technology dimension.

Theoretical recommendations	
Information sharing	Information should be consolidated automatically and centralized
	Integrate supply, demand, and S&OP workbench systems
Functionality & software	Use demand-side planning systems which enable statistical forecasting, integral planning, and demand plan development for different demand shaping strategies
	Use supply-side planning systems which enable supply plan development and includes constrained-based planning, scenario analysis, integral planning, and optimization
	Use a demand collaborator and a supply collaborator
	Use an S&OP workbench
	Use joint optimization software

This dimension is focused on an information process and thus differs from the three above described business processes. It concerns what kind of software that is used, i.e. spreadsheets, revenue and operations planning software, optimization software, or software allowing for joint optimization (Grimson & Pyke 2007). It also concerns if and how information is shared, consolidated or centralized, and the level of automation in the consolidation (Grimson & Pyke 2007). As illustrated in Table 10, Stage 1 companies have a few spreadsheets that are owned by individual managers and neither shared nor consolidated. Moving to Stage 4, companies classified in this stage have revenue and operations optimization software which are not jointly optimized but rather optimized sequentially or separately. Stage 4 companies moreover

have an S&OP workbench which is an automated tool for sharing information about sales and operations plans among the team members (Grimson & Pyke 2007). Stage 5 software was not achievable in this dimension at the creation of Grimson and Pyke's framework in 2007.

Grimson and Pyke (2007) stress that Stage 5 companies "employ real-time, integrated solutions that jointly optimize sales decisions, such as pricing, with operations decisions, such as production schedules" (Grimson & Pyke 2007, p. 334). There has however been development in this dimension and nowadays' APS system make optimization possible, even though it may still be difficult to accommodate all factors in complex environments.

In a study done by Ventana Research (2006), 76 percent of companies said that software is an important element of S&OP. However, few companies are satisfied with their current technologies (Ventana 2006). The companies that perform well are the ones that are most satisfied with their current technologies according to the study. The companies that only use simple methods such as spreadsheets are the least satisfied (Ventana 2006). Interesting in relation to this is that, according to Aberdeen Group (2010), many companies, 84 percent of overall respondents to its research, still use simple methods such as spreadsheets. One of the risks of using tools such as spreadsheet, which requires manual inputs, is that the accuracy can be questioned (Baumann & Crum 2009).

On the other hand, Lapide (2004/2005) discusses that technology itself is not very useful but it is the combination of a well functioning business process and the appropriate technology which is important. The author also concludes that it is important to remember that "business processes dictate the enabling technologies that one needs for supply chain improvement" (Lapide 2004/2005, p. 3). Baumann and Crum (2009) state that in order to reach a successful S&OP process companies need to integrate people, processes, and tools to work together. It is not enough to only implement a great tool and believe that it should lead to a successful process. Furthermore, Singh (2009) points out that technology and business process changes should be implemented concurrently. Since the S&OP process often is complex and needs to handle a lot of planning elements it is often necessary to use technology in order to achieve all the benefits according to Lapide (2004/2005).

Aberdeen Group (2010) stresses that a differentiator for best-in-class companies is their use of technology in areas such as supply planning, demand planning, inventory planning, and execute reporting. Similarly, Lapide (2004/2005) states that the S&OP process must be supported by three types of software applications: demand-side planning, supply-side planning, and, as also mentioned by Grimson and Pyke (2007), an S&OP workbench, see Figure 2. These systems need to be integrated in order to get a holistic view of the supply and demand situation (Lapide 2004/2005).

First, the demand-side planning system should be able to develop an unconstrained baseline forecast as well as statistical forecasts and scenarios including factors such as campaigns, new product introductions, pricing actions, and a changing competitive environment (Lapide 2004/2005). The demand-side planning system should moreover include a "demand collaborator" which should be used to share demand forecasts with customers and sales personnel and to capture, assemble, and process information (Lapide 2004/2005). Ivert and Jonsson (2010a) discuss the benefits of using APS systems in the S&OP process and they

stress that APS may support the demand-side steps of the S&OP process with statistical forecasting methods and demand planning tools able to integrate different departments and companies. Furthermore, the possibility to develop different demand plans based on different demand shaping strategies is an important functionality.

Second, the supply-side planning software should be able to support the development of supply plans, including inventory, production, and procurement plans. Similarly to the demand collaborator, the “supply collaborator”, discussed by Lapide (2004/2005), should capture and compile supply capabilities from for example purchasing personnel and suppliers. Ivert and Jonsson (2010b) discuss that the multi-site master planner in an APS system may support the S&OP process with integral planning, constrained-base planning, optimization, and what-if simulation (i.e. scenario analysis).

Third, the purpose of the S&OP workbench is to support the S&OP meetings with two types of information (Lapide (2004/2005)):

1. Generate dashboards to display a multitude of metrics that portray the planned supply versus “unconstrained” demand situation. The dashboard should also render it possible to perform what-if analysis during for example the meetings.
2. How well the process itself is working (KPIs).

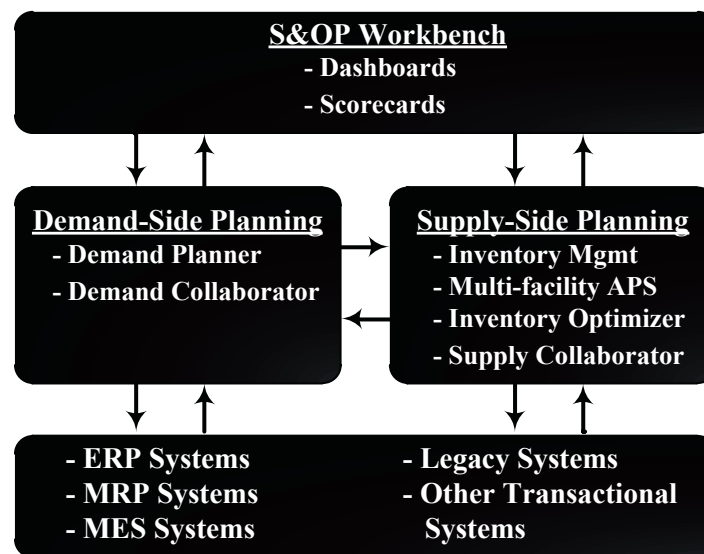


Figure 2. The S&OP process must be supported by demand- and supply planning software as well as an S&OP workbench (after Lapide 2004/2005, p.19).

Further, Ivert and Jonsson (2010a) stress that using APS to support the S&OP yields many different benefits. First, there are decision support benefits such as the possibility to perform optimization and what-if scenario analysis as well as visualize information. Second, there are planning efficiency benefits from reduced overall planning time and focus on data quality. Third, there are learning effects benefits from increased understanding and confidence in planning. The benefits of APS vary somewhat between the different process steps where different functionalities are used (Ivert & Jonsson 2010a). In the Create the demand plan process step, an APS system with the functionalities presented above results in benefits such as a reliable demand plan and visualization of and easy access to information (Ivert & Jonsson 2010a). When developing the supply plan, benefits include an optimal production plan,

possibility to conduct scenario analysis, and visualization of and easy access to information (Ivert & Jonsson 2010a). During the S&OP meetings, the possibility of using a tool such as an S&OP workbench to visualize and analyze different scenarios and thus being able to identify future events is valuable (Ivert & Jonsson 2010a). However, according to the study done by Ventana Research (2006), companies often miss features such as the possibility to perform scenario analysis and what-if analysis as well as a real-time S&OP dashboard.

Ivert and Jonsson (2010b) further stress that the S&OP aim, complexity, and maturity influence the effective APS usage. With an ambitious S&OP aim the need for APS functionalities increases as it may be hard to achieve aims such as generating optimal plans or identifying and analyzing future scenarios without supporting APS functionalities. Further, the higher S&OP complexity, the more there is need for APS functionalities. Ivert and Jonsson (2010b) also stress that the S&OP maturity influences the effective use of APS functionalities and thus that it is important to have a mature process before implementing an APS system. The authors also conclude that the APS functionalities statistical forecasting methods and constraint-based planning are important even though S&OP aim, complexity and maturity is low. On the other hand, what-if simulation and integral planning are important if any of the dimensions are high whilst optimization should be considered in contexts where at least the aim and maturity is high (Ivert & Jonsson 2010b).

2.5.5 S&OP PLAN INTEGRATION

Table 15 summarizes the main theoretical recommendations expressed concerning the S&OP Plan Integration dimension in this section. The recommendations have been grouped into two categories; Profit optimization and financial analysis and Plan creation.

Table 15. Theoretical recommendations for the S&OP Plan Integration dimension.

Theoretical recommendations	
Profit optimization and financial analysis	Optimize plans concurrently in order to optimize profitability
	Compare and temper plans with financial goals and budget
	Compare and temper plans by business goals
	Use financial budgets as an input when developing the plan. However, it should not constrain the plan
	Make sure future financial projections are well integrated with the new product, demand, and supply plans
	Sales and operations should be jointly accountable for setting price levels
Plan creation	Develop forecasts bottom-up
	Develop sales and operations plans collaboratively and concurrently

The S&OP Plan Integration dimension is the goal of the above four dimensions. It measures “how effectively a company builds its sales plans and operations plans, and how well the plans interface” (Grimson & Pyke 2007, p. 335). It thus includes if and how the plans are created. In the first stage there is no S&OP as earlier implied and thus no integration of plans. In the Stage 2, the sales plan completely drives the operations plan and capacity constraints and utilization are not considered. In Stage 3, the sales plan still drives the operations plan but operational information is also included and plans are adjusted accordingly. Stage 3 companies moreover develop forecasts bottom-up and the plans are thereafter compared with the business and financial goals and, if necessary, adjusted. In Stage 4, plans are developed

collaboratively and capacity constraints are considered by both marketing and operations. The planning process is moreover concurrent rather than sequential. Concerning the issue of marketing considering capacity constraints, Grimson and Pyke (2007) do not elaborate more on how this should be done. Moreover, it goes against the aforementioned mentioned creation of an unconstrained demand plan, something which is unanimously argued for above. Therefore, the authors of this thesis will disregard from this point from here on as not enough theoretical evidence has been found to support the recommendation.

Last, in Stage 5, companies have a process that is optimized concurrently for demand and supply to optimize profitability. When Grimson and Pyke's (2007) framework was created, Stage 5 technologies was not yet feasible to reach and thus this stage was neither feasible but the goal of profit optimization was still emphasized and the authors wrote that it should be started to be anchored in the organization. However, because of the technology development since 2007, companies may start to aim at reaching Stage 5 in this dimension as well. Having a process aiming at profit optimization includes that both sales and operations are accountable for "setting prices and adjusting inventories and production plans to jointly achieve more profitable outcomes" (Grimson & Pyke 2007, p. 334). Lapede (2004) also emphasizes the importance of developing supply and demand plans concurrently instead of a sequential process where the supply plan is developed to meet a pre-specified demand plan.

The study done by Ventana Research (2006) found that companies which use S&OP to adjust their finance, sales, marketing, and executive management plans are more likely to succeed. The same study also points out that easy actions such as creating an action plan and follow it up often leads to great performance improvements. As aforementioned, Ventana Research (2006) also states finance as one of the most important factors to achieve increased profitability. An interesting conclusion from Ventana Research (2006) is that only 42 percent of companies involve finance in their S&OP. However, the companies involving finance report much better results when it comes to achieving gains in revenue (90 percent), profit (70 percent), customer satisfaction (76 percent), and forecast accuracy (56 percent). The members from finance should also be highly involved with the work of matching the operation plans with the financial objectives of the company (Lapede 2004). AMR Research (2009) expresses that the greatest cultural difference to overcome is the role of finance, especially how the financial budget should be used when developing the plan. The budget should be used as an input but it should not constrain the plan (AMR Research 2009). Baumann and Crum (2009) state that the role of finance is to compare the plans with the budgets and to evaluate the implications. Furthermore, it is finance role to make sure that the future financial projections are well integrated with the new product, demand, and supply plans.

2.6 SCENARIO ANALYSIS IN THE S&OP PROCESS

It has been stressed above that the S&OP process should include what-if analysis and development of different scenarios. Since this is identified as a gap in chapter 5 and chosen for further study in RQ3, this chapter describes scenario analysis in S&OP. Since limited literature exists on this topic this section is complemented with expert interviews, as is explained in the Methodology, and which results are presented in the Empirical Findings.

2.6.1 SCENARIO ANALYSIS DEFINITIONS, GOALS, AND BENEFITS

Scenario analysis, also referred to as scenario planning and scenario management, has been defined in several ways in the literature. First, Michael Porter defined a scenario as (Porter 1985):

An internally consistent view of what the future might turn out to be — not a forecast, but one possible future outcome.

Using this definition, (Ringland 2006) defines scenario analysis as:

That part of strategic planning that relates to the tools and technologies for managing the uncertainties of the future.

Furthermore, Ringland (2006) states that scenario analysis is a set of processes which improves the quality of the educated guess, visualizes what the consequences of different alternatives are, and thus helps deciding when to gamble. Chermack (2011) uses the concept of performance-based scenario planning which the author defines as:

A discipline of building a set of internally consistent and imagined futures in which decisions about the future can be played out.

These definitions consolidated results in an understanding that scenario analysis, either described as a tool, technique, or process, includes managing the uncertainties of the future by creating internally consistent alternatives of future outcomes.

The purpose of scenario analysis is according to Schoemaker (1995) to build a framework that encourages diversity and sharper perception concerning external changes and opportunities. Additionally, Chermack (2011) states that the purpose is to change thinking, improve decision making, foster human and organizational learning, and improve performance.

As mentioned in the Theoretical background and in this chapter above, scenario analysis has become an important part of the S&OP process. Ventana Research (2007) states that scenario and what-if analysis are topping the list of wanted software capabilities within S&OP and, similarly, scenario analysis is amongst the key technical capabilities required in S&OP according to Gartner (2010). Thus, much of the focus in literature states scenario analysis as an important technological functionality for supporting S&OP. The rationale for its importance is that scenario analysis is considered important in the process in order to deal with complexity and uncertainty (similar and put equal to detail and dynamic complexity discussed by Ivert and Jonsson (2010b)) in the S&OP context (Schlegel & Murray 2010). As a consequence, and as stated above, making conscious choices on the best scenarios are stressed as a part of the aim of S&OP (AMR Research 2009; Muzumdar & Fontanella 2006).

Benefits of including scenario analysis in planning are that it handles uncertainty and complexity, gives increased understanding of possible future outcomes, and supports decision making (Chermack 2011). In other words, it allows for a better feel for potential changes and the impact these may have on the business (Schlegel & Murray 2010). Moreover, Ivert and Jonsson (2010a) emphasize that scenario analysis helps a company understand the implications of its network alternatives. Thus, it helps raise awareness of the company's ability and choices when it comes to acting on supply chain issues (Ivert & Jonsson 2010a).

This stresses that scenario analysis in S&OP is not only about testing how the plans are affected by uncertainty but also the impact of the company's actions and choices.

As stressed by Ivert and Jonsson (2010b) above, increased dynamic complexity, or uncertainty, motivates analyzing possible future events, and thus using scenario analysis. Similarly, Schlegel and Murray (2010) state that scenario analysis is best used where significant uncertainty exists and where the current process for creating plans and reaching consensus do not meet business objectives. Thus, it is clear that the use of scenario analysis is primary recommended to companies experiencing dynamic, but also detail complexity because of the many alternatives this may yield, as these are the companies which have the most to gain from using it.

2.6.2 INCORPORATING SCENARIO ANALYSIS IN THE S&OP PROCESS

Having described above that companies may have much to gain from including scenario analysis in their S&OP process, the next question is where in the process to incorporate it? AMR Research (2009) states that scenario analysis should be used to hedge against supply, demand, and product volatility and thus it is clear that scenarios should be done concerning different factors and consequently in several parts of the process. This is in line with what is presented concerning the S&OP process structure above where scenario analysis is touched upon in three process steps; in the creation of the demand plan, when developing the supply plan, and during the reconciliation meeting. Apart from these recommendations not much is written about where to include scenario analysis in the process.

Thus, first, scenario analysis should be used in the creation of the demand plan where, to begin with, different forecast scenarios should be developed (AMR Research 2009). This is also emphasized by Chermack (2011) who states that a forecast is only a point in a sea of probability and therefore creating different forecast scenarios is useful when planning. Furthermore, it is emphasized that different possible demand shaping scenarios thereafter should be created when developing the demand plan (AMR Research 2009). Gartner (2010) presents demand shaping strategies that may be considered, e.g. marketing programs, new product introduction, promotions, trade deals, sales incentives, and price management.

Second, scenario analysis should be used in the development of the supply plan, i.e. the third process step presented above. In this step, the different demand shaping scenarios should be evaluated, as earlier presented, resulting in alternative supply plans. The supply-side is also expected to develop different supply scenarios if there are gaps between supply and demand and these scenarios should consist of different ways of shrinking the gaps (Schorr 2007d). As aforementioned, the scenarios should be evaluated, and issues and constraints discussed for each alternative, and finally a recommendation on a preferred plan should be made.

Last, scenarios should be evaluated during the reconciliation meeting as aforementioned. In this step of the S&OP process, key demand and supply scenarios earlier developed should be presented and their consequences, risks, issues, and opportunities discussed before making a decision on a final plan (AMR Research 2009).

2.6.3 SCENARIO CREATION

Scenario analysis helps a company expand the range of possible futures it may see and in

order to do so, the company must separate its knowledge into two areas, according to Schoemaker (1995); (1) Things the company believes it knows something about and (2) elements it considers uncertain or unknowable. The possible outcomes of each uncertainty may then be evaluated and scenarios built (Schoemaker 1995). Chermack (2011) similarly separates predetermined elements from critical uncertainties where the latter should be used for creating scenarios. However, this concerns creating scenarios around uncertainties but important to remember is that, as discussed above, in S&OP it may be beneficial to create scenarios to evaluate different business alternatives, e.g. demand shaping and network alternatives.

In order to develop scenarios, Schoemaker (1995) presents a general ten step process. The first step is considered important in order to understand how and where scenario analysis can be incorporated in the S&OP process. Thus, the focus of this thesis is on the first step whilst the remaining steps are presented in Appendix 6. The first step consists of defining the scope of the analysis. To begin with, the time frame of the scenarios and the scope in terms of products, markets, geographic regions, and technologies should be set (Schoemaker 1995). Next, past sources of uncertainty should be identified (Schoemaker 1995). For the identification it is useful for the company to look at the past and think about what they know now that they wish they would have known then according to Schoemaker (1995). The author also proposes brainstorming sessions as useful in order to identify the issues.

2.6.4 SCENARIO EVALUATION AND DECISION MAKING

In order for scenario analysis to support the decision making, the consequences and impacts of the scenarios should be evaluated and discussed, as aforementioned. Some different evaluation parameters are discussed above. First, Schorr (2007d) states that scenario evaluation should include a profitability assessment as well as issues with each scenario. The author also state that during the reconciliation meeting, the key scenarios should be converted into monetary terms in order to see their affect on overall business goal. Monetary KPIs put forward are those such as revenue, cash flow and costs (Schorr 2007e). AMR Research (2009) similarly stress profitability and customer service as important parameters to consider whilst Bauman and Crum (2009) use the broader “financial modeling” as a help when evaluating scenarios. Other parameters useful for evaluating scenarios include growth rate and market share (Schoemaker 1995). Furthermore, a balanced scorecard where the effect of the scenarios on both operational and financial KPIs is useful as it allows all involved functions to understand the consequences of each scenario (Kinaxis 2008).

2.6.5 SUPPORTING TOOLS FOR SCENARIO ANALYSIS

To conduct scenario analysis in the S&OP process, supporting tools are required. In the literature, the tools discussed are mainly advanced tools such as APS systems with functionalities supporting scenario analysis. Scenario functionalities exists for the demand-side modules, when using statistical forecasting methods creating alternatives to the baseline forecast as well as to create demand shaping alternatives (Ivert & Jonsson 2010a). Similarly, the supply-side functionalities available include what-if simulation (Ivert & Jonsson 2010a). In the supply planning system, there should be a flow model of the enterprise where the company is modeled as a network of nodes, links, and associated costs and constraints using data from for example an ERP system (Schlegel & Murray 2010). The model may include

both hard and soft constraints where hard constraints are those which must be accomplished whilst a violation of soft constraints generates warnings in the simulation (Ivert & Jonsson 2010a). For generating and visualizing scenario analysis during the meetings, Lapide (2004/2005) recommends an S&OP workbench as previously presented.

No support for using less advanced tools, such as Excel, for scenario analysis has been found in the literature. However, Ivert and Jonsson (2010b) state that the level of advancement of systems necessary for supporting S&OP depends on various factors as discussed above. Thus, as aforementioned, companies which are experiencing much complexity may benefit more from using an advanced supporting system in their S&OP (Ivert & Jonsson 2010b). Hence, an APS system with scenario analysis functionalities is a better alternative than simple systems for supporting scenario analysis when experiencing complexity (Ivert & Jonsson 2010b).

2.6.6 PREREQUISITES FOR SUCCEEDING WITH SCENARIO ANALYSIS IN THE S&OP PROCESS

Scenario analysis is emphasized in AMR Research's (2009) S&OP process for "demand driven leaders", see Table 2, showing that scenario analysis may not be feasible for S&OP beginners. Moreover, Schlegel and Murray (2010) stress that scenario analysis mostly applies to mature S&OP processes and hence, in order to succeed with scenario analysis in S&OP, a company first needs a well developed S&OP process. The process maturity aspect here includes, amongst others, alignment to business models and the prerequisite of high quality data which is necessary to support well grounded scenario creation (Schlegel & Murray 2010). Schlegel and Murray (2010) also discuss the need for trust and understanding of the analysis and its outcomes amongst team members at all organizational levels as it is necessary in order to create scenarios that "are actionable and executable – not just academic exercises" (Schlegel & Murray 2010, p. 30).

3 METHODOLOGY

This chapter describes the methodology applied throughout the project. First, an overview, a model of analysis, is presented and it describes the working process for each of the three RQs as well as the methods chosen for data collection. Second, the methods used for data collection and what data that has been collected is further described. Last, the thesis's reliability and validity is discussed.

3.1 MODEL OF ANALYSIS

This master thesis was conducted at VTC where the company's current S&OP process was studied with the purpose of giving recommendations of how VTC can improve the process. As it was decided to only study VTC instead of a large sample of different companies, the research design of this thesis was thus a case study. The research design is used to structure the research and shows how all the parts of the project work together in order to address the RQs. Thus, the design steers how a certain method is used and how data is analyzed (Bryman & Bell 2003).

The case study is especially appropriate when studying processes and change according to Patel and Davidson (2003) and hence, a case study is a suitable design for studying S&OP. The advantages with a case study are that the phenomenon is studied in its real environment and that a great understanding and knowledge can be obtained of the studied object (Wallén 1996). In addition, the case study makes it possible to capture complex connections and it often gives the study a depth that cannot easily be obtained by other designs (Yin 2003). Furthermore, Yin (2003) puts forward the strength in the wide variety of evidence that can be collected, e.g. from interviews, documents, and observations. This is an advantage that was considered very useful and which was fully utilized in this thesis where data collection was performed with the help of many different methods, as further presented below.

Disadvantages related to the case study are foremost that it is time consuming and that it can be hard to draw general conclusions from it (Wallén 1996). The disadvantage concerning time were dealt with by having clear delimitations of the study, having a well thought through time plan which was continuously updated, and by having continuous discussions with the supervisors at Chalmers and VTC about when sub-objectives had been satisfactory achieved. Concerning general conclusions, this was somewhat traded-off against the possibility of giving useful and well grounded recommendations to VTC. However, the model of analysis and the Theoretical Framework are believed to be useful for other companies that want to improve their S&OP processes. Furthermore, certain generalizability and transferability of the results are considered possible as discussed in chapter 7.

In order to get a better understanding of the working process, the methods used, and how the outcomes are related to the working process, a model of analysis is presented, see Figure 3. The work was structured around the three RQs presented in chapter 1. The model of analysis presents which methods that have been used for data collection in order to answer each RQ. RQ1 includes to develop a theoretical framework and to map VTC's current S&OP process. A large portion of the data collection was performed in RQ1. The outcome of RQ1 is all identified gaps between the theoretical recommendations and VTC's current S&OP process. These gaps were further analyzed in RQ2 by taking the context and expected impact and

effort into consideration when deciding which gaps that should be closed and in which order. Further, an outcome of RQ2 is that one gap was chosen for deeper study, namely the gap concerning scenario analysis. Thereafter, RQ3 was formulated and the output of it is recommendations of how VTC may incorporate scenario analysis in its S&OP process. The three RQs and the chosen methods will be further described below.

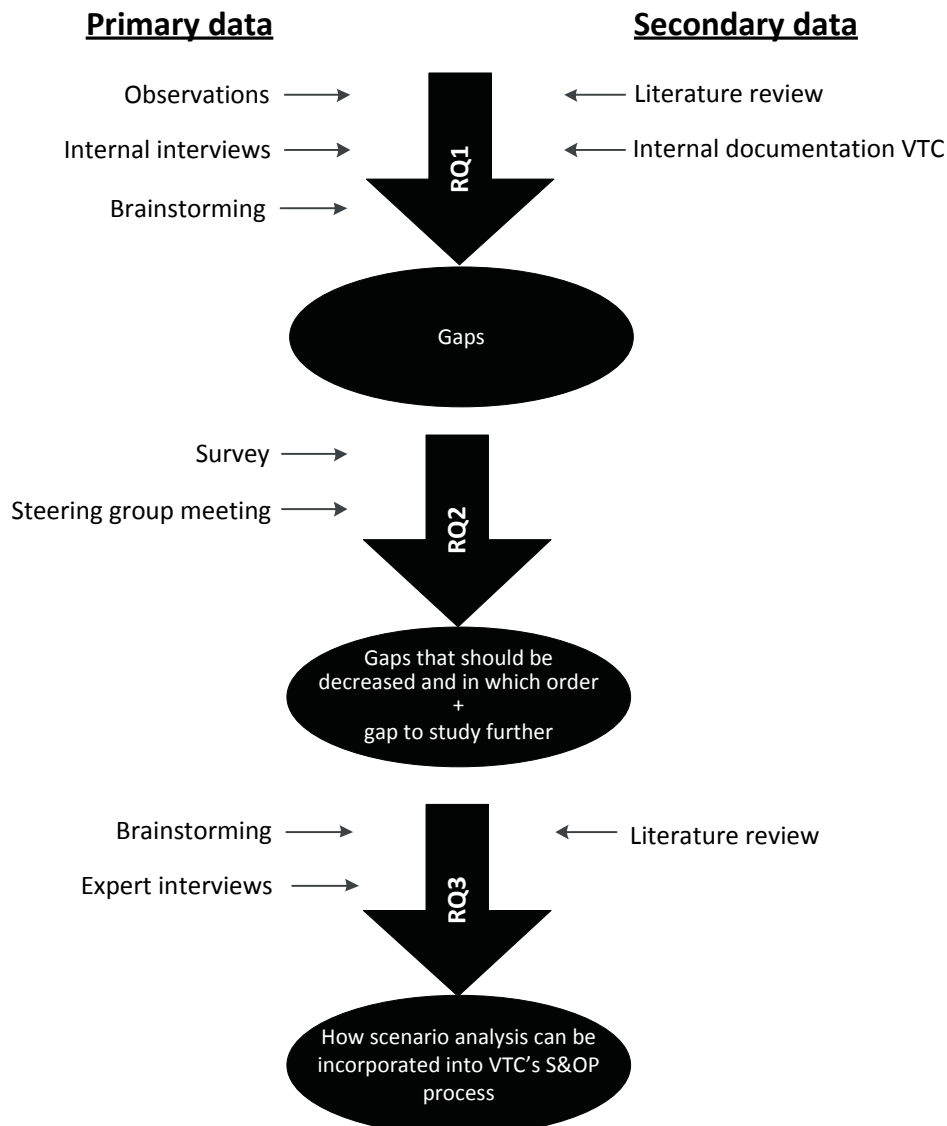


Figure 3. Model of analysis.

An important distinction in research work is how theory and empirics should be related to each other. As it was chosen to do a case study at VTC and, as mentioned above, compare VTC's S&OP process with the established theory, this thesis used a deductive approach. Deduction takes the starting point from theory and principles and from this conclusions are drawn concerning specific cases (Patel & Davidson 2003). Moreover, it was chosen that this thesis would conduct qualitative research. Since the purpose of this thesis was to assess how VTC's S&OP process may be improved, the broad perspective given by a quantitative method is not as important as the in depth understanding that can be obtained by the qualitative method (Holme & Solvang 1997). Furthermore, the qualitative method provides a larger flexibility as the research can be more adapted during the ongoing project (Holme & Solvang

1997) and this was considered important for this thesis. The disadvantage of the qualitative method is that it does not give the same possibility for generalizations as do quantitative methods (Björklund & Paulsson 2007). Furthermore, the research is more affected by interpretations made by the researcher and thus the reliability and validity of the research is dependent on how the collected information is interpreted (Bryman & Bell 2005). Reliability and validity is discussed at the end of this chapter.

3.1.1 RESEARCH QUESTION 1

The process of reaching the output for RQ1 is divided into five sub-objectives, see Figure 4.

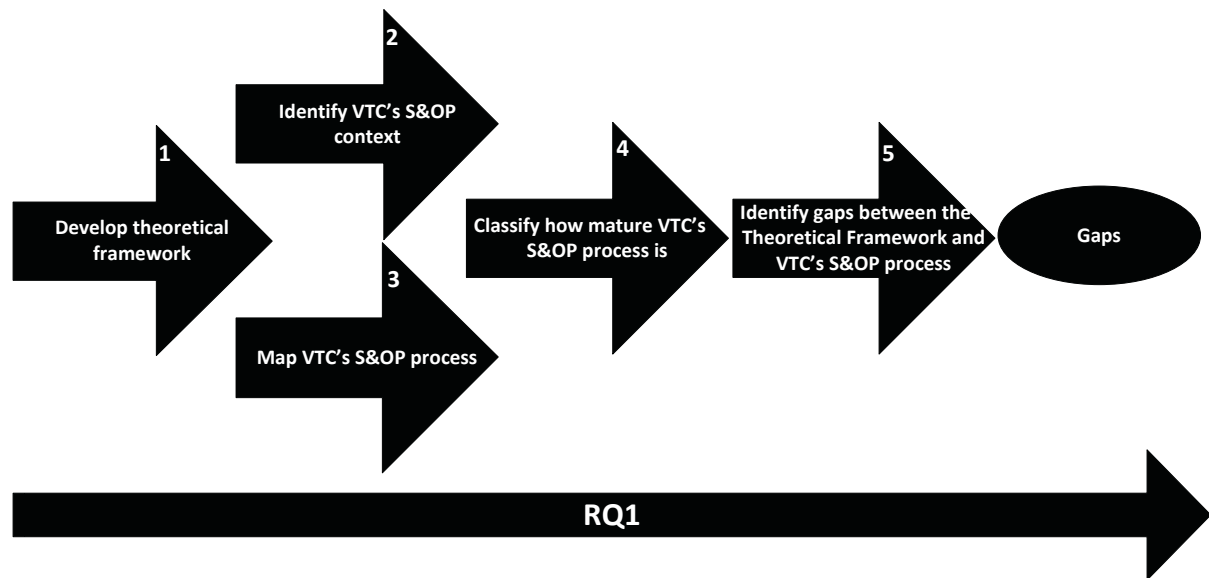


Figure 4. RQ1 is divided into five sub-objectives in order to reach the outcome, i.e. the gaps.

1. Develop theoretical framework

First, a literature study was conducted to develop a theoretical framework. A literature study was chosen because it creates a good understanding of what has been studied previously in the field. Moreover, according to Björklund and Paulsson (2007), a literature study is a cheap and a relatively quick method to gather a lot of information. Furthermore, as mentioned earlier, VTC has not developed its S&OP process according to the literature and it is interested of knowing how well it is doing according to the literature. Therefore, a wide approach towards the S&OP field was taken. The theoretical framework was developed and is structured around four main areas: S&OP definition and goals; S&OP planning parameters, S&OP process structure, and last, S&OP maturity which includes five dimensions important in S&OP. The last two, S&OP process structure and S&OP maturity, are two approaches which are closely related. The process structure focuses on the flow and the different activities that take place during a planning period whilst the dimensions take a holistic view and are present in most process steps. Hence, some aspects overlap and are covered both in the S&OP process structure discussion and in the S&OP maturity discussion. However, as some aspects only are captured in one of the areas, it is considered to be a strength of this thesis that S&OP is studied from both perspectives.

2. *Identify VTC's S&OP context*

The purpose of this step was to identify and describe VTC's S&OP context since the purpose of this thesis included taking VTC's S&OP context into consideration. In order to identify the S&OP context, internal documentation was studied as it was easy accessible, time efficient, and that it gave a broad overview of VTC's context. In addition, interviews were performed to gain deeper understanding of the context as it was time efficient, compared to for example studying reports about the truck market and industry. Interviews further gave the possibility to ask open questions about the context as it was not clear in beforehand what could be important in the S&OP context. A brainstorming session was also held with the purpose of helping to answer RQ3 but which also gave inputs to the identification of VTC's S&OP context. The context description together with the output from the brainstorming was further used to conclude upon VTC's S&OP complexity, as defined in the Theoretical Framework.

3. *Map VTC's S&OP process*

A third step was to get an understanding of VTC's current S&OP process. To gain knowledge about the process, it was chosen to study internal documentation about the S&OP process as well as to perform observations and interviews. Internal documentation was studied as it gave a good basic understanding of VTC's process. Observations were carried out as it is a good way to study what people actually do, not what they say they would do (Denscombe 2009). Hence, observations were a good way for the authors to have the opportunity to study the process objectively. Björklund and Paulsson (2007) point out that an interview is a good way of collecting data because it gives a deeper understanding of the topic as the questions can be adapted to fit each interviewee. Hence, interviews were also believed to be a good method for this part of the study.

4. *Classify how mature VTC's S&OP process is*

As a fourth step, VTC was classified between Stage 1 and 5 within each of the five dimensions presented by Grimson and Pyke's (2007) in their "Five-Stage Maturity Framework". The classification of VTC's S&OP process was done by the authors of this thesis using the process mapping in step 3.

5. *Identify gaps between the Theoretical Framework and VTC's S&OP process*

As a final step to answer RQ1, gaps were identified between the Theoretical Framework developed in step 1 and VTC's current S&OP process, as identified in step 3 and 4. The analysis was done by the authors by comparing the theoretical recommendations with how VTC currently is working with S&OP. Important to notice is that the majority of these gaps were identified solely based on theoretical recommendations, hence VTC's S&OP context was not considered for these gaps. The only exception concerns the S&OP planning parameters where there is a contingency approach in the literature. As described in the Theoretical Framework, for example the planning horizon should be set depending on context factors such as the lead time for capacity changes. Hence, in order to identify if there were gaps concerning the planning parameters, VTC's context had to be taken into consideration.

As some gaps were identified several times and because some gaps were similar to each other, the gaps were consolidated into a total of 26 gaps.

3.1.2 RESEARCH QUESTION 2

The process of reaching the output for RQ2 is divided into three sub-objectives, see Figure 5. The last sub-objective, which gap to study further, is needed in order to formulate RQ3.

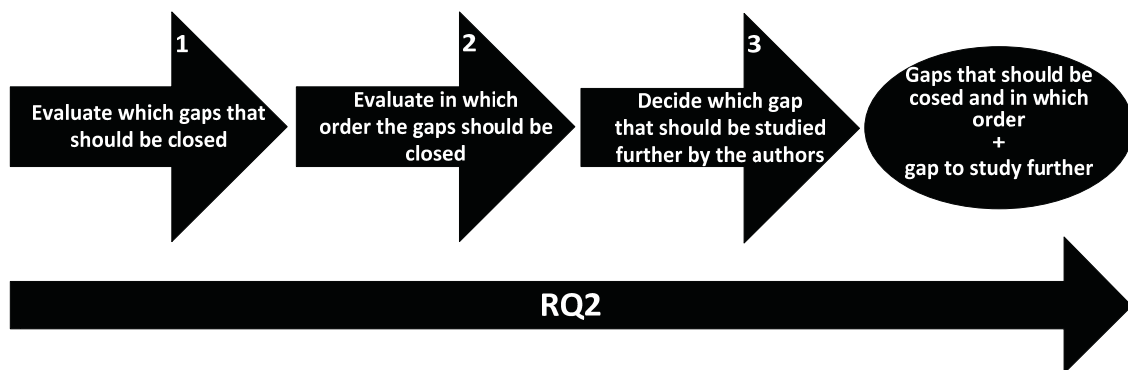


Figure 5. RQ2 is divided into three sub-objectives in order to reach the outcome, i.e. which gaps that should be closed and in which order as well as which gap that should be studied further.

1. Evaluate which gaps that should be closed

The outcome from RQ1 is 26 identified gaps. In this step, it was evaluated which of these gaps that should be closed based on the impact and effort to close the gaps taking the S&OP context including the complexity into consideration. It was chosen to do an Impact-Effort analysis mainly for two reasons. First, an Impact-Effort analysis is considered a good way to rank different alternatives and secondly, VTC has previously used Impact-Effort analysis and hence it was believed that the company would recognize the method and be comfortable with it. A survey was chosen to be conducted to collect VTC's opinions about the impact and effort to close the gaps. The gaps that were graded with higher effort than impact were decided not to proceed with and hence not to close.

Important to point out concerning the method here is that the authors made a choice to focus on gaps and not analyze matches further. However, since the context was not taken into consideration in the gap identification, analyzing the matches may result in some areas where VTC's context justifies not working in precise alignment with the theory. Those aspects are hence not covered by the model of analysis.

2. Evaluate in which order the gaps should be closed

As a final step to answer RQ2, it was evaluated in which order the remaining gaps should be closed because, as discussed in the Problem identification, Grimson and Pyke (2007) emphasize the importance of implementing S&OP in stages. This evaluation was done by the authors based on the Theoretical Framework, the results from the Impact- Effort analysis, how the gaps are related to each other, and VTC's S&OP context.

3. Decide which gap that should be studied further by the authors

Before formulating RQ3, it had to be chosen which of the gaps that the authors should investigate further. It was decided that the decision should be taken during a so called steering group meeting at VTC in order for both the authors and VTC to express their thoughts about a preferred area to study further. It was decided to proceed with scenario analysis and thus RQ3 was formulated to assess how VTC can incorporate scenario analysis in its S&OP process.

3.1.3 RESEARCH QUESTION 3

The process of reaching the output for RQ3 is divided into three sub-objectives, see Figure 6.

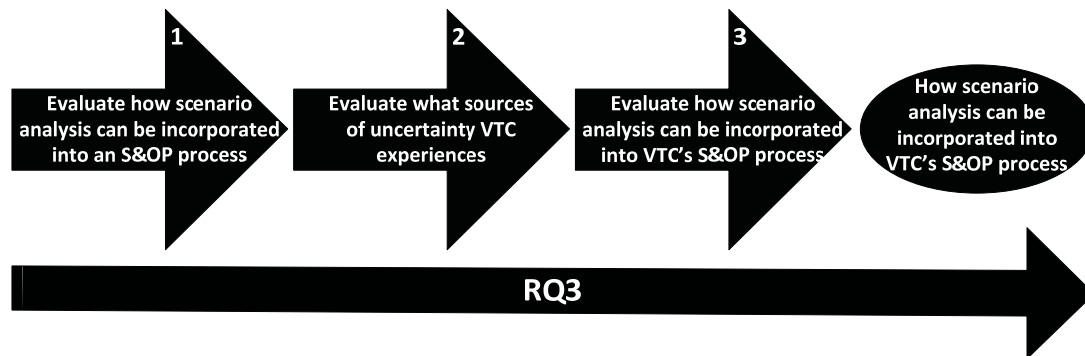


Figure 6. RQ3 is divided into three sub-objectives in order to reach the outcome, i.e. how scenario analysis can be incorporated into VTC's S&OP process.

1. Evaluate how scenario analysis can be incorporated into an S&OP process

In order to reach the sub-objective, a theoretical framework was first developed, by a literature study, in order to look into what has previously been written in the area of using scenario analysis in S&OP. The literature study was mostly considered useful in order to find general information about scenario analysis. However, since limited literature was found where scenario analysis is discussed in relation to S&OP, the literature study was supplemented by expert interviews with knowledge about S&OP and scenario analysis. The output is a foundation on how scenario analysis can be incorporated into an S&OP process.

2. Evaluate what sources of uncertainty VTC experiences

In order to evaluate what kind of scenarios that might be useful for VTC to perform, it was important to find out what sources of uncertainty VTC experiences. Sources of uncertainty at VTC were mainly identified through a brainstorming. A brainstorming was chosen as it is a creative session where people in a group can generate many new ideas (Gryskiewicz 2007). Sources of uncertainty are considered closely related to S&OP complexity, as described in the Theoretical Framework, and the sources of uncertainty are therefore presented in terms of internal, downstream, and upstream sources.

3. Evaluate how scenario analysis can be incorporated into VTC's S&OP process

Using the outcomes of step 1 and 2 above together with the previous knowledge about VTC's S&OP process and its context, the authors of this thesis analyzed how scenario analysis could be incorporated into VTC's S&OP process. This was done by looking at what type of scenarios VTC should conduct, how and where it should be performed within the S&OP process, how different scenarios should be evaluated, what tools that are necessary, and what prerequisites that must be met in order to start working with scenario analysis in the S&OP process.

As this thesis is delimited from final implementation the focus of the review has been *how to work* with scenario analysis and not on *how to implement* it. The outcome of RQ3 are recommendations of how to incorporate scenario analysis into VTC's S&OP process in order to close the gap and gain further benefits from S&OP.

3.2 DATA COLLECTION

The data collection was an important part of the work and in order to achieve good results from the study, the quality of the collected data was crucial. The methods used to collect primary data for this study were observations, internal and expert interviews, survey, brainstorming, and steering group meetings. The secondary data was collected by a literature study and from internal documentation at VTC.

3.2.1 PRIMARY DATA

Primary data is newly collected data which according to Björklund and Paulsson (2007) is to be used in a specific study.

Observations

Observations were mainly used for two purposes, to gain knowledge about VTC's S&OP process as well as to observe people's behavior and attitudes. Most of the observations were performed at VTC's HQ in Gothenburg, with the exception of one that was carried out at the Gothenburg plant and one that was carried out at VPT's HQ in Gothenburg. 15 observations were performed and the observations included all meetings that are part of VTC's S&OP process (as presented in Figure 11 below), apart from the Program proposal meeting (the meaning of each meeting is described in the Empirical Findings). Some other pre- and post-meetings to these meetings were also observed. The meetings have been observed between one to four times depending on whether the authors believed they would receive new information if attending an additional meeting. A full list of the meetings that the authors have observed as well as those not observed is presented in Appendix 7. The reasons for why not all meetings were observed were the length and depth of the study, cancelled meetings, and that the authors received information about the specific meeting in other ways such as through interviews. Not having observed all meetings is thus not believed to affect the results.

According to the literature, observations can be done in many different ways, for example "participative" where the observer is part of the studied operation or "non-participative" where the observer studies the operation without participating (Björklund & Paulsson 2007). As the authors of this thesis wanted to study the actual process and people's behavior and attitudes, the authors did not take part of the meeting as active participants. Questions were only asked occasionally during the meeting for further understanding but most of the questions were asked after the meeting. Hence, the observations were non-participative.

Observation can also take the form of direct or indirect. In a direct observation, the observed people are aware of that they are observed and what the purpose of the observation is (Björklund & Paulsson 2007). In the beginning of most meetings that the authors observed, the authors were presented and the other meeting participants were informed that the reason for the observation was that the authors were conducting a master thesis at VTC. Hence, direct observations were performed.

An observation can also be structured or non-structured. For a structured observation, activities of interest have been chosen in advance and the observer follows a structured observation-template (Björklund & Paulsson 2007). In the beginning of this thesis, the purpose of the observations were focused on understanding the S&OP process and a gain broad knowledge while the observations later in the working process were focused on more

detailed understanding, the efficiency of the meetings, and people's behavior and attitudes. Hence, in the beginning, the observations were non-structured while they were more structured in the end. However, no observation-templates were used.

During the observations, the authors took notes of what happened during the meeting. Afterwards, the notes were summarized and uncertainties were followed up by questions to the concerned people if needed. Furthermore, when performing observations it is crucial to be objective and not add personal opinions (Halvorsen 1992). Throughout the observations, the authors did their best in trying to achieve this and it is believed to have worked well as the authors were aware of this aspect before the observations were done.

Interviews

Interviews have been used in order to collect primary data for RQ1 and RQ3 and two interview rounds were performed. The first interview round was carried out in the beginning of the thesis work and internally at VTC with the purpose of getting a better understanding of VTC's current S&OP process and help to identify important areas within VTC's S&OP context. The second round of interviews was performed later in the study and with external experts with the purpose of getting a better understanding of scenario analysis.

Table 16 presents a summary of the internal interviews performed in round one and Table 17 presents a summary of the expert interviews performed in round two. 19 internal interviews and 2 expert interviews were performed, see Appendix 8 for a detailed table.

Table 16. Information about the internal interview participants.

General function	Function at VTC	Responsibility	Number of interviewees	Interview occasions
S&OP	GM	S&OP Manager	1	3
Demand	EuD and ID	S&OP collaborator	2	4
Demand	EuD	Market Analyst	1	1
Supply	GM, EM, IM and SAM	Responsible for the production units' answers to the Program proposal	4	4
Supply	GM	Inbound Process Manager	1	1
Finance	Finance and Business Control	Business Controller VTC and participates at the Program conference	1	2
Product Development	Volvo 3P	Project Leader Global Manufacturing projects	1	1
Purchasing and Suppliers	Internal suppliers: Volvo 3P, VPT, VLC	Responsible for the suppliers' answers to the Program proposal	3	3

First, the internal interviews in round one will be described further. During these interviews, interviewing people from most participating business functions in the S&OP process were important in order to be able to map VTC's current S&OP process and get input from all concerned parties. All interviewees have good knowledge about the S&OP process and the activities performed within the specific function.

The questions asked during the interviews in round one varied some depending on the

interviewee but in general, questions were asked about the context, the purpose of the S&OP process, what the interviewees do and what their responsibilities are during the monthly S&OP process, the meetings they attend, how they use the output from the Program process, how they work with the five dimensions identified in the literature, and what they see as potential problems with the current S&OP process. The interview with a market analyst at EuD was done in order to get a better understanding of the truck market and the interview with the S&OP coordinator at ID was also used for identifying how the S&OP context is characterized by the international truck market. An interview template was developed for each interview in beforehand and the interview templates can be found in Appendix 9. The authors sent out requests for interviews together with a short description of the areas that would be covered during the interviews. Everyone who was asked for an interview was very positive and only one declined. The interviews lasted between one and two hours, depending on the interviewee's availability and how much time that was needed to cover the wanted areas.

The theory distinguishes between three different types of interviews: structured, semi-structured, and un-structured (Björklund & Paulsson 2007). The performed interviews were of the semi-structured type. For this type of interviews, the particular subjects and areas to be discussed are predefined and the interviewer has some questions prepared. Compared to the structured interview, the interviewer should be flexible and let the interviewee develop his or her thoughts (Björklund & Paulsson 2007). The rationale for choosing semi-structured interviews is that the subject was clearly predefined, in this case the VTC's S&OP process and VTC's context. Furthermore, it was considered more suitable with flexible and open-minded questions since the authors of this thesis had a good idea of what they wanted to ask about but still wanted to leave it somewhat open for the interviewees to talk freely.

When performing the interviews, one of the authors was responsible for asking questions and to make sure that the interview was done within the scheduled time and that all areas were covered while the other author took notes on the computer. The interviews were structured around the prepared interview templates, but follow-up questions were also asked when considered appropriate. Throughout the interview, the interviewer also asked questions such as "Could you please explain that further" and "Why?". Eriksson and Widersheim-Paul (2001) state that it is important for the interviewer to be flexible and to be prepared with follow-up questions. The same authors also state that it is important that the interviewer does not ask yes- and no-questions, make own claims, or asks many questions at the same time because this might reduce the quality of the interview results. The interviewer was aware of these recommendations and kept them in mind throughout the interviews.

After the interviews, the authors went through the notes, discussed what was unclear and did a list with follow-up questions if needed. The notes were thereafter sent out to the interviewee who was asked to read it through to ensure validity.

For the second round of interviews, two expert interviews were performed with people who have knowledge about scenario analysis and S&OP and software tools applicable for S&OP and scenario analysis, see Table 17. Hence, the expert interviews aimed at getting a better understanding about how scenario analysis can be incorporated into the S&OP process and what supporting tools that is available. The interview template is found in Appendix 10.

It was chosen to perform one interview with a person from a software supplier as it was noticed in the literature that software seems to play an important role when it comes to scenario analysis. This person also had knowledge about S&OP and the importance of having a well working S&OP process in order to gain most benefits out from technology. The second interview was chosen to be performed with a person from the academia who has done research about, among others, the use of APS systems in the S&OP process where scenario analysis is a functionality of the APS system, and have gotten several articles published. The person is believed to have a lot of knowledge in excess of what has been written in the articles about S&OP and scenario analysis and an interview was therefore chosen to be performed.

Table 17. Information about the expert interview participants.

Organization	Position	Interview occasions
Oracle	Senior Director, Western Europe, SCM Applications	1
Chalmers University of Technology	PhD, Division of Logistics and Transportation	1

Concerning the reliability of these expert interviews, the person from the software supplier has many years of experience of S&OP and S&OP software applications and is therefore believed to have knowledge about how S&OP software applications are used in industry. There is a risk that the benefits of using advanced software might be exaggerated as that is what the company markets and sells. However, the authors of this thesis tried to evaluate all information objectively and used triangulation when possible. The person from the academia is a published researcher and the research reliability is therefore considered high.

These interviews were also in the form of semi-structured interviews and interview templates were developed in advance. The interview templates were sent out to the interviewees in beforehand to give them an understanding of the scope of the interview.

Survey and Steering group meetings

Steering group meetings were used throughout the working process at VTC in order to follow the progress, get feedback, validate the findings, discuss arising issues, and as a decision forum. For example, it was decided during a steering group meeting that the authors were going to focus on scenario analysis in RQ3. The steering group consisted of: The Director of Global Manufacturing Logistics (GML) and process owner of S&OP, The S&OP Manager and thesis supervisor, The Plant Director at the Gothenburg plant, the Production Program Process Responsible at EuD and the Logistic Manager equally S&OP Coordinator at ID.

The steering group was also involved in the Impact-Effort analysis of closing the gaps. The Impact- Effort analysis was an iterative process which involved several revisions. As a first step, the authors discussed and made their own Impact-Effort analysis of the gaps. The evaluation was sent to the supervisor at Chalmers University of Technology for comments and feedback and the authors' ratings were revised afterwards where it was found necessary. Furthermore, a person with industry knowledge of S&OP and system support was also asked for comments and feedback and these comments were also used as an input when the authors revised the evaluation. Furthermore, an Impact-Effort survey was created in order to find out the steering group member's opinions about the identified gaps and use it as input to the authors' evaluation.

The survey included the 26 identified gaps and the respondents were asked to evaluate the impact and effort of each gap on a scale from 1-5 where 1 being “no or very limited” Impact/Effort and 5 being “major” Impact/Effort. In addition to the one page survey, the respondents also received a document with further explanations of each gap. The survey was sent out to the steering group members a few days before the steering group meeting. The discussion and comments on the ratings during the steering group meeting was used by the authors to further revise their evaluation. The survey and the results obtained may be found in Appendix 11 and Appendix 12.

Next, the authors compared their revised ratings with an average of the steering group members’ ratings in order to identify gaps where the opinions differed much and thereby find out whether some gaps had been misunderstood either by the authors or the steering group or if some important aspects had been missed out. It is worth mentioning that the survey was only sent out to five people and it was therefore not possible to conduct any statistical analysis. The results were hence used as a qualitative assessment for the authors to question their own Impact-Effort analysis. This was done by comparing the authors’ and the steering group’s result and when the difference exceeded 1.5 for either the impact or the effort; the authors’ explanations to the ratings were sent out to the steering group for comments. Finally, the evaluation was revised once again and the final evaluation is presented in this master thesis. The result presented is still based on different people’s perception but as it has been revised several times in an iterative process, the validity of the ratings has been strengthened.

Brainstorming

One brainstorming session was held in order to help answering RQ3. The focus of the brainstorming was on sub-objective 2 in RQ3, namely to evaluate what sources of uncertainty VTC experiences. The brainstorming thus helped answering the first step in Schoemaker’s (1995) process for developing scenarios as presented in the Theoretical Framework. However, since sources of uncertainty are closely related to the S&OP context, the brainstorming results were also used in order to validate and add to the S&OP context description. Hence, the latter was developed in an iterative process.

Seven people from various business functions, such as EuD, ID, EM, GM and Finance, with knowledge about VTC’s S&OP process attended the brainstorming session. See Appendix 13 for a full list. Having a cross-functional group of participants was important in order to collect a broad set of opinions. The brainstorming lasted for one and a half hours and the authors of this thesis took the role as moderators. To start with, the moderators presented why companies should work with scenario analysis in order to give the brainstorming participants a background to why it would be beneficial for VTC to start working with scenario analysis. Next, the scope and time horizon, as discussed by Schoemaker’s (1995), were presented to set the scene for the upcoming brainstorming. Furthermore, the purpose of the brainstorming and general rules were presented. The rules were e.g., quantity over quality and that no one was allowed to critique other suggestions during the initial brainstorming as recommended by Gyskiewicz (2007).

The brainstorming was structured around four exercises based on suggestions and recommendations made by Chermack (2011). See Appendix 13 for more information about

the exercises. The first two exercises aimed at identifying a wide variety of sources to uncertainty which VTC experiences and this was done by asking one question which made the participants think about the past and one question which made the participants think about the future. The last two exercises aimed at discussing which of the identified sources of uncertainty that have most impact on the company and which are the most uncertain. Thereafter, the participants were asked to rank the main sources of uncertainty from the two perspectives. After an exercise had been presented by the moderators, the participants got time to think about the question and write down their thoughts before all the suggestions were presented for the group. This was done in order for the participants to get a chance to reflect over the question before the group started to discuss it. The authors had an idea of how to structure the answers in groups before the brainstorming began and the grouping the ideas into Internal, Downstream, and Upstream was found suitable.

The results from the brainstorming were summarized and sent out to the participants in order for them to make sure that they had been interpreted correctly and to give them the opportunity to give feedback.

3.2.2 SECONDARY DATA

Secondary data is data and information that has been collected by someone else and with other purposes than for the particular study. Thus, it is important to remember that it might not be comprehensive and that it can be biased (Björklund & Paulsson 2007). Secondary data in the form of literature was used to get a better theoretical understanding and internal data from VTC was used for gaining knowledge about VTC's current S&OP process and context.

Literature study

The literature study was of high importance in this study because, as mentioned earlier, VTC has not developed its S&OP process according to the literature and it is interested in knowing how well it is doing according to the literature. The literature study was performed continuously throughout the working process. However, there was more focus on the literature study in the beginning of the thesis, when a theoretical framework for S&OP was developed, as well as after it had been decided to study scenario analysis deeper and thus when a theoretical framework for scenario analysis was developed.

Articles, handbooks, research institute reports, consultant reports, as well as course literature was used when developing the theoretical framework. However, as mentioned earlier in the Theoretical background, the S&OP field has not gotten a lot of attention from the academics. Most of the literature has developed from the industry and it is therefore a heavy focus on "how" to use it and implement it. The literature tends to be focused on what has been working for individual companies. There has been limited research performed within the S&OP-field and for example Tom Wallace, a well-known and leading S&OP business consultant, cries out to the academic field for more research (Wallace 2009).

Another issue with the available literature is that much of the literature used has been written by consulting companies focusing on IT and/or IT-companies. Because of this, the literature may be biased towards IT-systems and the advantages of using them. For example, the Aberdeen Group is very technology focused and does a lot of research on IT companies and products. It was crucial to have this in mind when using these references. Furthermore, it is

always important to read the literature critically and question its objectivity (Ejvegård 2009). This was especially important when using white papers as sources since these sometimes highlights information favorable to the company sponsoring the paper. Thus, these white papers have not been considered as reliable as articles published in journals which has been reviewed and accepted and therefore has a higher reliability. One of the papers used, i.e. Ivert and Jonsson (2010b), is a working paper still in the process of being published and has hence not gone through all revising steps. The reliability of this paper is thus lower than if it would have been published but the authors have previously been published which increases their reliability.

Available data from VTC

Available internal documentation from VTC was used throughout the working process, see Appendix 14 for a full list of the studied documents. Using available data from VTC was an efficient way of gathering information because someone else already had put time and effort on gathering the data. The documents used were to begin with internal manuals about the S&OP process and its different sub-processes. These manuals were put together in 2005 but have been updated a few times since then. Many differences were noticed between the manuals and how VTC currently is working with S&OP. However, the manuals were useful in order to initially get a brief understanding of the process and the different meetings. Other studied internal documentation include the VTC logistics report, various Power Point presentations used during the S&OP meetings as well as for other purposes such as market outlook presentations, and Excel sheets of confirmed production and market plans. The Power Points and Excel sheets were useful in order to understand the meeting process and outcomes of the Program process.

3.3 RELIABILITY AND VALIDITY

Reliability and validity are two important terms when performing research as they determine whether a study is reliable and valid (Gripenberg 2006). Bell (2005) discusses that reliability is a pre-requisite, but not a guarantee, to achieve validity. A study is not automatically valid just because it is reliable; a question that gives the same answer every time it is asked is reliable but if the question asked is not the right one, it is not valid (Bell 2005).

3.3.1 RELIABILITY

Reliability is, according to Kumar (2008), when a study would generate the same result if it was conducted again with the same methodology. Bryman and Bell (2003) express reliability as whether a study is repeatable or not. Reliability is a term that is mostly used for qualitative research (Bryman & Bell 2003) and Cohen et al. (2007) discuss stability and inter-rate reliability as two important aspects in achieving reliability in a qualitative study. Stability concerns whether the same results would have been achieved independently of the time of the study and inter-rate reliability concerns whether the same results would have been achieved by another researcher if the same methodology had been used.

As the studied S&OP process at VTC is a repetitive monthly process it is likely that the study would have generated the same gaps between the Theoretical Framework and VTC's current S&OP process independently of the time of the study. Hence, the study fulfills the aspect of stability. The observations were mostly in the form of non-structured and no observation

templates were used. Hence, other researchers might have observed other aspects.

The interviews were in the form of semi-structured and another researcher would most likely have gotten similar answers to the questions but because the semi-structured interviews allow for follow-up questions, it is not certain that another researcher would have asked the same follow-up questions and hence the results might vary some. However, as the authors performed many interviews and many observations, the information gathered overlapped and in the end, the authors had a good understanding of the process. So even though another researcher would not have observed the exact same aspects or asked the exact same questions during the interviews, it is believed that the researcher would have ended up with a similar picture of the process. The only aspect where the inter-rater reliability could be questioned is for the authors' observations of people's behavior and attitudes as it naturally varies depending on the observer. However, the authors tried to be objective during these observations and if another researcher would do the same, he or she would most likely observe similar behaviors.

As the brainstorming intended for people to be creative when generating ideas there is a risk that another researcher would not have gotten the exact same results as the moderators' behavior can affect people's creativity. However, it is likely that similar aspects would have been brought up if another researcher had followed the above presented exercises during the brainstorming.

The authors' Impact- Effort analysis was, as earlier mentioned, the perceived impact and effort. Hence, this rating would most likely differ if another researcher performed it. However, as the authors' ratings have been validated and revised several times with input from the survey, the steering group, the supervisor at Chalmers, and a person with industry knowledge of S&OP and system support, the final rating would most likely be similar.

As the authors throughout the working process have validated their findings, as will be described below, it is believed that if another researcher would have done the same, he or she would end up with the same findings. Hence, the study fulfills the aspects of inter-rater reliability.

As the recommendations in which order the gaps should be closed has been done by the authors based on their acquired knowledge and experiences, there is a risk that another researcher would have come up with another recommendation as he or she probably would not have the exact same knowledge and experiences as this master thesis' authors.

3.3.2 VALIDITY

Thurén (2007) expresses validity to concern if the chosen methodology and working process ensure that the researchers study what they intended to study and what is expressed in the purpose. Bryman and Bell (2007) divide the term into internal and external validity. External validity is described as to which extent the results of the study could be generalized (Bryman & Bell 2007). Internal validity is, according to Gripenberg (2006), described as that the methods used really measure what was intended to be measured. Singh and Bajpai (2008) further explain it as controlling the variables which can affect the results. Bryman and Bell (2007) express that internal validity can be achieved by triangulation and Malterud (1998)

points out that triangulation is an especially useful tool when conducting qualitative research.

As this master thesis was conducted as a case study, the external validity, generalization, is rather low. The reason being that a particular company, VTC, has been studied and much of the conclusions are hence only valid for VTC. This is in alignment with Gripenberg (2006) who expresses that external validity is generally not achieved for case studies. However, some parts of the master thesis are believed to be generalized as further discussed in chapter 6.

Internal validity for this study has been ensured by several actions. After the interviews, as described above, the notes were summarized and sent out to the interviewees for them to give comments, correct mistakes, and add additional information when needed. Furthermore, the steering group meetings were used throughout the working process in order to present the findings and for the steering group members to give feedback on the work. Furthermore, the Empirical Findings chapter was sent out to the steering group members for them to read it through and give comments about the content, if something had been misunderstood, or if clarifications were needed. After the brainstorming, the findings were summarized and sent out to the participants for them to validate the results.

When performing observations, interviews, and the brainstorming, the authors valued it high to get input from all participating functions. Hence, both commercial and supply meetings were observed and the interviews were performed with people from many different functions such as the commercials, supply, and finance.

Throughout the work, triangulation was used when developing an understanding for VTC's S&OP process. Internal documentation, observations, as well as interviews were used together with the above mentioned feedbacks. These methods together are believed to have created a correct picture of VTC's S&OP process and hence internal validity is achieved.

4 EMPIRICAL FINDINGS

This chapter describes how VTC currently is working with S&OP, the so called “Program process” at VTC. The main aim is to provide an empirical foundation which is compared with the Theoretical Framework in the analysis in chapter 5. The first section describes VTC’s S&OP context and it is structured based on internal, downstream, and upstream S&OP context. The rest of the chapter is also structured according to the Theoretical Framework and thus, the following sections present VTC’s Program process goals, S&OP planning parameters, S&OP process structure, and the five dimensions part of the maturity framework discussed in the literature from the perspective of VTC. Last, results from the expert interviews concerning scenario analysis are presented.

The information in this chapter is derived from observations, interviews, brainstorming, informal discussions, and internal documentations, if not otherwise stated.

4.1 S&OP CONTEXT AT VOLVO TRUCKS

This section describes VTC’s S&OP context using the three dimensions of S&OP complexity; internal, downstream, and upstream, as described in the Theoretical Framework. The results from the brainstorming are also presented as it relates to the S&OP context and more precisely the complexity experienced in the context. The information will be used to conclude on VTC’s S&OP complexity and to analyze its S&OP process in Chapter 5.

4.1.1 INTERNAL S&OP CONTEXT

VTC’s internal S&OP context is described by including general information of VTC and AB Volvo as well as VTC’s strategy, organization, products, manufacturing footprint, planning levels, and lead times for capacity changes.

VTC is part of AB Volvo, a Swedish company founded in 1927, and today one of the leading manufacturers of heavy commercial vehicles and diesel engines. Having a vision of becoming the “world’s leading supplier of commercial transport solutions” the group is also offering customized solutions within, among others, finance, leasing, and services (AB Volvo 2010a). AB Volvo is divided into business areas (BAs) and business units (BUs) as illustrated in Figure 7. The Volvo Group BAs are Volvo Trucks, Mack Trucks, Renault Trucks, Volvo Buses, Volvo Construction Equipment, Volvo Penta, Volvo Aero, and Volvo Financial Services. There are also two other truck brands; UD Trucks and Eicher (AB Volvo 2010b).

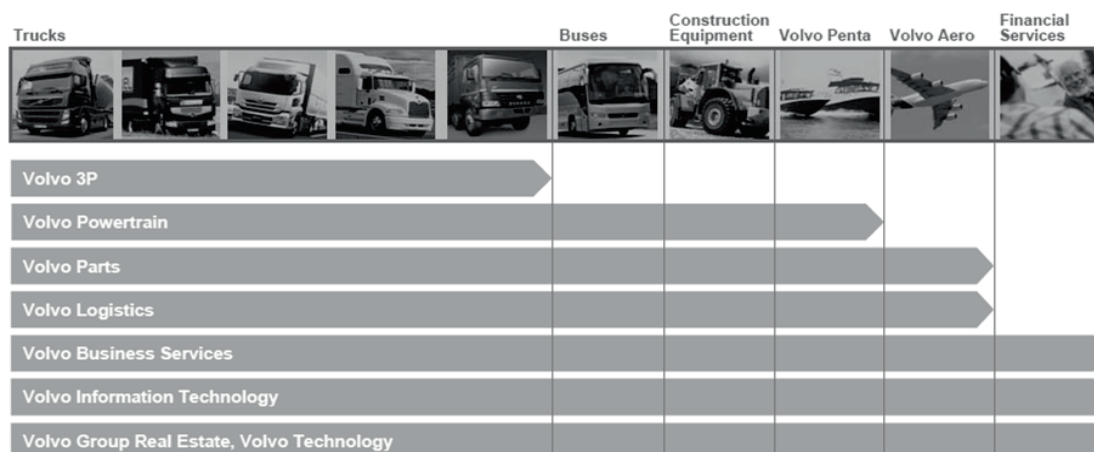


Figure 7. AB Volvo’s business areas and business units (AB Volvo 2011a).

The seven BUs listed above in Figure 7 provide support to the BAs. Three BUs are important from an S&OP perspective at VTC; Volvo 3P, Volvo Powertrain (VPT), and Volvo Logistics (VLC). Volvo 3P is responsible for product planning, product development, and purchasing for the truck brands. VPT is responsible for the development and manufacturing of heavy diesel engines, gearboxes, and driveshafts as well as supply of medium-heavy applications for the Volvo Group. VLC develops and provides transport and logistics solutions to automotive and aerospace companies worldwide, amongst others, VTC (AB Volvo 2010c).

VTC is the largest BA within the Volvo Group and the company manufactures, sells, and services medium and heavy-duty trucks for long-distance and regional transports and construction work to commercial businesses (AB Volvo 2010c). More than 95 percent of VTC's sales come from the heavy-duty truck segment, making VTC the second-largest heavy-duty truck brand in the world (AB Volvo 2010c).

Volvo Trucks' goals and strategy

Being a part of the Volvo Group, VTC shares the group's strategy, goals, and values. The Volvo Group has a strategy that "is based on customers' requirements and is focused on profitable growth, product renewal, and internal efficiency" (AB Volvo 2011b). The foundation in customer requirements results in the aim of offering solutions that are adapted to the customers' operations and with a high performance, quality, safety, and flexibility as well as a competitive total cost of ownership for the customers. The focus on product renewal is based in the stiff competition, the new environmental standards, and safety and quality requirements and means a strategy of ongoing renewal of the product range. Profitable growth means that the group aims at growing but with increased focus on profitability. The internal efficiency focus stands for the striving towards cost-efficiency and productivity by reducing costs in manufacturing, sales and administration.

The Volvo Group has three corporate values which are quality, safety, and environmental care and this corporate culture is considered a unique asset for the group and the group's objective is to keep a leading position in these areas (AB Volvo 2011b).

Organizational structure

VTC's governance structure is presented in the organization chart in Figure 8. On the commercial side, VTC is represented by Europe Division (EuD) and International Division (ID). EuD is responsible for the commercial operations on the European market. This market is divided into ten regions: Benelux, Central, Central East, France, Italy, Nordic, Russia, Spain, and last UK and Ireland. These regions are thereafter currently divided into 36 markets, where some regions, such as France, are also markets whilst others, for example the Nordic region consists of several markets, in Nordic's case Sweden, Norway, Finland, and Denmark (AB Volvo 2011c). ID is responsible for the commercial operations in the four commercial areas Latin America, Northern Africa and Middle East, Southern Africa, and Australia and Pacific. These areas are also divided into markets in the same sense as for EuD (AB Volvo 2011d).

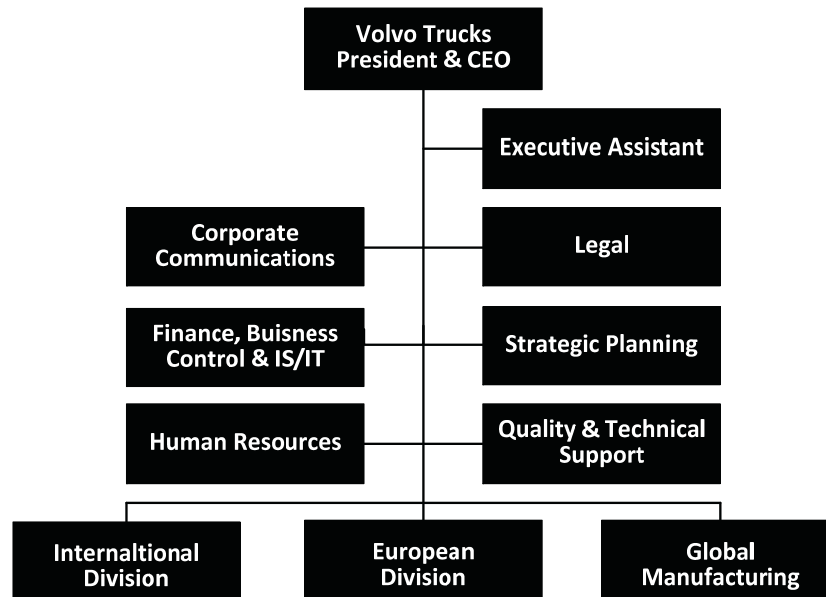


Figure 8. VTC's governance structure (AB Volvo 2011e).

On the supply-side, Global Manufacturing (GM) is the division which has the global responsibility for the production and delivery of VTC's trucks including the manufacturing and assembly of cabs and assembly of complete trucks within VTC. GM is divided into three production units; European Manufacturing (EM), International Manufacturing (IM), and South American Manufacturing (SAM) (AB Volvo 2010d). Apart from the commercial divisions and GM, the staff supporting units are also illustrated in Figure 8.

The products

VTC strives to be a “total solutions provider” and therefore, apart from focusing on new and used trucks and traditional aftermarket sales, VTC also offers financing and other value-added services, so called soft products, such as service and maintenance, action service, transport information systems, and insurance (AB Volvo 2010c). As the S&OP process at VTC concerns new trucks that will be the focus from here on.

The trucks that VTC sells within the covered divisions include the models FL, FE, FM, FH, and VM. FL is the smallest truck, developed for city distribution, and the second largest truck is FE which is constructed for use in e.g. regional transportation. VM is a medium-heavy truck manufactured in Brazil and sold on the Latin American market. Whilst FL, FE, and VM are put together and classified as medium-duty trucks and manufactured on the same line, FM and FH are grouped as heavy-duty trucks and similarly manufactured on the same line. FM is made for regional haulage, but also has a specific variant, FMX, made for heavy construction duties. FH has its usage within long distance haulage (AB Volvo 2011f). VTC's models are long-lived and for example the FH model was introduced in 1992 but has seen a couple of feature and design face lifts during its lifetime. The models are continuously improved to cope with, among others, environmental legislations. As this thesis is about S&OP and thus considers products on an aggregated level, such as product models and product groups, new product introductions which affect the S&OP process is considered to occur rarely. Further

concerning the products, the demand pattern for the models is overall similar even though there are some differences in seasonality.

These five truck models can further be divided into a numerous number of variants, the first two lower levels being “Type” and “Single variant (AB Volvo 2011f). For example, the VTC plant in Gothenburg manufactures several hundreds of variations of the FH trucks. Further, the trucks may need a so called customer adaptation (CA) where the customer wants a certain adaption. A CA may for example be to put a cement mixer on the truck or rebuild it to a fire engine. These orders normally get a longer lead time as the CA either is done after the line production in a separate area in the VTC plant or at a privately owned body builder. The customers may choose body builders and many customers have a certain body builders which they prefer to appoint. There is however an ongoing project at VTC which looks into the possibility of moving more CAs in-house instead of using external body builders.

Manufacturing footprint

VTC has nine wholly-owned assembly plants and nine factories which are owned by local interests as illustrated in Figure 9. Within EM there are four plants; the three assembly plants in Gothenburg, Ghent, and Kaluga, as well as a cab plant for the FH and FM models in Umeå which supports the assembly plants. The cabs for the smaller models, FL and FE, are purchased from Renault. SAM has one assembly and cab plant in Curitiba, Brazil. The assembly plants in Curitiba, Kaluga, Ghent, and Gothenburg are all CBU-plants, which stands for “completely built up” and is the usual way of assembling. The opposite to CBU is CKD, “completely knocked down”, where assembly kits are sent to the plants from the packing in the Gothenburg plant and the assembly of the kits are made in the plants. IM is responsible for the CBU-plant in Brisbane, Australia, as well as for the VTC-owned CKD-plants in Bangkok, Bangalore, and Durban and the remaining external CKD plants in Casablanca, Tunis, Jeddah (partly-owned by VTC), Teheran, Taipei, and Kuala Lumpur.

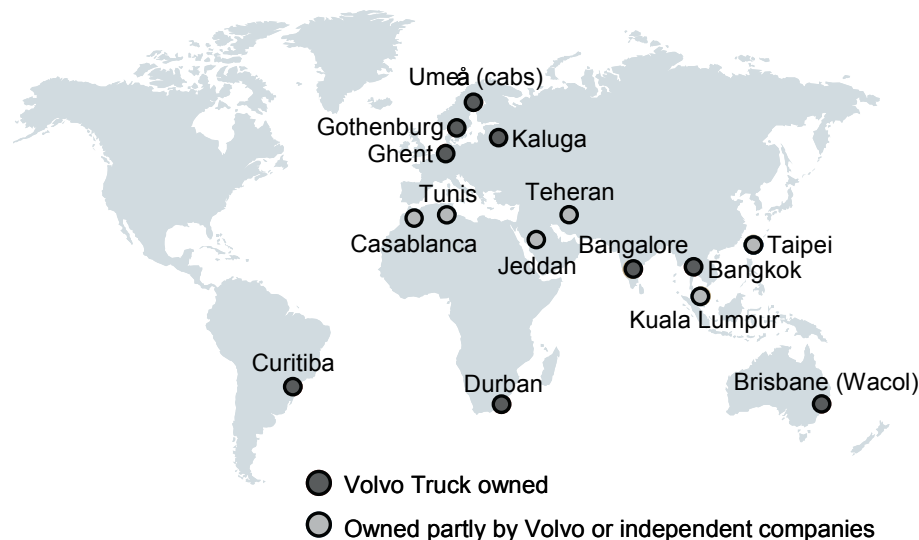


Figure 9. VTC’s manufacturing footprint (AB Volvo 2011g).

There are thus differences between the factories when it comes to being either CKD or CBU as well as when it comes to cab production, where Umeå is solely a cab plant whilst Curitiba

is both an assembly and cab plant. Moreover, the plants differ when it comes to which models and variants of the models they manufacture. For example, within EM, the Gothenburg plant manufacturers only the FH and FM models but all variants of these models. As mentioned above, the packing to the CKD plants also takes place in Gothenburg. Next, the Ghent plant manufactures all models but a limited variety when it comes to FH and FM variants. Last, the Kaluga plant manufactures some variants of the FH and FM. The Brisbane plant produces both Mack and Volvo trucks in the same facility. There is thus a complexity when it comes to resource planning as there are some limitations on where manufacturing of certain trucks can be planned. Furthermore, complexity is created by sharing of capacity, as is the case in Curitiba where VTC share some assembly capacity with Volvo Buses.

The assembly plants' processes are rather uncomplicated and simple equipment such as drilling machines are used and there are few breakdowns. The manufacturing process at the cab plants are more complicated but the stops that do occur rarely last very long and thus does not affect the S&OP process in a large extent. The manufacturing yield in the plants is expressed as high. However, internal disruptions, such as not finding where the components are located, are expressed as causing uncertainties and add to the dynamic complexity.

Planning levels at Volvo Trucks

Planning is done within different time horizons at VTC, from long-term strategic planning to short term execution. The strategic planning is called "Volume and Capacity Planning" and this planning has the "long range plan" as output. As illustrated in Figure 10, it has a horizon from three to ten years into the future. This strategic planning is done together with the other AB Volvo BAs and the CEO's of the different BAs meet once a year to decide upon the long term volumes. The Volume and Capacity Planning process was recently redesigned and improved and is expressed as working well.

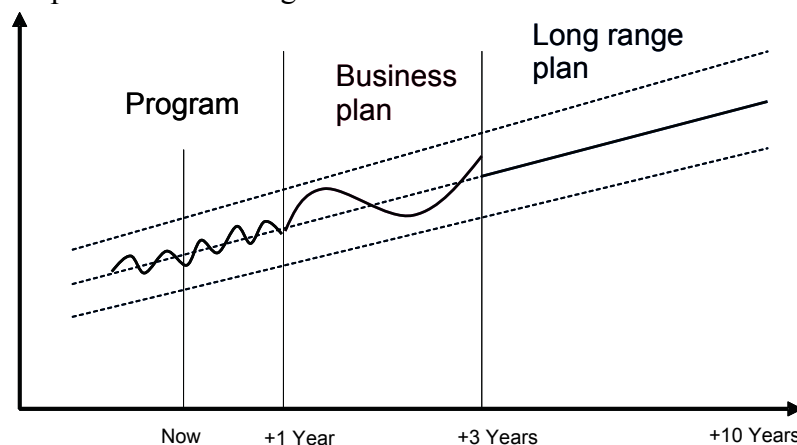


Figure 10. Long-term planning levels in VTC and the Volvo Group (from VTC internal documentation).

The next planning level at VTC is the business plan which has a horizon from one to three years into the future. VTC gets targets from AB Volvo and these targets are broken down for each division and function. The S&OP is called the "Program process" at VTC and its main output is the production plan, the so called Program plan, as well as the sales plan. It is a tactical planning process at VTC which covers from "now" to one-two years ahead as illustrated in Figure 10. The Program process and its time horizon will be described in detail below.

The plans created in the S&OP process are then broken down at the master production scheduling planning level to delivery plans based on an MRP system to the suppliers. These plans, consisting of both orders and forecast, are expressed in item numbers and are sent from each plant with EDI to the suppliers for the next rolling twelve months. How often these plans are sent to the suppliers differ between the plants.

VTC manufactures mainly to order and received end-customer orders are planned and given a Confirmed Delivery Date (CDD) depending on the order queue, the specifications on the order, and the Requested Delivery Date (RDD). Because of long lead times to ID's areas, there is seldom an end-customer order that drives the manufacturing but instead it is a dealer or importer that has ordered the truck. In Europe, the orders are firmed plan, during the so called Def run, in the Order Planning Tool (OPT) 15 days before the order is due for production.

Lead times in capacity changes

Changes in capacity may be done in different time horizons at VTC. Short term changes in capacity may be done by increasing or decreasing the working hours. There are different systems for this at the various plants.

A larger change in available capacity is to change the line rate. This means hiring or reducing staff and re-balancing the line. Another option is to add or remove a shift on the line and this also means hiring or reducing people. These alternatives have a longer lead time than using overtime and are thus medium-term options. The lead times for these changes differ between the plants but are in the horizon of two to four months.

Changes in the technical capacity have the longest lead times and usually it amounts to around 18 months or longer. The lead time is very much dependent on the complexity of the change. Larger investments, such as new paint shops in the cab plants or a new VTC plant, have a lead time of approximately three to five years depending on their complexity. When it comes to allocation of money to larger investments, AB Volvo has four occasions per year when larger investments are considered and approved.

4.1.2 DOWNSTREAM S&OP CONTEXT

VTC's downstream S&OP context is described by the following sections concerning the truck market, VTC's customers, and its competitors.

The truck market

Historically, there has been a strong correlation between GDP growth and freight transport growth (AB Volvo 2010e). Moreover, changes in the structure and location of manufacturing industries and changes in production methods due to demands for 'just-in-time' shipments also drive transport demand and ultimately sales of new trucks⁵. However, in developing countries, the transport market usually grows more than the general GDP growth as transportation often is a bottleneck for further economic development.

Being closely linked to the GDP development, the transport market was greatly affected by the last global financial crisis. The recession resulted in that VTC's deliveries of new trucks

⁵ Jon Jynnås, Market Analyst - Truck Market Forecasts & Truck Population, Volvo Truck Corporation, Interview 2011-02-18.

dropped by 55 percent, the largest drop in the history of the company, see Table 18 (AB Volvo 2010e). During 2010, the demand for trucks rapidly rose again and VTC's volumes increased with 59 percent in comparison with the low volumes in 2009 (AB Volvo 2011b). Since demand for trucks is highly dependent on the GDP development, the outlook can change rapidly in a matter of months in times of great uncertainty. This may have knock-on effects and the financial crisis highlighted the challenge and need of optimizing the forecast process. Thus, VTC is as an effect also experiencing difficulties of forecasting its demand in the medium- and long term.

Table 18. Total deliveries during the last four years (AB Volvo 2011b; AB Volvo 2010e).

Volvo Trucks	2007	2008	2009	2010
Total deliveries (# of new trucks)	100 109	105 952	47 411	75 229
Yearly change	-5%	6%	-55%	59%

A political factor affecting the truck market in some countries is corruption. As corruption highly hampers economic development in a country, it is consequently also affecting the transport sector⁶. The political effect on the truck sales varies between different geographical regions and for VTC, ID is more exposed to this issue than EuD.

Legal factors, such as import duties also affect the sales of trucks and were, amongst others, one of the reasons for VTC to build a plant in Brazil some 30 years ago. Another legal issue, as well as an environmental issue, is the environmental legislations affecting the transport industry, such as legislations on the level of emissions allowed and the allowed size on trucks and trailers. There are also technical issues related to the environment, such as how to make the driving more efficient and decrease emissions, as well as reduce the cost of driving.

The customers

VTC's trucks are sold and serviced in more than 140 countries worldwide (AB Volvo 2010c). The majority of VTC's customers are owner-operators driving long-haul as VTC traditionally has been aimed at the smaller customers. VTC therefore has a very large customer base and the Pareto principle does not apply to the customers. However, VTC also sells to fleet buyers who buy larger quantities of trucks.

The competitive situation

The competitive situation is believed to be an important aspect in the downstream context of a firm as it affects the customer behavior and the predictability of demand. The VTC market share is quite stable and generally there are no large changes in the distribution of market shares between the competitors.

4.1.3 UPSTREAM S&OP CONTEXT

VTC's upstream S&OP context is described by the following sections concerning VTC's supplier base and its lead times in sourcing.

The supplier base

As far as manufacturing is concerned, most of the material and components are outsourced.

⁶ Jon Jynnås, Market Analyst - Truck Market Forecasts & Truck Population, Volvo Truck Corporation, Interview 2011-02-18.

The cab production to FH and FM is an exception to this as in the cab plants, the cabs are produced, painted, and the interior is finalized. The cab plants then supply the assembly plants with finished cabs (except to the Gent plant where they trim the cabs themselves) or as CKD kits. Another exception is that frames are manufactured in-house in the Gothenburg plant. The remaining of the components is outsourced. To start with, VTC's assembly plants are supplied with engines, gear boxes, and drive shafts from the AB Volvo BU VPT. VPT has more than 900 suppliers where the majority supplies VPT's products aimed for VTC. Around 50 of these 900 suppliers stand for 60 percent of the purchased value. The remaining of the purchased components is sourced through the AB Volvo BU Volvo 3P. VTC has around 800 suppliers which are handled by Volvo 3P and which deliver to Europe, South America, and Asia. Of the suppliers handled by Volvo 3P, around 30 stand for 80 percent of the sourced value. These are large suppliers of for example steering components, tiers, and seats.

VTC uses global sourcing in many cases but also local sourcing to certain plants, especially to the Brazil plant where there is a requirement for 60 percent local content. Because of its global manufacturing footprint and global sourcing, VTC is affected by macro factors and especially important in relation to the supplier base are legal factors such as import duties.

Lead times in sourcing

When it comes to lead time for sourcing, VTC is much dependent on that the delivery plans that are sent out to the suppliers for rolling twelve months are reasonable accurate. The lead times are different between the various plants. For example, the transport lead times are very long to the Brisbane plant, around three to four months, which means that material is frozen in the delivery schedule for much longer time. However, if there is a lack of material, materials may also be expressed shipped by air. The CKD plants also have long transport time and here the packing time in the Gothenburg plant has to be added as well. The KPI measuring the suppliers' delivery precision is on a good level and thus not seen as a problem.

4.1.4 SOURCES OF UNCERTAINTY AT VOLVO TRUCKS – RESULTS FROM BRAINSTORMING

The brainstorming was foremost carried out in order to identify sources of uncertainty which VTC experiences in order to help answering RQ3. However, identified sources of uncertainty are closely related to the notation of S&OP complexity, as defined in the Theoretical Framework and therefore sources of uncertainty were structured into the three context groups: internal, downstream, and upstream. The results are hence also used in order to conclude on the S&OP complexity in chapter 5.

The full list of the results from the brainstorming, i.e. all the identified sources of uncertainty, are presented in Appendix 15. Among the sources of uncertainty presented in Appendix 15, sources with the highest impact and highest uncertainty were selected during the brainstorming and they are presented in Table 19. The brainstorming participants agreed upon that the total market development is the source of uncertainty that would generate the greatest impact if it was known. At the same time, they also agreed upon that the total market development is the source which is most difficult to predict. This gives an indication of that the demand-side is uncertain but also very important for VTC to understand. Furthermore, the second highest ranked source, which has a large impact on the decisions taken in the S&OP process, is new product introductions which includes the time schedules for introductions,

success of new products, and cannibalization rate of old products. Internal and upstream uncertainties of new product introductions may also lead to many uncertainties further up in the supply chain, such as component availability.

Table 19. Main sources of impact and main sources of uncertainty selected from all the sources of uncertainty identified during the brainstorming.

	Main sources of impact	Main sources of uncertainty
Internal	Internal flexibility and capacity constraints	
	Top management's willingness to invest and allocation of investment funds in AB Volvo	
	Time schedules for new product introductions (Rank: 2)	Time schedules for new product introductions
Downstream (Customers + Competitors)	Total economic development	Total economic development
	Total truck market development (Rank: 1)	Total truck market development (Rank: 1)
	Market shares	
	Brazil: Economic development, total truck market development, and legislations	
		Political situation and development (for ex. development in NAME and EU sanctions on Iran)
	Competitors' strategies, activities, and product introductions	Competitors' strategies, activities, and product introductions
	Success of new product introductions and cannibalization rate of old products at new product introductions (Rank: 2)	Success of new product introductions and cannibalization rate of old products at new product introductions
Upstream (Suppliers)	Material availability	
	Supplier (including internal suppliers) flexibility and capacity constraints	Supplier (including internal suppliers) flexibility and capacity constraints

4.2 S&OP DEFINITION AND GOALS AT VOLVO TRUCKS

The Program process at VTC is defined as covering up to when the trucks are delivered from GM to the commercial divisions, thus at GM's confirmed delivery date, CDD. As such, for example the CAs done at external body builders are not considered in the Program process. The commercial divisions are seen as customers to the Program process and thus have a somewhat different role in the process than the supply-side.

According to internal documentation of the S&OP process at VTC, the company's goal with working with S&OP is to book production capacity at the component factories, assembly and packing capacity as well as production capacity for purchased material in order to ensure that the customers are catered for. The main focus of VTC's S&OP process is on creating a good production plan whilst the sales plan is seen more as a bi-product. Previously, the S&OP process was entirely focused on the production plan but this has developed into including the commercial plans more and more. The S&OP manager at VTC expresses the goal as to secure production capacity and material availability in order to satisfy the commercial requests. From interviews performed at VTC, employees express the goal of the process in somewhat different terms. If generalizing, many utter the goal as to ensure the right capacity, optimizing available capacity in time and place, having an effective planning, and optimize utilization of available resources as well as to ensure deliveries. Furthermore, many express the goal of

being able to satisfy the market requests and making sure that the customers get the right truck delivered at the right time. Some spread answers also include goals such as communicating information about what will be produced to the entire supply chain, balancing risks both on the supply and demand-side of the business, matching supply and demand as efficiently as possible as well as keeping a stable customer response lead time. VTC has no explicit S&OP goal of optimizing the overall business goal. However, many decisions are taken with the business goals in mind and implicitly considered.

The documented goal for the Program process has not been updated for several years and VTC is open for renewing the goal so that it is more in line with the opinions above and, furthermore, the recommendations in the literature.

The benefits that the company believes to have experienced by its S&OP process include a more stable, and on target, customer response lead time. The goal for customer response lead time is eight to twelve weeks in Europe and since improving its S&OP process, VTC can better manage this goal. This has moreover resulted in less speculation from customers. Furthermore, benefits expressed include that VTC, because of the S&OP process, has become more proactive in its work, including taking capacity decisions based on the production plan instead of based on real orders. Moreover, the Working Capital Management Project within AB Volvo has concluded that the S&OP processes within the group have a major impact on the tied up capital and operating income of the AB Volvo Group.

There are however still obstacles in relation to the S&OP process. One obstacle that is expressed is the complexity caused by many different plants and set-ups around the world which makes it difficult to make decisions and sometimes results in decisions being postponed to the next Program conference. Furthermore, expressed obstacles, or difficulties, include being able to react when the market is changing rapidly. Even though the company believes to be more proactive because of its S&OP process, it is still a challenge to be flexible enough since the size of VTC and the Volvo Group makes the lead time long before all involved parties, including the 2nd, 3rd and 4th tier suppliers, have the same view and opinion about where the business is heading.

4.3 S&OP PLANNING PARAMETERS AT VOLVO TRUCKS

This section describes how the planning parameters are set at VTC.

4.3.1 PLANNING HORIZON

The Program process encompasses the following rolling twelve months as well as the total volumes for the following calendar year. Thus, the planning horizon varies between 13-24 months. Even though the plans are for the rolling twelve months, many at VTC express a concern that the company tends to focus mostly on the short-term in the Program process. Thus, the main focus is on the upcoming three months instead of on what will happen six or nine months ahead.

4.3.2 PLANNING FREQUENCY

The Program process is a monthly planning process and each month is a new period. Thus, the plans are updated every month.

4.3.3 PLANNING OBJECTS

The sales and production plans discussed in the Program process are expressed at product group level, i.e. the volumes are summed up per vehicle family. The focus is on above 16 tons-truck, the heavy-duty segment consisting of the FH and FM models, and below 16 tons, the medium-duty segment consisting of FL, FE, and VM. The plans are moreover expressed as volumes per region in the delivery plan and volume per plant in the production plan.

4.3.4 UNITS OF CAPACITY

The units of capacity that is used in the Program process are the number of trucks that can be produced per line and day for each plant. The packing of CKD kits has a separate capacity and is also expressed as trucks per day whilst the Umeå plant for example expresses its capacity as cabs per day.

4.3.5 TIME FENCES FOR CHANGES IN PLANS

VTC has no defined time fences in the Program process. However, what recently has been discussed and agreed upon at AB Volvo level are flexibility targets that should be achieved by all supply functions and units. These targets include percentages of how flexible the capacity should be in different time horizons with the latest confirmed production plan as a base. Since the def run is made 15 working days before production starts, the first month is almost entirely fixed and thus no flexibility is demanded during the first period in the plan.

Thereafter, there are targets on how much the capacity should be able to increase or decrease for two to three months ahead as well as for four to six months ahead. These targets are however, as described, not set as time fences for changes in the plans but should rather give a guideline concerning what changes that should be possible to approve.

The flexibility targets have not yet been measured but there are opinions saying that VTC is currently not achieving the targets. However, flexibility is expressed by some as a requisite in order to follow the ups and downs in the market and thus to be successful in the marketplace.

4.4 S&OP PROCESS STRUCTURE AT VOLVO TRUCKS

This section describes how the S&OP process is structured at VTC. VTC describes its Program process in general terms in the way illustrated in the cross-functional process chart in Figure 11. The functions listed are the main ones involved in the process and the times illustrate when meetings and deadlines take place in relation to the 0-week, which is when the first period planned in the production plan starts. Thus, the confirmed final Program plan is released the Tuesday the week before it starts to be valid. In VTC's original process description, mainly five meetings are listed; the Sales meeting, the Program proposal meeting, the production units' preparation meeting, the production units' response meeting as well as the final VTC Executive program decision meeting, also called the Program conference. In the general chart below, these meetings have been somewhat modified by the authors, illustrating that SAM and EM have separate production meetings and that Volvo 3P has a "Capacity and risk assessment meeting" as a pre-meeting in the S&OP process.

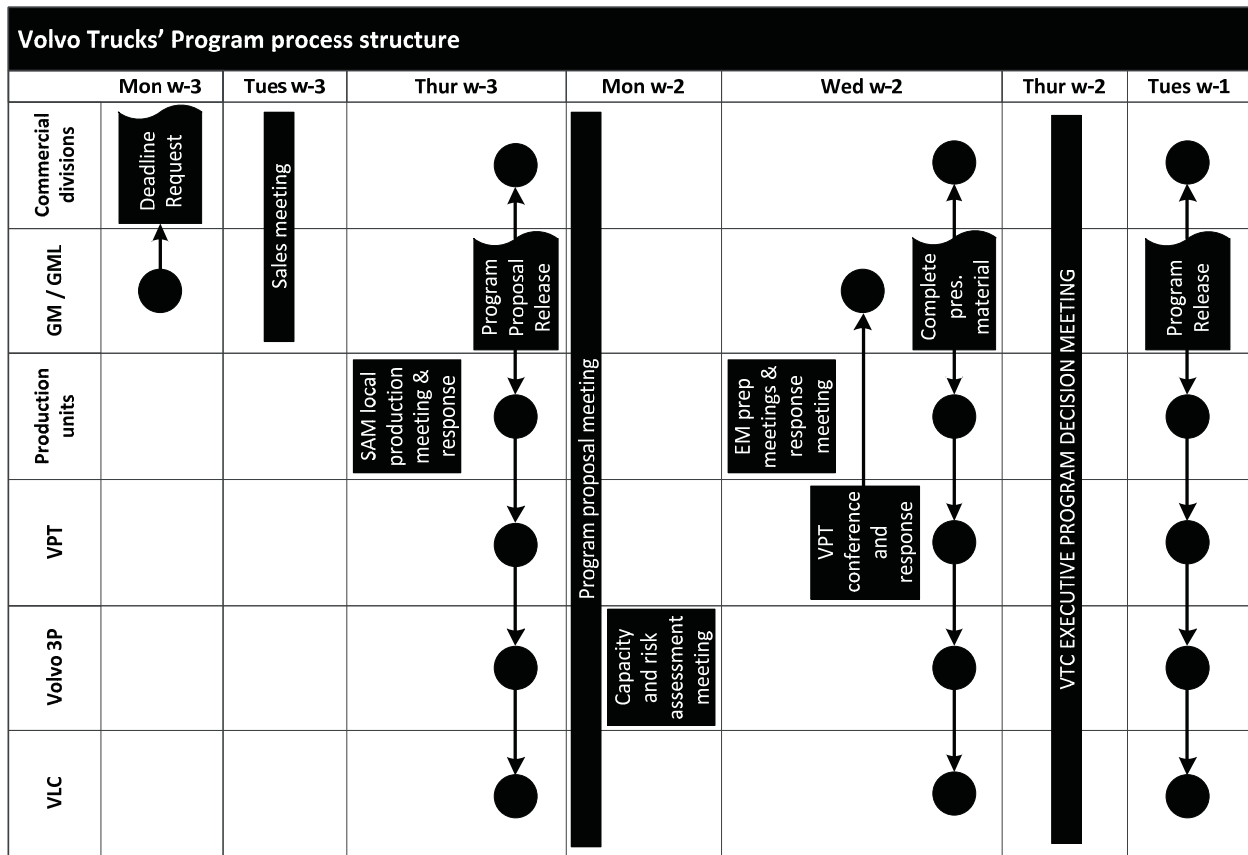


Figure 11. General process chart of VTC's S&OP process.

This general chart will be further explained and broken down below in the five process steps identified in the Theoretical Framework in chapter 2: Product management review, Creating the demand plan, Develop the supply plan, Reconciliation meeting, and Publish, communicate, and measure the plan.

4.4.1 PRODUCT MANAGEMENT REVIEW

There is no formal product management review as an initial step in the Program process at VTC. However, VTC is considering product management in some other steps of the process. Amongst others, it is discussed during EuD's telephone meetings with the regions as well as during EM's management assembly conference. Development of new products is done as individual projects run by Volvo 3P and meetings are held with the projects and GM as well as the commercial divisions. Market activities, ramp-up times, capacity requirements, and so on are discussed at top management project meetings together with the commercial divisions and GM. These meetings provide information to the commercial divisions on when to start to forecast demand for the new product as well as to the supply functions on when capacity is needed. Thus, there are inputs from product management into both the second and third step in the process. Moreover, there are reference meetings between the projects and GM every third week. Questions regarding the product portfolio are handled by Strategic Planning.

4.4.2 CREATING THE DEMAND PLAN

As illustrated above in Figure 11, the general described Program process starts with the deadline of the so called market requests. However, more in detail, there is a long process leading up to this deadline and this process may be described as the S&OP process step

Create the demand plan. As described above, VTC has separate commercial divisions and therefore, its processes of creating the demand plan are somewhat different. This will be briefly explained in this section but also in further detail in Appendix 16.

To start with, the market request is the term used at VTC for the preliminary demand plan developed by the commercial units. Thus, no alternative requests are formally created. Pipeline is considered already at this step and the market request may therefore also be seen as a requested production plan from the commercial units. This is moreover the case since the requested volumes are placed in the period when they should be produced and thus not when they should be delivered. This is however usually the same period for EuD, but not for ID. The market requests should be unconstrained and not consider available capacity in any part of the supply chain. The markets make their requests on volumes on FH/FM or FL/FE level per month in the following rolling twelve months as well as an annual number for the next year. The markets moreover specify a specific plant against which the request is placed.

The first step in developing the market request is the creation of a demand forecast. At EuD, a total market forecast is developed centrally for each market and region. This forecast thus describes the total truck sales volumes to be expected for all competing companies without consideration to VTC's market shares. This total market forecast is developed four times a year (before Program plan 1, 4, 7 and 10) and at these occasions also presented at the Program conference. The total market forecast is sent out to the regions and is the base for their sales forecast for VTC. Moving on to ID's forecast creation; there are big differences between the ID areas when it comes to possibility to forecast the size of the total market with reasonable accuracy. The process starts with the markets and areas forecasting their total market, this is thus not a central process as it is at EuD. From these centrally or locally developed total market forecast, each VTC market forecast its market demand and market share mainly using qualitative forecasting methods. The qualities of the forecasts which the markets develop vary a lot between the markets. See Appendix 16 for details on the forecasting process.

As further explained in Appendix 16, EuD and ID have somewhat different processes for handling the markets' requests but this is left out here. In general, and as illustrated in the simplistic flowchart in Figure 12, there are local region meetings before the markets hand in their proposed request to EuD or ID. The market request may occasionally differ from the forecast for example when EuD or ID want to increase sales of a specific model and thus plan for campaigns and market activities. However, there is no clear separation of forecast and request, neither in the name used for it nor in the communication to the other stakeholders.

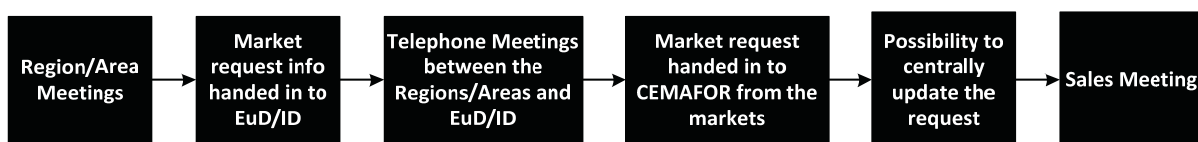


Figure 12. General flowchart of the Create the demand plan process for VTC's commercial divisions.

After proposed requests have been handed in, telephone meetings are held between the regions and EuD/ID. These meetings are attended by the responsible for the request at the region, S&OP coordinators at EuD and ID respectively, as well as other attendees as further

presented in Appendix 16. During these meetings, the regions describe their requests/forecasts and the underlying assumptions, order and inventory status, and issues and opportunities on the market. Moreover, new product introductions as well as product activities are discussed. Additionally, this is a forum where some gap analysis discussions take place, mainly concerning the estimated market share the regions present and the targeted market shares in the business plan. Gaps are highlighted and discussed and some actions to close the gaps are put forward. The regions activity plans, e.g. certain demand shaping activities are also presented. There is however very limited focus on scenario analysis. The regions present “best-case” and “worst-case” in their forecasts but these numbers are seldom questioned or analyzed and not used in order to create alternative market requests. Neither EuD nor ID sets inventory targets in the Program process. It is an opinion that the process could focus more on tied-up capital and how different plans and decisions would affect it. After the telephone meetings, each individual market hands in its request in the S&OP IT-system CEMAFOR.

Different from ID, and thus not illustrated in Figure 12, EuD also holds a request review meeting where top-management at EuD attends. The agenda includes discussing the requests per region and for EuD in total in comparison to targets and strategies. If the market requests do not live up to the targets and strategies or if EuD centrally does not agree with the assumptions made locally, the requests may be changed and thus the output of the meeting is a decision on what changes EuD will make centrally to the market requests. After the markets have handed in their requests in CEMAFOR, there is namely a possibility for EuD and ID to centrally make changes to the request as they see fit as illustrated in Figure 12.

After the final market requests have been set, the Sales meetings take place. The Sales meeting is owned by the S&OP Manager at GM and the commercial divisions, EuD and ID, have separate Sales meetings with GM. During these meetings, the divisions explain their requests and the underlying assumptions. The output for GM is a deeper understanding of the requests and for the commercial divisions the output is both an insight to whether there are any supply constraints that will affect them and what the other divisions are requesting. For GM, the Sales meetings and the market requests are inputs when creating the Program proposal, as will be explained in the following section.

4.4.3 DEVELOP THE SUPPLY PLAN

VTC’s process within the step of developing a supply plan involves several units and companies responsible for different aspects of supply. The production units EM, IM, and SAM answer for their capacities in assembly, packing, and in the cab plant. Volvo 3P answers for the suppliers, VPT answers for the capacity in the component factories and its suppliers, and VLC answers for the transport and logistics capacity and packaging material availability.

The first step in the process of creating a supply plan is the Program proposal. The Program proposal is a preliminary production plan created by the S&OP Manager where the markets requests are constrained to “more reasonable levels” according to VTC’s internal assembly and cab production capacity. The reason for constraining the request in this proposal is that the Program proposal is sent out live to the suppliers in their delivery schedules and VTC wants them to answer to levels more likely to occur. The Program proposal is released on Thursday week-3 to the commercial divisions, the production units, VPT, Volvo 3P, and VLC

as illustrated in Figure 11. GM sometimes adds buffers in the proposal as explained in Appendix 17. On Monday week-2 a Program proposal meeting is held where all parties which received the proposal are invited and where the S&OP Manager at GM explains the proposal in relation to the requests and the previous confirmed Program plan. An issue stressed in relation to the Program proposal is that the suppliers do not get to see the real market requests but a proposal which is a modified version and the real market demand is thus lost on the way.

Next, it is the supplying units' responsibility to investigate the proposal before the Program conference on Thursday the same week. It is the supplying units' obligation to answer to the Program proposal at the Program conference. Hence, the supplying units do not create any preliminary supply plans in that sense and the output of their supply review is rather a "yes" to the proposal or a "no" including suggested changes to it as illustrated in Figure 13. As the supplying units only answer to the proposal, they do not get any alternative demand plans to investigate. They can therefore not create alternative supply plans based on any demand shaping alternatives. The different supplying units; EM, IM, SAM, VPT, Volvo 3P, and VLC, have different processes of creating their answers to the Program proposal and these processes are explained briefly below and in detail, including functional flowcharts, in Appendix 17.

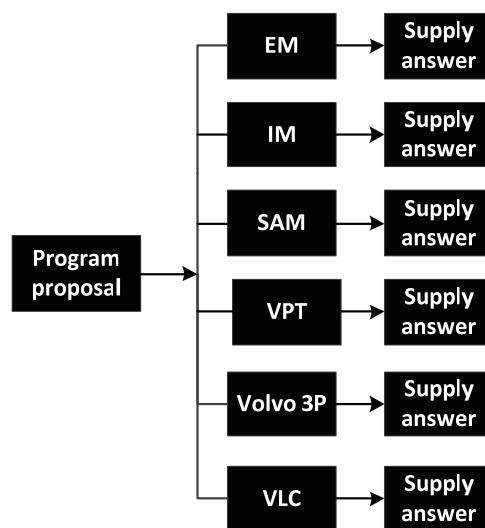


Figure 13. The supplying units create answers to the Program proposal.

EM's process of creating an answer to the proposal involves mainly three different pre-meetings. First, each EM plant holds a "Plant response meeting" where the proposal is checked against available capacity, issues as well as suggestions on how to meet the proposal are discussed. The next pre-meeting is the EM assembly conference which the planning responsible at each plant attends and the total available EM capacity is discussed. The output includes what capacity constraints exist and suggested changes either in the proposal or in available capacity. The last step in the EM process is an "EM management assembly conference", which EM's management team, including the Plant directors, attends. The S&OP coordinator at EM presents what has been suggested in the previous pre-meetings and the meeting attendees discuss the consequences of this and decide upon an answer to the Program proposal. Product capacity requirements and new product introductions are also issues discussed during this meeting.

Moving on to IM, its process leading up to the final Program conference is more informal. There are no formal assembly meetings in the same sense as EM has since IM is responsible for ten different plants around the world and the ownerships varies between the plants and thus also varies the information that VTC shares with the plants. Instead, IM has more continuous response discussions concerning available capacity and how to respond to the Program proposal. IM is also involved earlier in the S&OP process, in ID's local markets' work, as IM helps the market concerning where to place the request depending on the lead times as further explained in Appendix 17.

The final production unit SAM is, in the same sense as IM, involved in the commercial pre-meeting, in this case for ID's Latin America area. Thus, SAM has early insight into the markets' demands and starts to plan for the volumes already after the commercial meeting. SAM has a "Local Production Meeting" as a pre-meeting in the Program process which SAM's management as well as the local HR, VPT, and Volvo 3P attend. The output from the meeting is an answer to the request and if any changes in capacity is needed.

Moving on to VPT, as illustrated in Figure 11 above, it has a conference the day before VTC's Program conference, which is part of VPT's own S&OP process. During the VPT conference, VPT's plants, partners, and suppliers answer to VTC's and the other customers' requests. Thus, the output is that VPT knows how it should answer to, among others, VTC's proposal as well as risks associated with the Program plan. If capacity constraints exist, it has to be decided how the components should be allocated between the brands within the Volvo Group. This decision is often based on optimizing operating income for AB Volvo and could lead to favorable decisions for some brands and less favorable for others.

Volvo 3P answers for the external suppliers' capacities and capabilities to supply the proposed volumes. After Volvo 3P gets the Program proposal, the different commodity managers have the responsibility to look into if the suppliers have enough capacity to supply the volumes. This is thereafter discussed at Volvo 3P's pre-meeting, the so called "Capacity and risk assessment meeting" as illustrated in Figure 11. Especially, critical suppliers are discussed and followed-up and decisions concerning how to respond to the Program proposal are taken. An issue that is stressed by Volvo 3P is that since the Program proposal concerns volumes on product group level, it is hard to evaluate supplier capacity since the different truck variants need different items and thus different suppliers. This issue is presented further in Appendix 17.

VLC answers for the external suppliers of transport capacity for all transport modes, both the inbound and outbound flow, as well as packaging material capacity. After VLC obtains the Program proposal, the global key account manager for VTC at VLC informs VLC's key account managers for Inbound, Outbound, and packaging material as well as VLC Country Managers, and VLC Global purchasing of the volumes in the proposal. These stakeholders thereafter have three days to investigate the volumes and if there is enough available capacity. They should come up with an answer to the proposal as well as identify any risks. VLC Global purchasing investigates the suppliers for inbound transports whilst VLC Outbound has a forecasting tool where the proposal is inserted and sent to the suppliers who thereafter answers on their capacities. After receiving the answers from the stakeholders, the global key

account manager puts together VLC's answer to VTC's Program proposal.

One aspect of supply which is not considered in the Program process is the capacity of the body builders performing the CAs. As mentioned above, the Program process only covers up to GM's CDD and consequently, this is left out of the process. There have however been issues with available body builder capacity during the last year's upturn when the body builders were not prepared for the large volumes. This has been stressed as an issue leading to long lead times and low delivery precision to the end-customers. The above mentioned project of bringing more CAs in-house may be seen as a response to this issue.

As previously mentioned, the output from the different supply reviews are answers to the Program proposal for each supply unit and these answers are thereafter presented in the next step of the process as is explained in the following section.

4.4.4 RECONCILIATION MEETING

VTC's last meeting is called Program conference, also in Figure 11 referred to as "VTC Executive program decision meeting", and it is held on Thursday week -2. The people invited to this meeting, approximately 30-35 people, are the CEO and representatives from; EuD, ID, ATO, GM, EM, IM, GML, EML, IML, SAM, Volvo 3P, VPT, VLC, VTC Finance, and VTC Corporate Communications. The meeting attendance is approximately around 15-25 people and the meeting lasts for two hours. It is high focus on keeping the meeting time in order to get top management attention and attendance. The chairman of the Program conference is the Senior Vice President GM and the S&OP Manager coordinates the meeting. The people attending the Program conference are a mix of coordinators, managers, and middle and top management. Apart from the Senior VP GM and the Senior VP of Corporate Communication who usually attends the meeting, other senior management such as the CEO and the CFO attend the meeting from time to time and irregularly. The meeting gets more top management attention every quarter when there is an extended meeting which includes a business outlook.

The overall view of the purpose of the Program conference is clear and simple; to reach a consensus plan based on the markets' requests and the available capacities in production and from suppliers. It is also expressed that the purpose of the meeting is to give an answer to the commercial's requests, set the capacity-levels, and to make decisions about Program plan volumes. If capacity or material shortages exist, decisions should be taken on how to handle it, for example decisions regarding priorities. Furthermore, the purpose is also to get information about current market situation and limitations within the global system. The Program conference also gives everyone a chance to give their input on, comment, and question the Program proposal.

Some people believe that the Program conference meeting achieves its purposes while others do not. The main reasons why people believe it does not achieve its purposes are that the participants do not have a clear view of what the outcome will be, there is no clear definition between "yes" and "no" to the Program proposal, there is no common view of the risks for certain Program plan levels, it does not include a review of the effects of the last confirmed Program plan, some decisions are moved to other meetings such as TEG, and the final Program plan is not set during the meeting. Furthermore, one interviewee points out that the discussions are sometimes too detailed during the meeting, e.g. whether production should

handle a certain capacity level with the flex time or not.

The agenda for the Program conference includes an introduction where the S&OP Manager presents the Program proposal, critical issues, wanted decisions, and the two KPIs; Program quality and Customer response lead time. There is nothing mentioned about the overall business and strategic goals and their connection to the Program process. The introduction is followed by a standardized presentation from each commercial division which includes for example information about the divisions' requests and current market situation. Next, the responding functions, EM, IM, SAM, VPT, Volvo 3P, and VLC present their answers to the proposal. EM, IM, and SAM are using a standardized presentation material but not VPT, Volvo 3P, and VLC. The presentations differ a little but most of them include the functions' current capacity level, ongoing and planned actions, current issues, critical suppliers, and whether they say yes or no to the Program proposal.

An issue related to the responding supply functions' answers concerns the definition of saying "yes" or "no" to the Program proposal. Volvo 3P puts out that if the proposal cannot be validated, the answer to it should be "no" and it should include an explanation of how it will be handled. Lately, Volvo 3P's answer to the proposal has been "no to the proposal but yes to support" which means, according to Volvo 3P, that it has not been able to validate the proposal and can therefore not say yes but despite this, it will do its best to fulfill the final Program plan. During the interviews, several interviewees pointed out that there is no clear definition of what "yes" means and what "no" means and many mentioned Volvo 3P's "no to the proposal but yes to support" answer. It was also pointed out that if someone says no to the proposal, it should also include to what volumes it can say yes to, which according to some interviewees is not the case for Volvo 3P. Volvo 3P also mentions that even though it says no to the proposal, VTC usually confirms the volumes anyway and Volvo 3P therefore sometimes experiences difficulties to fulfill the Program plan's needs.

If VPT's answer to the Program proposal is yes, it also includes if there are any specific risks associated with the yes. For example, that it is experiencing problems with a particular supplier which might not be able to deliver X units unless it manages to solve the problems.

VTC Finance and VTC Communication do not make any presentations during the meeting and do not provide any specific input. Finance's role during the meeting is to take part in order to make sure that none of the decisions will affect the finances very negatively and to raise questions about for example the pipeline and invoicing. VTC Communication takes part of the meeting in order to be informed about the current situation and to get an understanding of what should be communicated to media and shareholders.

The meeting is finished with a summary and a discussion about the issues and wanted decisions. The summary includes a presentation of: comparison of order intake and Program proposal, order cancellation rate, pace per division and production unit, and a risk matrix.

Not many discussions take part during the Program conference. Many discussions and decisions are done either before the Program conference or after it, for example in the TEG-forum. Questions that might be brought outside the Program conference are decisions about allocation between markets, financing, investments, and hiring. The Program process often

develops the questions and information about it while the decisions are taken in other forums such as VTC's top management meetings. The reasons for this is time limitations during the Program conference, more time is needed to investigate it further as a business case, or that it is a decision which top management have to be part of.

Examples of areas brought up for decision during the Program conference is for example capacity trade-offs. Limited scenario thinking takes place in the discussions. However, an example of scenario thinking is discussions about whether or not to try to match a big temporary demand increase on one market. Such a decision is however often lifted out of the conference and investigated in another forum.

The total Program plan volumes are decided upon during the Program conference, thus one of the outputs, but the allocation per planning period and market are not set. The final plan is instead delivered a few days later, on Tuesday, when the Program plan is released.

4.4.5 PUBLISH, COMMUNICATE, AND MEASURE THE PLAN

After the Program conference, the S&OP Manager has until Tuesday noon to consolidate the information and set a final Program plan. It is desirable not to change the Program plan too much from the proposal but, depending on the discussions and decisions taken during the Program conference, the volumes might be re-allocated between the planning periods and between the commercial divisions and markets. The S&OP Manager has the responsibility to create the final Program plan but it is done in close collaboration with the Director GML. Furthermore, informal meetings with the different stakeholders, such as commercial and production, are also used to clarify some questions and used as an input for the adjustments.

Once the Program plan is inserted into CEMAFOR, it is sent to OPT and the new information supersedes the old one. When the plants send out the delivery plans as EDIs to their suppliers, the suppliers will get information about the updated plans. The internal suppliers can collect the information themselves through the OPT system. The S&OP Manager also prepares an Excel-sheet with information that is sent out by email to the different stakeholders such as the commercial divisions, production, finance, and internal suppliers.

VTC measures four KPI's which are specifically related to the Program process and they are followed up monthly. Furthermore, two of them, Program quality and Customer response lead time, are presented during the next Program conference.

4.5 S&OP MATURITY AT VOLVO TRUCKS

The following sections describe how VTC is working with the dimensions within Grimson and Pyke's (2007) maturity framework, as previously defined in the Theoretical Framework.

4.5.1 MEETINGS AND COLLABORATION

There are many meetings held within VTC which are connected to the S&OP process. The monthly Program process consists of clearly defined pre-meetings and a consensus meeting named Program conference as described above. The general pre-meetings, as presented in Figure 11 and as previously mentioned, are; Program request meeting, Logistics phone conference, Sales meeting, Program proposal meeting, EM conference, and the VPT conference. Apart from these there are additional pre-meetings within each function as presented in the process structure description above. In addition to the formal meetings

included in the process, several informal meetings and discussions exist. VTC has a well-structured and formal S&OP process and the meetings are scheduled routinely and with a given frequency as discussed in 2.3.1, S&OP planning parameters at Volvo Trucks. Most formal meetings have a meeting agenda and every meeting has a chairman who is responsible for the specific meeting.

All VTC's Program process meetings are scheduled in advance, see Appendix 18 for a calendar, and event-driven S&OP meetings do not occur very frequently. An example of an event-driven S&OP meeting was when a market closed a large deal after the market requests had been placed and an additional meeting was held. However, this meeting did not include the entire S&OP team. Other event-driven meetings, not directly with an S&OP focus, are scheduled within the organization when needed but they do not supersede any scheduled meetings. One function explains that if disruptions happen it tries to handle them internally. Furthermore, the event-driven meetings that do occur usually take place on a higher management level than the S&OP network.

As described above, the Program conference has varying executive participation and may thus not be considered a fully "Executive meeting". It has been expressed during the interviews that it is not considered possible currently to convince more executives to attend the Program conference. However, it is pointed out that the people who attend the Program conference have own authority or mandate through their managers to highlight their functions' opinion and be part of the decisions. The preparatory work is done by both coordinators and managers. The S&OP Manager does a lot of preparatory work including for example consolidating material from the different functions and preparing meeting materials. Standard presentation material has been developed for the meetings in order for the material to look the same, be easy to understand, and for senior management to quickly absorb the data.

The process is based on collaboration between commercials and operations and there is a single number attitude amongst the employees. The requested volumes from the markets are, after adjustment by the S&OP Manager to constrained market requests, the Program proposal, used by the supply-side to analyze its possibility to respond to the requested volumes. Opinions from both the commercial and supply-sides are thus taken into consideration while deciding upon the final Program plan.

VTC intends to involve most of its suppliers and consider their capacities as part of the Program process by including VPT, Volvo 3P, and VLC in the process and, as mentioned above, VTC takes part of VPT's S&OP process as a customer.

VPT in its turn works actively with including the suppliers' capacity in its S&OP process and 40-50 of VPT's key suppliers are connected to VPT's PCC program, a proactive IT tool which is used to check suppliers' available capacity, and it is the main IT system for VPT's S&OP process. The suppliers update their capacities and possibilities to deliver and once the requested volumes from VTC and VPT's other customers are added, bottlenecks can easily be detected. For example, it is possible for a plant to get information about VPT's need at a specific line. VPT itself believes that it has the best tools within the Volvo Group to involve its suppliers and share volumes.

As explained above, Volvo 3P's role during the Program process is to represent all VTC suppliers managed by Volvo 3P. Volvo 3P has problems with validating all the supplier capacities and therefore not all, or a broad range of, supplier data has been checked or incorporated in its supply answer. One issue in relation to this is limited time due to that the proposal is for product groups and the suppliers have to wait for the EDIs from the plants before they can validate their capacities. Furthermore, unlike VPT, Volvo 3P does not have an IT-system which can be used to validate suppliers and this renders it more difficult to incorporate supplier data as it leads to that all validation has to be done manually and is therefore very time consuming. A few years ago, Volvo 3P initiated a project with the aim of implementing VPT's PCC system but the project was not successful and it was cancelled. The main reason, according to Volvo 3P, that the project failed is because the system could not handle Volvo 3P's large number of suppliers and item numbers.

VTC has many small customers, as mentioned before, and it hence makes it difficult to involve them directly in the Program process why they are not currently involved. However, some commercial regions and markets ask dealers for input in their forecasting process.

4.5.2 ORGANIZATION

The Program process is organized under GM and the process owner is the Director GML. No one has expressed their dissatisfaction about this and most people believe it works well. It has also been mentioned that it is good that the process is organized under GM with the explanation that the function that has to solve potential issues, which often is the production, should be the process owner. No one believes that it would be better to have it organized under the commercial side. The reasons are mainly because the commercial side is divided into three different divisions and that commercial tends to have more optimistic views of the reality than production. Hence there would be a risk for dimensioning the capacity to high. It is also mentioned that it is good to have the process under GM as GM is in the middle, between the suppliers and the commercial divisions.

VTC has a full time S&OP Manager reporting to the Director GML. The S&OP Manager has its own team, seven people including the manager. However, only the manager works full time with S&OP and another person works with it half time. The team's purpose is amongst others, in addition to the Program plan work, to make forecasts concerning the different variants and the lower level component program. The component program can be seen as a bi-product to the Program process and it is a service provided to the component suppliers. The S&OP Manager expresses that the formal S&OP team rather is the S&OP network, the people who attends the Program conference, as earlier presented. A few of these people work full-time with the Program process but most of them work with it part time. However, most people have S&OP as part of their job description.

VTC's S&OP network involves most functions and can be seen as a cross-functional team. However, product engineering and design and IT functions are not part of the team. The S&OP Manager expresses the importance of having one person, and not several, responsible from each function. The difference between the operational work and the Program conference is also pointed out. Management attention is not as important for the operational pre-work as it is for the Program conference. It is also highlighted that the title is not the most important

but rather that the person has authority to make decisions. As mentioned in Meetings and Collaboration, it is clearly defined who is responsible for each step in the process and every meeting has a chairman who is responsible for the specific meeting.

The process is well understood in the company according to all interviewees. The S&OP Manager believes that the process is widely recognized as one of the most important processes for VTC. However, a general comment is that the further out in the organization, the awareness of the S&OP process diminishes. The further out, people are more focused on its own part and do not have a holistic view and understanding of the process's complexity. VTC does not have any formal training programs about S&OP but information is shared informally when needed.

The Program process itself has full executive sponsorship at VTC and it is believed to be an important process in the company. In general, most people find the S&OP process important for VTC to succeed. However, depending on whom you ask in the organization the answer might vary. For example, it has been expressed that people close to the market or close to the plants would most likely like to see a larger flexibility than what exists today and they therefore might find the S&OP process big, complex, slow-moving, and not very flexible. In order to reach profitability it is important to get a balance between demand and supply and it is a common view that the Program process handles this in a good way. Most people can see the connection between the company's profitability and the Program process. It is expressed that VTC's profitability is highly dependent on the Program process because the process decides upon the volumes and the allocation of volumes between the commercial divisions.

4.5.3 MEASUREMENTS

In order to achieve the company's overall objectives, VTC measures, amongst others, operating leverage which is considered the most important performance measurement in the company. Moreover, measuring cash flow and return on operating capital is important to achieve the overall strategic goals. Furthermore, GIB (Group Information Board) Supply Chain presents the KPIs within the groups Customer view, Efficiency and Secure input as important for the business. The Customer view includes for example delivery precision, the Efficiency group for example inventory and logistics costs whilst Secure input includes for example forecast accuracy and order quality. The entire list of KPIs is found in Appendix 19.

Discussing S&OP process performance, the most important KPIs for the Program process are expressed as Request quality, Program quality, Truck type quality (however measured on variant level) and Customer response lead time. These KPIs are measured monthly and the Program quality and Customer response lead time are presented at the Program conference. The Request quality measures the quality of the requests based on both model types and per plant. The Program quality is believed to measure how well the Program plan is set and does so by comparing the actual volume for a specific month with the confirmed volumes for that month in the previous five periods. The Truck type quality measures how well the Program plan corresponds to what is actually sold and produced on a lower product type level. The Customer response lead time is defined as the number of weeks until the accumulated number of free slots in production adds up to one day of production. Additional information concerning VTC's Program process effectiveness measurements may be found in Appendix 19.

The commercial divisions and markets are measured on their efficiency in the Program process by for example the request quality over time and other measurements in the monthly logistics report. Manufacturing is measured based on industry delivery precision and inventory. Each functional unit also has its own functional measurements which are measured and followed within the function and some of these are presented in Appendix 19.

VTC also has specific measures for new product introductions. GM measures for example delta Q, the Program process measures the Program quality and the commercial units measure the time to market. There is a project ongoing at VTC, "Production Planning", which will include an analysis of how new product introductions should be connected to the Program process and a toolbox will be developed in how to report new product introductions.

Many highlights that the process should focus more on delivery precision and how to optimize the entire supply chain. Delivery precision is measured in the company but it is expressed that it should be highlighted in the Program process. Since the delivery precision becomes a consequence of amongst others how large risks the company takes with a specific plan, it is expressed that the delivery precision and Program plan therefore have to be presented together. Finance further expresses that it believes that the pipeline should get more attention during the Program conference. It is also expressed that the Program process has limited connection to strategic initiatives. One example presented is that even though a certain market is prioritized on a top management level it does not get prioritized in the Program process. Neither is it measured how the Program process supports strategic initiatives.

The different functions feel partly responsible for VTC's profitability since they are part of the company and have their own responsibilities. Most people believe that the Program process is not responsible for optimizing VTC's profitability but rather that the process affects the company's profitability, e.g. the Program process is expressed as a method used to achieve profitability. Revenue, costs, and tied-up capital are put forward as financial measurements that are affected by the S&OP process. However, they are currently not used to evaluate the process results. For example it is mentioned that costs are dependent on choice of plant, number of shifts at the plant, overtime and so on which are affected by the Program process. When it comes to tied-up capital, it is important to have an efficient supply chain and not to produce trucks based on speculations with the risk of having trucks in stock for a long time.

There is no formal feedback connected to the Program process and the functions and employees involved. However, even though there is no formal feedback it is possible to give feedback during for other meetings and when the network meets up. The S&OP owner and manager for example have meetings with the commercial divisions four times per year where potential feedback may be discussed. Furthermore, all employees at VTC get feedback from its managers and for some people their work with the Program process is included in this feedback. There is no formal process for suppliers, end-customers, dealers, or regions to evaluate VTC's Program process.

4.5.4 INFORMATION TECHNOLOGY

VTC does not use any advanced IT system for its Program process and most of the work is Excel-based. Excel sheets are used to, e.g. communicate inputs from the markets and the Program proposal. Even though every function tries to consolidate its Excel sheets there are

many different sheets used in the company. The only system used for the Program process is CEMAFOR, a mainframe, where, as aforementioned, the individual markets insert their requests and the system consolidates them. The S&OP Manager can withdraw information from the system as an Excel based pivot table in order to examine the market requests. However, CEMAFOR cannot be used as, or considered being, an S&OP workbench which connects information from both the demand and supply-side systems and which can be used to visualize and analyze data. Once the Program plan is confirmed after the Program conference, the S&OP Manager inserts the volumes as truck models per market and plant into CEMAFOR and the system breaks down the models into single variants per market and plant. The breakdown is done using percentage allocations for different types of trucks and markets.

Two other systems which are linked to the Program process are OPT and VTOM (Volvo Truck Order Manager). OPT is a production planning system, i.e. supply-side system, which updates the capacities daily and takes restrictions into consideration. OPT keeps track of how many of the allocated slots that have been used by the markets. The commercial divisions can log in to the system to get information about placed orders and how many slots remain per market. The Program plan volumes set in CEMAFOR is transferred to OPT and these become maximum slots per market. If the commercial divisions want to reallocate volumes between the markets it is done in OPT and it is never shown in CEMAFOR since it is only a one way communication between the systems. Hence, the S&OP Manager has to manually make updates in the CEMAFOR system when changes are done in OPT. VTOM is an order system used by the markets to create an order with detailed specifications of the trucks and VTOM is connected to OPT as it checks if there is available capacity to cater for the order. However, VTOM cannot be classified as a demand-side planning system in the sense that it helps with forecasting and demand scenario creation and for those purposes VTC only uses Excel. The demand and supply-side systems are not linked more than that OPT and the order system VTOM is automatically connected to each other as mentioned above and the communication between OPT and CEMAFOR is only one way.

VTC does not have any automated tools for sharing information about the Program plans apart from CEMAFOR and OPT. The suppliers receive information about the production plans through the plants' EDI systems. Apart from this, all information is distributed as Excel sheets by e-mail, hence, VTC does neither have a supply collaborator, like VPT's previously mentioned PCC -system, linked to its suppliers. Nor does the company have a demand collaborator which could be used to share demand forecasts with dealers and sales personnel. The company also lacks linkages between the financial planning systems and the Program process systems. None of VTC's above mentioned systems can be used for revenue or operations optimization on S&OP level. OPT may be used for some sequencing optimization on the shop floor but not for any S&OP optimization. Further, VTC has no formal or structured way of conducting scenario analysis or tool to support such analysis except for Excel. However, the different functions include some limited scenario analysis in their preparatory work. For example, ID compares different risk scenarios with the market requests as a base scenario and EuD asks its markets to provide a lowest and highest scenario. SAM expresses that the supply-side does not perform any scenario analysis. EM tries to optimize the supply answer based on an efficient Europe perspective and it also performs proactive

work by creating an understanding of what the next steps will be and the effects of it.

4.5.5 S&OP PLAN INTEGRATION

As the S&OP Plan Integration dimension is the goal of the above dimensions it is closely connected to VTC's goals with working with S&OP and thus the Program process as presented above. As aforementioned, VTC's goal with the Program process is mainly to match supply and demand and create a good production plan. Thus, since there is no explicit goal of profit optimization, VTC does not optimize the Program plans based on profit. Neither is financial plans used as input to the Program process and there are no clear discussions of financial aspects in relation to the Program plan during the Program conference. However, margins and profits are discussed but these discussions often take place in other forums such as VTC's top management meetings. It is an opinion that there are great possibilities to further integrate financial aspects into the Program process. It is also highlighted that one obstacle to working more with profit optimization in the Program process is that the commercial side is divided into three divisions. There is thus an internal competition between the divisions and when capacity constraints exist and allocations must be done they are often based on a cheese slicer principle instead of profit.

Further discussing Finance's involvement, Finance takes, as previously mentioned, part of the Program conference but it does not provide any input to the meeting. The process is, according to Finance, created by the commercial divisions and supply, and Finance role is more to observe and to take part of the decision making. The Program process is however very important for Finance which uses the information and the confirmed volumes as input to its further work. Finance and business control at VTC has a reporting obligation to the owner AB Volvo and the forecasts and estimates that are sent out monthly, and four longer forecasts quarterly, are based on the output from the Program process. The information is also used for other purposes, e.g. to analyze capacity utilization and how to optimize the tied-up capital.

Gap analysis between financial plans and the S&OP plans are done at least once a month in order to make consequence analysis of the budgets and forecasts. These monthly analysis is focusing on short-term which is four months. Four times a year an analysis is done for a longer time perspective of 12 months. These gap analyses are however not done in connection to, or during, the Program process. Thus, the S&OP plans are not used to do any simulations and the Program plan is not translated into monetary terms to test its financial impact.

Consequently, Finance does not set any specific goals for the Program process and the plans are not compared with financial goals. The plans are however compared with several, mainly functional, business goals along the process. First, the market requests are compared with amongst others targets for inventory and market shares, as presented in the process description above. In addition, the comparison with the business goals may lead to some tempering of the plans as mentioned above when for example ID had a target of increasing sales for a specific model. Second, when analyzing the Program proposal the supplying units take business goals into consideration, such as for example the new flexibility targets.

Price levels are not set in relation to the Program process but it is sometimes highlighted during the Program conference that for example the order intake decreases due to that the markets work with increasing the price levels. It is an opinion that price-levels should not be

set as part of the Program process but that margins should be discussed in order to make better prioritizations. A reason for this opinion is that VTC currently use standard prices and discount guidelines are set centrally but that the regions and markets thereafter have much responsibility in how they use the discounts. Thus, many of the pricing decisions are taken at a regional or market level and thus not at the HQ.

Concerning the development and integration of plans, the market requests, as presented above, are used as input when creating the Program proposal which then in its turn is used as input for the supply answers. Hence, the market requests are constrained by different supply constraints. First, key constraints are, as presented above, used when creating the Program proposal and then each supply unit applies its constraints in its answer to the proposal. The market requests are thus constrained and the sales plan thus changed and updated along the process. As such, the development of the sales plan is concurrent rather than sequential. Furthermore, as the Program proposal is first created and later updated by additional supply constraints the production plan may also be considered developed concurrently. Last, EuD may change the allocation between markets after the Program conference and before the final Program plan is released. Thus, this is the final fine-tuning of the plans which also emphasizes that the development of the plans is quite concurrent and collaborative.

4.6 SCENARIO ANALYSIS IN THE S&OP PROCESS – RESULTS FROM THE EXPERT INTERVIEWS

This section presents the results from the two performed expert interviews and complements the presentation of scenario analysis in the S&OP process found in the Theoretical Framework and thus aims at helping to answer RQ3. Refer to the Methodology for descriptions of how the interviews were performed.

4.6.1 EXPERT INTERVIEW 1 - ACADEMIA⁷

Scenario analysis benefits

Scenario analysis supports handling uncertainties in the S&OP process and results in a better understanding of possible future outcomes. The more uncertainty a company experiences the more it has to win from conducting scenario analysis in the process. Moreover, scenario analysis supports decision making and gives guiding in specific questions since it shows the impact and consequences of the different evaluated alternatives. As such, it also helps facilitating the collaboration between functions.

Incorporating scenario analysis in the S&OP process

Scenario analysis is useful when creating the demand and supply plan. It also supports decision making to present and discuss key scenarios during the reconciliation meeting.

When creating the demand plan, different scenarios based on different demand shaping activities may be generated. In the creation of the demand plan, the forecast should not simply be accepted but instead the company should use demand shaping in order to create a plan that is in line with what the company wants to sell. In the creation of this demand plan, different

⁷ Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

scenarios based on different demand shaping activities may thus be generated such as based on different dates for product introductions, campaigns, and so on.

Next, scenario analysis is also a useful tool on the supply-side. In the development of the supply plan, the different demand shaping scenarios may be tested in order to evaluate the effect on the capacity of different demand plans. Moreover, it is useful to generate supply scenarios for the different demand scenarios in order to see the consequences of different alternatives to meet the demand and help in the decision making.

It is considered important to present some of the key scenarios created in the previous steps to the management team during the reconciliation meeting since it may be a top-management decision to decide which scenario to go for in the final plan. In order to further facilitate the discussion, it could be beneficial to be able to create new scenarios during the reconciliation meeting if the meeting attendants want to try to effect of new assumptions or strategies.

Scenario creation

The time frame of a company's scenario analysis should depend on the decisions the company wants to take in the process. Hence, scenarios should neither be conducted with longer time frame than the planning horizon of the S&OP process nor with shorter time frame than the time fences in the planning. Moreover, depending on the decision, the time frame for the scenarios may be the entire planning horizon or only certain periods. Generally speaking, alternatives, issues, or sources of uncertainty concerning the balance of supply and demand in the S&OP process, and which thus may be useful to consider for scenario analysis in the process, are, amongst others, alternatives for in which plant the products should be produced, which suppliers to use, which markets to prioritize, consequences of a higher or lower demand than expected, and product introductions.

Scenario evaluation and decision making

When evaluating scenarios in the S&OP process, the scenario evaluation parameters should be aligned with the goal of the S&OP process. Since the latter in its turn should be aligned with the overall business goals of the company, the result is that the scenarios should be evaluated according to their affect on overall business goals. Depending on what is important for the company and what their order-winners are this may thus be profit, costs, tied-up capital, delivery precision, and so on. However, in order to use these evaluation parameters, it might be a prerequisite to have an APS-system. This, if plans are developed with a simple system such as Excel the different plans could instead be compared based on for example how the available capacity can be used most efficiently or how the demand can be satisfied and thereafter, the plan that is best aligned with the company's goals is chosen.

Supporting tools for scenario analysis

APS systems may be used to support the S&OP process with demand and supply planning modules. The demand planning module is used to gather, generate, evaluate, and visualize the forecasts. Furthermore, the possibility to develop different demand plans based on different demand shaping strategies is an important functionality in this system. To enable the users to plan promotions, the shape of the life-cycle curve, and deciding on the point in time at which new products will be launched, some demand planning modules support scenario simulations. The supply planning module uses the demand plans and master data in order to generate an

optimal plan. The supply planning system may moreover visualize and evaluate different scenarios. While all APS systems can be used for scenario analysis, some APS vendors provide more complete facilities to compare plans. This ranges from the ability to have multiple copies of the different plans visible for side-by-side comparison to the ability to produce cost analyses of various planning options.

It is also possible to use simple tools such as Excel or ERP systems to support scenario analysis. However, companies which are experiencing much complexity and have an ambitious S&OP aim probably benefit more from using a more advanced supporting system in their S&OP. The reason is that the less advanced systems in these environments may be difficult to handle as much input data must be handled manually and the model soon becomes very complex. Furthermore, it is difficult to model detail complexity, such as many production sites, customers, or suppliers, in simple systems. What also is lacking in simple systems, and which is an advantage of using an APS system for scenario analysis, is the possibility to evaluate the scenarios based on their impact and consequences on for example profitability. Disadvantages of using an advanced system for scenario analysis are, amongst others, that it demands much time from the users and that it is difficult to create a good model, with the right parameters and high quality input data. Moreover, there is a risk of over-interpreting the results and trusting them blindly even though more information may be necessary for decision making. Also, it could be difficult to believe in, and use, the optimal plan generated by the APS system as the logic behind it is not understood. Therefore, it is important to clarify with what purpose the scenario analysis should be done and thus on what aggregation level the company should be modeled.

When modeling the company and its network in the supporting system there may be most to win on creating the model on a quite aggregated level as most systems only can handle a certain level of complexity. Thus, there is a trade-off between the complexity in the model and the computer time, thus the time taken to run the scenarios. Since it is considered useful to be able to create scenarios during the meetings it is thus necessary to choose an appropriate level of detail in the model.

Prerequisites for succeeding with scenario analysis in the S&OP process

Since scenario analysis may be performed using either simple tools or advanced systems the prerequisites vary a lot. Scenario analysis using simple systems does not require as many prerequisites. However, in order to gain the benefits of scenario analysis previously discussed, it may require that there is a well developed S&OP process in place and that the quality of the input data is good as the plans can never be better than what has been used as input. If using an advanced system for scenario analysis, there are more prerequisites. An important prerequisite is the quality and effectiveness of the input data. What input data that is necessary depends to some extent on what sources of uncertainty the company has, for example input data concerning suppliers' capacities and lead times if the suppliers are a source of uncertainty. However, as the model cannot simulate everything, only critical suppliers should be included in the model. Further, depending on what evaluation parameters the company uses for its scenario assessment, financial data such as costs in the network, prices on the products, margins et cetera are necessary inputs to the system. The supporting system for scenario analysis must also be getting this data as inputs and it thus requires links between the

scenario system and other systems, such as master planning data stored in the company's ERP system. Furthermore, related to both process and technology, a good model of the company network must be developed in order to use an advanced system for scenario analysis, including soft and hard constraints, and the parameters in the model must be set right.

4.6.2 EXPERT INTERVIEW 2 – SOFTWARE SUPPLIER⁸

Scenario analysis benefits

Scenario analysis supports decision making in S&OP by considering uncertainties, risks, and alternatives a company is facing. The basis for the benefits is that creating multiple scenarios and evaluating their impacts visualizes the consequences of the decision making and makes the company's choices more explicit. Thus, it emphasizes what the company has to make decisions about. After making a decision, the company can track its decisions and learn in the process. It is important to ask if any of the evaluated scenarios actually came true, if the supply capabilities were overestimated, or if something happened which was not considered in the analysis and which should be incorporated for the next planning period.

Incorporating scenario analysis in the S&OP process

Scenario analysis may be performed, and is useful, in the forecasting process, when creating the demand plan, when creating the supply plan, and during the reconciliation meeting.

When creating the demand plan, different forecast scenarios and demand shaping scenarios should be created. In the supply review, the demand scenarios should first be tested and the resulting supply alternatives evaluated. However, there may be constraints in meeting the demand scenarios, alternative ways of meeting them, or uncertainties surrounding the supply-side. Hence, second, different supply alternatives should be created and evaluated in this step. If the demand plans cannot be met, the process should go back to the first step where alternative demand shaping may be possible. Thus, there should be iteration between the demand shaping scenarios and the supply scenarios.

During the reconciliation meeting, key scenarios together with their impact and probability of occurrence should be presented to the management team and discussed with the help of an S&OP workbench. It is helpful to visualize key scenarios in a matrix similar to the example presented in Table 20. In the example, all demand scenarios are possible to balance with supply using different actions but the impact of the supply uncertainties are different depending on the demand scenarios. Demand and supply scenarios based on certain uncertainties, and thus having a certain probability of occurrence, may be visualized together with alternatives, such as demand shaping scenarios, where the company can make an active choice. The impact illustrated in the table should be presented in terms of the main company KPIs as discussed in the next section. After having visualized the possible key scenarios, a decision concerning what scenario to go for must be made by the management team together with action plans on how to mitigate risks related to the uncertainties.

During the upcoming planning period, it is important to measure and follow up in order to see if the scenario aimed for is the one actually occurring. If not, it is important to be flexible and adjust to the new reality even though the plan is set until the next planning period.

⁸ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

Table 20. An example of how scenarios may be presented at the reconciliation meeting. Three different demand scenarios D₁, D₂, and D₃, created from different uncertainties are presented together with D₄, and D₅ which are based on two different demand shaping scenarios. The demand scenarios have been assessed as feasible by supply to meet by different actions, and they are evaluated against five supply scenarios. The three supply scenarios S₁, S₂, and S₃ are created from different uncertainties whilst S₄, and S₅ are based on two different supply alternatives. Their individual probabilities of occurrence are illustrated as well as the impact of each of the nine possible scenarios.

	D₁ – Best case (30%)	D₂ – Medium /base case (60%)	D₃ – Worst case (10%)	D₄ – Additional campaign	D₅ – New date for product introduction
S₁ – Normal supply (90%)	Impact	Impact	Impact	Impact	Impact
S₂ – Internal problems (5%)	Impact	Impact	Impact	Impact	Impact
S₃ – Supply disruptions because of Japan crisis (5%)	Impact	Impact	Impact	Impact	Impact
S₄ – Meet demand by using three shifts	Impact	Impact	Impact	Impact	Impact
S₅ – Meet demand by using overtime	Impact	Impact	Impact	Impact	Impact

Scenario creation

When conducting scenario analysis in the S&OP process, the time frame of the scenarios should be such that the scenarios relate to the decisions taken in the process. E.g. if the company uses time fences and does not allow any changes in the plan the first months then the focus of the analysis should be after the initial months. Furthermore, the time frame of the scenarios should stay within the planning horizon of the S&OP process.

There are no limitations in what types of scenarios that can be created and it is up to the company to decide how deep it wants to go in the analysis. Generally speaking, it is useful to consider competitors in the scenarios and how their activities affect the company in question. Furthermore, suppliers should be considered as well as actions that the company can affect itself such as timing of new product introductions. It is important to focus on the root cause of uncertainty. Moreover, the creation of scenarios is much based on expert’s opinions. Thus, experts may recommend creating scenarios based on certain sources of uncertainty and these are then broken down to financial numbers for evaluation purposes.

Scenario evaluation and decision making

When a company should evaluate its scenarios it is important to ask what the goal of the S&OP process is and evaluate the scenarios consequently. Depending on the company’s goals and strategies, and thus the goal of the S&OP process, evaluation parameters may be e.g. profit, costs, margin, delivery precision, tied up capital, and market share.

Supporting tools for scenario analysis

In order to perform scenario analysis in the S&OP process a company needs support from a demand planning system, a supply planning system, an S&OP workbench and moreover

connection to the financial system. All these systems should moreover be linked. The demand planning system should support scenario creation and demand shaping. In the supply planning system the company's network should be modeled with nodes, costs and constraints.

Excel is not considered being an appropriate tool as the manual handling easily results in mistakes and the Excel file gets fast very complex and difficult to update. However, even though an APS system may handle complexity better than Excel, there is still a need for modeling the network on a quite aggregated level in order for the system to be able to run and generate scenarios fast when needed. Furthermore, the more complex the network is, the more thorough the company has to be when creating the network model in the system. It is recommended to iterate when developing the model and thus start with developing a simple model to create understanding amongst the employees of how the model works and thereafter add details and complexity.

Prerequisites for succeeding with scenario analysis in the S&OP process

Using scenario analysis in the S&OP process is a question of process maturity. It is important to secure process quality before implementing scenarios analysis. Quality in the process includes making good forecasts, having high quality data, and make sure that everyone in the S&OP team is active in the process. It is also important to develop the process, the people and the technology together. Moreover, concerning the people aspect, conducting scenario analysis in the S&OP process requires resources and it should be understood that it may require adding people to the S&OP team who are given scenario analysis responsibility.

Input data that is necessary includes a link between the supply-side system and the MRP system where data on capacities are stored. Furthermore, the supply plan system needs data to describe the entire network such as capacity constraints, costs, and supplier data if they are a source of uncertainty, and so on.

5 ANALYSIS

This chapter analyzes the Empirical Findings against the Theoretical Framework and answers the RQs. This chapter thus includes, to begin with, an evaluation of VTC's S&OP complexity followed by an assessment of VTC's S&OP process against the maturity framework and identification of gaps. Moreover, it includes an analysis of the identified gaps including evaluation of which gaps that should be closed and in which order. The chapter ends with analyzing how to incorporate scenario analysis in the S&OP process since it is the gap chosen for further study.

5.1 S&OP COMPLEXITY AT VOLVO TRUCKS

The information presented in the Empirical Findings concerning VTC's internal, downstream, and upstream context, including the results of the brainstorming, is in this section used to conclude about VTC's S&OP complexity. From the results of the brainstorming, previously presented in Table 19, it is concluded that VTC's uncertainty is based in both detail and dynamic complexity. The majority of sources of uncertainty are due to dynamic complexity but certain sources are also due to detail complexity as is explained in the sections below. The S&OP complexity is important for the gap analysis as well as to answer RQ3. The section is structured according to the definition of S&OP complexity in the Theoretical Framework and the structure of the context description in the Empirical Findings and S&OP complexity is hence presented in three perspectives, i.e. internal, downstream, and upstream complexity.

5.1.1 INTERNAL S&OP COMPLEXITY

To begin with, the internal detail complexity is high at VTC. A first reason is VTC's geographically separated production sites with certain dependencies, e.g. the cab plant delivers to the assembly plants and the packing in Gothenburg delivers to the CKD-plants. Second, detail complexity results from the product variants where some variants must be manufactured in a certain plant. Third, the size of VTC with several commercial divisions and production units that must be coordinated creates complexity. Furthermore, VTC being a part of AB Volvo is a dimension which creates increased detail complexity since, amongst others, some decisions taken within the S&OP process are affected by decisions taken at higher planning levels within Volvo Group. During the brainstorming, internal sources of uncertainty were identified, as presented above, such as internal capacity constraints and flexibility, top management's willingness to invest, and allocation of investment funds in AB Volvo. These uncertainties are considered being an effect of the high detail complexity experienced.

Concerning internal dynamic complexity, it is considered to be on a medium level. There are few breakdowns because of the quite uncomplicated process equipment used in assembly and moreover, the stops that do occur rarely last long enough to affect the S&OP process. Moreover, the manufacturing yield is high and rush orders are not allowed as the manufacturing orders are firmed planned during the Def run. These issues points to low internal dynamic complexity. However, main sources of uncertainty which were identified during the brainstorming and that adds to the internal dynamic complexity of VTC are uncertainties related to the introduction time for new product as presented in Table 19. This may result from for example complexity of estimating the length of the new product projects as well as legal and technological macro factors affecting new product introductions.

5.1.2 DOWNSTREAM S&OP COMPLEXITY

Since VTC has a very large customer base the downstream detail complexity is high. It is also affected by the customers being spread worldwide since that adds complicating macro factors such as economic, legal, and political factors, as presented above, and which was highly emphasized during the brainstorming. The opinion is that these macro factors cause both detail and dynamic complexity. Detail may result from for example many different political environments and dynamic from for example uncertain and dynamic political environments.

The downstream dynamic complexity is also considered to be high for several reasons. To start with, many macro factors drive the dynamic complexity. As the truck market is closely linked to the development of GDP, the total economic development is of high importance but also stressed as very uncertain and as a result, so is the total truck market development. The total truck market was also pointed out by the brainstorming participants as being most uncertain but also having the largest impact on decision making in the Program process. The political development in for example North Africa and Middle East (NAME) was pointed out during the brainstorming as being hard to predict and it was also mentioned that it is very hard to predict the next “political crisis”. The competitors’ strategies, activities, and new product introductions, is another main source of uncertainty presented in Table 19 resulting in downstream dynamic complexity. The dynamic complexity becomes higher during new product introductions as it is hard to predict how the market will react to the new product and the cannibalization rate of the old products. Thus, new product introductions are a source of dynamic complexity in the downstream context as well as in the internal context. Furthermore, Brazil was specifically highlighted as having high impact of the sources of uncertainty due to economic development, total market, and legislations. Thus, there is high downstream dynamic complexity in this market.

5.1.3 UPSTREAM S&OP COMPLEXITY

In the same sense as for the number of customers, VTC experiences high detail complexity when it comes to the upstream context because of the large supplier base. Furthermore, complicating factors resulting from global sourcing also increase the detail and dynamic complexity. During the brainstorming, suppliers’ flexibility and capacity constraints were pointed out as main sources of uncertainty which are hard to predict and thus adds complexity. The opinion is that the uncertainty is an effect of both the high detail complexity which makes it hard to keep track of all suppliers and thus creates uncertainty as well as dynamic flexibility where supplier flexibility and capacity constraints actually do vary.

The upstream dynamic complexity is considered to be medium. Even though the supply lead times to some plants are long, the suppliers’ delivery precision is at stable level and thus not a large source for dynamic complexity. The uncertainty mentioned above concerning supplier and capacity constraints however also adds dynamic complexity. Furthermore, material availability was identified as a main source of uncertainty during the brainstorming. Macro factors are also sources of uncertainty in the upstream context as presented in Appendix 15. To conclude, the upstream dynamic complexity is medium.

5.2 S&OP MATURITY CLASSIFICATION OF VOLVO TRUCKS

Using Grimson and Pyke's (2007) S&OP maturity framework presented in the Theoretical Framework as well as the Empirical Findings, VTC's S&OP usage is analyzed and classified against the five dimensions and stages as presented in Table 10. Figure 14 illustrates the classification together with the actions needed in order to reach higher stages. As illustrated, VTC is, on average, a Standard user. The following sections describe the rationale behind the classification for each dimension.

5.2.1 MEETINGS AND COLLABORATION

As presented in Grimson & Pyke's (2007) S&OP maturity framework in Table 10, Stage 1 within Meetings and Collaboration denotes that a company does not have any S&OP meetings or collaboration between sales and operations. Furthermore, Stage 2 companies mainly discuss financial goals and do not integrate plans and there is still little collaboration. As VTC has a clear S&OP process with defined meetings and the process is based on collaboration between the commercial divisions and the supply units, it is evident that VTC is beyond Stage 1. Further, as VTC is not discussing only financial goals during its meetings, but have a clear purpose of integrating the plans and balance supply and demand, Stage 2 is also achieved.

Next, Stage 3 includes three main points, as presented in Table 10; staff pre-meetings, executive S&OP meetings, and that some key account customers and supply data is incorporated in the process. As pre-meetings are held within all functions, on both commercial and supply-side, this point is clearly achieved by VTC. Concerning executive S&OP meetings, this point is not considered fully achieved since not a majority of top executives normally attends the Program conference and most of those that do attend do so irregularly. In the Theoretical Framework, it is presented that Grimson and Pyke (2007) also emphasize that unresolved conflicts should be solved in the process and this is not always true for VTC as issues are often moved to other forums. As presented in the Empirical Findings, the internal suppliers VPT, VLC, and Volvo 3P are included in the Program process and their data is considered. Moreover, some customer data is incorporated in some regions when developing the market request and thus the point of "some supplier/customer data" is achieved. Thus, VTC is considered having achieved many, but not all, of the points in Stage 3 and is thus rated as a 2.75 on the scale for Meetings and Collaboration in Figure 14.

However, when moving on to Stage 4, VTC includes VPT, VLC, and Volvo 3P in the Program conference and since Volvo 3P represents many customers it may be argued that a broad range of suppliers are incorporated, as the framework puts forward to achieve Stage 4. However, as there are issues with considering all critical suppliers' capacities within the time frame and because of the lacking IT support, there is still more to be done in this stage. Moreover, incorporating more customer data would be necessary in order for VTC to achieve Stage 4. Concerning the points to achieve Stage 5, the event-driven meetings that occur at VTC, as presented in the Empirical Findings, seldom includes the entire S&OP network. Moreover, the event-driven meetings are either internal within the functions or at top management level and this point is therefore not believed to be fully achieved.

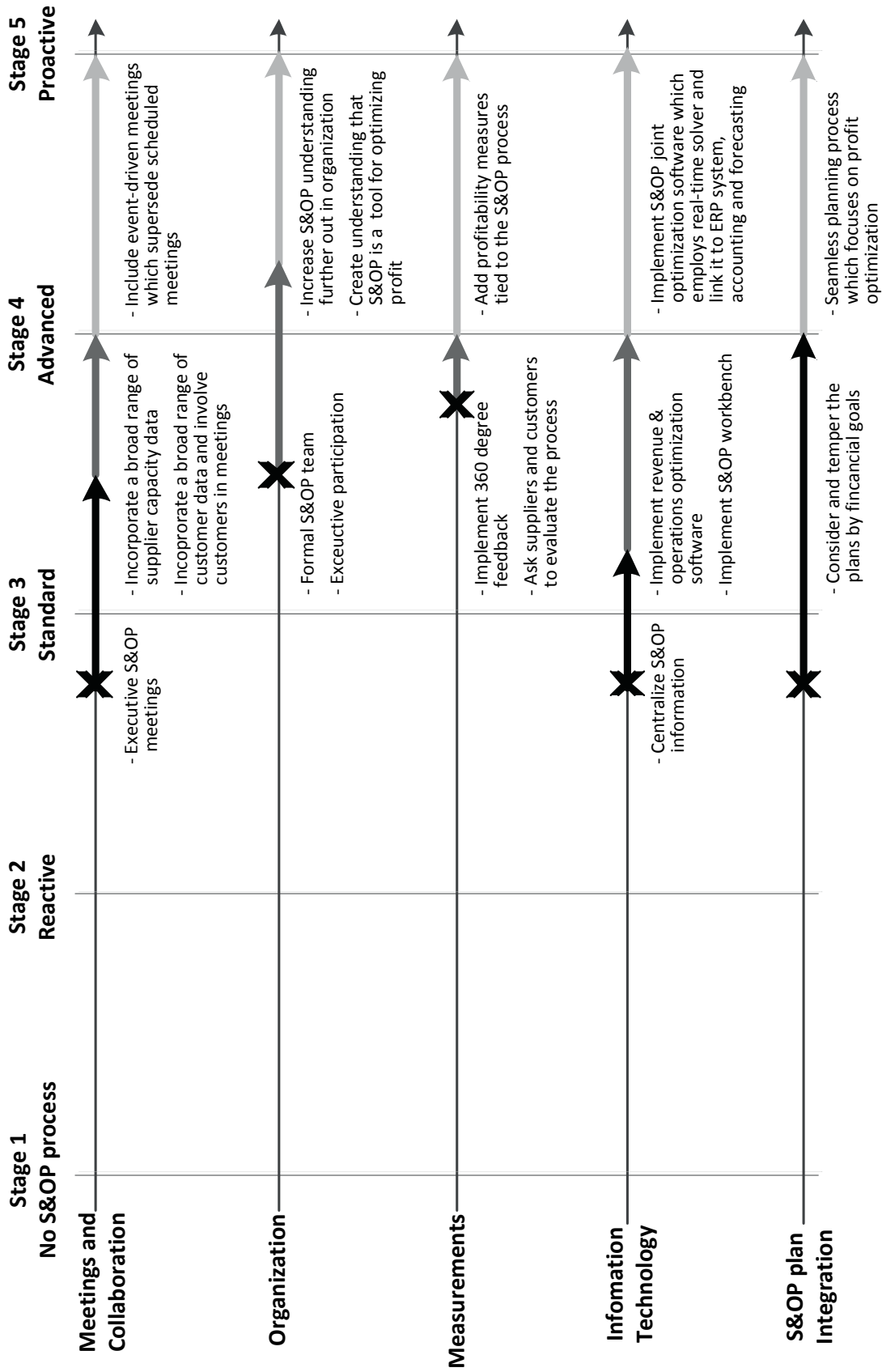


Figure 14. VTC S&OP maturity classification according to Grimson and Pyke's (2007) S&OP maturity framework. The crosses represent VTC's current maturity in each dimension and the arrows represent what VTC would have to do to in order to reach a higher maturity stage.

5.2.2 ORGANIZATION

Since Stage 1 and 2 in the framework were defined in Table 10 as having no S&OP organization (Stage 1), having no formal function, and that components of S&OP are performed in other positions (Stage 2), VTC is considered having achieved these stages.

The main point in Stage 3 is, as presented in Table 10, that the S&OP function becomes a formal function but under the responsibility of another position is also a stage which VTC achieves. VTC has a clear S&OP function as it has an S&OP Manager and, since the Director GML is responsible for the process, it is clearly the responsibility of another position. Since Stage 4 adds a formal S&OP team with executive participation, it is not considered fully achieved by VTC. The rationale for this is, first, it is not considered that VTC has a formal S&OP team since the people attending the Program conference are not formally put together as a team and instead put forward as a network. Second, the S&OP network has not full executive participation. However, since most of the people attending the Program conference have S&OP as part of their job descriptions and since there is some executive participation in the network, VTC is considered being a 3.5 on the scale in the Organization dimension.

Stage 5 includes S&OP understanding and respect in the organization and as it was put forward by many interviewees that there is a deep understanding in many parts of the organization; VTC may already have achieved some parts of Stage 5. One potential issue in this aspect is, that people further out in the organization understand the process less. Further, the aspect of S&OP being a tool for optimization of profitability, may be questioned as S&OP is seen more as having effects on profitability rather than being a tool to optimize it.

5.2.3 MEASUREMENTS

As presented in the Empirical Findings, VTC uses several performance measurements and thus Stage 1 in this dimension is achieved. In Stage 2, operational measurements are added and since VTC measures several operational performance indicators such as delivery precision, quality, and lead times, this stage is also achieved. Further, Stage 3 adds that sales should be measured on forecast accuracy and the Market request quality measurement may be seen as an attempt to cover this and thus, VTC is considered having achieved this stage.

Two measurement areas are added in Stage 4, as presented in Table 10, namely new product introduction and S&OP effectiveness measurements. Since VTC has several measurements when it comes to measuring the success of new product introductions this point is considered being achieved. Concerning measuring S&OP effectiveness, VTC's Program quality measurement as well as the Customer response lead time, which are both measured over time, and additional functional measurements, such as delivery precision, are attempts to cover this aspect. However, as presented above, VTC does not have any formal 360 degree feedback program and neither does it let customers and suppliers evaluate the process. Since Grimson and Pyke (2007) consider these vital parts when measuring S&OP effectiveness, VTC does not fully achieve Stage 4 and is thus rated as 3.75 on the scale for Measurements in Figure 14.

In Stage 5, profitability measures tied to the S&OP process are added, and since the Program process is not considered accountable for profitability and since there is no financial evaluation of the plans, VTC is not considered having any such measures.

5.2.4 INFORMATION TECHNOLOGY

As VTC has the production planning system OPT, Excel for demand planning, and moreover CEMAFOR for the Program process, the company has achieved Stage 1 and 2 where companies are classified to only use separate spreadsheets (Stage 1) or spreadsheets with some manual consolidation (Stage 2).

As presented in Table 10, in Stage 3 information should be centralized in an automated way and there should be revenue or operations planning software. The view here is that VTC does, with its above mentioned systems, have revenue and operations planning software and that the information concerning these issues in daily operations is quite centralized. However, when it comes to CEMAFOR and the market requests and Program plans, this information is not centralized in an automated way and therefore VTC is considered to lack some in Stage 3 and is therefore classified as 2.75 on the scale for Information Technology.

Further, concerning Stage 4 which adds Revenue and operations optimization software, VTC lacks much here as well. OPT is used to do some sequencing when it comes to restrictions and capacity, as previously presented, but this is considered to be on a too low level to be considered when discussing S&OP optimization. Neither does VTC have any revenue optimization system nor an S&OP workbench, which also are prerequisites in Stage 4. As VTC does not live up to Stage 4 technology; naturally it nor achieves Stage 5 technology.

5.2.5 S&OP PLAN INTEGRATION

As the S&OP Plan Integration dimension is the goal of the other dimensions, some aspects here will be the effect of previous discussions. Starting with Stage 1, it is above described as companies with no S&OP and consequently no integration of plans. Clearly, VTC has S&OP, both concerning process and organization as described above, and there is integration of plans. Moreover, as the Program plan is created, not only by considering the market requests but the capacity constraints and utilization, Stage 2 is also achieved.

Moving on to Stage 3, it is presented above as involving a sequential process where business and financial goals are taken into consideration and forecasts developed bottom-up. Next, Stage 4 develops the sequential process into a concurrent and collaborative process. It is complicated to classify VTC on this dimension as it achieves many of the requisites for Stage 4 simultaneously as not all aspect of Stage 3 are achieved. As described above, VTC develops forecasts mostly bottom-up and moreover takes some business goals into consideration in the process and when developing the plans. These business goals are however mainly those such as market share and inventory and more rarely overall business goals such as profitability and growth. Moreover, concerning the process being either sequential or concurrent, the view, as presented above, is that VTC has a quite concurrent process where sales and production plans are developed and updated through several steps, hence achieving many aspects of Stage 4. What leaves VTC before Stage 3 is the aspect of considering and tempering the plans by financial goals. As mentioned earlier, during the Program process, there is little connection to financial aspects, e.g. the plans are not converted into monetary terms in the process. Hence, it obstructs the possibility of comparing the plans with financial goals. Thus, VTC does not achieve all aspects of Stage 3 and is classified as 2.75 on the scale for S&OP Plan Integration.

Concerning Stage 5, it is not achieved as VTC does not have an explicit goal of profit

optimization for the Program process, hence the company does not optimize on profit and seeing the current limited financial connection, this would be difficult to accomplish today.

5.3 GAP IDENTIFICATION

This section identifies the gaps between VTC's current process, as presented in the Empirical Findings, and the literature presented in the Theoretical Framework. As previously argued for in the Methodology chapter, the gaps concerning S&OP planning parameters are identified using VTC's S&OP context since there is a contingency approach in the literature concerning this area. For the remaining gap identification, VTC's S&OP context is not taken into consideration and instead used later, in the Gap analysis. The summarizing tables presented in the Theoretical Framework are used to compare VTC's current S&OP process with the theoretical recommendations for S&OP planning parameters, S&OP process structure as well as for the S&OP maturity framework dimensions. The comparison uses the notation of gap and match. The notation of a gap is defined in the Problem identification and a match consequently means working in alignment with the theory and thus, neither under-performing or over-performing in the area.

5.3.1 S&OP GOALS GAPS

As previously discussed, matching supply and demand and to secure production capacity and material availability are two important goals of VTC's Program process. These areas are also discussed as important in the Theoretical Framework where, among others, the initial definition of S&OP emphasized the balancing of supply and demand. There is thus a match between the theory and VTC's goal concerning the founding goals of S&OP.

However, the goal of S&OP has evolved, at least when it comes to what is recommended in the literature, and it is now also seen as a strategic process which integrates the entire business and that the goal of the S&OP process should be aligned with overall business goals. Concerning the alignment between the overall business goals and the S&OP process at VTC, it has not been explicitly expressed by VTC as a goal to align the two. Thus, the Program process has not as a formal goal to reach overall business goals such as AB Volvo's goals of profitability and growth or VTC's goals for operating leverage. Neither is the optimization of the overall business goals highlighted as a responsibility of the Program process. Furthermore, AB Volvo's and VTC's overall business goals and strategies are rarely discussed during the Program process and there is no clear connection of how the Program plan affects these business goals or strategies. It is however considered that some business goals are taken into consideration in the process, for example market share targets when developing the market requests. Moreover, as mentioned previously, it is an opinion that even though the business goals are not explicitly discussed, people are aware of the goals and make decisions with regard to the business goals and strategies. A gap can nevertheless be identified between the theory's focus on a clear alignment between the S&OP process and the company's overall business goals and strategies and VTC's current limited alignment. Furthermore, there is a gap in the aspect of that the process should try to optimize the overall goals as VTC does not explicitly focus nor optimize on the overall goals.

5.3.2 S&OP PLANNING PARAMETERS GAPS

A comparison of the theoretical recommendations and the empirical findings at VTC

concerning the S&OP planning parameters is summarized in Table 21 below.

Table 21. S&OP planning parameters – comparison of theoretical recommendations and empirical findings at VTC.

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
Planning horizon	1-2 years	- Rolling 12 months plus total volume next year	Match
	As long as the lead time for capacity changes	- Changes in technical capacity takes around 18 months and up to 3-5 years for larger investments	Gap
Planning frequency	Rolling monthly schedule	- Rolling monthly schedule	Match
	Depending on market volatility	- The truck market is volatile but limited volatility within a month, i.e. within a planning period	Match
Planning objects	Low level of detail	- Low level of detail in plans	Match
	Aggregated product family level	- FH/FM in one group and FL/FE/VM in one group - The product families are also discussed per region and per plant, thus higher level of detail	Match
	Products with similar characteristics within the group	- FH/FM manufactured on the same line and FL/FE/VM on the same line - Overall similar demand pattern	Match
Units of capacity	Low level of detail	- Low level of detail	Match
	Total objects/tons per month	- Number of trucks per line and day	Match
Time fences for change in plans	Percentages of how big changes that are allowed in different time horizons	- No set time fences	Gap
	Depending on time taken to get access to material	- Longest lead times to Brisbane. 3-4 months with normal sea transport but air freight is also possible	-
	Depending on the lead time for capacity changes	- Short term capacity changes takes at least three weeks.	-
	Depending on the flexibility of operations	- Flexibility targets recently set but not followed up yet	Match

Planning horizon

VTC has a planning horizon of rolling twelve months plus total volume next year and is thus aligned with the theoretical recommendations of one to two years. However, the literature also recommends that the planning horizon should be as long as the lead time for capacity changes. The lead time for technical capacity changes is approximately 18 months but up to three to five years if it is a larger investment. Therefore, a gap can be identified as VTC's planning horizon is shorter than the lead time for large capacity changes.

Planning frequency

Most literature suggests a rolling monthly schedule and VTC has a rolling monthly schedule and is thus aligned with the recommendations. The theory also recommends that the planning frequency should depend on the market volatility and as previously discussed, the truck market is volatile and is sensitive to market fluctuations. However, VTC's planning frequency is not being questioned to be shorter than a month because the nature of the demand volatility is not believed to be captured better with a shorter planning frequency. The demand volatility within a month is not believed to be as troublesome as the demand volatility over the years.

Planning objects

All factors discussed for planning objects are identified as matches. The Program process at VTC focuses on volumes and it is thus a low level of detail in the plans. Further, VTC has, as

discussed in the Empirical Findings, divided the truck models into two product families, heavy-duty and medium-duty segment. The theory discusses that products in the same group should have similar demand behaviors as well as similar resource requirements. The demand pattern is overall similar even though there are some differences in seasonality. However, this is not considered a large enough difference to cause a gap. Further, the products within each product family have similar resource requirements as FM/FH and FL/FE are respectively produced on the same line. The product families are also divided between different regions and plants in the requests and Program plans and thus give a higher level of detail. This is not directly discussed in literature and thus difficult to determine whether it is a gap or not.

Units of capacity

The Theoretical Framework presents recommendations about low level of detail for the units of capacity and VTC also uses a low level of detail, hence no gap. VTC expresses its units of capacity as number of trucks per line and day while, as previously mentioned, the literature discusses total objects/tons per month. However, it is still believed to be a match since the level of detail is low and as the capacity varies per month depending on number of working days et cetera, the capacity would hence be difficult to express per month.

Time fences for change in plans

VTC is not working with time fences within its Program process and a gap is therefore identified as it is suggested in the Theoretical Framework that time fences for changes in plans should be used. However, flexibility targets have been set on AB Volvo level and are thus a match with the literature which discusses that the time fences should be set depending on, among others, flexibility of operations.

5.3.3 S&OP PROCESS STRUCTURE GAPS

The following sections identify gaps within the five S&OP process steps.

Product management review

A comparison of the theoretical recommendations and the empirical findings at VTC for the Product management review step is summarized in Table 22.

Table 22. Product management review - comparison of theoretical recommendations and empirical findings at VTC.

Theoretical recommendations	Empirical findings at VTC	Match / Gap
Product management review meeting as a first formal meeting in the S&OP process	- No formal product management review as part of the Program process	Gap
Review of the product portfolio and other product activities	- Product activities discussed at commercial meetings and in Strategic planning	Match
Output: new product plans, new activities plans and resources for implementing the plans, issues related to the plans, and assumptions and risks	- The areas discussed at top-management project meetings and reference meetings	Match
Otherwise included in other steps when forecasting demand, investigating demand shaping possibilities, and when discussing resource requirements	- Considered when developing the market requests and the preliminary supply plans	Match

As mentioned in the Theoretical Framework, Schorr (2007) and Bower (2005) are the two authors who include Product management review as a formal step in the S&OP process. VTC does not have a formal Product management review meeting and this is thus a gap as

illustrated in Table 22. However, other authors include these product reviews discussions in other steps in the process. As product management is discussed during for example EuD's telephone meetings as well as during EM's management assembly conference, product management is considered in other steps of the process and it is hence a match. Furthermore, Volvo 3P runs individual projects for new products and discussions about for example new product plans and resources for implementing the plans are carried out at top management project meetings and reference meetings. These meetings are not part of the Program process but outputs from these meetings are used as input to step 2 and 3 in VTC Program process. To summarize, product management discussions are carried out in the company but it is not part of the Program process and thus identified as a gap in this step.

Create the demand plan

A comparison of the theoretical recommendations and the empirical findings at VTC for the Create the demand plan step is summarized in Table 23.

Table 23. Create the demand plan - comparison of theoretical recommendations and empirical findings at VTC.

Theoretical recommendations	Empirical findings at VTC	Match / Gap
Collect sales and market input	- Sales and market input collected mainly bottom-up but also, at EuD, top-down	Match
Create unconstrained forecast	- Unconstrained forecast created	Match
Use quantitative forecasting methods	- Mainly qualitative methods used	Gap
Create a demand plan which refers to what the company wishes to sell and deliver in each period, i.e. with demand shaping considered	- Some demand shaping activities discussed - No formal alternative demand plans created based on demand shaping - No distinct difference. Market request refers to both forecast and demand plan	Gap
Include gap analysis, what-if analysis, and scenario analysis	- Some gap analysis concerning market share estimations and business plan targets - Limited what-if and scenario analysis	Gap
Demand review meeting where the preliminary demand plan is set	- EuD has an executive central response meeting but not ID - No meeting including all divisions	Gap
Output: Unconstrained demand plan (what the company wishes to sell and deliver in each period)	- Output: Unconstrained market requests of volumes to be produced in a certain period, thus with inventory deducted	Gap
Communicate the plan	- Market request sent and communicated to GM, the process owner, in the Sales meeting - Constrained version communicated to the supply functions in the Program proposal meeting	Match

As presented in the Theoretical Framework, the first step of creating the demand plan should be to collect sales and market input and this step is considered to match with VTC's current process. Further, an unconstrained forecast is created which at VTC is called the market request and, as recommended in the literature, it does not take any constraints into consideration while it does take planned market activities into consideration. This does consequently also create a match between the theory and VTC's current process. The market request is developed mainly using qualitative forecasting methods. Consequently, this is a gap as literature suggests that quantitative forecasting methods should also be used.

The literature separates the forecast from the demand plan where the first should only refer to the market demands, i.e. the forecast, and the latter to what the company wishes to sell and deliver in each period, i.e. with demand shaping considered. Thus, an unconstrained forecast should be created but the output of this step should be an unconstrained demand plan. At VTC, there is no distinct difference between these two and the market request, as handed in from the markets, may be seen as a forecast whilst it after being updated, for example during EuD's central response meeting, develops into a demand plan. Some demand shaping actions are discussed in relation to this when there are gaps between the requests and the targets. As VTC does not clearly separate the forecast from the demand plan, this may be seen as a gap. Further, as presented in Table 23, the unconstrained demand plan should represent what the company wishes to sell and deliver in each period and this is not the case for VTC's market requests as they instead represent the volumes that the commercial divisions want to have produced in a certain period, thus with inventory deducted. Hence, this is also a gap.

Another identified gap is the aspect of "Including gap analysis, what-if analysis, and scenario analysis" in the Create the demand plan step. VTC does very limited what-if and scenario analysis when creating the demand plan and neither are any formal alternative demand plans created. This is a major gap in comparison to AMR Research's (2009) process and Baumann and Crum's (2009) view, where creating additional demand plans based on different demand shaping opportunities is stressed as important. Concerning gap analysis, some comparisons take place between the market requests and the business targets. To summarize, the identified gap mainly concerns scenario and what-if analysis and less the gap analysis aspect.

Further, in the process of developing the demand plan, the literature suggests a demand review meeting where the preliminary demand plan is set. As ID does not have an internal demand review meeting and as there is no common demand review meeting for the entire sales side of the business, this must be identified as a gap. In the Theoretical Framework it is moreover, for example, highlighted that this meeting should be attended by product management and this is not the case for EuD's central response meeting today.

Last to carry out in the Create the demand plan step, as presented in Table 23, is to communicate the plan. In the Theoretical Framework it is presented that the demand plan should be communicated to involved parties. As the market requests are handed in to GM, presented during the Sales meetings, and presented in a shorter version during the Program proposal meeting, it is considered communicated and hence a match.

Develop the supply plan

A comparison of the theoretical recommendations and the empirical findings at VTC for the Develop the supply plan step is summarized in Table 24.

The first step is that the demand plan should be used as input to the development of the supply plan. This is a match in the sense that the market requests are used when developing the Program proposal. However, the actual supplying units use the Program proposal as input when developing supply answers, thus a partly constrained demand plan. Whether this is positive or negative may be discussed. VTC expresses benefits of using a Program proposal as the proposal is sent to the suppliers and VTC wants to communicate volumes more in line with its internal capacity. On the other hand, as is presented in the Theoretical Framework,

Schorr (2007d) emphasize that supply is expected to develop scenarios if there is a gap between supply and demand. Thus, not communicating the actual demanded volumes may possibly lead to less scenario analysis and less responsiveness to demand.

Table 24. Develop the supply plan - comparison of theoretical recommendations and empirical findings at VTC.

Theoretical recommendations	Empirical findings at VTC	Match / Gap
Demand plan used as input	- Program proposal used as input	Match
Consider all aspects of supply	- All aspects except body builder capacities considered	Gap
Evaluate the demand shaping scenarios, conduct what-if analysis based on supply, and develop supply scenarios	- Some future supply alternatives discussed but the output is mainly answers to the proposal - Limited evaluation of demand shaping scenarios as no formal alternatives are presented for evaluation	Gap
Analyze the gaps and the best alternatives based on the overall business goals	- Focus on supplying the Program proposal and not on analyzing alternatives based on overall company goals - Gaps between the proposal and available capacity is highlighted and actions discussed	Gap
Supply review meeting	- Individual supply review meetings at most supplying units - No meeting including all supply functions	Gap
Output: Recommendations on valid supply plans, scenarios, and actions to close gaps	- Output: Individual answers to the Program proposal from each supply function, often including gaps and how the proposal needs to be changed, or actions to close the gaps	Gap

In this stage it is moreover emphasized that all aspects of supply must be considered. Leaving some aspects of supply out of the step may lead to sub-optimization within the company and thus not find the best alternative for the company based on overall goals. This is considered a gap since VTC is not including the body builders' capacities in the review.

Similarly to what is discussed above concerning the creation of the demand plan, what-if analysis and scenario analysis are important aspects within the creation of the supply plan according to many authors referenced in the Theoretical Framework. As the creation of demand shaping scenarios is a prerequisite for having any demand scenarios to evaluate, and since no such scenarios are formally created, this consequently causes a gap for the supply plan creation as well. Furthermore, each supplying unit mainly creates one supply scenario even though some alternatives are discussed. To summarize, the lack of formal scenario and what-if analysis creates a gap between the literature and VTC's current process.

Further, an issue in close relation to this is, as presented in Table 24, to "analyze the gaps and the best alternatives based on the overall business goals". As limited alternatives are created, there are limited alternatives to compare with the overall goals. Gaps between the proposal and available capacity are discussed and actions to possibly close the gaps are created. However, there is no formal evaluation of these gaps against business goals. Consequently, a gap has been identified concerning the lack of evaluation of supply alternatives and especially based on the overall business goals.

Alike to the creation of the demand plan and the demand review meeting, a supply review meeting is recommended in the literature. As presented in the Empirical Findings, most supplying units have internal supply review meetings, with the exception of IM. Since IM lacks a meeting and since there is no common supply review meeting creating a unified

supply answer, this must be identified as a gap.

Last, the output from this step should be, as presented in Table 24, “recommendations on valid supply plans, scenarios, and actions to close gaps”. As the main output from the supplying units’ reviews are supply answers to the Program proposal including any constraints they may have identified and the related changes they suggest, this is a match to the aspect of “recommending valid supply plans”. The aspect of “actions to close the gaps” can also be given a match since the supplying units often suggest actions to close any identified gaps. However, if there are no actions available, changes to the proposal are instead recommended. Nevertheless, because of VTC’s lack of scenario creation and analysis, a gap is identified because scenarios should be part of the output from this step.

Reconciliation Meeting

A comparison of the theoretical recommendations and the empirical findings at VTC for the Reconciliation meeting step is summarized in Table 25.

Table 25. Reconciliation meeting- comparison of theoretical recommendations and empirical findings at VTC.

Theoretical recommendations	Empirical findings at VTC	Match / Gap
Attended by managers from all involved functions	- All functions except product management represented at the Program conference	Match
Objective is to reach a balance in supply and delivery plans in a way that reaches overall business and strategic goals	- Objective to reach a consensus plan based on the markets’ requests and the available capacities	Gap
Includes evaluation of the preliminary demand and supply plans together with key scenarios, converted into monetary terms, against business plan, strategy, and performance metrics.	- Market requests and supply answers to the proposal are presented and questioned - Limited discussion on gaps and scenarios - No conversion to monetary terms - Limited comparison against overall goals, strategy, and performance metrics	Gap
Include discussion of issues, consequences, risks, and opportunities	- Issues and risks discussed - Limited discussion of consequences and opportunities	Gap
Include decisions on capacity trade-offs	- Capacity trade-off decisions taken	Match
Executive reconciliation meeting or additional senior management review. The president should own the meeting.	- Program conference, owned by the Senior VP GM, is the final meeting and there is no additional senior management meeting - Varying executive participation in the meeting	Gap
Output: Final settlement on the plans by top-management	- Output: Issues and wanted decisions taken - Total volumes set but final plan including allocation per planning period and market is set in next step - Issue of no definition of “yes” and “no” to the Program proposal	Gap

As previously discussed in the Theoretical Framework, managers from all involved functions should attend the reconciliation meeting and this is also the case at VTC where all functions, except product management, are represented during the meeting and this is hence a match.

VTC’s gathered opinion of the goal of the Program conference is to reach a consensus plan based on the market’s requests and the available capacities which differs somewhat from the theoretical recommendation which also includes that the plans should be set in a way so the overall business and strategic goals can be met. A gap is hence identified.

As discussed in the Theoretical Framework, the reconciliation meeting should include an evaluation of the preliminary demand and supply plans together with key scenarios, converted into monetary terms, and compared against business plan, strategy, and performance metrics. The market requests and supplier answers are presented and questioned during the meeting. However, no other scenarios are presented, the plans are not converted into monetary terms, and there are limited discussions about the connection to overall goals, strategies, and performance metrics, and this is hence a gap.

AMR Research (2009) also emphasizes, as previously mentioned, that the meetings should include discussions about issues, consequences, risks, and opportunities. Even though issues and risks are discussed, this is identified as a gap since there are limited discussions about consequences and opportunities. The same authors also pointed out that decisions should be taken about, among others, capacity trade-offs and as decisions are taken about capacity trade-offs during the Program conference, for example regarding ramp ups, this is a match.

According to the theoretical recommendations, the reconciliation meeting should either include executives or being divided into two meetings, where recommendations are developed during the first and decisions are taken during the second, the senior management review meeting. It is also pointed out that the meeting should be owned by the president. As VTC only has one meeting which has varying executive participation and the Program conference's chairman is the Senior VP GM, this is identified as a gap.

Finally, the output from the meeting should, according to the theoretical recommendations, be a final settlement on the plans. Even though many at VTC express the objective of the Program conference as reaching a consensus plan, a final Program plan is not set during the meeting. Even though it is decided upon the total volumes during the Program conference, the allocation per planning period and market, i.e. the final Program plan, is set after the Program conference. As the Program plan is not set during the Program conference and accepted by all stakeholders, this is a gap to the theoretical recommendations. Moreover, as presented as an experienced issue in the Empirical Findings, the fact that there is no clear definition of "yes" and "no" to the Program proposal makes it hard to have a clear settlement of the plans. However, issues and wanted decisions are presented during the Program conference and formal decisions are taken about these issues during the meeting.

Publish, communicate, and measure the plan

A comparison of the theoretical recommendations and the empirical findings at VTC for the Publish, communicate, and measure the plan step is summarized in Table 26.

The theoretical recommendations for this step includes that the plans should be published and communicated to all involved parties. This is considered a match since VTC publishes the plan in CEMAFOR and transfers it to OPT and it thus becomes available for the plants. Further, the final Program plan is also sent out as an Excel sheet to all stakeholders.

Table 26. Publish, communicate, and measure the plan- comparison of theoretical recommendations and empirical findings at VTC.

Theoretical recommendations	Empirical findings at VTC	Match / Gap
Plans published and communicated to all involved parties	- Plan published in CEMAFOR and thus distributed through OPT - Excel sheet with the plan communicated to stakeholders	Match
Measure effectiveness of the plans and the S&OP process	- KPIs which evaluate the Program process effectiveness are followed up monthly	Match
Measure results of the S&OP plans	- Results such as financial and customer service are measured in other forums but not followed up in relation to the process - CRLT measures the results of previous plans	Gap

Furthermore, it is presented in the Theoretical Framework that it is important to measure the effectiveness of the plan and the S&OP process as well as measure the results of the plan. As VTC has, as discussed in the Empirical Findings, four KPIs which evaluate the Program process and they are measured monthly, this is a match. However, gaps concerning effectiveness measurements will be identified below as VTC’s measurements are not considered comprehensive. Further, even though VTC measures results such as financial results and customer service outcomes, these are not connected to the Program process or put into relation to the Program plans and this is thus identified as a gap. However, the CRLT measurement is considered to measure the results of previous plans but it is not considered enough comprehensive for this aspect to be considered a match.

5.3.4 S&OP MATURITY GAPS

In this section gaps are identified between VTC’s current S&OP process and the theoretical recommendations within the five S&OP dimensions in Grimson and Pyke’s (2007) S&OP maturity framework. Hence, both gaps between the fifth stage in the framework as well as between the additional theory with each of the five dimensions, as presented in the Theoretical Framework, and VTC’s current process are identified.

Meetings and Collaboration

A comparison of the theoretical recommendations and the empirical findings at VTC for the Meetings and Collaboration dimension is summarized in Table 27.

The sole reason VTC is not considered having achieved Stage 3 in Grimson and Pyke’s (2007) S&OP maturity framework is that the company does not have enough executives attending the Program conference. Thus, the lack of executive S&OP meetings is a gap that VTC needs to close in order to reach higher stages. Not only Grimson and Pyke (2007) emphasize senior executive attendance, it is also stressed by many authors in the Theoretical Framework and is thus a gap for VTC against most theoretical recommendations as illustrated in Table 27. Further, in the Meeting participants grouping, “participants having the authority to make decisions” is one stressing point for VTC. This point may be related to executive S&OP meetings in the framework since Stage 3 involves “conflicts being solved in the meetings”, as earlier presented. Further, concerning that the participants should have authority to make decisions this may to some extent be linked to not having all executives present. However, as presented in the Theoretical Framework, Lapide (2004) states that subordinate director-level managers may take senior management’s role if the latter cannot attend, but

then the subordinates must have full authority to make the decisions. As big decisions quite often are moved from the Program conference, and up to senior management who takes the decisions, it is clear that the participants at the Program conference do not have full authority. Hence, there is a gap here between theory and VTC's current process.

Table 27. Meetings and Collaboration – comparison of theoretical recommendations and empirical findings at VTC.

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
Meeting structure	Routinely S&OP meetings with a given frequency, and structured meeting agendas	- Routinely monthly meetings - Structured pre-meetings with predefined meeting agendas - A predefined agenda is used for the Program conference	Match
	Pre-meetings before the consensus meetings	- Both formal and informal pre-meetings - Each commercial division, production unit, and internal supplier have individual pre-meetings	Match
	Event-driven meetings included in the process and supersede scheduled meetings	- Event-driven meetings regarding S&OP questions occur from time to time but are not formal and do not include the entire S&OP network. Rather they take place on a higher management level than the S&OP network - The event-driven meetings do not supersede scheduled meetings - Most functions try to handle disruptions internally	Gap
	Material presented in a format that is suitable for the senior executive team	- Standardized presentation material which is suitable for the senior executive team at the Program conference - Overall presentation material is clear and simple and is easy to grasp quickly	Match
	Formalized S&OP process	- VTC has a clear S&OP process with formal meetings	Match
Meeting participants	Executive S&OP meetings	- Executive attendance varies at the Program conference - VTC does not have a formal senior management review meeting after the Program conference - Executive meetings concerning S&OP related questions but not formally part of the S&OP process	Gap
	Participants have authority to make decisions	- People attending the Program conference have own authority or mandate through their managers to highlight their functions' opinion and be part of the decision - Big decisions are often moved to other meeting forums	Gap
Collaboration	Collaboration between sales and operations	- The market request used as input and revised to the Program proposal which thereafter is used to develop the supply answers	Match
	Incorporate a broad range of supplier capacity data and involve suppliers in parts of the meetings	- VPT, Volvo 3P, and VLC are part of the Program process meetings - Supplier capacities are considered but not a broad range and there is a varying depth of information	Gap
	Incorporate a broad range of customer data and involve customers in parts of the meetings	- End- customers are not involved in the Program process and dealers are involved to a limited extent	Gap

Further, there are gaps against the framework concerning the incorporation of supplier and customer data and participation. On the supply-side, it is mainly a gap between the current process and incorporating a broad range of supplier data on Volvo 3P's side. On the customer side, no end-customer data is incorporated and very limited dealer data is incorporated in the process and further, no customers participate in the meetings. Thus, there is a gap here between the current process and achieving higher stages in the framework. Moreover, since the event-driven meetings that VTC sometimes has seldom include the entire S&OP network and instead take place at a higher management level and moreover do not supersede the scheduled once, this is also a gap.

Apart from the framework classification, other aspects of Meetings and Collaboration that are discussed in the Theoretical Framework are mapped against VTC in Table 27 which illustrates both additional gaps but also many matches. Concerning the grouping Meeting structure, there is mainly matches between the theoretical recommendations and the empirical findings. The Meeting participants grouping is already covered by above discussions whilst within the Collaboration grouping, the only potential issue not yet covered concerns the collaboration between sales and operations. There is clearly high collaboration between the functions through them concurrently developing the final plans and there is thus a match in this aspect.

Organization

A comparison of the theoretical recommendations and the empirical findings at VTC for the Organization dimension is summarized in Table 28.

VTC is classified as a 3.5 for the Organization dimensions with the comments that the company has not achieved Stage 4 since the S&OP network, as defined in the Empirical Findings, is not a formal team. Hence, when it comes to having a formal S&OP team there is a gap between the higher stages of the framework and VTC's current process. Moreover, another reason for VTC not achieving Stage 4 is the lack of broad executive participation in the team. As executive level participation is highlighted as essential by many authors this is a gap between VTC's current process and both the framework and additional theoretical recommendations. Furthermore, in relation to this aspect, as recommended in the literature, the process and meetings should be lead and owned by senior executives. As the Program process is owned by the Director GML, hence middle management, this is a gap. Concerning achieving the highest stage within the Organization dimension, the last aspect to highlight is that S&OP should be "understood as a tool for optimizing company profit" as presented in Table 10. As discussed above in S&OP maturity classification, it is expressed that the S&OP understanding and respect is quite high in the organization and that most people find it important in order to reach profitability. With this information, it may be stated that there is no gap in this aspect but the opinion is that this information would need to be further validated in order to make any final conclusions concerning the potential match or gap.

Apart from the above gaps, additional matches and gaps in the Organization dimension are illustrated in Table 28. The Formality grouping has already been covered by above discussion and so has some issues in the Ownership and participation grouping. Concerning the latter, additional comments can however be made. Most importantly, it is stressed by Baumann and

Crum (2009) above that the S&OP process should have an independent owner but as VTC's S&OP process is organized under GM, thus a supply function, there is a gap here. Concerning the remaining recommendations in this grouping, there are mainly matches between VTC's current process and the theoretical recommendations. The only other comment is concerning having a cross-functional team, where VTC is lacking some functions in the network, most importantly, product development. However, as most other concerned functions are represented this is not highlighted as a gap. Regarding the S&OP anchored in the organization grouping; most aspects are covered in the discussion above apart from a gap concerning VTC not performing any formal training programs about S&OP.

Table 28. Organization – comparison of theoretical recommendations and empirical findings at VTC.

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
Formality	Formal S&OP function and team	- Formal function with an S&OP manager - No clear formal S&OP team. Instead, the S&OP network is seen as the S&OP team	Gap
	S&OP team members whose job descriptions specify S&OP	- Most people involved in the Program process have it specified in their job descriptions	Match
Ownership and participation	Independent S&OP process owner	- The Program process is organized under GM	Gap
	The S&OP process should be facilitated by an S&OP coordinator	- Full time S&OP Manager who reports to the Director GML. The S&OP Manager works as an S&OP coordinator	Match
	Every step in the S&OP process should have different owners and coordinators	- Every meeting has a chairman who is responsible for the meeting - It is decided who is responsible for each step in the process	Match
	Cross-functional S&OP team	- The network consists of people from: GM, GML, SAM, IM, EM, Volvo 3P, VPT, VLC, EuD, ID, ATO, VTC finance, and VTC Corporate Communication. - Product engineering and design and IT functions are not part of the team	Match
	Executive level participation, sponsorship, and ownership	- The people attending the Program conference are a mix of coordinators, managers, and middle and top management - The Program process has full executive sponsorship - The process owner is the Director GM and the Program conference owner is the Senior Director GM	Gap
S&OP anchored in the organization	S&OP should be understood and respected in the organization	- Considered well understood in the organization but with some diminishing understanding further out in the organization - The S&OP Manager believes that the process is widely recognized as one of the most important processes for VTC	-
	Understanding that the S&OP process leads to a more "profitable outcome for the company"	- Most people can see the connection between the company's profitability and the Program process - Not everyone further out in the organization might agree	-
	Formal training program about S&OP	- No formal training program about S&OP - Informal information sharing	Gap

Measurements

A comparison of the theoretical recommendations and the empirical findings at VTC for the Measurements dimension is summarized in Table 29.

Table 29. Measurements -comparison of theoretical recommendations and empirical findings at VTC.

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
S&OP goal measurements	S&OP partially accountable for the profitability	- Program process itself is not responsible for optimizing VTC's profitability but it is considered that the process strongly affects the company's profitability	Gap
	Measure company profitability and other financial metrics linked to the S&OP process	- Not measured as the Program plans are not translated into monetary terms	Gap
Company performance	Overall measurements: profitability, perfect orders, revenue, and inventory	- Measures Operating leverage - Financial measurements such as revenue, cost, tied-up capital, profit margin, cash flow and return on operating capital	Match
	Major strategic initiatives	- Apart from tracking market shares there is limited connection to, and measurement of, strategic initiatives in the S&OP process	Gap
	Key supply chain performance indicators	- GIB Supply Chain follows important KPIs within the areas of: Customer view, Efficiency, and Secure input - Customer response lead time is one of the four KPIs for the Program process	Match
	Measure results of new product introductions	- Uses specific measurements for new product introductions, for example: delta Q and time to market. - Ongoing project	Match
	Functional measurements	- Each functional unit has its own functional measurements which are measured and followed within the respective functions	Match
S&OP process performance	S&OP effectiveness measurements including feedback and suppliers and customers' evaluation	- Program quality, Customer response lead time, and Truck type quality are three of the four KPIs for the Program process - No formal feedback program - No formal process for customers and suppliers to evaluate the Program process	Gap
	Forecast accuracy for sales over time	- Request quality is one of the four KPIs for the Program process	Match
	Improvements in delivery precision	- Delivery precision is measured in the monthly Logistics report	Match
	Use cross-functional measurements	- VTC is foremost using functional measures	Gap

The rationale for classifying VTC as 3.75 on the scale, and not as 4, for Measurements is that the company is not measuring some of the S&OP effectiveness measures that Grimson and Pyke (2007) recommend. Thus, there is a gap concerning VTC not having a formal feedback program for the Program process and since the company is not asking end-customers, dealers or suppliers to evaluate the process. As presented in the Empirical Findings, VTC is however using many additional measures to try to track the effectiveness of the Program process which cannot directly be matched against any theory. Concerning additional literature in this aspect, i.e. in the S&OP process performance as the grouping is named in Table 29, functional

measurements such as delivery precision and forecast accuracy over time are measured by VTC and here there is thus a match. It is also stressed in the Theoretical Framework that cross-functional measures should be used and as VTC is foremost using functional measures there is a gap in this aspect.

It is stressed by Grimson and Pyke (2007), and presented in the Theoretical Framework, that a company needs to apply measurements to both S&OP process effectiveness and company performance. The latter is a requisite to achieve the earlier stages in the authors' framework. As presented in the matching in Table 29 in the Company performance grouping, VTC matches the theoretical recommendations except for when it comes to measuring major strategic initiatives. Since the company has very limited connection and measurement of strategic initiatives in the Program process this is a gap.

In order to reach Stage 5 in Grimson and Pyke's (2007) framework a company needs to have measurements that measures the company profitability linked to the S&OP process. In the S&OP maturity classification, it is concluded that VTC has no such measures and this is thus a gap. A prerequisite for being able to measure the S&OP plan against financial measures is to be able to express the S&OP plans in terms of revenue and margins, as stressed by Aberdeen Group (2010) and presented in the Theoretical Framework. As VTC does not translate the plan into monetary terms, this is a gap. It is also stressed in Stage 5 that the S&OP process should be partially accountable for the company's profitability and since this is not explicitly stated at VTC, and no such measures are used, there is a gap in this aspect as well.

Information Technology

A comparison of the theoretical recommendations and the empirical findings at VTC for the Information Technology dimension is summarized in Table 30.

The rationale for VTC not having achieved Stage 3 in the framework is the lack of consolidation and centralization of information within the Program process. Since having centralized information is a requisite for achieving Stage 3 this is a gap between VTC's current process and achieving higher stages in the framework. As presented in Table 30, the first gap under the Information sharing grouping, concerns this aspect. Further, achieving higher stages in the framework demands revenue and operations optimization software and an S&OP workbench, as previously discussed. It is concluded above that VTC lacks most of these systems and this may thus be identified as a gap between VTC's current process and reaching higher stages in the framework. To reach Stage 5, a company also needs joint optimization software, as previously presented. VTC lacks these tools and hence this is also a gap as presented in the end of Table 30.

Table 30 also highlights some gaps not yet covered by the above framework paragraph. First, the theory recommends integration of supply, demand, and S&OP workbench systems. Since VTC does not have any workbench system, as mentioned above, this is naturally a gap again. There is also limited integration between the S&OP system CEMAFOR and the supply and demand systems, since this planning mostly is done in Excel, causing a gap. Furthermore, concerning the grouping Functionality and software, there are several gaps as presented in Table 30. The gaps are related to VTC lacking functionalities in its demand and supply-side

systems as well as the low advancement level of using Excel for the purpose of demand and supply collaborator.

Table 30. Information Technology – comparison of theoretical recommendations and empirical findings at VTC

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
Information sharing	Information should be consolidated automatically and centralized	- Use of separate Excel sheets in the Program process leads to low consolidation and centralization of process information - CEMAFOR consolidates market requests but the information is not centralized	Gap
	Integrate supply, demand, and S&OP workbench systems	- OPT and CEMAFOR are only connected one-way - Only Excel has demand-side system, i.e. limited integration with other systems - No workbench system used	Gap
Functionality & software	Use demand-side planning systems which enable statistical forecasting, integral planning, revenue optimization, and demand plan development for different demand shaping strategies	- Excel used for forecasting and demand plan development and there is thus limited tools for advanced forecasting, different demand plans, integral planning, or revenue optimization	Gap
	Use supply-side planning systems which enable supply plan development and includes constrained-based planning, scenario analysis, integral planning, and operations optimization	-Excel is mainly used to create supply plans - No tools for constraint-based planning on S&OP level - No scenario analysis or optimization tools except for Excel on S&OP level - No tools for integral planning	Gap
	Use a demand collaborator and a supply collaborator	- Excel is used as to collect and share information from the markets and the plants	Gap
	Use an S&OP workbench	- Not used	Gap
	Use joint optimization software	- Not used	Gap

S&OP Plan Integration

A comparison of the theoretical recommendations and the empirical findings at VTC for the S&OP Plan Integration dimension is summarized in Table 31.

As discussed above in the S&OP maturity classification, the sole reason for VTC not achieving Stage 3 is the lack of comparison with financial goals and that the plans accordingly are not tempered by the financial goals. This is thus a gap between VTC’s current process and reaching higher stages in the framework. Another aspect of reaching Stage 5 is the profit optimization in the process which VTC is not performing and which thus also is a gap. The issue of profit optimization and finance in relation to the S&OP process is emphasized in the Theoretical Framework where, amongst others, Ventana Research’s (2006) study showed that companies involving finance gain more benefits from S&OP. The Profit optimization and financial analysis grouping in Table 31 moreover illustrates some additional

gaps concerning these aspects. Ones not covered by the above discussion is that the financial budget should be used as an input to the process and since this is not the case for VTC, this is a gap. As further presented in the Theoretical Framework and in Table 31, sales and operations should be jointly accountable for setting prices and since this is done internally at the commercial divisions at VTC today this is moreover a gap. Matches in this grouping include that VTC uses the Program plan in financial projections and that the plans are compared with, and tempered by, business goals, here mainly referring to functional business goals and not to overall business goals such as profitability and growth.

Concerning the grouping Plan creation, VTC develops most of its forecasts bottom-up which is a match. Moreover, as VTC has a quite concurrent process with much collaboration between the commercial divisions and the supply functions there is a match here as well.

Table 31. S&OP Plan Integration– comparison of theoretical recommendations and empirical findings at VTC.

	Theoretical recommendations	Empirical findings at VTC	Match / Gap
Profit optimization and financial analysis	Optimize plans concurrently in order to optimize profitability	- No financial analysis when developing plans and thus no profitability optimization	Gap
	Compare and temper plans with financial goals and budget	- The Program plans are not translated into monetary terms to test its financial impact or compared and tempered by financial goals - The Program plan is used to make financial gap analysis but outside the process	Gap
	Compare and temper plans by business goals	- The market requests and production plans are compared with functional business goals and sometimes tempered	Match
	Use financial budgets as an input when developing the plan. However, it should not constrain the plan	- The financial budget is not used as input to the Program process	Gap
	Make sure future financial projections are well integrated with the new product, demand, and supply plans	- The Program plans are used as an input to develop financial forecasts, estimates, and budget	Match
	Sales and operations should be jointly accountable for setting price levels	- Price levels are not set in the Program process. They are set within each commercial division	Gap
Plan Creation	Develop forecasts bottom-up	- VTC develops market requests mainly bottom-up but some total market forecasts top-down	Match
	Develop sales and operations plans collaboratively and concurrently	- The market requests are being constrained and thus the sales plan changed through the process. - The Program proposal is a first production plan which is updated by the supplying units and final production and sales plans are created	Match

5.4 GAP ANALYSIS

This section analyzes the identified gaps and from the analysis it is determined which gaps that should be closed and in which order these gaps should be closed, i.e. RQ2 is answered. In order to answer RQ2, the analysis uses the S&OP context description in the Empirical Findings as well as the S&OP complexity discussion above in this chapter.

From the Gap identification it is evident that there are several gaps between the theory and VTC's current S&OP process. In the Problem identification, a gap is defined as a misalignment between the theoretical recommendations and the current process and could consist of not working with one aspect but also of over-performing in another aspect. However, the gaps identified have been of the first type, namely that VTC has not been working enough with the stated recommendations.

Many of the above identified gaps are similar to each other as theoretical recommendations presented in one section in some cases are close to recommendations presented in another section. Moreover, some gaps are very close aligned, for example when it comes to certain methods of analysis and the supporting technology tool. In these cases it would make little sense to analyze the gaps separately as they are considered requisites for each other. The rationale for the latter opinion is that both the "method gap" and the "tool gap" must be closed in order to gain any benefit in the area. Therefore, gaps that are alike or closely aligned will be merged and presented as a consolidated gap for the means of further analysis. After consolidation, the gaps identified in the Gap identification are merged into in total 26 gaps, see Appendix 20 for a complete list, and thus, RQ1 is answered. These 26 gaps will be presented and further analyzed in the following section.

5.4.1 IMPACT - EFFORT ANALYSIS OF THE IDENTIFIED GAPS

This section presents the conducted Impact-Effort analysis and analyzes the importance of closing the individual gaps. The 26 consolidated gaps are grouped into five different groups; The S&OP goal, Decision support, Process, Organization, and Supply Chain and the gaps are given id:s from 1 to 26. The graph in Figure 15 presents the Impact-Effort analysis for each gap using the id:s but also highlights the five groups. Following the graph are presentations of the gaps including the rationale for the rating in the analysis. VTC's S&OP context is important in the rating and in order to answer the first part of RQ 2, thus which gaps that should be closed.

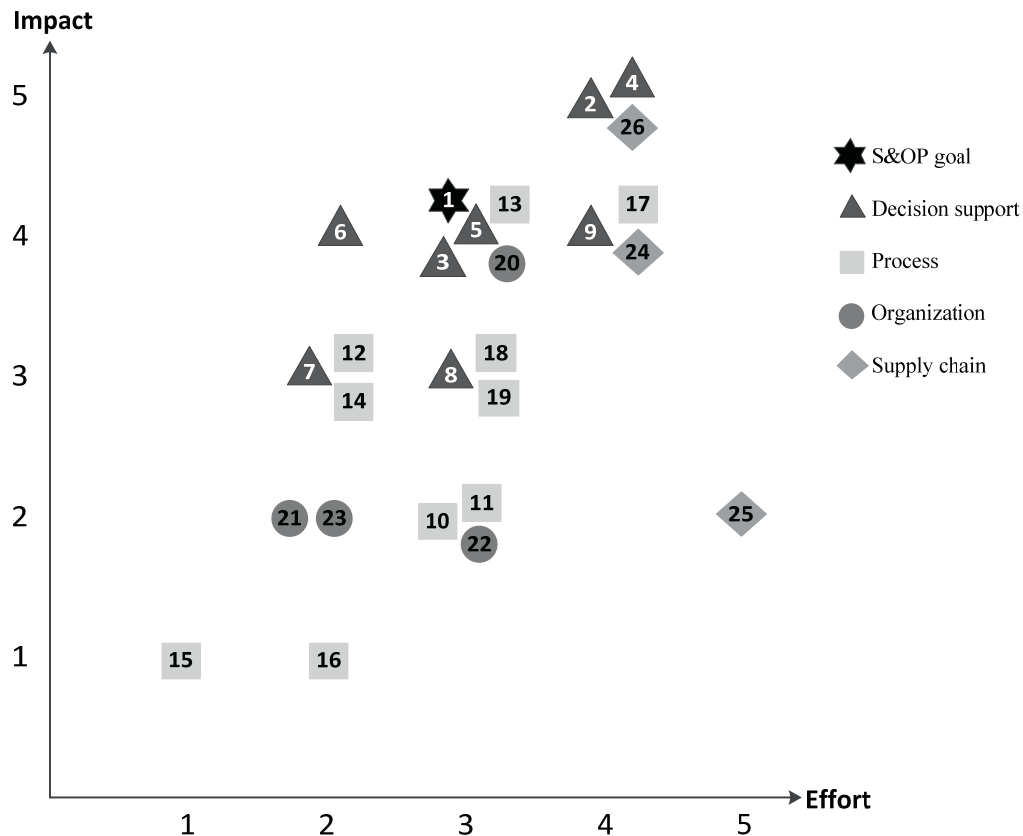


Figure 15. Impact – Effort Analysis of the 26 gaps grouped into the five groups: The S&OP goal, Decision support, Process, Organization, and Supply chain. The id:s refer to the gaps presented below and in Appendix 20.

The S&OP goal

This group consists of one single gap which thus is emphasized as especially important for VTC to consider. However, many of the motivations concerning the gap are considered generalizable to other companies and thus this gap is believed important to at least consider, if not close, for most companies.

1. The Program process has not as a formal goal to, and is nor partially accountable for, integrating plans in a way that reaches overall business and strategic goals

Impact: 4, Effort: 3

The goal of the Program process is considered the “founding gap” for the process since it states VTC’s ambition for the process. As such, it is the base for which of the other gaps that should be closed. Hence, if VTC did not want to close this gap many of the other gaps, e.g. gap 2 concerning optimization of overall business goals, gap 3 concerning finance, and gap 5 concerning scenario analysis may not be as important to close. The rationale being that these gaps are considered important mainly in order to be able to work towards a more strategic goal. Consequently, if VTC wanted to keep its current goal, these mentioned gaps may as a result not be prioritized to close. As expressed in the Empirical Findings, VTC is open for renewing its goal and is open for a goal more in alignment with the theoretical recommendations. As aforementioned, VTC’s implicit goals include focus on the overall business goals and thus, VTC has an ambition and wants a formal goal in alignment with the implicit goal and thus the theory.

Since this gap is considered a foundation for the other gaps, it is considered having high impact, and thus rated as a 4. The rationale for this further being that since the Program process has been stressed as having great effect on VTC's profitability and tied-up capital, updating the goal so that the process is more aligned with, amongst others, the profitability goal should have positive effects on the latter. The opinion is that there is higher likelihood of reaching the overall business goals if processes which affect the goals also have a formal goal of reaching them. Similarly, the process affects strategy and aligning the process to strategic aims will also increase the likelihood of reaching the aims. An example is the discussion in the Empirical Findings where it is stated that the "cheese-slicer" principle sometimes is used to allocate volumes between the commercial divisions. Hence, the allocation is currently not done with the overall business goals or strategies in mind. Another important rationale for the impact rating is based in the discussion in the Theoretical Framework where it is proposed that S&OP complexity affects the S&OP aim and that companies which are experiencing complexity benefits from a more ambitious goal. As presented above, VTC experiences both detail and dynamic complexity in many dimensions. Hence, taking VTC's context into account only highlights the importance of an ambitious goal.

Renewing the goal of the process has been given a 3 in effort as only updating the goal should not demand very much effort whilst some effort however is related to making the process partly accountable for the overall goals. However, working to reach the goal is considered demanding and as expressed above, increasing the ambition for the process means that some of the following goals become important to close as will be discussed below.

Decision support

This group consists of eight gaps and the importance of the group is, in the case of VTC, much related to the need of closing these gaps as a means of working towards the new S&OP goal but also to deal with the complexity experienced. However, there are also gaps in the group which are considered generally important to close and not due to any context factor. The gaps in this group have all been rated as high impact but also quite high effort.

2. No optimization against the overall business goals, targets, and strategies in the Program process and no tools to support such methods

Impact: 5, Effort: 4

This gap is rated as a 5 on the impact scale. The rationale for this rating is that since it has been expressed that the ambition is to update the Program process's goal also optimizing towards the overall business goals and strategies is considered important. Furthermore, since the Program process has great affect on the overall goals and strategies, starting to actually optimizing towards these goals and strategies could improve them and hence have great impact for VTC.

The gap is rated as a 4 in effort. The reason for this is that because of optimization's complexity it is hard to perform manually and it is therefore heavily dependent on available technology. Since VTC is experiencing much complexity from, amongst others, its manufacturing footprint, product variants, and many markets worldwide, it puts high demand on the optimization software and on adding the constraints into the system. Furthermore, additional unique context for VTC is that it being part of AB Volvo means that VTC should

not only optimize its own profitability but help optimizing the profitability for the Volvo Group. This constraint may be difficult to incorporate in the optimization. Also, closing this gap would require incorporating more financial aspects in the process as discussed next.

3. Finance is little involved in the Program process, the budget is not used as input to the Program process, and plans are neither translated to monetary terms nor compared or tempered by financial goals

Impact: 4, Effort: 3

This gap is rated as a 4 on the impact scale. One reason for why it is considered to have such a high impact is that since VTC wants to close gap 1 and incorporate reaching overall goals into the Program process's goals, it is considered essential to be able to compare the Program plan to the financial goals. In addition and in close relation to this, the belief is that including Finance more and translating the Program plan into monetary terms, will enable more effective decision makings as well as optimization. This opinion rests on Ventana Research's (2006) findings, presented in the Theoretical Framework, that 90 percent of companies that report overwhelming gains in revenue include Finance in their S&OP process. Furthermore, the financial appraisal is considered important to help evaluate alternative plans. This gap is thus closely related to gap 2 and 5 concerning optimization and scenario analysis respectively.

The gap is rated as a 3 on the effort scale. The effort is believed to mostly result from the cultural difference related to the role of Finance in the S&OP as expressed by AMR Research (2009). Since Finance is currently little involved in the Program process, its role would need to be much modified thus creating some effort. Concerning the tools needed to translate the Program plan into monetary terms, it is expressed above that Finance currently use the Program plan in its financial forecasts and when creating the budget and thus limited effort is related to the technology aspect of this gap. However, there is also a need for more resources and time in the process in order to add the financial aspects.

4. Limited scenario analysis in the Program process and there is no tool to support such analysis

Impact: 5, Effort: 4

In the Theoretical Framework, analyzing different scenarios is stated as important in many steps of the S&OP process and since VTC currently performs very limited scenario analysis, this is a gap that is given a 5 on the impact scale. The rationale is that including scenario analysis would enable more effective decision making and it is a method which enables working towards overall goals. Further, scenario analysis is put forward as a method for mitigating uncertainty, complexity, and risk within the S&OP process (Schlegel & Murray 2010). Moreover, it is presented that high dynamic complexity motivates an aim of creating and evaluating multiple scenarios. Hence, seeing the detail and dynamic complexity which VTC experience together with the need for increased flexibility, which is discussed in the Corporate background, this gap is believed to be especially important for VTC to close. It is considered that evaluating different scenarios will make VTC more flexible to react to changes since alternatives are considered. Thus, if for example another demand scenario than the one considered the most likely happens, and VTC previously has considered the possibility of such a scenario, the company may faster react to the new reality.

The gap is given a 4 in effort as it demands working with parallel plans in the process and requires some restructuring of the current meeting agendas since scenario analysis means another area up for discussion during the meetings. It also requires that there is time in the process for creating the scenarios and conducting the analysis. Moreover, VTC lacks advanced tools to support such analysis and implementing these tools also takes effort. As presented in the Theoretical Framework, scenario analysis may be performed using both simple tools, such as Excel, and advanced such as APS systems. The effort will consequently much depend on what tool is chosen for supporting the analysis. However, it is proposed in the Theoretical Framework that the need for APS functionalities increases with the S&OP complexity experienced. Therefore, since VTC experiences high S&OP complexity, the effort suggested is related to using advanced software, and hence it is rated as a 4.

5. Limited discussion of consequences, risks, and opportunities in relation to the Program plans

Impact: 4, Effort: 3

This gap is given a 4 in impact. Increasing the discussion concerning these issues is considered highly important as the discussion should make VTC more prepared for future events and the expected outcomes of the final plan. Positive impact is also believed to result from a shared view of what the company is saying “yes” and “no” to, e.g. the risks that are accepted when deciding on a plan.

The effort has been rated as a 3 since closing the gap is believed to demand more analytical pre-work such as preparing numbers on consequences and risks for the plan or several scenarios. Depending on how advanced this pre-work is, the effort may however be lower or higher. Scenario analysis with the help of advanced software has for example been discussed above as demanding high effort.

6. The results of the Program plan is not followed up in relation to the Program process

Impact: 4, Effort: 2

This gap is given a 4 in impact since closing it means that VTC will see the effects of the last confirmed Program plan, as discussed in the Theoretical Framework, which is believed to help the company evaluate its decisions and learn from its mistakes and successes. It is also considered to help aligning the process with the overall goals and may be necessary to close in order to start working towards a new Program process goal.

The effort has been given a 2 since most of the results, such as revenue, costs, profitability, inventory, and so on is measured in other forums. Thus, to close the gap, these measures just need to be followed up in relation to the Program process.

7. Limited cross-functional measurements used to evaluate S&OP efficiency

Impact: 3, Effort: 2

This gap is given a 3 in impact since it is considered important in order to align the Program process with the overall goals of the company (gap 1). Using cross-functional measurements creates shared responsibility and is believed to result in increased collaboration and, according to the literature, in less sub-optimization.

The effort is considered rather low and given a 2 on the scale since many functional

measurements exist and these just needs to be related to each other and used to measure S&OP efficiency in order to close the gap.

8. Low consolidation and centralization of S&OP information in an automated way

Impact: 3, Effort: 3

Since the theory stresses the importance of that information about both demand and supply should be consolidated automatically and centralized, this gap is given a 3 in impact. Closing the gap should facilitate information sharing and knowledge about the status in different parts of the process. Moreover, it means less manual work.

It is given a 3 in effort as it requires somewhere where the information can be centralized since the information in CEMAFOR may be consolidated but is not centralized in the aspect that many people have access to it. Moreover, it may be hard to consolidate the current Excel sheets from supply and demand in an automated way. This gap is however highly connected to the following gap and the issues will be discussed more below.

9. No S&OP workbench and low integration of supply, demand, and S&OP workbench systems

Impact: 4, Effort: 4

This gap is given a 4 in impact. The rationale being that since an S&OP workbench allows for visualization and centralization of information, it supports decision-making and the discussion between the functions, as discussed in the Theoretical Framework.

The effort is given a 4 but this is highly dependent on what kind of S&OP workbench, as well as supply and demand-side planning system, which are considered necessary. If considering advanced software, as discussed in the Theoretical Framework, the effort to implement the systems, and hence close the gap that way, would be high, hence a 4. Since VTC currently mainly uses Excel for Demand and Supply-side planning on the S&OP level, an Excel-based S&OP workbench would be an option and not demanding a 4 in effort. However, it may be argued that advanced software may yield more benefits because of VTC's complexity. Hence, VTC has a decision to make here which may require further evaluations.

Process

This group mainly consists of gaps which are generally important for VTC, as well as other companies, to close as many of them are prerequisites for reaching higher maturity stages. However, four out of the ten gaps in the group are not considered important for VTC to close and the rationale for this being internal context related as described below.

10. Prices are not set in the Program process

Impact: 2, Effort: 3

This gap is given a 2 in impact. The rationale is that since discounts are a large part of the pricing decision and these are currently decided upon on a regional and market level within the commercial divisions, it is not considered to yield much impact to set these discounts in the Program conference. However, some impact may result from aligning the process with the pricing strategies.

However, seeing high internal detail complexity with somewhat different prices for different markets, it would mean much extra work for the supply-side to get knowledgeable in the area

and that is why the gap is given a 3 in effort. Since the effort is higher than the impact this is not assessed as a gap which VTC should close.

11. The planning horizon is shorter than the lead time for technical capacity changes

Impact: 2, Effort: 3

This gap is given a 2 in impact with the explanation that decisions concerning capacity changes with longer lead time than the Program process's planning horizon are taken in other forums, more exactly in the Volume and Capacity Planning, as described in the Empirical Findings. Thus, the impact of changing forum is not considered very big, hence a 2.

The gap has been given a 3 in efforts since the Program process is more detailed and has higher planning frequency than the Volume and Capacity Planning. As a consequence, additional work would have to be performed, such as more pre-work in the commercial divisions which would have to make longer forecasts. The latter has already been expressed as a difficulty with the current planning horizon. Since the capacity decisions with longer lead time often affect several BAs in the group, it is considered reasonable to keep these decisions within the Volume and Capacity Planning. Moreover, since the Volume and Capacity Planning process recently was redesigned and is considered to work well, there is no company wish to move decisions between the processes. As a result of this, as well as the higher effort than impact given to the gap, this is not assessed to be a gap which VTC should close.

12. Time fences for allowed changes are not used

Impact: 3, Effort: 2

This gap has been given a 3 in impact. The rationale for this is that, according to the Theoretical Framework, time fences help companies focusing on the long-term which currently is an issue for VTC. This may also help in VTC's decision-making as it helps focusing the discussions and decision-making on the right time frame where changes practically can be made and thus where decisions need to be made.

Concerning effort, this gap is given a 2 on the scale. Since the current flexibility targets may be used as time fences, no effort is related to investigating what fences VTC should use. However, in order to start working with time fences, the belief is that VTC needs to put effort on tracking them and making people accountable for following the fences. Moreover, the fences need to be incorporated into, amongst others, the order management.

13. Limited use of quantitative forecasting methods and there is no tool to support such methods

Impact: 4, Effort: 3

This gap is given a 4 in effort with the argument that the forecasts are such an important input into the process. Moreover, since many of the sources of uncertainty which VTC experiences come from the downstream context and the unpredictability of demand thus is high, good forecasting possibilities and amongst others the possibility of making demand-side scenario analysis feasible is especially important for VTC. Moreover, having standard methods and systems for the forecasting process is considered particularly important for VTC seeing the vast amount of markets making individual forecasts with varying quality. Thus, standard tools and methods may help with the understanding of the numbers as well as it may help following

up the forecast quality, which today only is measured by Market request quality.

The effort is rated as a 3 and it is mostly related to the current lack of any forecasting, or rather, demand-side planning system, apart from Excel and hence a new system may be necessary in order to close the gap.

14. No clear separation of unconstrained forecast and demand plan and market request not in accordance with theoretical demand plan definition

Impact: 3, Effort: 2

This gap is given a 3 in impact which mostly relates to the issue of separating the forecast from the demand plan. This is considered important as it highlights what is demanded from the customers, hence the forecast, as well as what VTC wishes to sell, i.e. what demand shaping activities that could be used to modify demand and create the demand plan. Separating this information is considered important for information sharing and getting a shared view on the company's end-customer demand as well as possible demand shaping strategies. Having this information separated is moreover considered important for, amongst other, scenario analysis at the demand-side where different demand plan scenarios then could be created with the forecast as a base. The fact that the market request is not in accordance with the theoretical demand plan definition, i.e. inventory is deducted is understandable since VTC has structured it that way in order to be able to compare different geographical areas to which the lead times differ. Hence, it justifies expressing the market requests in what the commercial divisions want produced in a particular month. Hence, no impact is believed to result from changing this and that part of the gap is thus not considered important to close.

The effort for closing the gap is considered small and is rated as a 2 since the effort mainly results from some extra work keeping the forecast and plan separated. However, in order to do it in a way that is easy to visualize, another system than Excel may be necessary which is not added to the effort here.

15. Limited event-driven S&OP meetings which supersedes scheduled meetings and include the whole S&OP team

Impact: 1, Effort: 1

This gap is given a 1 in both impact and effort. The background to this is that this gap mainly exists because the current event-driven meetings take place on a higher management level than the S&OP network. Simply closing the gap by having the event-driven meetings with the S&OP network, i.e. on a lower management level is not considered to yield any benefits but rather the opposite.

However, it is neither considered to take much effort to close the gap if the closure means that the new meetings with the S&OP network replace the top management event-driven meetings. The issue instead relates to the limited top management involvement in the process, as earlier identified as a gap and discussed in gap 18 below. Thus, if gap 18 was to be closed, this gap would be closed as an effect. This is therefore not assessed as a gap which VTC should close but the company should instead focus on increasing the executive participation.

16. Product management review meeting not part of the Program process

Impact: 1, Effort: 2

This gap is given a 1 in impact since all the product management work is done in other forums and thus no big impact is believed to result from simply adding a new meeting in the Program process. Moreover, since VTC has a limited number of new product introductions, this speaks for handling the introductions when they take place rather than adding a meeting in the process. However, since new product introductions are a main source of uncertainty for VTC, it is important to continuing to feed the process with information concerning the new product projects.

The effort is rated as a 2 since closing the gap requires adding another meeting in the process which may have to take time from other reviews. Hence, with VTC's context in mind and the resulting impact and effort, it is not assessed as a gap which VTC should close.

17. No consolidated demand or supply review meetings

Impact: 4, Effort: 4

This gap is rated as a 4 in both impact and effort. The rationale for the impact rating is that having consolidated demand and supply meetings respectively is believed to result in a more efficient Program conference. The conference may moreover focus more on strategic issues and discussions instead of detailed issues concerning individual markets or supply answers. Furthermore, this is believed to be an enabler for convincing more executives to attend the conference as well as to enable scenario analysis as further explained below.

The rationale for the effort rating is that there are two separate commercial divisions at VTC as well as ATO, which is not even part of VTC, which may obstruct having a common demand meeting. Moreover, effort results from finding time in the process for the meetings and since EM and VPT have their pre-meetings the day before the conference, the Program conference may have to be moved one day in order to leave room for a consolidated supply review meeting.

18. No final Program plan is set during the Program conference

Impact: 3, Effort: 3

This gap is rated as a 3 in both impact and effort. The rationale for the impact rating is that setting a final plan is considered important in order to get a shared view and reach a final consensus around the concluding numbers. Moreover, this gap has been put forward as an issue in the Empirical Findings which currently creates some tension within the S&OP network and loosing this tension is believed to have positive impact at well.

The motivation for the effort rating is that more pre-work possibly is necessary since many details currently are presented at the Program conference. Furthermore, including these details into the plan is difficult to do during the time of the conference. For the same reason as above, the Program conference thus may have to be moved one day in order to allow for the Program proposal to be modified with the small changes before the start of the Program conference.

19. S&OP efficiency measures do not include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, efficiency of review meetings, and suppliers and customers are not asked to evaluate the Program process

Impact: 3, Effort: 3

This gap is rated as a 3 in impact. First, the measurements concerning meeting preparedness, meeting attendance, action plan follow-up, and efficiency of review meetings are considered valuable in order to build the process and make sure that the people involved respect the process and attend the meetings. Furthermore, feedback programs and evaluation by suppliers and customers are considered valuable for continuous improvement efforts.

The gap is rated as a 3 in effort since closing the gap requires surveys sent out to suppliers and customers and later analyzed. Because of VTC's high downstream detail complexity it makes more sense to ask the dealers to evaluate the Program process rather than the end-customers. Further, collection of feedback from peers for the feedback programs and feedback sessions create effort. Moreover, several new measurements, as listed in the gap, need to be added to the S&OP efficiency measurements and all together this is considered a considerable effort.

Organization

This group is closely related to Grimson and Pyke's (2007) Organization dimension and, as is explained below, the reason for the importance of these gaps is not context related for VTC. Hence, it is considered important for most companies to consider closing gaps in this group.

20. Limited executive participation (team and meeting) and participants at the Program conference do not have the full authority to make decisions

Impact: 4, Effort: 3

Since the Program conference decides upon plans affecting the overall goals of the company and moreover what risks that are allowed for, it is considered that it should be discussed at executive level and is given a 4 in impact. A rationale also being that it is considered very important in the literature and in VTC's case that it would allow more strategic decisions to be taken in the formal process. In the Theoretical Framework it is moreover stressed that the need for executive sponsorship grows stronger the larger and more complex the company is and thus the impact of closing the gap should be especially high for VTC.

The effort of closing the gap has been given a 3 whilst the actual closing of the gap could be performed in several ways. Either it relates to convincing more executives to attend the Program conference which might require more pre-work and changes in the agenda in order to make the conference more aimed at senior executives. Another alternative, as discussed by Jonsson and Mattsson (2009) and Schorr (2007e), is to add a senior management review in the Program process, schedule it after the Program conference and leave the actual decision-making to this meeting.

21. No formal S&OP team

Impact: 2, Effort: 2

In order to be a mature S&OP user, a company needs, according to the literature, a formal S&OP team with executive participation. However, executive participation is covered by the

above gap and thus the remaining gap here is the aspect of a formal team. This gap is rated as a 2 in impact as it is considered to help achieve a culture of cross-functional and shared responsibility which is especially important if the process is to be party accountable for the overall goals, as stressed in gap 1.

The effort rating is a 2. Even though most Program conference participants have S&OP in their work descriptions, effort has to be put in order to align these people to a team. Moreover, since the commercial divisions currently are seen as customers to the process their role would have to be modified in order for them to join the S&OP team.

22. The Program process is not organized under an independent function

Impact: 2, Effort: 3

Closing this gap means less risk of sub-optimization since an independent function generally is less likely to optimize with functional goals and incentives in mind. However, as GM's ownership has not been expressed as an issue by any function the conclusion is that no function feels less prioritized currently and thus the impact of a change should be small. Therefore the gap is given a 2 in impact.

The gap is rated as a 3 on the effort scale since it means moving the responsibility of the process as well as requiring knowledge transfer between functions. Because of this impact-effort rating and the lack of dissatisfaction with the current ownership, it is not assessed as a gap which VTC should close.

23. No formal training program about S&OP

Impact: 2, Effort: 2

This gap is rated as a 2 in both impact and effort. The rationale for the impact rating is that the understanding for the process is considered important in order to build respect for the process and the decisions taken at the Program conference. It was stressed during the interviews that the understanding for the process is quite high but changing the goals of the Program process may require additional understanding from the employees and thus the impact of a training program is rated as 2.

Furthermore, the rationale for rating the effort as a 2 is that some pre-work would have to be made before starting the training program in order to investigate the current understanding and where to put the resources. Naturally, the actual training sessions also requires some effort.

Supply chain

This group mainly concerns issues included in Grimson and Pyke's (2007) Meetings and Collaboration dimension and the importance of this group for VTC is much dependent on the downstream and upstream complexity which VTC, as well as many other companies, experience.

24. Not all aspects of supply considered in the Program process

Impact: 4, Effort: 4

This gap is given a 4 in impact since, as expressed in the Theoretical Framework, considering all aspects of supply is necessary in order to manage trade-offs between maximizing customer service, minimizing inventory, and minimizing operating costs. Thus, the impact of

incorporating body builder capacity in the process results from less risk of sub-optimization and decisions being made with all consequences for VTC, as well as the end-customer, considered. Moreover, since VTC experiences high upstream detail complexity, aiming to expand outside the intra-organizational boundaries is recommended in the Theoretical Framework and this is hence in line with closing this gap.

The effort is also considered high, hence given a 4 on the scale, seeing that there are such a vast amount of body builders that would have to be incorporated in the process. Furthermore, the definition of the Program process would have to be expanded as it currently only incorporates up to GM's CDD.

25. Customers are little involved in the Program process, limited customer data is incorporated, and no demand collaborator is used

Impact: 2, Effort: 5

This gap is rated as a 2 in impact. In the literature, the incorporation of customer data as well as the involvement of customers in parts of the meetings is important parts of being a mature and proactive S&OP user. However, because of VTC's high downstream detail complexity resulting in that the company is not as dependent on single customers, incorporating them into the process is not expected to yield many benefits. Dealers may however be involved to a larger extent than today in the forecasting process and this is believed to yield some impact.

The effort has been rated as a 5 because of VTC's many customers and dealers as well as the effort of implementing a demand collaborator linked to all these customers or dealers. With the impact-effort rating resulting from VTC's S&OP context in mind, this is not assessed as a gap which VTC should close.

26. A broad range of supplier data is not incorporated in the Program process and there is no supply collaborator

Impact: 5, Effort: 4

This gap is given a 5 in impact since it is considered to help avoid sub-optimization within the company by instead having a broader supply chain view in the process. Moreover, it helps Volvo 3P to validate the suppliers and answer to the Program proposal. As presented in the Empirical Findings, VTC outsources most of the manufacturing and it represents a high share of the truck value. Hence, VTC is very dependent on the suppliers and is experiencing high upstream detail complexity and thus incorporating their data should help in the decision making as higher certainty should exist concerning the supply base risk and capacity. In the same sense as for gap 24, this is also in line with the Theoretical Framework where high upstream detail complexity speaks for integrating suppliers in the process. This gap is moreover a requisite for creating supply scenarios as well as being able to conclude on supply consequences in the Program process which is important since VTC also experiences some upstream dynamic complexity.

The effort is considered high and given a 4 since incorporating more supplier data is considered requiring a supply collaborator at Volvo 3P, a project that failed the last time it was tried. Furthermore, the suppliers would have to get linked to the supply collaborator and this also creates effort, if perhaps not directly to VTC. Knowing VTC's large supplier base,

i.e. the high upstream detail complexity, this may be difficult. However, it should be emphasized that not all suppliers need to be incorporated in the process, but a broad range, as emphasized above, meaning mainly important and critical suppliers. Last, it has been emphasized that Volvo 3P needs the volumes broken down to item numbers in order to validate the supplier capacity and this adds complexity to the supply collaborator.

5.4.2 SIX GAPS SHOULD NOT BE CLOSED

In the above analysis it is concluded that six of the 26 gaps should not be closed and hence these changes should not be carried out at VTC:

- ✓ Set prices in the Program process (gap 10)
- ✓ Prolong the planning horizon so that it equals the lead time for technical capacity changes (gap 11)
- ✓ Increase the number of event-driven S&OP meetings (gap 15)
- ✓ Include a product management review in the Program process (gap 16)
- ✓ Organize the Program process under an independent function (gap 22)
- ✓ Incorporate customer data and customers in the Program process (gap 25)

The joint rationale for not recommending these changes is due to VTC's context. The rationale behind the customer incorporation and the product management review may be transferred to companies sharing VTC's context in terms of high downstream detail complexity (where the Pareto principle does not apply) and few product introductions. However, the remaining gaps are not considered justified for VTC to close because of unique VTC context as motivated above. Consequently, this leaves 22 gaps which are believed to yield high impact for VTC if they were closed. In which order these gaps should be closed will be analyzed further below.

5.4.3 FOUR ROUNDS OF IMPROVEMENTS FOR CLOSING THE GAPS

It is stressed in the Theoretical Framework that technology and business process changes should be implemented concurrently (Singh 2009) and furthermore, Baumann and Crum (2009) state that people, processes, and tools should be implemented together in order to reach a successful S&OP implementation. If referring to Grimson & Pyke's (2007) framework, this hence means that it is not eligible to improve only in one dimension but that the process should be lifted on an even front. It is considered that these opinions may be generalized to apply to S&OP improvement projects as well. However, the opinion is also that a difference between an implementation project and an improvement project is that in the latter, it may be eligible to improve in one dimension only if that one is falling behind the others. An output from the Gap analysis is also that the closing of some gaps may be considered prerequisites for succeeding to close others. Furthermore, in some cases there are other context related issues which obstructs the closing of some gaps immediately and this is important to consider when designing the improvement project. Furthermore, as discussed in the Problem identification, it is important to implement S&OP in stages (Grimson & Pyke 2007). This is also considered generalizable to improvement projects and thus the authors of this thesis believe that it is important to suggest steps in which the gaps should be closed.

The outcome of this discussion is that four improvement rounds are recommended below. In Figure 14, the steps needed in order to reach higher stages in Grimson and Pyke's (2007)

framework is presented. These steps are incorporated in the remaining 20 gaps and thus the closing of the gaps could be performed in relation to Grimson and Pyke's (2007) recommendation. However, VTC's S&OP context has been an important part of this thesis and it continues to be so. Therefore, some gaps are considered important to close directly for VTC because of its context whilst some other gaps have been given lower priority or considered justified putting in a later improvement round as will be explained below.

Round 1 – Consider important prerequisites

Table 32 presents the gaps which VTC is recommended to include in the first round of improvements. What characterizes these gaps are that they have been considered important prerequisites in order to be able to close other gaps, set the stage, and ensure high quality inputs to the process. Thus, there is no specific VTC context argument for placing these gaps in the first round but rather it is considered important for all companies to ensure closure of these types of gaps before taking on other gaps in its improvement project. Gaps included in this round are from the Process Goal, Process, and Organization groups and hence include both people and process in alignment with Baumann and Crum's (2009) recommendations.

Table 32. Gaps included in the first round of improvements.

Gap id	Gap description	Impact	Effort
1	The Program process has not as a formal goal to, and is nor partially accountable for, integrating plans in a way that reaches overall business and strategic goals	4	3
13	Limited use of quantitative forecasting methods and there is no tool to support such methods	4	3
14	No clear separation of unconstrained forecast and demand plan	3	2
23	No formal training program about S&OP	2	2

The gap that is considered important to close first is gap 1 concerning the goal of the process. It is aforementioned that the goal of the process is the “founding gap” and moreover that VTC is interested in renewing the goal for its S&OP process. Hence, it is regarded as an important first step to close this gap as it will lead the way for how other gaps should be closed. It is also important since the new aim, according to the Theoretical Framework, should include ensuring that the plans and performances of all business functions are aligned to support the overall business goals. Furthermore, it is presented above that S&OP complexity influence the S&OP aim. It is stated in the Theoretical Framework that detail complexity motivates a goal of expanding outside the intra-organizational boundaries and dynamic complexity motivates a goal of identifying and analyzing possible scenarios. Thus, since VTC experiences detail and dynamic complexity in all three S&OP complexity dimensions, a new formal goal for the Program process is suggested to be something in line with:

The Program process aims at balancing demand with all types of supply chain capabilities⁹ in order to decide upon one final consensus program plan that optimizes VTC's overall business goals and strategies in order to drive capacity management and provide directions for operations and commercials.

⁹ Supply chain capabilities refer to internal and external capacities in production, logistics, and finance.

This new S&OP goal for VTC differs from the previous goal by explicitly stating overall business goals as an important consideration and aim to reach for the Program process. Previously, the external focus was limited to “book production capacity for purchased material” which now is expanded into the broader aim of considering all types of supply chain capabilities.

In the Process group, gap 13 concerning quantitative forecasting methods and gap 14 concerning separation of forecast and demand plan are included in the first improvement round. The rationale is that the high quality in the forecasting is considered an important input into the process and a requisite for reliable plans and well-grounded decision making. As mentioned in the gap description above, closing gap 14 is considered important since separating forecast from demand plan where demand shaping should have been considered is such a fundamental issue in the literature. Further, it is important in order to amongst others work with scenario analysis where different scenarios may be done on forecast and demand plan respectively.

What is moreover considered important in the first improvement round is to close gap 23 and thus start with conducting S&OP training programs. This is regarded as important to do initially in order to create a foundation for the new S&OP goal as well as to build understanding for the improvement project.

Round 2 – Increase maturity and consider important context gaps

In the Theoretical Framework, it is presented that Ivert and Jonsson (2010b) propose that the S&OP maturity influences the S&OP aim. It is thus considered important to increase VTC’s S&OP maturity in order to successfully be able to work towards the new S&OP goal and therefore the second round of improvement has been designed so that it will result in VTC taking a big step in the maturity framework towards being entirely classified in stage 3. The second improvement round thus means improving in a wide perspective as it would result in technology and business process changes being implemented concurrently in accordance with Singh (2009).

Table 33 presents the gaps which VTC is recommended to include in the second round of improvements. When it comes to gaps included in order to increase VTC’s maturity (mainly gap 3, 8, and 9) there is hence no context related reason for placing them in this improvement round. Rather, in the same reason as above, they are considered important for most companies to close fast if they want to work towards a more ambitious S&OP goal. However, except for the above arguments the focus in the second round has also been to deal with VTC’s S&OP complexity and therefore the focus in this round is within the Decision support group. VTC has expressed a need for better understanding the future and becoming more flexible. Furthermore, S&OP complexity affects the S&OP aim, as discussed in the Theoretical Framework, and as considered in the suggestion for VTC’s new S&OP goal. Hence, there is a context rationale for placing some gaps, i.e. gap 4 and 5, in the second round of improvements for VTC. Thus, these gaps may not be as important for other companies to close in initial rounds.

Table 33. Gaps included in the second round of improvements.

Gap id	Gap description	Impact	Effort
3	Finance is little involved in the Program process, the budget is not used as input to the Program process, and plans are neither translated to monetary terms nor compared or tempered by financial goals	4	3
4	Limited scenario analysis in the Program process and there is no tool to support such analysis	5	4
5	Limited discussion of consequences, risks, and opportunities in relation to the Program plans	4	3
8	Low consolidation and centralization of S&OP information in an automated way	3	3
9	No S&OP workbench and low integration of supply, demand, and S&OP workbench systems	4	4

Concerning reaching higher S&OP maturity, gap 3 concerning financial involvement in the Program process is an important gap in the second round of improvements. The rationale for this is that the financial aspect is a major gap for VTC in the S&OP Plan Integration dimension as illustrated in Figure 14 and closing this gap would mean reaching Stage 3 (and Stage 4) in this dimension. Moreover, increased financial involvement for example by translating the plans to monetary terms is considered necessary in order to align the plans with the overall goals and thus reach the new S&OP goal. Further, in order to not fall behind in some S&OP dimension, gap 8 and 9 concerning technology are included in the second round. These gaps are moreover necessary to close in order to reach stage 3 and 4 respectively in Grimson and Pyke's (2007) framework as illustrated in Figure 14. As expressed by Singh (2009) above it is often necessary to use technology in order to achieve all the benefits from S&OP and this is believed true in this case and gap 8 and 9 were given high impacts in the Impact-Effort evaluation above.

Looking at Figure 14, one gap necessary to close in order to reach Stage 3 has been left out of the first improvement round, namely Executive S&OP meetings, represented by gap 20 above. This gap would generally be recommended to close early but the rationale for leaving it to later improvement rounds here is that VTC currently does not feel that it is possible to convince more executives to attend the Program conference. Thus, the aim in this case will be to try to change the process first and thereafter try to get the executives more interested in it. Nevertheless, the output of the second round will be that VTC's S&OP maturity is increased since it means improvements two of three dimensions that were falling behind for VTC, i.e. Technology and S&OP Plan Integration.

Further, as argued for above, early improvement within the Decision support group is considered especially important for VTC. Making conscious choices on the best scenarios is expressed as an aim for S&OP by AMR Research (2009). Furthermore, Schoemaker (1995) expressed that being able to see a wide range of possible future scenarios make managers better positioned do deal with uncertainties and take advantage of them. Because of VTC's S&OP context, characterized by amongst other high dynamic complexity, gap 4 concerning scenario analysis is also rated as a 5 in impact and thus very valuable for VTC to close. Hence, to close this gap is considered part of the second improvement round. As a result of closing gap 4, gap 5 is believed to be naturally closed since scenario analysis results in

discussing and choosing between different possibilities based on, amongst others, consequences, risks and opportunities.

Round 3 – Increase the maturity further

Since it is recommended that S&OP improvements should be implemented in stages, the third round of improvements takes on where the second ended. Similarly to the previous round, it is here recommended to make improvements in several areas in order to increase VTC’s S&OP maturity and improve the process. Thus what unities the gaps in this round is that closing them would yield higher S&OP maturity for VTC and there is thus no context related issue for placing most of them in this round. Apart from executive S&OP meetings, VTC would reach Stage 3 by closing the gaps in round 1. Thus, looking at Grimson and Pyke’s (2007) framework in Figure 14, the next natural steps is to work on the areas needed to reach Stage 4. Table 34 presents the gaps which VTC is recommended to include in the third round of improvements. The round includes closing gaps within the groups of Decision support, Process, and Supply chain.

Table 34. Gaps included in the third round of improvements.

Gap id	Gap description	Impact	Effort
2	No optimization against the overall business goals, targets and strategies in the Program process and no tools to support such methods	5	4
6	The results of the Program plan is not followed up in relation to the Program process	4	2
7	Limited cross-functional measurements used to evaluate S&OP efficiency	3	2
12	Time fences for allowed changes are not used	3	2
17	No consolidated demand or supply review meetings	4	4
19	S&OP efficiency measures do not include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, efficiency of review meetings, and suppliers and customers are not asked to evaluate the Program process	3	3
26	A broad range of supplier data is not incorporated in the Program process and there is no supply collaborator	5	4

To begin with, Gap 2 concerning optimization is part of the third round and considered in the Technology dimension in order to reach Stage 4 and 5 in Grimson and Pyke’s (2007) framework. Apart from looking at the framework, the rationale for not putting optimization in the second round is because of its complexity and its dependability on advanced tools. Thus, the opinion of the thesis authors is that the new goal for the Program process should first be anchored in the organization as well as for example the closing of gap 3 concerning finance needs to be finished before starting working on the optimization gap. This is moreover in line with what is presented in the Theoretical background where it is argued that APS optimization functionalities are useful when S&OP aim and maturity is high. Thus, it is important for VTC to both update its goal and close the gaps in the first and second round in order to increase its maturity before moving on to optimization.

Other gaps related to reaching Stage 4 in Grimson and Pyke’s (2007) framework are gap 26 concerning incorporating a broad range of supply data and gap 19 concerning S&OP efficiency measures and these have thus been included in the third round of improvements.

Gap 26 is rated as high impact and high effort as illustrated in Table 34. As the effort is rated so high it is believed to be hard to incorporate this gap in the second round since other, more prioritized gaps, require much effort in that round. However, in order to succeed with for example optimization, and not sub-optimizing within the company, gap 26 is considered important to close in the second round. Gap 19 is discussed as important in order to build the respect for the process and for continuous improvements and it is thus considered important to not delaying closing of this gap to the third round.

Furthermore, gap 6 and 7 are included in the second round of improvements. These gaps are related to “add profitability measures tied to the S&OP process” as included in order to reach Stage 5 in the Measurement dimension in Grimson and Pyke’s (2007) framework. These gaps are however considered especially important and thus included here. The rationale not being any VTC’s specific context but that, for example, following up the result of the process is given high impact in relation to its effort and is believed to be important to close in order to see how the process succeeds with reaching its new goal. The same rationale goes for including gap 7 in the second improvement round.

Gap 12 concerning time fences for allowed changes is moreover included in the third round of improvements. Seeing the Impact- Effort evaluation of the gap it is not considered justified to include it in the previous improvement rounds, also because it is not a prerequisite for closing any other gaps. However, nothing has been identified that constraints or requires delaying closing this gap and thus it is included in the third round.

Finally, gap 17 concerning consolidated demand and supply review meetings are included in the third round. The rationale for this is that closing this gap is discussed as an enabler for convincing more executives to attend the conference as well as it should help setting a plan at the Program conference since details then instead can be handled at these pre-meetings. Thus, closing this gap is considered somewhat of a prerequisite for being able to close gap 18 and 20 and therefore it is included in the third round.

Looking at Grimson and Pyke’s (2007) framework and Figure 14, the only gaps not closed in order to reach Stage 4 is in the Meeting and Collaborations concerning “Executive S&OP meetings” and in the Organization dimension concerning “executive participation” and “formal S&OP team”, represented by gap 20 and 21. These have been left to the fourth improvement round because of reasons explained below.

Round 4 – Consider areas where context issues create limitations

Table 35 presents the gaps which VTC is recommended to include in the fourth round of improvements and thus are the last ones to be closed. What characterizes these gaps is that there are context specific issues for VTC which makes it difficult to close the gaps in previous rounds. The context issues considered here mainly being the internal context which causes requisites for closing the gaps. Thus, there is no generalization to be made to other companies why these gaps should be placed in the last round but rather it is up to individual companies to investigate its context and discover its own requisites and limitations.

Table 35. Gaps included in the fourth round of improvements.

Gap id	Gap description	Impact	Effort
18	No final Program plan is set during the Program conference	3	3
20	Limited executive participation (team and meeting) and participants at the Program conference do not have the full authority to make decisions	4	3
21	No formal S&OP team	2	2
24	Not all aspects of supply considered in the Program process	4	4

As aforementioned, gap 20 concerning executive S&OP meetings and executive involvement is left to the fourth round of improvement since VTC does currently not think that it is possible to close this gap and hence the changes in the previous rounds are considered prerequisites in order to get more executive attention for the Program process. Likewise, gap 21 concerning formal S&OP team is considered suitable to leave for the fourth improvement round. The rationale is that the formal team should include executives and thus there is no possibility to close this gap before gap 20 is closed.

Gap 18 concerning no final Program plan being set during the Program conference is included in the fourth round of improvements. The motivation for this is that the opinion is that closing this gap requires more pre-work being done in the process so that fewer details are discussed at the conference. Thus, gaps such as gap 17 as well as gap 9, thus having an S&OP workbench in which changes to the plan may be added during the conference, are considered as potential prerequisites to closing this gap.

The last gap to be discussed is gap 24. This gap is given a 4 in impact, but also high effort because of the perceived difficulty of incorporating body builder capacity in the process. However, since there is an ongoing project looking into the CAs there may be increased possibility to consider their capacity in the future. Hence, this gap should not be closed before the finishing of that project and is therefore included in the fourth round of improvements.

After these improvement rounds, VTC may be classified as having reached Stage 5, i.e. being a Proactive S&OP user, in all dimensions but Meetings and Collaboration. The rationale for the latter is that it is not recommended for VTC to close gap 25, to involve customers in the S&OP process, because of the company's context. Hence, it is clear that in the case of VTC there are context motivations for not achieving Stage 5 in all dimensions.

5.5 SCENARIO ANALYSIS IN VOLVO TRUCKS' S&OP PROCESS

Limited scenario analysis in VTC's Program process is identified as a gap which VTC should close in order to gain more benefits from its S&OP process. This section thus analyzes how scenario analysis should be incorporated in the process and aims at answering RQ3.

5.5.1 SCENARIO ANALYSIS DEFINITION, GOALS, AND BENEFITS

In the Theoretical Framework, scenario analysis definitions were consolidated into a description of a tool, technique, or process which includes managing the uncertainties of the future by creating internally consistent alternatives of future outcomes. No other definition is discussed in the Empirical Findings and thus this is used as the definition in this thesis. Concerning purpose and benefits, there are great similarities between what is presented in the Theoretical Framework and in the Empirical Findings and it is concluded that scenario

analysis is a useful tool in S&OP in order to handle uncertainties (or dynamic complexity) and increase the understanding of possible future outcomes as well as to make the company aware of the impact of its demand-shaping and network alternatives and thus its own decisions.

Closing VTC's gap of limited scenario analysis in the current S&OP process is given a high impact because of VTC's high detail and dynamic complexity. VTC's goal of conducting scenario analysis should thus be related to the above mentioned benefits of handling the two types of complexity. Thus, scenario analysis should be performed with the aim of handling uncertainties in order to make VTC more aware of possible future outcomes and thus also meet the request of better being able to cope with volatile market conditions and the need for being more flexible as expressed in the Corporate background. Furthermore, scenario analysis should be performed with the aim of making VTC more aware of the impacts of its alternatives and decisions and thus make its choices more explicit.

5.5.2 INCORPORATING SCENARIO ANALYSIS IN THE S&OP PROCESS

It can be concluded from both the Theoretical Framework and the Empirical Findings that scenario analysis in the S&OP process should be incorporated in three of the process steps; in the creation of the demand plan, in the development of the supply plan, and during the reconciliation meeting. The scenarios are mainly developed in the first two steps whilst key scenarios are presented and discussed in the third step, during the reconciliation meeting.

Scenarios should be developed where the company experiences many uncertainties and as is further discussed below, VTC is experiencing uncertainties in relation to both demand and supply, supply including both internal and external capacities. VTC should therefore incorporate scenario analysis in the development of the market requests and during the production units' and suppliers' response meetings and in the supply-sides final answers to the Program proposal. Furthermore, key scenarios should be discussed during the Program conference in order to support the decision making around a final Program plan.

Scenario analysis in the creation of the demand plan

First, in the creation of the demand plan, the literature and the findings from the expert interviews have a shared view of that different forecast scenarios should first be created and thereafter different demand shaping scenarios. When developing different forecast scenarios, experienced uncertainties should be taken into consideration and the likelihood of each scenario to occur should be evaluated. The demand plans should be created based on different demand shaping strategies such as additional promotions, price management, and timing of new product introductions according to the Theoretical Framework and the expert interviews.

Concerning VTC, it does not clearly separate the forecasts from the demand plans with demand shaping activities and this is also identified as a gap above. VTC's demand plans, i.e. market requests, sometimes include demand shaping activities and sometimes not. It is considered a prerequisite to close this gap in order to start working with scenario analysis. As described in the Empirical Findings, forecasting is conducted both on a regional and central level and thus both forecasts and demand shaping scenarios could potentially be conducted on a regional level as well as on a central level. However, prerequisites for scenario analysis discussed above in the Theoretical Framework and emphasized in the Empirical Findings,

include amongst others making good forecasts and supporting the scenarios with high quality data. Thus, the belief is that it is better to initially focus on making sure each region provides good input to the process and instead leave the scenario analysis to the central divisions. However, it would be beneficial for the regions to discuss different scenarios with the central EuD and ID when evaluating the regions' requests as this could be a valuable input to the central scenario creation. This latter is somewhat done today when EuD's regions are asked to fill in "best" case and "worst" case scenarios. However, the likelihood and consequences of them are not discussed. ID's areas are more involved in the forecasting process than is EuD's regions and their inputs will be valuable for ID when creating its different scenarios.

It is considered that the forecast scenarios should be created centrally at EuD and ID and uncertainties concerning the demand should be discussed and identified. Further, it is considered important to highlight the main uncertainties on the demand-side and to create alternative forecasts with them as a base. Since VTC has separate commercial divisions and since these make individual forecasts and separately decide upon its demand shaping strategies, the recommendation is to start creating scenarios within the commercial divisions separately. However, despite the different geographical regions some of the downstream uncertainties are shared between the divisions and thus it is considered valuable to also cooperate in the forecast scenario creation. The output of this step is thus different forecast scenarios with its estimated probability of occurrence.

Thereafter, VTC is recommended to use the forecast scenario with the highest probability of occurrence in order to create different demand plans. Depending on whether EuD and ID are satisfied with the most likely forecast and if there are any gaps to the business goals, different demand shaping scenarios may be considered. Thus, if the forecast is in line with what the company wants to sell, demand shaping may not be necessary. As discussed above, also the main demand shaping scenarios should be developed at a central level. However, if a region or area is particularly interesting or uncertain and would have a large effect on the total volumes, it might be brought up as a scenario on a central level. The output from this step should be different demand shaping scenarios where one for each division is evaluated as being the best option and thus placed as the market request. This would thus be the updated version of the market requests in CEMAFOR after central EuD and ID have made their central demand shaping.

Scenario analysis in the development of the supply plan

In the development of the supply plan it is suggested in both the Theoretical Framework and by the experts in the interviews that the demand shaping scenarios should be evaluated and tested by the supplying units and supply uncertainties identified and analyzed. It has been stressed that there might be gaps between supply and demand and there might be alternative ways to meet the demand. In these cases, different supply alternatives could be created in order to evaluate the consequences of different alternatives. Finally, as described in the Theoretical Framework, the supply review meeting should recommend a preferred plan and decide upon key scenarios that should be discussed at the reconciliation meeting.

As discussed above, VTC experiences very high internal detail complexity due to its manufacturing footprint and the dependencies between the plants. Moreover, as is considered

important in this aspect, VTC does not have one supply review meeting for all supplying units, which is identified as a gap. Instead, each production unit and supplying BU gives its own response to the Program proposal. Hence, there is no interaction and no discussions of how the demand plan could be met in different ways by collaboration. Furthermore, the high upstream complexity together with the many product variants with different suppliers creates complexity. As presented in the literature, companies experiencing high complexity benefit from an APS system and during the expert interviews, it is emphasized that simple tools may be hard to use in complex environments. Hence, if VTC should be able to take different demand scenarios as inputs to the development of the supply plan and be able to evaluate them; an APS system where the network is modeled is believed necessary. Thus, one option for VTC is to invest in a system which can handle the company's complexity.

With the present systems, it is not possible to use different demand scenario inputs since CEMAFOR does not allow for alternatives. Currently, only one plan, the Program proposal, is evaluated by suppliers, external as well as internal. In order to evaluate several scenarios, a system which can handle different alternatives is needed and this system should preferably be able to do it automatically. As only one plan can currently be evaluated, it is considered difficult for VTC to work with alternative supply plans as it is seen as a greater risk to choose a scenario that has not been fully investigated. Asking suppliers to evaluate different alternatives could however be difficult as they have other customers to take into consideration as well. Thus, whether it is possible and suitable to send alternative supply plans to its suppliers must be further evaluated. Further, if evaluating different network alternatives in a simple system, it will not be on a deep enough level that it would help in the decision making in the sense that another scenario than the proposal could be seen as an option to choose. Thus, VTC has a choice to make here and the opinion of the authors is that more investigation has to be performed in order to evaluate if there is a supply-side module that would give VTC the possibility to model its network on a level deep enough for the purpose of helping in its decision making. Some aspects to consider are stressed in a section below.

Regardless of whether different demand shaping scenarios or supply alternatives may be considered or not, it is considered important to identify supply uncertainties and to evaluate their effects on the supply answer. If the production units as well as the internal suppliers work independently with evaluating the Program proposal, many uncertainties will be identified. As they are interdependent, an uncertainty in for example component availability will affect the potential outcome from the plants. Hence, it is the opinion of the authors that the supplying units should collaborate when evaluating the uncertainties and it must be decided upon which uncertainties that are the most critical. These should be brought up as key scenarios for the total supply-side, i.e. the number of trucks that can be produced depending on uncertainties. This would however require a common supply review meeting. Even though it would be beneficial to close the gap of having a common supply review meeting, it is not considered a prerequisite for scenario analysis. Thus, if such a meeting is not implemented, the key uncertainties for each supplying unit should instead be identified.

Scenario analysis in reconciliation meeting

Last, as brought up both in the Theoretical Framework and during the expert interviews, key demand and supply scenarios should be brought up together with the recommended plan at

the reconciliation meeting. Key scenarios are those that demand and supply have considered possible to occur and with the most potential impacts for the companies as well as alternatives requiring a top management decision. The reason to include the scenarios based on uncertainties is to put the recommended plan in relation to the risks and opportunities associated with it. The impact and the probability of occurrence of key scenarios should be presented¹⁰ and their consequences, risks, issues, and opportunities discussed. This is preferable done with the assistance of an S&OP workbench or with a matrix summarizing the different scenarios. Thereafter, there is a common view on that a decision should be taken upon a final plan and this should be done by the top management. Karlsson¹¹ also stresses that action plans on how to mitigate the risks associated with the chosen scenario should be developed. It is also pointed out by Ivert¹² that it is useful to be able to create new scenarios during the reconciliation meeting to see the effects of a different scenario.

For VTC, key demand and supply scenarios may be presented at the Program conference. Depending on if VTC considers acquiring an APS system on the supply-side, the supply answers may be based on one Program proposal or several scenarios. If considering the former, the supply answers will only be based on one demand scenario. Hence it may be useful to present the other demand scenarios considered in the creation of the demand plan at the Program conference. For example, since the total truck market is emphasized as the main source of uncertainty, the commercial divisions may present the other developed forecast scenarios. The rationale is that it may help in understanding the risk and the impacts of the Program plan if any of the other demand scenarios occur instead of the one which the supply answers are based on. Further, even if different supply alternatives cannot be produced it is important to discuss the supply uncertainty scenarios and their possible impact. A matrix similar to the one discussed by Karlsson¹³ and presented in Table 20 may be useful to visualize the possible demand and supply scenarios. Depending on the different scenarios' probability of occurring and the potential impact, the proposed Program plan may be adjusted. Since the aim of the scenario analysis is to help in decision making, it is important that the scenarios are presented where the actual decision making takes place. Thus, increasing the executive participation at the Program conference, adding a senior management review after the Program conference, as discussed in the Theoretical Framework, or presenting the scenarios to the top management before the Program conference if that is where the decisions are taken, are options in order to fully make use of the scenarios created. If the top management meeting occurs after the Program conference, the current Program conference meeting could be used to discuss different scenarios and decide upon a recommended scenario which later is presented for top management.

5.5.3 SCENARIO CREATION

In the Theoretical Framework, the scenario creation is presented from a general planning point of view, without specific emphasis on S&OP. However, the literature may be

¹⁰ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

¹¹ Ibid

¹² Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

¹³ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

complemented with the Empirical Findings in order to conclude on how scenario analysis should be structured within S&OP.

First, concerning the time frame, the expert interviews provided the view that the time frame should be related to the decision the scenarios aim at supporting. Furthermore, the frame should be equal to, or shorter than, the planning horizon for the S&OP and relate to periods where changes in the plan actually can be made and thus time fences in the planning must be considered. Since VTC's planning horizon is rolling twelve months plus the total for the next calendar year the time frame of the scenarios should consequently vary between 13 and 23 months depending on what month the scenarios are conducted. VTC's lack of time fences in planning is identified as a gap above but the current flexibility targets may initially be used in order to get an understanding of how large changes that may be made in the plan and thus the limits in the short-term scenarios. For example, there is no point for VTC's commercial divisions to evaluate a demand shaping scenario of + 50 percent two planning periods ahead since this exceeds the flexibility targets and will thus not be possible to accommodate.

Second, the scope in terms of amongst others products and geographic regions should be set according to the Theoretical Framework. For VTC, this question is closely related to the discussion above concerning where in the process the scenarios should be created since the scope of the analysis will vary depending on where it is performed. Since the focus above has been to start with scenario analysis on a central EuD and ID level and since the decisions at VTC's Program conference should not go into details, the scope should be entire volumes for the company, for certain divisions, or important markets if there is a specific decision related to these to be made. Concerning the scope in terms of products, it is considered important to start performing scenario analysis on a quite aggregated level and hence have the focus on the product groups. However, as presented in the Empirical Findings, VTC has high detail complexity in terms of many production sites and product variants that in some cases may be produced at various locations and in some cases there are one-market plants. Furthermore, it is expressed in the Empirical Findings that Volvo 3P has problems validating the supplier capacity on a product group level and thus if VTC wants to create scenarios for certain critical suppliers, the product groups must be broken down to item numbers for supplier validation purposes. However, an analysis on the supply-side deeper than on product group level is considered to require an advanced planning system and if such a system is not acquired, analysis deeper than on product group level is considered difficult.

Third, past sources of uncertainty should be identified according to the Shoemaker (1995) in the Theoretical Framework. The results from the expert interviews include general sources of uncertainty in the S&OP process such as competitors, product introductions, and suppliers. However, it is important to point out that sources of uncertainty may change over the time and thus, as put forward by Karlsson¹⁴, it is important to use experts in order to suggest new uncertainties that should be evaluated. However, it is considered important that the process put in place for scenario analysis should be able to evaluate different kinds of uncertainty and for example not change depending on the current economic climate.

VTC's identified sources of uncertainty may be used in order to analyze what the focus of

¹⁴ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

VTC's scenario analysis ought to be. To start with, it is considered important to focus on the source of uncertainty which was identified as the most uncertain and with the greatest impact during the brainstorming presented in Table 19; the total truck market development. However, as put forward by Karlsson¹⁵, it is important to focus on the root cause of uncertainty. Since the truck market is closely linked to the total economic development, the latter is considered the main root cause for uncertainty concerning the truck market. This source of uncertainty is classified as downstream dynamic complexity since it creates unpredictability of demand. Thus, it is an important uncertainty to consider in the creation of the forecasts and the demand plans. Creating different forecast scenarios depending on probabilities of future economic development is one way of dealing with the uncertainty. Moreover, if there is demand shaping strategies which could affect the total market these may be interesting to evaluate. Since this is the source of uncertainty with both greatest impact and highest uncertainty, it is moreover expected that the different demand plans created by different forecast scenarios are amongst the key ones which may be discussed during the Program conference.

Moreover, the success and cannibalization rate of new product introductions cause large uncertainty regarding demand and depending on the timing of new product introductions, caused by internal sources, the demand may vary between different product groups and planning periods. Hence, this is a source of uncertainty which is considered valuable to evaluate in scenarios. This is also in line with the opinions presented during the expert interviews. However, there are also other factors affecting the downstream dynamic complexity such as the political development in certain geographic regions and competitors whose activities may affect VTC and which should be considered for scenario analysis. Including competitors in the analysis was also expressed as important during the expert interviews. Scenarios concerning certain geographic regions, such as the expressed uncertainty concerning Brazil, may best be done in close proximity to the market and hence in the region in question. However, if the uncertainty may have great effect on the entire company and thus requires a top management decision, it is considered important that it is presented as a key scenario during the reconciliation meeting.

Last concerning the downstream complexity, VTC is also concluded to experience high downstream detail complexity. In this aspect scenario analysis does not relate to any uncertainty. Rather, there are occasions when supply constrains demand and when this happens there may be many different options of which customers (or rather markets or regions) who should be constrained. Hence, it may be useful to create scenarios in which different regions are constrained in order to evaluate the best alternative for the entire company. Because of scenario analysis advantage of showing the consequence of different alternatives making these scenarios should help in the decision making as it visualizes to the commercial divisions which option that actually is the best for VTC.

Concerning the internal context, it is concluded above to result in high detail and medium dynamic complexity for VTC. As different internal supply alternatives are possible, there may be occasions where VTC has to make decisions on how to supply the demand, e.g. from which plant. Since benefits of scenario analysis according to both the literature and the

¹⁵ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

empirics include that it supports decision making and, according to Ivert and Jonsson (2010a), that it helps a company understand the implications of its network alternatives, it is considered a useful tool for VTC to deal with its internal detail complexity. The internal dynamic complexity is concluded to mainly result from uncertainties concerning timing of new product introductions since the length of the projects are somewhat uncertain. Thus, it is considered useful when there are new product introductions coming up to try different scenarios concerning both what demand would be depending on different possible introduction dates and consequently what supply is needed to balance demand. Product introductions decisions and uncertainties, resulting from internal and downstream complexity as well as from demand shaping, was given high impact during the brainstorming. Thus, scenarios concerning this issue are considered important to highlight during the product conference if the different evaluated scenarios have different consequences and thus a decision has to be made.

Last, VTC is concluded above to experience high detail and medium upstream dynamic complexity. The main sources of uncertainty identified in relation to the upstream context are the suppliers' flexibility and capacity constraints which are discussed above as an effect of both detail and dynamic complexity. These sources of uncertainty were moreover given high impact during the brainstorming and are thus considered important to consider in the development of the supply plan. VTC also experiences uncertainty because of macro factors, e.g. due to the global sourcing which may be tested in scenarios. For example, creating scenarios where different demand plans are tested against the capacity of a critical supplier or identifying risks within the supply base and test the impact of this risk on different demand plans are ways of dealing with the complexity. However, there are many prerequisites, such as an APS system, before VTC can start doing these types of scenarios as discussed below.

5.5.4 SCENARIO EVALUATION AND DECISION MAKING

As discussed in the Theoretical Framework, the developed demand and supply scenarios should be evaluated throughout the process in order to understand each scenario's impact on the business and in order to identify the key scenarios. There is a shared view between the recommendations from literature and what was pointed out during the expert interviews; scenarios should be evaluated based on the impact on the goals of the S&OP process and the risks associated with each scenario, i.e. relate impact to probability. Hence, there is a trade-off between potential benefits and the risks the company is willing to take. As the S&OP goals should be aligned with the business goals, this means that the scenarios should be evaluated based on their impact on the overall business goals. The business goals vary from company to company but could for example be KPIs such as profitability, market shares, growth rate, delivery precision, tied-up capital et cetera. However, Ivert¹⁶ also pointed out that how the scenarios can and could be evaluated is dependent upon the goals with scenarios and the available tools. If a company only uses Excel for scenarios, it might be difficult to use the above mentioned business goals for evaluation.

Preferably, VTC should therefore evaluate the different demand and supply scenarios based

¹⁶ Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

on the overall business goals. As discussed in the Empirical Findings, VTC is part of AB Volvo and shares strategy and goals of being focused on profitable growth, product renewal, and internal efficiency. The scenarios should therefore be evaluated on important KPIs measuring this such as growth in net sales, operating margin, and reduced costs. It has also been stressed that operating leverage is one of the main KPIs at VTC and this is therefore also a suitable KPI to use for evaluation of the scenarios. Furthermore, it is stressed that the Program process should be more focused at delivery precision and that it has a large effect on tied-up capital and it could therefore be argued that these two KPIs are good evaluation parameters as well. Moreover, it is important to remember that the decisions taken also should take the overall strategies into consideration even though it might not always be the most suitable based on the other evaluation KPIs. For example, if AB Volvo has decided to prioritize a certain market this should be considered when evaluating different scenarios and making prioritizations between different markets. In addition to the overall business goals, each function can also evaluate the scenarios with their goals. For example, the initial demand plans could be evaluated towards the commercial divisions' goals on markets shares in order to make sure they are in alignment with the business plans. If not, additional demand shaping activities might be necessary in order to reach the overall business goals. However, if VTC does not acquire an APS system, it may be hard to evaluate the scenarios this thoroughly. If using simple systems the effects on the volume of different uncertainties may be used instead. Karlsson¹⁷ also emphasize the importance to measure and to follow up what is happening in order to see if the scenario aimed for is the one actually occurring. If not, the company needs to adapt to the new reality. If different scenarios are discussed during the reconciliation meeting, the company is more prepared for a changing environment and can thus easier adapt.

5.5.5 SUPPORTING TOOLS FOR SCENARIO ANALYSIS

It is stressed both in the literature and in the expert interviews that some supporting tools are necessary in order to perform scenario analysis. The available literature discusses these tools as being more advanced software. Karlsson¹⁸ points out that simple tools such as Excel is not appropriate to use whilst Ivert¹⁹ discusses that simple tools such as Excel or ERP system can be used to support scenario analysis. However, Ivert²⁰ also stresses that companies that are experiencing a lot of complexity, probably benefit more from using more advanced supporting systems. Hence, it could be argued that VTC probably would benefit from using more advanced software than Excel.

The literature and the experts emphasize that demand and supply-side planning modules with scenario analysis functionalities are useful in order to perform scenario analysis in the S&OP process. It is also recommended to use an S&OP workbench to visualize and analyze different scenarios. Karlsson²¹ emphasizes the importance of linking all these systems together in order to facilitate the collaboration and to make the work more efficient. It is also pointed out by

¹⁷ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

¹⁸ Ibid

¹⁹ Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

²⁰ Ibid

²¹ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

Karlsson²² that these systems also should be connected to the financial system. Both Karlsson²³ and Ivert²⁴ point out that when modeling the network, it is preferable done on a quite aggregated level. Further, when implementing a new system, a rather simple model should be developed to start with and thereafter be further developed²⁵.

As aforementioned, in order for VTC to perform more advanced scenario analysis, more advanced software than the current use of Excel would be needed. First, VTC would benefit from using a demand-side planning module with functionalities such as statistical forecasting and possibility of generating alternative demand shaping scenarios as many of the main uncertainties is connected to the demand-side. It is also considered important that the different commercial divisions have a common tool even if they have separate processes for generating scenario. The rationale being that it is considered important that they are working in the same way and use the same type of analysis in order for everyone to understand the logic behind the scenarios and its assumptions. As this system preferably should be the same as the one needed in order to close gap 13 concerning quantitative forecasting methods, VTC is hence suggested to acquire a demand-side system in the first round of improvements.

Second, a supply planning module could be beneficial for VTC in order to evaluate alternatives for supplying different demand scenarios. However, to model VTC's complex network could be rather difficult and it is therefore important to thoroughly evaluate different systems in order to make sure that it can efficiently model VTC's network on a deep enough level to support VTC's decision making. Hence, in order to know whether a supply planning module would be worth investing in, a deeper analysis must be performed.

Third, VTC is considered to benefit from incorporating an S&OP workbench in its S&OP work, thus close gap 9, in order to support scenario analysis. The rationale for this opinion is that it would facilitate the sharing of information between the different functions as well as be used for visualization of the information. An S&OP workbench could be in the form of an Excel document or as a module in more advanced software. What would be suitable for VTC to use is also something which has to be analyzed further.

As it is important that the demand, supply, and workbench modules can be integrated, the authors would like to stress that VTC keeps all these modules in mind when evaluating whether it should implement any new systems. For example, if VTC chooses to first implement a demand-side module, it is important to have the possibility of connecting a supply-side module and a workbench at a later stage.

5.5.6 PREREQUISITES FOR SUCCEEDING WITH SCENARIO ANALYSIS IN THE S&OP PROCESS

The literature and the experts stress that in order to succeed with scenario analysis, prerequisites such as a well developed S&OP process, accurate forecasts, and high quality input data are necessary. Further, Karlsson²⁶ expresses that it is important that everyone in the S&OP team is involved and Schlegel and Murray (2010) emphasize that it is important that

²² Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

²³ Ibid

²⁴ Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

²⁵ Per-Magnus Karlsson, Senior Director, Western Europe SCM Applications, Oracle, Interview 2011-05-05.

²⁶ Ibid

people trust and understand the scenario analysis. Ivert²⁷ points out that there are more prerequisites if using more advanced software than a simple system.

The gaps in the first round of improvements, gap 13: quantitative forecasting, 14: separation of forecast and demand plans, and 23: training program are all believed to be prerequisites for scenario analysis as they will enable high data quality and get the S&OP team onboard for the upcoming changes when incorporating scenario analysis.

Depending on VTC's ambitions with scenario analysis, VTC may benefit from investing in an APS system. Having more advanced software is considered a prerequisite if VTC for example wants to work with parallel plans and thus make it possible for supply to evaluate several demand plans and create different supply alternatives. Moreover, in order to evaluate critical suppliers a system which allows for supply scenarios as well as the possibility of breaking down the volumes to item numbers is necessary. This would however also require a supply collaborator, thus a closure of gap 26, in order to get the necessary input data. Moreover, to evaluate the scenarios based on evaluation parameters such as financial results and delivery precision, advanced software with financial input data is necessary. Hence, if investing in an APS system, high data quality is especially important. Further, as been discussed above, having common demand review meetings and common supply review meetings could be beneficial when working with scenario analysis. However, it is not considered to be a prerequisite but it would improve the collaboration between the commercial divisions and supplying units respectively as they could together come up with important uncertainties and key scenarios. Further, it would also make the final meeting more efficient. Another prerequisite for scenario analysis is that it requires resources and thus VTC may have to add employees to the S&OP team and give them scenario analysis responsibility. Furthermore, an output from the above analysis is that scenario analysis not only requires resources such as people and technology but also time. Thus, it is important to understand that time during the meetings and in the process must be dedicated to scenario analysis and it may require that some pre-meetings or the Program conference are scheduled differently.

The S&OP maturity is hence considered to play an important role in the incorporation of scenario analysis in the S&OP process as wide ranging issues such as technology, people, input data, and a well-developed S&OP process are emphasized as prerequisites or enablers.

²⁷ Linea Kjellsdotter Ivert, PhD Student, Division of Logistics and Transportation, Chalmers University of Technology, Interview 2011-05-06.

5.6 KEY POINTS FROM THE ANALYSIS

In this chapter, VTC's *S&OP complexity* has been discussed and concluded upon and the output is that VTC is considered to experience high internal detail complexity, medium internal dynamic complexity, high detail and downstream dynamic complexity, high upstream detail complexity, and medium upstream dynamic complexity. The S&OP complexity is considered an important part of the *S&OP context* and the S&OP context, including the S&OP complexity, is a key area considered in the Gap analysis concerning both if gaps should be closed and in which order they should be closed.

From the Gap identification the main output, as presented in the Gap analysis, is that VTC experiences gaps which are consolidated and grouped in *five groups*, namely; *S&OP process goal, Decisions support, Process, Organization, and Supply chain*. The S&OP goal has been particularly emphasized as it is stressed as being the “founding gap” and thus sets the scene to what gaps that should be closed. VTC is not recommended to close six of the identified gaps belonging to the Process, Organization, and Supply chain groups due to different context reasons.

The *S&OP maturity* has also played an important role in the analysis. VTC's S&OP maturity is classified as being either Stage 2 or Stage 3 across the five dimensions and this played a big role when suggesting appropriate improvement rounds. Further, concerning the improvement rounds, the main takeaway, both for VTC and in general, is that there initially are certain gaps which should be closed as they are considered important prerequisites. Thereafter, the second and third rounds are characterized by increasing the maturity in order to be able to reach the goal as well as taking certain consideration to gaps important to close due to context issues. The motivation for leaving gaps for the last round is however entirely dependent on certain context issues which put limitations on closing these gaps immediately.

Concerning *incorporating scenario analysis in the S&OP process*, the outcome from the analysis is that VTC, as well as other companies experiencing detail and/or dynamic complexity, should use scenario analysis to deal with uncertainties and to consider alternatives both on the supply and demand-side. Scenario analysis may be incorporated in three of the S&OP process steps; in the creation of the demand plan, in the development of the supply plan, and during the reconciliation meeting. The types of scenarios considered should depend upon the context and the sources of uncertainty. The scenario analysis is also dependent on the S&OP maturity as there are prerequisites, such as a well developed S&OP process and high data quality, before trying to incorporate scenario analysis in the S&OP process. Further, there are also certain issues which must be considered and decided upon by VTC before incorporating scenario analysis. These are mainly related to what system support that should be used as this decides upon the possibilities for evaluation parameters and the depth in the decision support.

6 DISCUSSION OF THEORETICAL AND MANAGERIAL IMPLICATIONS

This chapter provides a discussion around the contribution of this thesis in terms of theoretical and managerial implications as well as the possibility of transferability and generalizability.

The research design of this thesis has been a case study and thus, according to Wallén (1996), it may be hard to draw general conclusions from the results. However, it is the opinion of the authors that there in some aspects are novelties in the results where general conclusions may be drawn and where the thesis provides theoretical as well as managerial contributions.

6.1 KEY THEORETICAL VERIFICATIONS AND PROPOSALS

The thesis has so far provided insight in a wide range of S&OP theory. However, it is the opinion of the authors that certain key points may be distinguished. These key points originate both from the results and from the theory leading up to the results and are emphasized as they are considered important in order to assess the improvement potential of a company's S&OP process. Hence, they have played a big part in reaching the purpose of this thesis.

First, the *importance of the S&OP goal* is a key take away. Initially, in the gap identification in RQ1, the focus was on the differences between VTC's goal for the Program process and the S&OP goals recommended in literature. As stressed by AMR Research (2009), the goal of S&OP has evolved and from this conducted case study it is clear that at least VTC's goal has not evolved at the same pace as the literature's recommendations. It can thus be questioned whether there is a general mismatch between the S&OP goals among practitioners and the goals suggested in literature? Ventana Research's (2006) study where practitioners stress less strategic goals than academia points towards that it could be a general gap. However, as an answer to this question cannot be provided from the results of this thesis, this could be an interesting topic for further research. Concerning the importance of the S&OP goal, it is further proposed in literature that the S&OP goal is influenced by the S&OP complexity and maturity (Ivert & Jonsson 2010b). Regarding the S&OP complexity, it is in VTC's case used to motivate an ambitious S&OP goal in RQ2. Since VTC experiences e.g. high downstream dynamic complexity, scenario analysis is considered especially important and adding scenario analysis to the goal of the process makes the S&OP goal more ambitious. Hence, the complexity influence a more ambitious goal in the case of VTC and this thesis thus provides some verification of Ivert and Jonsson's (2010b) proposal. Moreover, concerning the S&OP maturity, Ivert and Jonsson (2010b) propose that maturity and aim are interrelated and thus, reaching an ambitious aim may not be possible without a mature process. The thesis provides some verification concerning this proposal as well since how the goal is set affects which gaps that should be closed and hence how mature VTC ought to become. Thus, making an explicit decision on the goal is considered very important since it sets the scene for the remaining improvements. Therefore, the last point concerning why the S&OP goal is considered so important when it comes to S&OP improvements is that the goal sets the scene concerning what other gaps that should be closed and how mature the process should become.

Second, the *multifariousness of S&OP* is an important point and verified by the results. In the literature, among others, Singh (2009) expresses S&OP as a cross-functional business process and the many functions which should be involved in the process are listed by many authors

(e.g. Baumann & Crum 2009, Grimson & Pyke 2007, Ventana Research 2006). Further, from the many dimensions listed in S&OP maturity frameworks, refer to Appendix 1, as well as the inputs given by S&OP planning parameters and the S&OP process descriptions, refer to Table 4, S&OP is understood as being very multifarious. This is also evident from the results of RQ1 where it is identified that VTC experiences gaps in five diverse groups, i.e. *S&OP process goal, Decisions support, Process, Organization, and Supply chain*. Thus, when doing S&OP process improvements, changes may be required in a broad range of areas.

Third, the *S&OP context affects how a company should improve its S&OP process*. The need for a contingency approach in S&OP is stressed by Ivert and Jonsson (2010b) who discuss that the complexity of the S&OP context, the S&OP aim, and the S&OP maturity affect the needs of the S&OP process. Further, research supports a contingency approach within the MPC-field (e.g. Tenhiälä 2011, Jonsson & Mattsson 2003, and Berry & Hill 1992). However, apart from these contributions, a contingency approach to S&OP is considered a quite unexplored field since limited contribution has been found within the area. The results of this study support a contingency approach since VTC's context has been found to affect how the S&OP process should be improved. The rationale for the latter is that VTC's context affects both which gaps that should be closed and in which order, i.e. the output of RQ2.

Concerning VTC's five groups of gaps, the need for closing gaps within two groups is considered to depend on a company's context. The Decision support group is found important for VTC in order to work towards a more ambitious S&OP and to deal with the company's S&OP complexity. Hence, if closing gaps in this group may yield improvements for companies are related to the S&OP goal and the complexity experienced. Similarly, the motivations used within the Supply chain group are mainly VTC's downstream and upstream complexity. Hence, it is proposed that in these two groups a contingency approach is useful and perhaps necessary. However, the motivations for the remaining groups are mainly general and thus there is possibility for generalizations concerning the importance of gaps in these groups as discussed further below. The motivation for not closing certain gaps is also based in VTC's context as aforementioned. VTC's high downstream detail complexity, its few product introductions, and other internal context factors justified leaving some gaps untouched. Hence, it appears that considering the S&OP context is important since a company otherwise may spend resources on improvements which are not necessary due to its context and which will not provide any benefits. As stressed in the Problem identification, Lapidé (2004) discusses that many companies do not gain the expected benefits from its S&OP investments and it is proposed by the authors that it may be due to the lack of a contingency approach. The results hence support this proposal but more research is necessary in order to validate it.

From the proposed improvement rounds it is also clear that the context affects the order in which gaps may be closed, e.g. the last improvement round is characterized by gaps placed there due to VTC unique context. Further, it is the belief that every company has its own unique context including limitations which affects which gaps that should be placed in the last improvement round. It is however also clear that the order in which other gaps may be closed is quite general as is the case with the first improvement round. The rationale being that the latter is characterized by gaps which have been considered important requisites and thus, no matter the context or maturity, it should be ensured that these gaps are closed as a first step.

Fourth, *S&OP maturity frameworks are useful for understanding the current state of the S&OP process as well as appropriate next improvement steps*. According to Lapide (2005), maturity frameworks are useful in order for a company to understand how it is working today, where gaps exist compared to best-practices, and how its S&OP process could be improved. In this study, a maturity framework has been used for all these three purposes and its usefulness, as stressed by Lapide (2005), is verified. Grimson and Pyke's (2007) framework is used in RQ1 to classify VTC and moreover to identify gaps. Furthermore, the maturity framework was useful, together with the S&OP context as aforementioned, when deciding upon the order to close the gaps in RQ2, i.e. the four improvement rounds. Especially in the second and the third rounds, the focus is on increasing the S&OP maturity. Thus, after having dealt with the prerequisites, it is recommended to focus on increasing the S&OP maturity as a mean of working towards a more advanced S&OP goal. This recommendation is hence in line with Ivert and Jonsson's (2010b) proposal that the S&OP maturity influences the S&OP aim. Concerning S&OP maturity, another main take away is that depending on the S&OP goal and context, Stage 5 might not be the desired end state for all companies. For example, VTC is not recommended to close gap 25, to involve customers in the S&OP process, because of its context. Thus, VTC will not achieve Stage 5 in Meetings and Collaboration.

Fifth, from the results of the thesis and the above discussion it is proposed that *the S&OP context influences the optimal S&OP maturity*. However, this is a proposal which must be further validated and that goes hand in hand with the former mentioned lack of research which explores a contingency approach to S&OP.

Sixth and last, from the results of RQ3 it is proposed that *the S&OP context, maturity, and goal affect how scenario analysis can be incorporated in the S&OP process*. Many theoretical recommendations are general and in some aspects useful. However, the results illustrate that a company's goal with the scenario analysis as well as its S&OP maturity and its S&OP context, including its complexity, affect how scenarios can and should be created in the process. However, more research is necessary in order to validate this proposal.

6.2 A GENERAL S&OP IMPROVEMENT MODEL

Successful companies have realized the need for structured long-term planning for creating sales and operations plans in a collaborative process in order to deal with the increasingly complex business environment and this is where S&OP becomes interesting. However, despite promising benefits linked to S&OP, many companies have not experienced the expected benefits from their S&OP. There are many views on how to structure the S&OP process and one reason for why companies do not succeed with S&OP could be that they underestimate, or might not even be aware of, the importance of a contingency approach as discussed above. Hence, it seems like many companies are not aware of how they should be working to gain the most out of their S&OP processes and it is therefore considered that there is a great potential for improvements and also a need for a model of how this can be done. It is the opinion of the authors that the model of analysis developed for reaching the purpose of this thesis covers important aspects which should be considered when improving an S&OP process. Further, even though it is developed for VTC and used in its context, it is believed to apply equally well for evaluating other companies' S&OP processes. Thus, it is considered

that the model can be generalized and useful for other companies that want to improve their S&OP processes. Since, as far as the authors are aware, the S&OP field has not previously presented such an improvement model for S&OP, it is considered to have theoretical implications. Moreover, it is considered to have managerial implications, i.e. that it can be put to use since other companies may use it to improve their current S&OP processes.

The model of analysis is structured around the three RQs; see Figure 3 to Figure 6. The first two RQs and some of their sub-objectives are considered important for a general model of analysis. As discussed in the Methodology, the decision taken in this thesis was to focus on the gaps and not analyze matches further. However, for some companies there may be possibilities for improvements concerning the matches. Hence, this aspect is included in the general S&OP improvement model. Furthermore, this thesis is delimited from implementation and follow-up but it is considered important to emphasize these steps in a general improvement model. It is considered equally important to emphasize that S&OP improvements, in conjunction with general improvement cycles, should be a continuous work and thus the general S&OP improvement model developed by the authors is presented as a cycle in Figure 16. Since, amongst others, contexts are changing, it is important to focus on continuous improvements. The generalized model of analysis, i.e. the general S&OP improvement model, consists of eight steps as will be further justified and explained below.

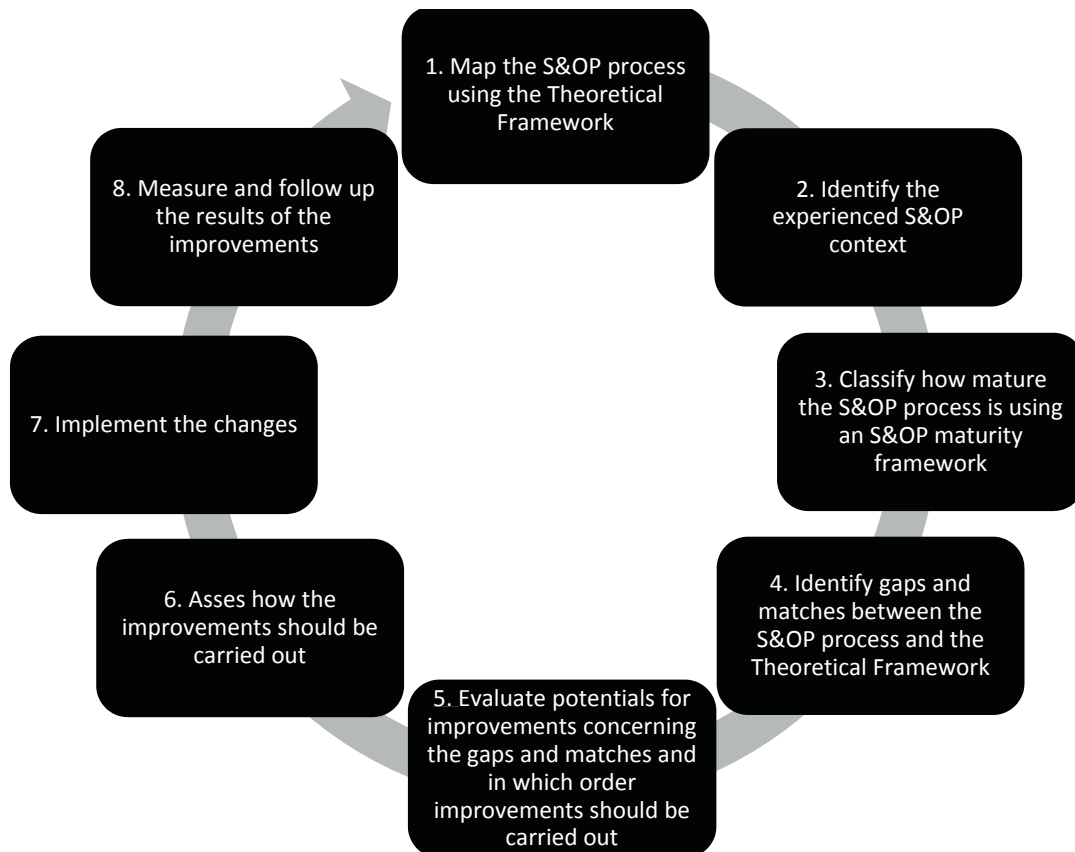


Figure 16. A general S&OP improvement model developed from the model of analysis.

1. Map the S&OP process using the Theoretical Framework

As a first step, the importance for a company to understand its current S&OP process and map it is emphasized. The rationale is that it is stressed in the literature that in order to know how to improve, it is important to know where you currently are (Lapide 2005) and this view is shared by the authors. It is suggested that this mapping could be done by using the Theoretical Framework developed and presented in section 2.2 to 2.5 in order to get an understanding of what is suitable to cover. This Theoretical Framework covers four areas, S&OP definition and goals, S&OP planning parameters, S&OP process structure, and S&OP maturity including five dimensions. These areas are considered to give a broad view of S&OP. The Theoretical Framework was found useful and comprehensive in this study and since it is developed to cover S&OP in general, it is considered to provide a good theoretical foundation for all companies no matter the experienced context.

2. Identify the experienced S&OP context

As a second step, which is also part of understanding the current situation, it is recommended that companies should identify their S&OP context, both internal and external. The rationale for this is that both literature and the results of the thesis support a contingency approach to S&OP and the importance of the S&OP context in S&OP improvements is put forward as a key theoretical implication of this thesis. As a consequence, the importance of considering the context should be possible to generalize to all companies considering S&OP improvements and thus this step is part of the general S&OP improvement model.

3. Classify how mature the S&OP process is using an S&OP maturity framework

As a third step, it is recommended that a company's maturity should be classified by using an S&OP maturity framework. The rationale for this is in alignment with the fourth theoretical point discussed above, namely that S&OP maturity frameworks are useful for understanding the current state of the S&OP process as well as appropriate next improvement steps. Hence, it was seen useful to work with a maturity framework when identifying gaps as well as when deciding in which order the gaps should be closed. It can be argued that these benefits of using a maturity framework apply to other companies and thus, using a maturity framework to identify a company's current position and find next suitable improvement steps is part of the general S&OP improvement model.

As presented in the Theoretical Framework, there are some different maturity frameworks available in the literature. The authors of this thesis prefer Grimson and Pyke's (2007) maturity framework for reasons discussed in the Theoretical Framework. Further, since the Theoretical Framework is based on the dimensions from Grimson and Pyke's (2007) framework, it must be used if a company wants to use the Theoretical Framework in full.

4. Identify gaps and matches between the S&OP process and the Theoretical Framework

As a fourth step, it is suggested that a company should identify gaps between its current S&OP process, as mapped in step 1 and step 3, and the Theoretical Framework. As discussed in step 1, the Theoretical Framework is considered to give a broad view of S&OP and should hence capture most existing gaps and matches. As presented in the Theoretical background, S&OP processes have been developed in many different ways and one reason could be, according to the authors, that companies have developed their S&OP processes without taking

available S&OP literature into consideration. VTC also expresses that it has not developed its S&OP process in alignment with recommendations from literature or best-practice. This thesis has done this comparison between VTC's way of working with S&OP and what is recommended in the literature and many potential improvement areas have been identified. It is considered that this comparison could be beneficial for many other companies and hence, step 4 is considered generalizable and thus part of the general S&OP improvement model.

The authors found it useful to do this gap analysis without taking the context into consideration (the exception being in S&OP planning parameters as discussed in the Methodology) and instead include the context in the next step when evaluating which of the identified gaps that should be closed. The rationale for this is that it is considered a more straightforward approach to apply since taking context into consideration when identifying gaps means that theory, empirics, and context would have to be merged together in one go which is considered complex. A rationale is also that even though the context plays an important role, many of the results are also non context related and thus applying the theory in a straight forward way is considered valuable.

5. Evaluate potentials for improvements concerning the gaps and matches and in which order improvements should be carried out

Fifth, it is recommended that the identified gaps and matches should be evaluated to assess where potential for improvements exists and in which order improvements should be carried out. Concerning VTC, it has been discussed that both the S&OP goals and context affect which gaps that should be closed. Further, the S&OP goals and context are considered to be closely related to how a mature a company should become and thus which gaps that should be closed. As discussed above, depending on the S&OP goals and context, Stage 5 might not be the desired end state for VTC or for other companies. If adding the possibility of matches also being potential sources of improvements, the step of evaluating possibilities for improvements, based on the S&OP goals and the S&OP context, is considered to be generalizable and thus part of this model.

Next, a company needs to evaluate in which order improvements should be carried out as not all of them can be carried out at once. This is also pointed out by Grimson and Pyke (2007) who emphasize that it is important to implement S&OP in stages. When it comes to deciding in which order improvements should be carried out, it is argued that a company's S&OP context and maturity affect the order for reasons discussed in the previous section.

For these reasons, evaluating potentials for improvements concerning the gaps and matches and in which order improvements should be carried out is considered to be important to include in an analysis of how a company's S&OP process can be improved. Hence, these are considered general aspects which all companies preferably should take into consideration and are thus part of the proposed S&OP improvement model.

6. Assess how the improvements should be carried out

As a sixth step, it is emphasized to assess how the improvements should be carried out. As stressed in the Problem identification, it is important to understand not only *what* to change but *how* it should be changed. Thus, each gap and match which has been evaluated to provide potential for improvements may require an analysis in order to decide how the improvement

should be carried out. In this thesis, the authors evaluated the gap of limited scenario analysis further. Hence, additional rationales for the importance of *how* are the results from the scenario analysis evaluation from where it is evident that there are different ways of incorporating scenario analysis in the S&OP process. The improvement may thus be carried out in different ways, again depending on the goal of the S&OP process and the context. Therefore, assessing how the improvements should be carried out is considered an important step in the S&OP improvement model as companies should understand that there may be different ways of how to improve.

7. Implement the changes

Implementation has not been considered in this thesis but considered a general step as no benefits from the suggested improvements will occur until the changes are implemented. This is also in line with other, more general, improvement cycles such as PDCA and DMAIC where A in PDCA stands for *Act* and I in DMAIC stands for *Improve* and thus emphasize the actual implementation phase (Sörqvist & Höglund 2007).

8. Measure and follow up the results of the improvements

Similarly to the seventh step, this eighth step has not been covered in the thesis but when suggesting a general improvement model, which covers the entire improvement project, it is an important step. It is also emphasized in, amongst others, DMAIC where the C stands for *Control* (Sörqvist & Höglund 2007), thus stressing the importance of following up the results of the implemented changes. Since this step is part of general improvement cycles it is considered generalizable to include it in the S&OP improvement model.

In the Methodology chapter, method choices made in this thesis are described and the chapter may thus provide examples of how the first six steps may be tackled.

6.3 RELEVANCE OF THE RESULTS FOR OTHER COMPANIES

Apart from the theoretical points and the general S&OP improvement model, the thesis is moreover considered to provide certain transferability of the results. Thus, the results are considered to have managerial implications as companies experiencing similar contexts may use some of the recommendations to VTC in order to improve their own S&OP process.

Important context related issues in this thesis are that VTC experiences high complexity in both its up- and downstream context. The upstream S&OP complexity is in the case of VTC used to argue for an aim of expanding outside the intra-organizational boundaries and include suppliers more in its S&OP process. Since specialization and outsourcing have been some of the trends in business the last decades, leading to a focus on competition amongst supply chains, the opinion is that VTC shares the aspects of detail and upstream dynamic complexity with many companies. Thus, the thesis provides transferability concerning the importance of supplier incorporation. Likewise, due to VTC's high downstream dynamic complexity, it is argued above that quantitative forecasting methods and scenario analysis, thus better being able to forecast and understand the future, are especially important for the company. Since another trend experienced by many companies is increasingly dynamic economic environments where market and customer demand are changing rapidly, the aspect of downstream dynamic complexity is one additional context dimension VTC is believed to

share with many companies. Hence, issues such as quantitative forecasting methods and scenario analysis may be important to consider for these companies according to the results. Further, because of VTC's high downstream detail complexity with many small customers, the company is not recommended to incorporate end-customers in the process since it is considered to demand more effort than the benefits created. This may similarly be transferred to companies with large customer bases and where the Pareto principle does not apply.

Due to trends such as off-shoring and globalization, it is moreover the belief that many companies share VTC's high internal complexity. More specifically, internal complexity because of a complex manufacturing footprint and dependencies between the plants is a state that is believed to be common for many companies. For managers in these companies, discussions held in the thesis concerning how this complexity makes network models more complex, how it increases the need for advanced planning tools, and how it may be considered resulting in a greater need for evaluating network alternatives, may hence be useful. Further, it is stressed that the need for executive sponsorship grows stronger the larger and more complex the company is. Hence, it can be argued that large companies should especially try to get more executives involved in the S&OP process.

Apart from the above improvement areas where the context plays a big role, some of the analyzed gaps are considered important in general and not due to any VTC specific condition. Hence, if other companies experience these gaps as well, it could be recommended to close them without consideration to the S&OP context. Some of these are gaps which are considered prerequisites and important to consider initially and these are the ones presented in the first improvement round to VTC. Moreover, other areas such as having financial involvement in S&OP is considered quite generally applicable as quoted research suggests that companies which are including finance in their process yield more benefits from S&OP. Further, no finding in the thesis suggests that finance should be more or less included due to some specific context. However, important to stress when discussing generalizability in this aspect is that S&OP maturity greatly affects when certain gaps are appropriate to close. Hence, even though certain gaps may be recommended to close for most companies, the companies' maturity should set the scene for when the gaps may be feasible to close as aforementioned.

As this thesis has been performed as a case study at VTC, many of the recommendations still only apply to VTC. The rationale for this is that some aspects of the company's context actually are unique to VTC and few companies share them. These specific recommendations concern first, the fourth round of improvement presented above as the placement of these gaps in the last steps mainly is motivated by internal company characteristics. Second, recommending not closing six of the identified gaps is mainly motivated by VTC's internal context including complexity. The internal context for example plays a role in the authors not recommending an expansion of the planning horizon since AB Volvo has a planning process taking care of those decisions. Furthermore, even though it theoretically may be argued that the S&OP owner should be an independent function in the company, since the current placement at VTC is considered to work well according to all involved functions, no motive is found for changing the ownership. In another company, where the current ownership causes tensions and sub-optimization, this gap may be essential to close. Consequently, other

companies must identify its own unique conditions and identify what is currently causing problems in the process.

It has previously been proposed that the S&OP context as well as the goal for the scenario analysis and the S&OP maturity play important parts concerning how to incorporate scenario analysis into the S&OP process. However, there are still some generalizations which can be made. Recommendations that apply to most companies are, first, that before incorporating scenario analysis into the S&OP process, prerequisites such as high forecast accuracy, high data quality, and S&OP participants' understanding of scenario analysis should have been achieved. Hence, this shows that the S&OP maturity affects how companies should work with S&OP. Second, companies need to identify what uncertainties they are experiencing in order to know what to focus the scenario analysis on. Third, the literature briefly discusses that scenario analysis should be conducted in three of the process steps and this is further validated from the results and the data collection. Hence, as most companies are experiencing both demand and supply uncertainties and alternatives, it is considered important to incorporate scenario analysis in both the demand and supply reviews as well as during the last reconciliation meeting. More context specific recommendations, and hence where the contingency approach is considered important, include that the results show that it is complicated to incorporate scenario analysis in the case of VTC since the company is experiencing high upstream and internal detail complexity. Hence, VTC and companies with similar complexity are recommended to start simple in order to gain understanding and thereafter develop the depth of the analysis over time. Another main managerial contribution is that it is shown that the choice of supporting tools highly affects what kind of scenarios that can be created and how they can be evaluated. Thus, companies need to decide whether they want to use simple tools such as Excel for their scenario analysis or more advanced software such as APS systems.

To conclude, it is the opinion of the authors that some of the results may be transferred to other companies and in some cases generalized. However, even though some context dimensions are shared among companies in the current business environment, each company also has its own unique conditions which affect what improvements that are appropriate and when the improvements should be scheduled. As a consequence, using the proposed S&OP improvement model may be the best option for a company in order to fully understand the improvement potential of its S&OP process.

7 RECOMMENDATIONS TO VOLVO TRUCKS

This chapter presents recommendations to VTC on how the company could, given its S&OP context, improve its S&OP process and gain further benefits from S&OP. In order to provide concise recommendations, this chapter summarizes the results from the analysis and provides checklists of the thesis's suggestions to VTC.

As presented in the Introduction, the purpose of this thesis is to assess how VTC can further improve its S&OP process given the company's S&OP context and this is previously analyzed in chapter 5. VTC is recommended to close 20 out of 26 identified gaps. Furthermore, VTC is recommended to close the gaps in four improvement rounds by taking S&OP maturity and prerequisites into account and thus close the gaps in an, for VTC, appropriate order. Thus, if leaving the notation of "gaps", VTC is recommended to do the following improvements in the four improvement rounds. Please refer to chapter 5 for further description of the suggested improvements.

7.1 RECOMMENDATIONS FOR THE FIRST ROUND OF IMPROVEMENTS

VTC is recommended to start improving its S&OP process by renewing the goal of the Program process as well as to take actions in areas which are important inputs to the process as well as prerequisites for further improvements. VTC is thus recommended to include the following improvements in the first round of improvements:

- ✓ Renew the goal for the Program process so that the process has a formal goal of, and is partially accountable for, integrating plans in a way that reaches overall business goals and strategies (close gap 1). Taking VTC's S&OP context into consideration, VTC is recommended to implement a goal in line with the following suggestion:

The Program process aims at balancing demand with all types of supply chain capabilities²⁸ in order to decide upon one final consensus program plan that optimizes VTC's overall business goals and strategies in order to drive capacity management and provide directions for operations and commercials.

- ✓ Start to use quantitative forecasting methods and implement a tool to support such methods (close gap 13).
- ✓ Make a clear separation between unconstrained forecast and demand plan (close half of gap 14).
- ✓ Implement a formal training program about S&OP (close gap 23).

7.2 RECOMMENDATIONS FOR THE SECOND ROUND OF IMPROVEMENTS

VTC is recommended to include improvements which result in a higher S&OP maturity and better decision support in the second round of improvements:

- ✓ Make Finance more involved in the Program process, start using the budgets as input to the process, and start translating the plans to monetary terms and compare and temper the plans by financial goals (close gap 3).

²⁸ Supply chain capabilities refer to internal and external capacities in production, logistics, and finance.

- ✓ Incorporate what-if and scenario analysis in the Program process and implement tools to support such analysis (close gap 3, see further specific scenario analysis recommendations below).
- ✓ Start discussing consequences, risks, and opportunities in relation to the Program plan (close gap 5).
- ✓ Start consolidating and centralizing S&OP information in an automated way (close gap 8).
- ✓ Implement an S&OP workbench and increase the integration of supply, demand, and S&OP workbench systems (close gap 9).

7.3 RECOMMENDATIONS FOR THE THIRD ROUND OF IMPROVEMENTS

VTC is recommended to continue increasing its S&OP maturity by including the following improvements in the third round of improvements:

- ✓ Start optimizing against the overall business goals, targets, and strategies in the Program process and implement tools to support such analysis (close gap 2).
- ✓ Start following up the results of the Program plan in relation to the Program process (close gap 6).
- ✓ Implement cross-functional measurements in order to evaluate S&OP efficiency (close gap 7).
- ✓ Implement time fences for allowed changes (close gap 12).
- ✓ Include a consolidated demand review meeting for the commercial divisions and a consolidated supply review meeting for the production units and VPT, VLC, and Volvo 3P in the Program process (close gap 17).
- ✓ Include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, and efficiency of review meetings in the S&OP efficiency measurements and start asking suppliers and dealers to evaluate the process (close gap 19).
- ✓ Incorporate a broad range of supply data in the Program process and implement a supply collaborator (close gap 26).

7.4 RECOMMENDATIONS FOR THE FOURTH ROUND OF IMPROVEMENTS

Last, VTC is recommended to leave the following improvements to the fourth round of improvements as there are prerequisites amongst the above improvements as well as ongoing VTC projects which obstruct implementing these improvements immediately:

- ✓ Start setting the final Program plan during the Program conference (close gap 18).
- ✓ Ensure high executive participation in both the S&OP team and the Program conference and ensure that the participants at the Program conference have full authority to make decisions (close gap 20).
- ✓ Implement a formal S&OP team (close gap 21).
- ✓ Consider all aspects of supply, including body builder capacity, in the Program process. Thus, expand the definition of the Program process (close gap 24).

7.5 RECOMMENDATIONS FOR HOW TO INCORPORATE SCENARIO ANALYSIS IN THE PROGRAM PROCESS

VTC should incorporate scenario analysis in the Program process in order to support the decision making. The following recommendations are given:

- ✓ Close gap 13: quantitative forecasting, gap 14: separation of forecast and demand plans, and gap 23: training programs since they are considered *prerequisites*.
- ✓ *Decide upon ambitions and goals* with incorporating scenario analysis into the S&OP process. It is recommended that the aim of scenario analysis should be two-folded and include handling uncertainties in order to increase the awareness of possible future outcomes as well as increase the awareness of the impacts of alternatives and decisions. Thus, make choices and their consequences more explicit.
- ✓ *Set the scope and time frame for the analysis*. It is recommended that the time frame is set to the planning horizon of the Program process. The possible scope is dependent on the goal of the analysis and the available supporting tools.
- ✓ *Incorporate scenario analysis in three of the process steps*, i.e. in the creation of the market requests, in the development of the supply answers, and during the Program conference. Start simple and increase the depth of the analysis over time in order to reach the goals and ambitions.
- ✓ *Evaluate and decide upon what supporting tools to use for the scenario analysis*. As VTC is experiencing high complexity, it is recommended to investigate the possibility of investing in more advanced software. Acquiring a demand-side planning system is recommended initially as no direct limitations have been found in this aspect. What type of supply-side planning system and S&OP workbench that should be used must however be further evaluated. Moreover, it must be ensured that the systems can be integrated and receive input data from other systems, e.g. from the financial system.
- ✓ *Develop scenarios around the main sources of uncertainty* which have been identified as: e.g. the total truck market development, the total economic development, success, cannibalization rate, and timing of new product introductions, uncertainties in specific markets such as Brazil, material availability and suppliers' flexibility and capacity constraints. As uncertainties are changing over time, the experienced uncertainties must continuously be evaluated and updated.
- ✓ *Develop scenarios around potential alternatives* both on the demand and supply-side. E.g. to consider demand shaping alternatives is recommended for the commercial divisions and, depending on the decision taken concerning supply-side planning system, it is recommended to create different supply alternatives as well as evaluate the best allocation of volumes between markets.
- ✓ *Decide upon how the scenarios should be evaluated*. If deciding upon an ambitious goal for the scenario analysis, it is recommended that the evaluation is done in alignment with overall business goals. However, this requires advanced planning software. Independently of the goals and tools, it is recommended that the scenarios are evaluated with the company's strategy in mind.

8 CONCLUSIONS

This chapter concludes upon the results of the thesis and the main theoretical and managerial implications as well as proposes fields for future study.

S&OP is commonly agreed upon as an increasingly important planning process in today's business environment where volatile markets and complex supply chains increase the need for determining future actions and collaboration in the creation of sales and operations plans. Moreover, benefits connected to S&OP range from improved profitability and reduced inventory to increased customer service and shared goals instead of previously competing functional objectives. Consequently, S&OP is expressed as one of the most exciting possibilities for businesses in the future. VTC is one company interested in knowing what S&OP improvements it could do in order to gain further benefits from the process. With this background, the thesis had a purpose of assessing how VTC can improve its S&OP process given the company's S&OP context.

The results from this thesis are recommendations which concisely summarize areas where VTC could make changes in order to improve its process, divided into four consecutive improvement rounds. It is concluded from the analysis that VTC has 20 gaps between its current S&OP process and the theoretical recommendations where improvements are appropriate seeing the company's specific S&OP context. The closure of these gaps would result in VTC progressing from the current classification of a Standard S&OP user in the maturity framework to Stage 5, a Proactive user, in all dimensions but one, i.e. Meetings and Collaboration. Because of context rationales, the latter is left to Stage 4 and it may thus be concluded that reaching the highest stage in all dimensions is not appropriate for the company seeing its unique context. The improvements which are evaluated to be beneficial for VTC are within the areas of the S&OP process goals at VTC, available decision support, the structure and planning parameters of process, the organization, and how the suppliers are considered and incorporated in the process. Concerning the four improvement rounds, VTC is recommended to start closing gaps which are considered prerequisites. Next, the focus should be on closing gaps in order to increase the S&OP maturity. In the last round, it is recommended to close gaps which, due to internal S&OP context reasons, cannot be closed immediately. Concerning scenario analysis, the results include recommending VTC to incorporate scenario analysis in three of the S&OP process steps and develop scenarios around its main sources of uncertainty as well as around its potential alternatives both on the demand and supply-side. Further, how the scenario analysis should be carried out and the depth of the analysis are heavily dependent upon available supporting tools. Thus, VTC should investigate the possibility to invest in more advanced software supporting the scenario analysis.

The theoretical contribution of this thesis lies foremost within the development of the general S&OP improvement model which provides guidelines on steps that are important to consider when improving an S&OP process. Furthermore, theoretical verifications and proposals have been discussed and suggested. Verifications include the importance of the S&OP goal in S&OP improvements and the multifariousness of S&OP. Further, the results verify that the S&OP context affects how a company should improve its S&OP process and that S&OP

maturity frameworks are useful for understanding the current state of the S&OP process as well as appropriate next improvement steps. Hence, taking a contingency approach to S&OP has in this thesis proven to be important. From the results of this thesis, it is proposed that the S&OP context influences the optimal S&OP maturity. Further, it is also proposed that the S&OP context, maturity, and goal affect how scenario analysis can be incorporated in the S&OP process. The managerial implications are, first, the possibility to put the developed S&OP improvement model to use in order to assess how a company can improve its S&OP process. Second, some of the results of the thesis may be generalized and an even greater amount transferred to companies that share some of VTC's S&OP context.

A potential limitation of this thesis is related to the method choice of focusing on investigating the gaps further whilst not analyzing areas where VTC's current S&OP process matches the theoretical recommendations. In theory, analyzing the matches could have resulted in some areas where VTC's context justifies not working in precise alignment with the theory. However, concerning VTC, it is not considered that any of the matches provide any potential for improvements and hence, in the case of VTC, all potential improvements are considered to result from the gaps. Thus, the method choice has not restricted reaching the purpose of this thesis. However, as it may limit other companies, matches are considered in the proposed general S&OP improvement model.

This thesis may serve as a starting point for future work at VTC as well as point to areas in need of future research. The results provide VTC with recommendations of improvement areas but since scenario analysis is the sole recommendation investigated further, VTC may use the recommendations as a starting point for which improvement projects that should be initiated and in which order. Concerning future research, the difference between the S&OP goal described in literature and the one used in practice is an interesting topic for further study. Moreover, further exploration of how the S&OP context affects the optimal design of the S&OP process and the creation of a contingency framework for S&OP are areas to consider. The rationale for this is that there are limited contributions in the literature in the field of taking a contingency approach to S&OP whilst there is an obvious need in the industry for such contributions. Connecting a contingency framework to the current maturity frameworks is another idea for future research since it would highlight the need for different maturity levels depending on the experienced S&OP context. Such research would thus investigate the authors' proposal that the S&OP context influences the optimal S&OP maturity. Furthermore, future research may be conducted in order to assess how scenario analysis should be incorporated in the S&OP process and case studies assessing the current use in industry may be one appropriate method. In order to strengthen the contribution of this thesis, the proposed general S&OP improvement model could be used for case studies in other companies. This would be appropriate in order to validate the model and its usefulness in various contexts.

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APPENDIX 1 – COMPARISON OF MATURITY FRAMEWORKS

Some different maturity frameworks are presented in the literature. Grimson and Pyke's (2007) "Five-Stage Maturity Framework" is considered to be the most extensive and was thus chosen to be used for the classification in this study. Figure 17 illustrates how four of the other maturity frameworks somewhat cover the different dimensions presented in Grimson and Pyke's (2007) "Five-Stage Maturity Framework", namely; Meetings and Collaboration, Organization, Measurements, Information Technology, and S&OP Plan integration. The size of the box represents whether the specific framework covers everything that Grimson and Pyke (2007) cover or if it only covers part of the dimension.

	Meetings & Collaboration	Organisation	Measurements	Information Technology	S&OP Plan Integration
Aberdeen Group (2010)	Organization	Organization Knowledge Mgmt	Performance Mgmt	Technology Knowledge Mgmt	Process Technology
Lapide (2005)	Meetings held Demand and Supply plan alignments			Enabling technologies	Demand and Supply plan alignments Enabling technologies
AMR Research (2009)	Balance: S&OP	Ownership	Metrics		Goals Balance: S&OP
Ventana Research (2006)	People Process	People	Performance Mgmt	Technology	Technology Performance Mgmt

Figure 17. Comparison of Aberdeen Group (2010), Lapide (2005), AMR Research (2009), and Ventana Research's (2006) frameworks with Grimson and Pyke (2007).

APPENDIX 2 – ABERDEEN GROUP’S “S&OP COMPETITIVE FRAMEWORK”

Aberdeen Group’s (2010) framework, see Figure 18, is based on a study done with 196 companies on how they are currently working and best practices have been developed based on this. The framework classifies three maturity classes; Laggard, Industry average, and Best-in-Class based on an aggregate performance on four KPIs, namely; Forecast accuracy, Perfect order delivered to customers, Cash-cash cycle, and Change in gross profit margin. Being an advanced S&OP user is believed to lead to good results in these metrics. However, the authors of this thesis do not believe that there is any guarantee that companies performing well in the metrics are automatically mature S&OP users. The framework presented by Aberdeen Group (2010) is believed to be more suitable as best-practice instead of using it to classify a company’s maturity level.

The framework includes five categories; Process, Organization, Performance measurement, Technology, and Knowledge management, where each maturity class showed similar characteristics within the class but significant differences to the other classes.

	Best-in-Class	Average	Laggards
Process and Organization	Ability to evaluate constrained planning scenarios during supply demand balancing		
	46%	25%	20%
	Ability to evaluate and optimize inventory and service policy to maximize cash flow and profitability as part of the S&OP process		
	38%	17%	11%
Performance Measurement	Ability to create upside opportunity assessment scenarios to analyze S&OP plan		
	28%	13%	11%
	High-level reporting designed for executive management		
	54%	34%	32%
Technology	Ability to consider the KPIs from previous periods with regard to capacity, forecast accuracy and inventory		
	44%	41%	25%
	Ability to express the S&OP plan in terms of revenue and margins		
	48%	30%	26%
Knowledge Management	Automated features / functionalities:		
	<ul style="list-style-type: none"> ▪ Demand Planning – 53% ▪ Supply Planning – 58% ▪ Inventory planning – 51% 	<ul style="list-style-type: none"> ▪ Demand Planning – 33% ▪ Supply Planning – 28% ▪ Inventory planning – 32% 	<ul style="list-style-type: none"> ▪ Demand Planning – 30% ▪ Supply Planning – 26% ▪ Inventory planning – 26%
	Our people understand the business strategy, products, and processes		
	68%	39%	25%
Knowledge Management	Our people manage critical relationships through the end to end supply chain		
	47%	27%	15%
	Our people view the supply chain holistically, in terms of linked processes		
	44%	23%	13%
	Our people utilize statistical analysis and fact based decision making		
	30%	27%	18%
	Our people understand business systems (ERP, Advanced Planning, BI) and utilize them effectively		
28%	26%	12%	

Figure 18. Aberdeen Group’s (2010) “S&OP Competitive Framework”.

APPENDIX 3 – LAPIDE’S “FOUR-STAGE S&OP PROCESS MATURITY MODEL”

Lapide’s (2005) maturity model, see Figure 19, is described as a diagnostic tool that can be used by companies to identify where their current process is on the scale and to identify gaps between the “as-is” status and the ideal. The framework presents four stages of process maturity: Marginal, Rudimentary, Classic, and Ideal. The different stages are described by the three categories: Meetings, Processes, and Technology. Once the gaps are identified, an action plan needs to be developed by doing a cost/benefit analysis of the possible actions of how to reach an optimal level (Lapide 2005).

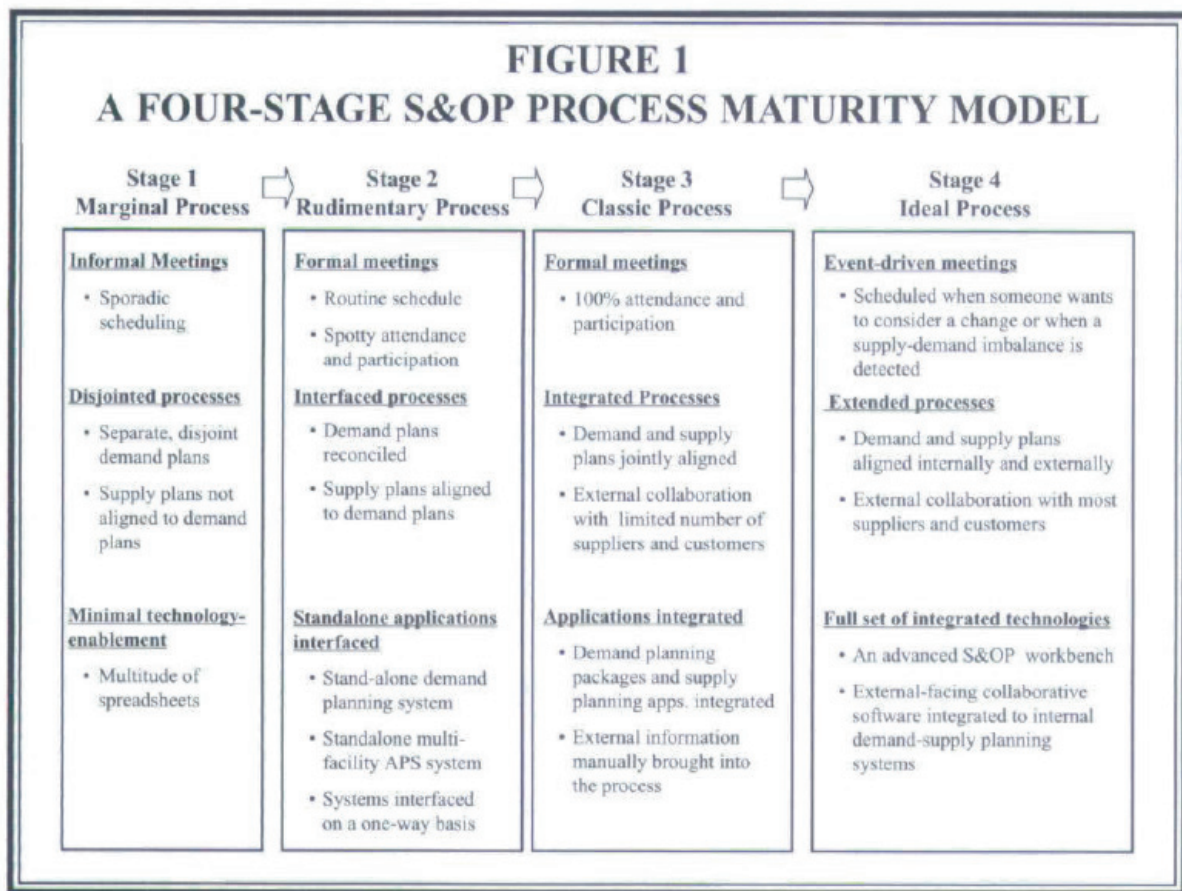






Figure 19. Lapide’s (2005) “Four-Stage S&OP Process Maturity Model”.

APPENDIX 4 – AMR RESEARCH’S “THE MATURITY MODEL”

AMR Research’s (2009) framework, see Figure 20, describes “the journey for demand-driven S&OP transformation”. The group has developed a test where a company can assess how demand driven its S&OP process is and from there continue the journey. AMR Research (2009) mentions that even though 85 percent of companies have an S&OP process not many of them look the same. It could therefore be difficult to state what best practice is. However, the authors conclude that companies that have succeeded all have good answers to three questions: “What is the goal of S&OP?”, ”What does good look like?”, and “How is the plan executed?”. Companies need clear goals, aligned metrics, and the planning needs to be connected to execution according to AMR Research (2009). Therefore, the framework includes four categories: Balance between S and OP, Goal, Ownership, and Metrics. The four stages presented are: Reacting, Anticipating, Collaborating, and Orchestrating. Progressing to a more advanced stage goes hand in hand with an increase in organizational balance (AMR Research 2009). The only information found about the AMR Research (2009) framework is the figure below, Figure 20, and thus, it would have been difficult to use this framework for the mapping and classification of VTC.

Stage	1 Reacting	2 Anticipating	3 Collaborating	4 Orchestrating
Balance: S&OP				
Goal	Development of an operational plan	Demand and supply matching	Profitability	Demand sensing, and conscious trade-offs for demand shaping to drive an optimized demand response
Ownership	S = Sales OP = Factory capabilities	S = Sales and marketing plans OP = Planning and factory capabilities	S = Go-to-market plans OP = Design of demand-driven plan, make, and deliver processes	S = Go-to-market strategies and solutions OP = Translation of demand into plan, make, deliver, source, and service strategies, with connection to execution
Metrics	Order fill rate, asset utilization, inventory levels	Order fill rate, forecast error, inventory turns, functional costs	Demand error, customer service, working capital, total costs	Demand risk, customer service, cash flow, market share, and profit

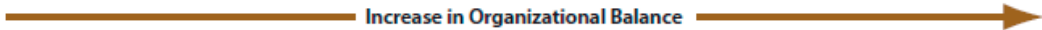


Figure 20. AMR Research’s (2009) “The Maturity Model”.

APPENDIX 5 – VENTANA RESEARCH’S “MATURITY MODEL”

Ventana Research’s study (2006), see Figure 21, is based on a study of 470 respondents and the survey questions were divided into four categories; People, Process, Technology, and Performance management, which later were used to evaluate companies’ maturity within each category. These four categories are also the basis for its presented framework. As Ventana Research’s study (2006) is based on what companies believe are needed, this might neither be aligned with what academia believes is needed nor with what actually yields most benefits.

The framework distinguishes between four levels: Tactical, Advanced, Strategic, and Innovative. The study showed that most companies can be found at the Tactical or Advanced level and only 16 percent can be considered Innovative. The study states that most companies have great potential for improvement and that it is important to align people, processes, performance management, and technology.

Tactical: Does only the basics of S&OP, such as demand and supply balancing.

Advanced: Progressed in knowledge and skill of S&OP beyond the basics, for example, to formal planning and review meetings.

Strategic: Uses S&OP to align operational planning with corporate strategic objectives.

Innovative: Runs S&OP using a variety of performance management techniques.

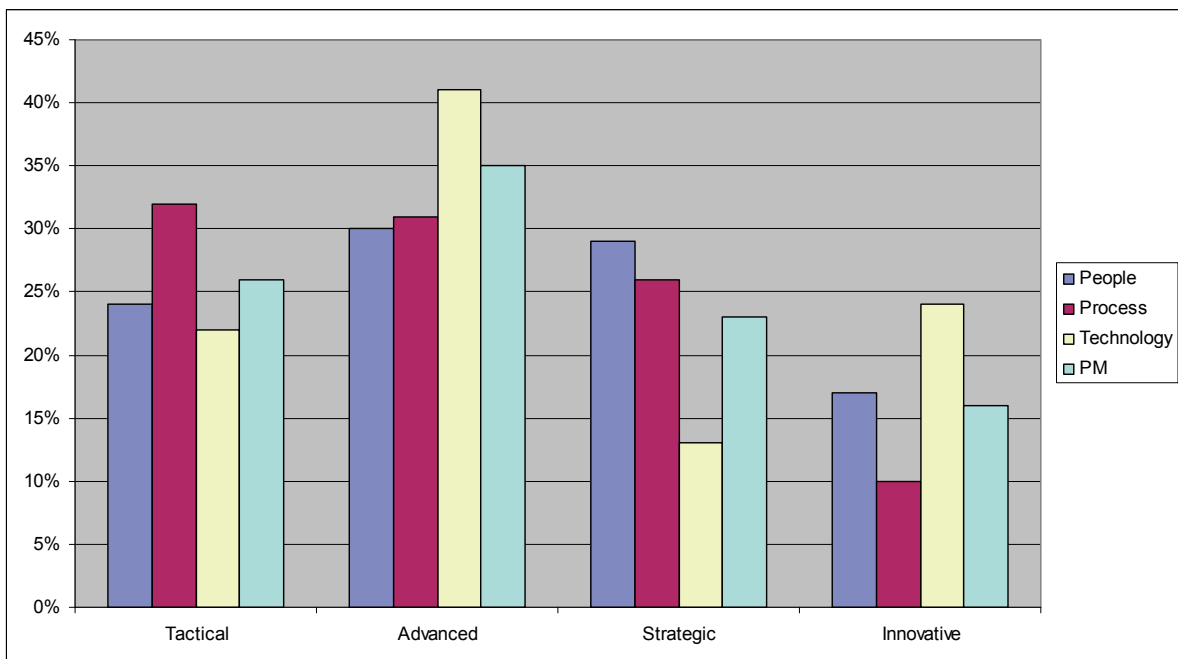


Figure 21. Ventana Research’s (2006) “Maturity Model”.

APPENDIX 6 – SCHOEMAKERS’ PROCESS FOR SCENARIO CREATION

In order to develop scenarios, Schoemaker (1995) presents a general ten step process:

1. Define the scope

The first step consists of defining the scope of the analysis. To begin with, the time frame of the scenarios and the scope in terms of products, markets, geographic regions, and technologies should be set. Next, past sources of uncertainty should be identified. For the identification it is useful for the company to look at the past and think about what it know now that it wish it would have known then.

2. Identify major stakeholders

Stakeholders who are interested in, affected by, or may influence the issues identified in step 1 should be identified in the second step.

3. Identify basic trends

Trends that will affect the issues in step 1 should be identified as a third step. Trends may be political, economic, societal, technological, legal, or industry trends.

4. Identify key uncertainties

Events, whose outcomes are uncertain, and which will significantly affect the issues identified in step 1 should be identified. Thereafter, outcomes of each uncertainty should be determined. It is useful to keep the outcomes simple and few, three outcomes such as high, medium and low may be enough.

5. Construct initial scenario themes

From the above steps, the main ingredients for scenario creation are gathered. Thereafter, as a fifth step, scenario themes should be created. One alternative is to identify extreme worlds by putting all positive elements in one and all negative elements in one. Another alternative is to select the top two uncertainties and to cross them.

6. Check for consistency and plausibility

There are probably internal consistencies in the above created simple scenarios and thus they need to be checked for consistency and plausibility. Are the trends compatible with the chosen time frame? Do the scenarios combine outcomes of uncertainties that indeed go together? Are the major stakeholders placed in positions they do not like and can change?

7. Develop learning scenarios

Some general themes should merge from the fifth and sixth step. Hence, next themes should be identified that are strategically relevant and thereafter the possible outcomes and trends should be organized around them.

8. Identify research needs

This step leaves room for additional research that might be needed in order to further understand the uncertainties and trends.

9. Develop quantitative models

As a ninth step, the internal consistencies of the scenarios should be reexamined and thereafter it should be assessed whether certain interactions should be formalized via a quantitative model.

10. Evolve toward decision scenarios

Finally, an iterative process should be used to converge towards scenarios that are useful in order to test strategies and generate ideas.

APPENDIX 7 – OBSERVATIONS

Table 36 presents which meetings that have been observed and how many times.

Table 36. Information about the performed observations

Meeting	Attended	Number of times attended	Note
Regional sales meeting (EuD)	No		
Telephone meetings with the regions (EuD)	Yes	3	
Central response meeting (EuD)	No		
Area meetings (ID)	No		
Telephone meetings with the areas (ID)	Yes	2	
Sales meetings (EuD)	Yes	2	
Sales meetings (ID)	Yes	1	
Program proposal meeting	No		
VPT Conference	Yes	1	
3P internal pre-meetings	No		
Local production meeting (SAM)	No		
Plant response meeting (EM)	Yes	1	Gothenburg plant
Assembly conference (EM)	Yes	1	
Management assembly conference (EM)	Yes	1	
VTC Program conference	Yes	3	
Total number of observations		15	

APPENDIX 8 - INTERVIEWS

Table 37 presents which interviews that have been conducted and how many times.

Table 37. Information about the performed interviews

Function / Organization	Name	Title	Number of occasions	Note
GML	Emil Jonsson	Manager, Dept. 27130, Program & Planning / Sales & Operations Planning	3	Master thesis supervisor
GML	Stefan Karlsson	Inbound Process Manager	1	
EM	Jan Ohlsson	General Manager European Manufacturing	1	Responsible for EM's answer to the Program proposal
EM	Gunnar Askman	Planning Manager or Process Coordinator Program & Planning	1	EM's S&OP coordinator
IM	Torgny Wennerholm	Manager IML	1	Responsible for IM's answer to the Program proposal
SAM	Jorge Marquesini	Director SAM	1	Responsible for SAM's answer to the Program proposal
EuD	Ingela Wahl	Production program process responsible EuD	2	EuD's S&OP coordinator
EuD	Jon Jynnås	Market Analyst - Truck Market Forecasts & Truck Population	1	Truck market context
ID	Ulrik Andersson	Logistic Manager and S&OP coordinator ID	2	ID's S&OP coordinator
Finance	Lars Westlund	Manager Group Controller and Business Controller for VTC	2	
VPT	Henry Rostén	Director Order & Volume Planning	1	Responsible for VPT's answer to the Program proposal
Volvo 3P	Jan Klingberg	Vice President, 3P Purchasing Europe	1	Responsible for Volvo 3P's answer to the Program proposal
Volvo 3P	Hans Elmquist	Project Leader Global Manufacturing projects	1	
VLC	Ronny Börjesson	Manager Purchasing Strategy & Support at Volvo Logistics	1	Responsible for VLC's answer to the Program proposal
Oracle	Per-Magnus Karlsson	Senior Director, Western Europe, SCM Applications	1	
Chalmers	Linea Kjellsdotter Ivert	PhD, Division of Logistics and Transportation	1	
Total			21	

APPENDIX 9 – INTERVIEW TEMPLATES – INTERNAL INTERVIEWS

This appendix presents the interview templates for the commercial divisions, production units, finance and business control, internal suppliers, and for the market analyst.

INTERVIEW TEMPLATE – COMMERCIAL DIVISIONS – EUD AND ID

Introduction: Present who we are and what we are doing our master thesis about.

Areas we want to discuss with you about: S&OP context, S&OP goal and process, S&OP dimensions: Meetings & Collaboration, Organization, Measurements, IT, Plan Integration; Drivers and Constraints, and Issues.

Title:

- Is your title correct?
- Could you please tell us more about your work?
- What is your role in the Program process?

S&OP CONTEXT

CUSTOMERS

1. Who are your customers?
2. How many customers does VTC have?
3. Does the Pareto Principle apply to your customers?
4. How do you segment the market? Which are VTC's target segments?
5. How do you further segment your customers? (For example geographically, how they buy, what they buy, order winners etc)
 - a. What characterise VTC's European customers?
6. Could you please describe customer behaviour? How does it differ between the segments/regions/fleet/retail?
7. How price elastic is the customers?
8. What different distribution channels does VTC use?

PRODUCTS

9. Please tell me about your products:
 - a. How do you segment your products? (Model, type, single variant, variant combination → item number?)
 - b. How many different types of trucks do you sell including CA (Customer Adaptation)?
10. Does the Pareto Principe apply to your products?

OTHER

11. Is there something else in the context that you can identify as important for the S&OP process?

S&OP GOAL AND PROCESS

GENERAL

12. What do you think the purpose is with the S&OP process?
13. Do you think it achieves its purpose?

PROCESS

FORECASTING AND MARKET REQUEST

14. Could you please describe the process to forecast demand which leads up to the market request?
 - a. Bottoms up / top down / mixture?
 - i. You said yesterday during the meeting that the markets are adapting to what has been confirmed in previous programs. What did you mean with that and how does that affect the forecast?
 - b. What forecasting methods do you use?
 - c. Which factors do you base your forecast on?
 - d. Who is involved? Organizational levels?
 - e. Time frame? 3 / 6 / 12 / 18 month / Other?
 - f. How long does it take to generate a forecast?
 - g. How often are forecast generated and updated?
 - h. What tools do you use – spreadsheets / more sophisticated software?
 - i. Do you involve your customers?
15. Is there any difference between the forecast and market requests (sales/delivery plans)?
16. How is the market request done and what does it consist of?
 - a. Trucks to be delivered or sold or produced (production order)?
 - b. What factors do you base your request on? (for example, economic climate, history, order-book status, strategic assessment, campaigns)
 - c. How do you use buffers?
 - d. By whom is the market request done?
 - e. What Software do you use?

MEETINGS

This section covers the meetings that the commercial division attends.

Sales meeting

17. What's the purpose of the sales meeting according to you?
18. Do you think it achieves its purpose?
19. How do you prepare?
20. What is your obligation during the meeting?
21. "The sales meeting arranges the order of priority within the markets?" is listed as one of the responsibilities of the sales meeting. Could you please explain to us what that means.
22. "There shall be review of: market request per region & Market shares and total market in the below and above 16 tonne gross weight category" is listed as part of the sales meeting. Is this still correct?
23. What is the output of the Sales meeting for you?
24. How do you use this output?

Program Proposal meeting

25. What's the purpose of the Program proposal meeting according to you?
26. Do you think it achieves its purpose?
27. How do you prepare?
28. What's included in the meeting? What happens?
29. What is your obligation during the meeting?
30. What is the output of the Program Proposal meeting for you?
31. How do you use this output?

Program conference

32. What's the purpose of the Program conference according to you?
33. Do you think it achieves its purpose?
34. How do you prepare?
35. What is your obligation during the meeting?
36. What is the output of the Program conference for you?
37. How do you use this output?

DIMENSIONS

ORGANIZATION

38. Is there a formal S&OP team at VTC?
39. Is there a formal S&OP team at EuD?
40. Who is responsible for the S&OP process at EuD?
41. How is EuD's organization structured and which parts are involved in the S&OP process?
42. Is S&OP a part of your job description?
43. Is the S&OP process at VTC understood and respected among the employees at EuD?
44. Does everyone find the S&OP process important for VTC to succeed?
45. Do you see the connection between the S&OP planning and profitability? Other people at EuD?
46. Yesterday at the meeting you mentioned increasing prices, how is the pricing connected to the S&OP process?
47. How do you work with increasing the awareness of the S&OP process and its importance? Training?
48. What is your opinion of the fact that the S&OP program is organized under GM? Pros / Cons? And Drivers / Constraints?

MEETINGS AND COLLABORATION

49. Are your customers actively participating in the process (meetings)?
50. How do you respond to disruptions to your demand forecast?
 - a. Do disruptions lead to event driven S&OP or is it within regular meetings?

MEASUREMENTS

51. What performance measurements do you use at EuD?
52. Do you measure the efficiency of your part in the S&OP process?
 - a. Forecast accuracy over time?
 - b. On time deliveries?
53. Does someone outside EuD measure EuD's efficiency in the S&OP process?

54. Do you get any feedback about your work in the S&OP process?
 - a. Do you get feedback from peers, supervisors and subordinates about your work in the S&OP process? (360-degree feedback)
55. Are customers asked to evaluate the S&OP process?
56. What measures are used for new product introduction? (Development cost, time to market, ramp up time, number of successful introductions). Who to ask about this?
57. Are you at EuD accountable for VTC's profitability? (Together with production units)
58. Is the S&OP process accountable for optimizing VTC's profitability?

IT

59. What IT structure is used for demand, supply, and S&OP planning?
 - a. Spreadsheets – is there a single one or several? How many?
 - b. Revenue and operations optimization software?
 - c. Are the demand and supply-side systems linked?
 - d. Is the information consolidated and centralized?
 - e. Do you use any automated tools for sharing information about the sales and operations plans between the S&OP team members? For example Market Requests
 - f. Do you use an ERP system for the S&OP work? SAP etc
 - g. Do you perform any Scenario simulation and analysis?

S&OP PLAN INTEGRATION

60. Do you perform any Constrained based planning in the market request? (sales plan)

DRIVERS AND CONSTRAINTS

61. Can you see any internal constraints that affect VTC's way of working with S&OP? Are there any that are specific for you/EuD?
62. Can you see any internal drivers that affect VTC's way of working with S&OP? Are there any that are specific for you/EuD?

ISSUES

63. Do you see any problems/issues with the current S&OP process? Any benefits that haven't been obtained that you were expecting?

64. Is there anything in the current process you would change if given a possibility?

This example is from the interview with IM. Similar interview templates were used for EM and SAM.

INTERVIEW TEMPLATE – PRODUCTION UNITS – (EM, IM, AND SAM)

Introduction: Present who we are and what we are doing our master thesis about

Areas we want to discuss with you about: S&OP context, S&OP goal and process, S&OP dimensions: Meetings & Collaboration, Organization, Measurements, IT, Plan Integration; Drivers and Constraints, and Issues.

Title:

- Is your title correct?
- Could you please tell us more about your work?
- What is your role in the Program process?

S&OP CONTEXT

1. Is there something in VTC's context (manufacturing process, business environment, customers, suppliers, competitors...) that you can identify as important for the S&OP process?

S&OP GOAL AND PROCESS

GENERAL

2. What do you think the purpose is with the S&OP process?
3. Do you think it achieves its purpose?

PROCESS

4. In what steps of the process are you involved?
5. Could you please tell about how you do capacity checks
 - a. IM responsible for Brisbane, Durban, Bangalore & Bangkok plants.
 - i. What characterises the different plants?
 - ii. Who is responsible for the partly owned Volvo plants ex. Taipei, Kuala Lumpur. Are they involved in the program process?
 - b. How do you keep updated on the capacity in the plants?
 - c. When does it take place?
 - i. Every month?
 - ii. In what step of the program process?
 - iii. Before after program proposal meeting?
 - d. How do you use the market request/ program proposal in these discussions/meetings?
 - e. How do the plants prepare before these meetings?
 - f. AND How do the plants calculate how much capacity they have in the plants?
 - i. How is this calculation done?
 - g. What is being discussed during the meetings?
 - h. What is the output of the discussions?
 - i. How is the output used?
6. How can you change the capacity in the plants?
 - a. Short/medium/long-term?
 - b. How far in advance must changes be decided upon? What's the lead time for capacity changes?

MEETINGS

Program Proposal meeting

7. What's the purpose of the Program proposal meeting according to you?
8. Do you think it achieves its purpose?
9. How do you/IM prepare?
10. What is your/IM's obligation during the meeting?
11. What is the output of the Program Proposal meeting for you/IM?
12. How do you/IM use this output?

Program conference

13. What's the purpose of the Program conference according to you?
14. Do you think it achieves its purpose?
15. How does IM prepare?
16. What's IM's obligation during the meeting?
17. What is the output of the Program conference for IM?
18. How does IM use this output?

DIMENSIONS

ORGANIZATION

19. Is S&OP a part of your job description?
20. Is the S&OP process at VTC understood and respected among the employees at IM?
21. Does everyone find the S&OP process important for VTC to succeed?
22. Do you see the connection between the S&OP planning and profitability? Other people at IM?
23. What is your opinion of the fact that the S&OP program is organized under IM? Pros / Cons? And Drivers / Constraints?

MEETINGS AND COLLABORATION

24. How do you/IM respond to disruptions in operations?
 - a. Do disruptions in operations lead to event driven S&OP or is it within the regular meetings?

MEASUREMENTS

25. What performance measurements do you use at IM?
26. Operational: inventory turns, obsolescence, delivery performance, capacity utilization.
27. How often are measurements taken?
28. Do you measure the efficiency of your part in the S&OP process?
29. Does someone outside IM measure IM's efficiency in the S&OP process?
30. Do you get any feedback about your work in the S&OP process?
 - a. Do you get feedback from peers, supervisors and subordinates about your work in the S&OP process? (360-degree feedback)
31. Are you at IM accountable for VTC's profitability? (Together with commercial units)
32. Is the S&OP process accountable for optimizing VTC's profitability?

IT

33. What IT structure is used for supply and S&OP planning?
 - a. Spreadsheets – is there a single one or several? How many?
 - b. Revenue and operations optimization software?
 - c. Are the demand and supply-side systems linked?

- d. Is the information consolidated and centralized?
- e. Do you use any automated tools for sharing information about the sales and operations plans between the S&OP team members?
- f. Do you perform any Scenario simulation and analysis?

S&OP PLAN INTEGRATION

- 34. Do you perform any Constrained based planning in the operations planning?

DRIVERS AND CONSTRAINTS

- 35. Can you see any internal constraints that affect VTC's way of working with S&OP?
Are there any that are specific for you/IM?
- 36. Can you see any internal drivers that affect VTC's way of working with S&OP? Are there any that are specific for you/IM?

ISSUES

- 37. Do you see any problems/issues with the current S&OP process? Any benefits that haven't been obtained that you were expecting?
- 38. Is there anything in the current process you would change if given a possibility?

INTERVIEW TEMPLATE – FINANCE & BUSINESS CONTROL

Introduction: Present who we are and what we are doing our master thesis about

Areas we want to discuss with you about: S&OP goal and process, S&OP dimensions: Meetings & Collaboration, Organization, Measurements, IT, Plan Integration; S&OP context, Drivers and Constraints, and Issues.

Title:

- Is your title correct?
- Could you please tell us more about your work?
- What is your role in the Program process?
- How are you working with the commercial units and the operational units?

S&OP GOAL AND PROCESS

GENERAL

1. What do you think is the purpose with the S&OP process?
2. Do you think it achieves its purpose?

PROCESS

3. What is Finance and Business control's role in the program process?
4. What is your role in the program process? Which steps in the process are you involved in?
5. What is Finance and Business control's input to the process?
6. What is your obligation in the process?
7. What is your output from the process?
8. Which meeting do "Finance" participate in the program process?

MEETINGS

Program conference

9. What's the purpose of the Program conference according to you?
10. Do you think it achieves its purpose?
11. How do you prepare?
12. What is your obligation during the meeting?
13. What is the output of the Program conference for you?
14. How do you use this output?

S&OP - FINANCIAL ASPECTS

PROFITABILITY

15. Do you see any connection between the S&OP planning and profitability? Other people?
16. Do you create a profit optimized supply-demand balanced plan?
17. Is the S&OP process accountable for optimizing VTC's profitability?
18. Do you express the S&OP plan in terms of revenue and margins?

19. Is inventory target setting part of the S&OP process?
20. Do you evaluate and optimise inventory and service policy to maximize cash flow and profitability as part of the S&OP process?
21. How do you look at the trade-off between delivery precision and volume? Do you take conscious decisions here?
22. How do you set price levels at VTC? Are prices set in relation to the S&OP process?

INTEGRATING FINANCE WITH S&OP

23. Is financial planning and budgeting integrated with the S&OP process?
24. How are financial aspects integrated in the S&OP process?
25. Does finance set any goals for the S&OP process? (Connected to the overall financial goals of VTC?)
26. How are the numbers/goals in the business plan set? How fixed are they? Are they a goal for the S&OP process?
27. Do you at finance evaluate the implications of the S&OP plan?
28. Do you do any simulation, trying to translate the program into money terms to test its financial impact? E.g. do you develop financial plans that are integrated with the new product, demand and supply plans? (Financial plans here refer to income statements, balance sheets and cash flow across the planning horizon)
29. Do you perform gap analysis between financial plans and S&OP plans and take corrective actions?
30. Is projections used to identify gaps between current projections and VTC's goals and targets?
31. How often do you perform revenue forecasting? Connected to the S&OP process? E.g. do you get data from the S&OP process fed into your process?

RISK MANAGEMENT

32. How do you work with risk management in the program process?
33. Formal process and techniques?
34. Do you perform any scenario analysing or simulation?
 - a. If yes, what software do you use for this purpose?

DIMENSIONS

MEASUREMENTS

35. What are the core performance measurements at VTC?
36. Does the program process help achieve overall objectives?
37. Do you think the program process measurements (Request quality, Program quality, Truck Type Quality & Customer Response Lead Time) align well with these overall objectives?
38. Are there any other measurements you would like to see?
39. Do you use any financial measurements to evaluate the S&OP effectiveness?
40. Cash flow, revenue, costs
41. Do you measure the efficiency of your part in the S&OP process?
42. Do you connect your financial planning accuracy to the S&OP process? (The right S&OP performance threshold for this financial impact is 95 % accuracy on the financial planning process (e.g. Actual profit results/planned profit results and actual cost results/planned budget).

IT

43. What IT structure is used for financial planning?

44. How do you use the modules in SAP?
45. Are your systems linked to the S&OP systems?
46. If not, do you see any possibility of connecting your planning systems to the S&OP systems?
47. How do you share information with the S&OP team and keep updated on their work?

S&OP PLAN INTEGRATION

48. Do you perform any constrained based planning in the operations planning? (For example including constraints on pricing, competitive actions, capacity constraints, supply chain constraints)

S&OP CONTEXT

MANUFACTURING

49. How much do you manufacture in house/is some outsourced/ what is the split?
 - a. Gunnar Askman said something about 400' of the 500' in manufacturing cost was purchased material? (How confidential?)
50. How long time does it take to manufacture a truck? (Ca 70 h said Gunnar)

INVESTMENTS

- a. How do you apply for money for an investment? Lead times?

OTHER

51. Is there something in VTC's context (manufacturing process, business environment, customers, suppliers, competitors...) that you can identify as important for the S&OP process?

DRIVERS AND CONSTRAINTS

52. Can you see any internal constraints that affect VTC's way of working with S&OP? Are there any that are specific for you/IM?
53. Can you see any internal drivers that affect VTC's way of working with S&OP? Are there any that are specific for you/IM?

ISSUES

54. Do you see any problems/issues with the current S&OP process? Any benefits that haven't been obtained that you were expecting?
55. Is there anything in the current process you would change if given a possibility?

This example is from the interview with Volvo 3P. Similar interview templates were used for VPT and VLC.

INTERVIEW TEMPLATE – INTERNAL SUPPLIERS (VOLVO 3P, VPT, AND VLC)

Introduction: Present who we are and what we are doing our master thesis about

Areas we want to discuss with you about: S&OP context, S&OP process, S&OP dimensions: Meetings & Collaboration, Organization, Measurements, IT, Plan Integration; Drivers and Constraints, and Issues.

Title:

- Is your title correct?
- Could you please tell us more about your work?
- What is your role in the Program process?

S&OP CONTEXT

3P vs VTC

1. What is the relationship between 3P and VTC? 3P as a supplier/partner?

SUPPLIER SITUATION

2. How many suppliers do VTC have?
3. Does the Pareto Principle apply to the suppliers? Key suppliers?
4. How much power do the suppliers have? How dependent is VTC on its current suppliers? (Switching cost, Unique service / product, Ability to substitute)
5. Does the supplier situation differ between the different plants? Products?
6. Are the suppliers also supplying VTC's competitors?

S&OP PROCESS

GENERAL

7. What do you think is the purpose with VTC's S&OP process?
8. Do you think it achieves its purpose?

PROCESS

9. What is 3P's role in VTC's program process?
10. Which steps in VTC's program process is 3P involved in? (Both input to VTC and to VPT, indirectly to VTC.)
11. What is your role in the program process?
12. What is 3Ps input to the process?
13. What is your obligation in the process?
14. What is your output from the process?

S&OP PROCESS DIMENSIONS

MEETINGS

PROGRAM PROPOSAL MEETING

15. What's the purpose of the Program proposal meeting according to you?
16. Do you think it achieves its purpose?
17. How do you prepare?
18. What is your obligation during the meeting?
19. What is the output of the Program Proposal meeting for you?
20. How do you use this output?

POWERTRAIN CONFERENCE

21. What's the purpose of the Powertrain conference according to you?
22. Do you think it achieves its purpose?
23. How do you prepare?
24. What is your obligation during the meeting?
25. What is the output of the Powertrain conference for you?
26. How do you use this output?

PROGRAM CONFERENCE

27. What's the purpose of the Program conference according to you?
28. Do you think it achieves its purpose?
29. How do you prepare?
30. What is your obligation during the meeting?
31. We've heard you say during two conferences that you "say no to the program"
32. What is the output of the Program conference for you?
33. How do you use this output?

S&OP DIMENSIONS

MEETINGS AND COLLABORATION

34. Are VTC's suppliers actively participating in the process (meetings)? Any differentiation in involvement between different suppliers? (Those more or less important/big).
35. How does 3P respond to disruptions from the supply base?
 - a. Do disruptions to event driven S&OP or is it handled within the regular meetings?

MEASUREMENTS

36. Are you measured on the efficiency of your part in the S&OP process?
37. Do you get any feedback about your work in the S&OP process?
 - a. Do you get feedback from peers, supervisors and subordinates about your work in the S&OP process? (360-degree feedback)
38. Are the suppliers asked to evaluate VTC's S&OP process? Both 3P as a supplier and VTC's suppliers managed by 3P.

IT

39. What IT structure is used for supply planning?
 - a. Are your systems linked to VTC's?
 - b. Do you have any system linked with the suppliers? Automated/manually?

- c. Is your supplier information consolidated and centralized? For example when it comes to supplier capacity and their possibility of meeting the program volumes?

S&OP PLAN INTEGRATION

40. Do you perform any Constrained based planning in the supply planning?

DRIVERS AND CONSTRAINTS

41. Can you see any internal constraints that affect VTC's way of working with S&OP?
Are there any that are specific for 3P?
42. Can you see any internal drivers that affect VTC's way of working with S&OP? Are there any that are specific for 3P?

BENCHMARKING

43. What is your opinion of VTC's S&OP process in comparison to the rest of your customers?

ISSUES

44. Do you see any problems/issues with VTC's current S&OP process?
45. Is there anything that you would in the current process if you were given a possibility?

INTERVIEW TEMPLATE – MARKET ANALYST (EUROPEAN MARKET)

Introduction: Present who we are and what we are doing our master thesis about. The questions concern the European market unless other is stated.

Areas we want to discuss with you about: Market size and trends, Competitive situation, Business environment (PESTLE), Customers, Market attractiveness and power structure (PORTER), and Differences between markets

Title: Market Analysis - Truck Market Forecasts & Truck Population

- Is your title correct?
- Could you please tell us more about your work?
- What is your role in the Program process?

MARKET SIZE AND TRENDS

1. What is the size of the market in Europe?
2. What is the size of the total market in the world?
3. What is the market growth on the European market?
4. Have you observed any general trends on the European market?

COMPETITIVE SITUATION

5. How many competitors does VTC have and who are they?
6. How large market shares do the different brands have?
7. How would you describe the competitive situation? How intense is the competition?
8. What does it take to be competitive on the market? (for example resources, competences, technical knowledge et cetera)
9. How does VTC differentiated from the competitors?

BUSINESS ENVIRONMENT (PESTLE)

10. Could you please tell us more about how the macro business environment affects the truck market? (Political, Economic, Social, Technological, Environmental, and Legal)?
11. How sensitive is the truck market to economic cycles (business cycles)? Does it follow changes in GDP?

CUSTOMERS

12. What characterize truck customers in Europe? (E.g. what type of trucks do they buy?)
13. How can you segment the customers? (E.g. geographically, buying behavior, order winners?)
14. How would you describe European customers buying behavior?
15. How many customers does VTC have?
16. What are VTC's target customer segments?
17. Does the Pareto principle apply to your customers?

MARKET ATTRACTIVENESS AND POWER STRUCTURE (PORTER)

18. How strong is the customers' bargaining power?

19. How strong is the suppliers' bargaining power? (Switching cost, unique service / product, ability to substitute)
20. Could you please tell us more about possible entry barriers and exit barriers?

DIFFERENCES BETWEEN MARKETS

21. How does the European truck market differ from other markets in the world?
22. How do the markets differ within Europe?

APPENDIX 10 – INTERVIEW TEMPLATES – EXPERT INTERVIEWS

This interview template was used for the two expert interviews.

INTERVIEW TEMPLATE – EXPERT INTERVIEWS

1. What use have you seen of scenario analysis in S&OP?
 - a. What kind of scenarios is currently created? (What uncertainties exist that companies perform scenarios on?) (Det vill säga vad finns det för osäkerheter och vad händer det för saker som man måste agera på och därmed kan behöva göra scenarier kring?)
 - b. What kind of scenarios do you think should be created?
 - c. What is the time horizon is used in scenario analysis?
 - d. Should/how can/ scenario analysis be used in different parts of the S&OP process?
 - e. Is the scenario analysis different in up- respective downturn?
2. How do you think scenarios should be evaluated? E.g. what evaluation parameters should be used?
 - a. What are common ways of evaluating scenarios in industry today?
3. What input data is needed?
4. What systems are necessary in order to perform scenario analysis in the S&OP process?
 - a. What features do you believe that a system needs in order to perform scenario analysis in the S&OP process?
 - b. What links are necessary to other systems? (Is this dependent on the input-data?)
 - c. Is scenario often one module/part of an APS-system or are there separate systems available?
5. How does VTC's complexity (manufacturing footprint, many markets etc.) affect how the company can be working with scenario analysis?
 - a. How does it affect the choice of system support?
 - b. How long time does it take to "run" a scenario?
6. What are the benefits with scenario analysis?
7. What are the disadvantages with scenario analysis?
8. What are common problems that companies have faced when implementing and performing scenario analysis?
9. What are success factors when implementing and performing scenario analysis?
10. What other tools are available to use in the S&OP planning process?

APPENDIX 11 – IMPACT - EFFORT SURVEY

We would like you to grade the Impact and Effort of each gap. E.g. how large will the Impact be for VTC if it is decided to close the gap and how much Effort will it take to close it. Please grade from 1-5 where 1 is “no or very limited” Impact/Effort and 5 is “major” Impact/Effort.

ID	Gaps	Impact	Effort
1	The Program process has not as a formal goal to, and is nor partially accountable for, integrating plans in a way that reaches overall business and strategic goals		
2	No optimization against the overall business goals, targets and strategies in the Program process and no tools to support such methods		
3	Finance is little involved in the Program process, the budget is not used as input to the process, and plans are neither translated to monetary terms nor compared or tempered by financial goals		
4	Limited what-if and scenario analysis in the Program process and there is no tool to support such analysis		
5	Limited discussion of consequences, risks, and opportunities in relation to the Program plans		
6	The results of the Program plan is not followed up in relation to the Program process		
7	Limited cross-functional measurements used to evaluate S&OP efficiency		
8	Low consolidation and centralization of S&OP information in an automated way		
9	No S&OP workbench and low integration of supply, demand, and S&OP workbench systems		
10	Prices are not set in the Program process		
11	The planning horizon is shorter than the lead time for technical capacity changes		
12	Time fences for allowed changes are not used		
13	Limited use of quantitative forecasting methods and there is no tool to support such methods		
14	No clear separation of unconstrained forecast and demand plan and market request not in accordance with theoretical demand plan definition		
15	Limited event-driven S&OP meetings which supersedes scheduled meetings and include the whole S&OP team		
16	Product management review meeting not part of the Program process		
17	No consolidated demand or supply review meetings		
18	No final Program plan is set during the Program conference		
19	S&OP efficiency measures do not include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, efficiency of review meetings, and suppliers and customers are not asked to evaluate the Program process		
20	Limited executive participation (team and meeting) and participants at the Program conference do not have the full authority to make decisions		
21	No formal S&OP team		
22	The Program process is not organized under an independent function		
23	No formal training program about S&OP		
24	Not all aspects of supply considered in the Program process		
25	Customers are little involved in the Program process, limited customer data is incorporated, and no demand collaborator is used		
26	A broad range of supplier data is not incorporated in the Program process and there is no supply collaborator		

Please add if you have any comments:

APPENDIX 12 – RESULTS FROM SURVEY SENT OUT TO STEERING GROUP MEMBERS

Results from the survey sent out to the steering group members. The impact and effort presented here is a mean value of the four collected results.

ID	Gaps	Impact	Effort
1	The Program process has not as a formal goal to, and is nor partially accountable for, integrating plans in a way that reaches overall business and strategic goals	2,5	3,3
2	No optimization against the overall business goals, targets and strategies in the Program process and no tools to support such methods	3,2	4,0
3	Finance is little involved in the Program process, the budget is not used as input to the process, and plans are neither translated to monetary terms nor compared or tempered by financial goals	2,8	3,3
4	Limited what-if and scenario analysis in the Program process and there is no tool to support such analysis	2,0	3,0
5	Limited discussion of consequences, risks, and opportunities in relation to the Program plans	3,5	3,3
6	The results of the Program plan is not followed up in relation to the Program process	2,5	3,5
7	Limited cross-functional measurements used to evaluate S&OP efficiency	3,0	2,3
8	Low consolidation and centralization of S&OP information in an automated way	3,3	4,3
9	No S&OP workbench and low integration of supply, demand, and S&OP workbench systems	2,3	2,7
10	Prices are not set in the Program process	2,0	2,5
11	The planning horizon is shorter than the lead time for technical capacity changes	2,3	2,3
12	Time fences for allowed changes are not used	2,8	3,0
13	Limited use of quantitative forecasting methods and there is no tool to support such methods	3,0	2,3
14	No clear separation of unconstrained forecast and demand plan and market request not in accordance with theoretical demand plan definition	3,8	3,0
15	Limited event-driven S&OP meetings which supersedes scheduled meetings and include the whole S&OP team	3,5	3,8
16	Product management review meeting not part of the Program process	2,7	4,0
17	No consolidated demand or supply review meetings	3,3	4,0
18	No final Program plan is set during the Program conference	3,0	2,8
19	S&OP efficiency measures do not include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, efficiency of review meetings, and suppliers and customers are not asked to evaluate the Program process	2,3	3,3
20	Limited executive participation (team and meeting) and participants at the Program conference do not have the full authority to make decisions	2,0	3,0
21	No formal S&OP team	2,0	2,8
22	The Program process is not organized under an independent function	3,0	3,3
23	No formal training program about S&OP	2,8	2,8
24	Not all aspects of supply considered in the Program process	2,5	2,5
25	Customers are little involved in the Program process, limited customer data is incorporated, and no demand collaborator is used	3,3	3,8
26	A broad range of supplier data is not incorporated in the Program process and there is no supply collaborator	2,8	4,5

APPENDIX 13 – BRAINSTORMING PARTICIPANTS AND EXERCISES

Table 38 shows information about the seven brainstorming participants.

Table 38. Information about the brainstorming participants.

Function	Title
EuD	Production program process responsible EuD
ID	Logistic Manager and S&OP coordinator ID
ID	Business Controller
EM	Planning Manager or Process Coordinator Program & Planning
EM	Business Controller
GML	Manager, Dept. 27130, Program & Planning / Sales & Operations Planning
Finance	Manager Group Controller and Business Controller for VTC

EXERCISES DURING THE BRAINSTORMING

The brainstorming session was held in Swedish and the exercises will therefore be presented both in Swedish, as they were presented during the brainstorming, as well as in English.

EXERCISE 1 / ÖVNING 1:

“What would you have wanted to know 2-23 months ago in order to support the decisions taken in the Program process that you know today?”

”Vad hade du velat veta för 2-23 månader sedan för att stödja VTC’s beslutsfattande i Programprocessen som du vet idag?”

EXERCISE 2 / ÖVNING 2:

” If you could speak with the Oracle from Delphi, what would you like to ask about the upcoming 2-23 months that would affect the decision making in the Program process today?”

“Om du fick prata med Oraklet i Delfi, vad skulle du vilja veta om de närmaste 2-23 månaderna som skulle påverka beslut i Programprocessen idag?”

EXERCISE 3 / ÖVNING 3:

”Which three of the above identified sources of uncertainty have the most impact on VTC”

”Vilka 3 faktorer har högst potentiell påverkan på VTC? ”

EXERCISE 4 / ÖVNING 4:

”Which three of the above identified sources of uncertainty are the most uncertain?”

”Gällande vilka 3 faktorer är det svårast att förutspå vad som kommer hända? (osäkerhet om utvecklingen) ”

APPENDIX 14 – INTERNAL DOCUMENTS

Table 39 presents the internal documents which were studied in this thesis.

Table 39. List of internal documents used

Content of the document	Type of document	Note
S&OP process manuals	Word	General description of the process as well as detailed description of the sub-processes. The material is from 2005 and thus, many changes have been done to the process since.
Presentation material from Telephone meetings with the areas	Power Points	Pre-meetings at ID
Sales meeting presentation material	Power Points + Excel	
Program Proposal presentation	Power Point	
Program Conference presentation	Power Point	
Truck market outlook	PDF	
Program and planning KPI presentation	Power Point	
Flowchart used for the regions' market requests	Excel	
GIB Supply Chain KPIs	Power Point	
Logistics report	Excel	Monthly logistics report
S&OP AB Volvo group workshop presentation	Power Points	
S&OP presentation	Power Point	Made by Professor at Chalmers
VTC S&OP presentation	Power Point	Presentation created to describe VTC's S&OP Process at Chalmers
Order to Delivery functional map	Power Point	
Company information	AB Volvo's Intranet	AB Volvo's Intranet is called Violin

APPENDIX 15 – RESULTS FROM THE BRAINSTORMING

The outputs from the brainstorming, the identified sources of uncertainty, are presented in Table 40 and Table 41. Table 40 summarizes the identified sources of uncertainty divided into the three context groups: internal, downstream, and upstream.

Table 40. Sources of uncertainty (upstream, internal, and downstream) affecting decision making in the Program process.

Internal	Downstream (Customers and Competitors)	Upstream (Suppliers)
Internal capacity constraints	Total truck market development	Supplier capacity constraints
Internal flexibility	Total truck market in Latin America and NAME	Supplier flexibility
Overall Equipment Effectiveness	Market shares	VPT capacity constraints
Inventory development	Order intake	VPT flexibility
Effect of shorter lead times	Time for fleet Order intakes	Allocation of components within the Volvo Group's BAs
Product cost	Level of order cancellations	Most critical suppliers
Industry and customer delivery precision	Demand distribution between product variants	Material availability and disruptions
Success of strategies	Multi-brand strategy AB Volvo Group	Supplier delivery precision
Strategy alignment between supply and commercial	Competitors' strategies, activities, and product introductions	Supplier capacity, material availability, and disruptions during new product introductions (Time schedules for product introductions)
Multi-brand strategy AB Volvo Group	Development of Chinese competitors	
Top management's willingness to invest and allocation of investment funds in AB Volvo	Success of new product introductions	
Product sales strategy	Cannibalization rate of old products at new product introductions	
Time schedules for new product introductions		

Many macro factors were brought up during the brainstorming and these are summarized in Table 41 which also shows whether the macro factor affects the upstream, internal, or downstream context.

Table 41. Sources of uncertainty (Macro environment) affecting decision making in the Program process.

Macro environment effects			
	Internal	Downstream (Customers + Competitors)	Upstream (Suppliers)
Political		Occurrence and effects of Austerity and stimulation packages (for ex. Euro 6 incentives)	
		Political situation and development (for ex. development in NAME and EU sanctions on Iran)	
Economical	Currency development	Total economic development	
		Economic development in the US, Europe, and Brazil	
		Oil-price development	
Technological	Development and effect of hybrid technology	Development and effects of hybrid technology	Development and effect of hybrid technology
Legal	Occurrence and effects of new legislations	Occurrence and effects of new legislations	Occurrence and effects of new legislations
		Legislations in Brazil (for example pre-buy)	

APPENDIX 16 - ADDITIONAL EMPIRICS CONCERNING THE CREATE THE DEMAND PLAN PROCESS STEP

This appendix presents additional empirical findings concerning the Create the demand plan process steps to what was presented in the Empirical Findings in chapter 4.

FORECASTING

TOTAL MARKET FORECAST

EuD's total market forecast is developed with the help of inputs from research institutes presenting macro-economic factors and their development, statistics within the truck industry and registration statistics of trucks, customer's purchasing behavior and expectations as well as amongst others internal information on sales and order intake. This centrally developed total market forecast is sent out to the EuD regions that are asked to comment and share their local insights from the market where after the forecast may be updated again centrally.

INDIVIDUAL MARKET FORECASTS

With the help of the total market forecast, which is either developed centrally at EuD or locally at ID, the individual markets thereafter forecast the demand for VTC's trucks in their market and hence their expected market share. This forecast is based on technical turns, product introductions, decreases or increases within specific segments, new regulation happening on the markets, agreement with fleets, price targets as well as other factors affecting VTC's market shares on the specific market. Taking into account seasonal variations, campaigns, and VTC sales status at the current, a forecast is created.

EU D'S CREATE THE DEMAND PLAN PROCESS

The functional flowchart in Figure 22 illustrates in detail EU's Create the demand plan process including the time aspect, i.e. when in the different meetings take place.

After the markets have received the total market forecast and made their own forecast, mainly concerning market share, EuD is centrally sending out Excel sheets where the total market forecast is added and where the regions should fill in their forecasted market share and their pipeline. From these factors, the markets thereafter calculate their market requests.

The markets have a deadline to EuD for when they need to update their request in CEMAFOR. In period 1, 4, 7, and 10 when there is a total market forecast the deadline is on Tuesday week -3 and otherwise the deadline is on Wednesday week -3. In period 1, 4, 7, and 10 EuD holds telephone meetings with the regions after they have handed in their requests, as illustrated in Figure 22. These meetings are attended by the S&OP coordinator at EuD, the sales support and business manager at EuD, Logistics at EuD as well as the region's logistics manager and commercial trucks manager. As is further described in the Empirical Findings, the purpose of these meetings is for the regions to explain their market request and the underlying assumptions.

The remaining periods when there is no total market forecast or telephone meetings, EuD is centrally comparing and analyzing the requests.

As illustrated in Figure 22 and explained in the Empirical Findings, EuD holds central response meeting after the telephone meetings where the market requests are discussed by

EuD management.

Even though the markets have a deadline to EuD for the requests in CEMAFOR in week -3, the actual deadline to GM is on Monday week-2. This deadline of the request is called the m-version. After this deadline, the VTC S&OP manager releases the n-version of the requests in CEMAFOR. This is the version where EuD centrally can update the request if it has been considered necessary after the telephone meetings and the request review meeting. EuD moreover uses buffers centrally when it believes that the markets have not been focusing enough on the long-term. Moreover, in times when there is a high pressure on trucks, EuD may keep a buffer centrally to use for high profitable deals. This central EuD buffer is thus added in the n-version of the market request. The final market request, hence the n-version, is then discussed at the Sales meeting held at Tuesday week-2 as illustrated in Figure 22.

ID'S CREATE THE DEMAND PLAN PROCESS

ID's process up to the market request's m-version deadline is somewhat different than EuD's as illustrated below in the flowchart in Figure 23.

A first difference concerns the market request which is unconstrained and consists of volumes to be produced, hence with inventory deducted, in the same sense as for EuD. However, because of the long lead times to the ID markets and the many CKD plants supplying these markets there is extra complexity in the creation of the market requests for ID. For the requested volumes from the CKD plants the request is defined as volumes to be packed in the packing in Gothenburg in the period. Thus, because of long lead times to the plants, the forecasted demanded volumes in one period will be requested in two or three periods earlier to include the lead times. The ID markets dealing with CKD get input from IM concerning when to request volumes depending on when the customers have ordered it.

Most of the ID areas have local meetings where they agree on their request before sending in an information package concerning the request to ID centrally. This package is used at the following telephone meetings held on Thursday week-4 and Monday week-3 as illustrated in the flowchart. This deadline thus concerns information about the requests and not, as is the case for EuD's regions, the actual request in CEMAFOR.

The telephone meetings are attended by the S&OP coordinator at ID together with central logistics and the area managers in charge of the request locally. The areas describe their forecast and the underlying assumptions, order and inventory status, issues and opportunities on the market, and what they plan to put in the request in CEMAFOR on Monday week-3. This meeting gives central ID a chance to question the request and call for changes in the request if it thinks it is necessary. The markets thereafter hand in the request to GM through CEMAFOR before the previously mentioned deadline on Monday week-2. Since ID has its meetings with the areas before the markets hand in its requests there is seldom need for any changes in this m-version of the request as EuD does. ID neither uses buffers in the same sense as EuD since ID's markets mainly are one-plant-markets and thus there is little room to move volumes between plants and markets. Therefore it is the m-version of the request which is used for discussion during ID's Sales meeting with GM.

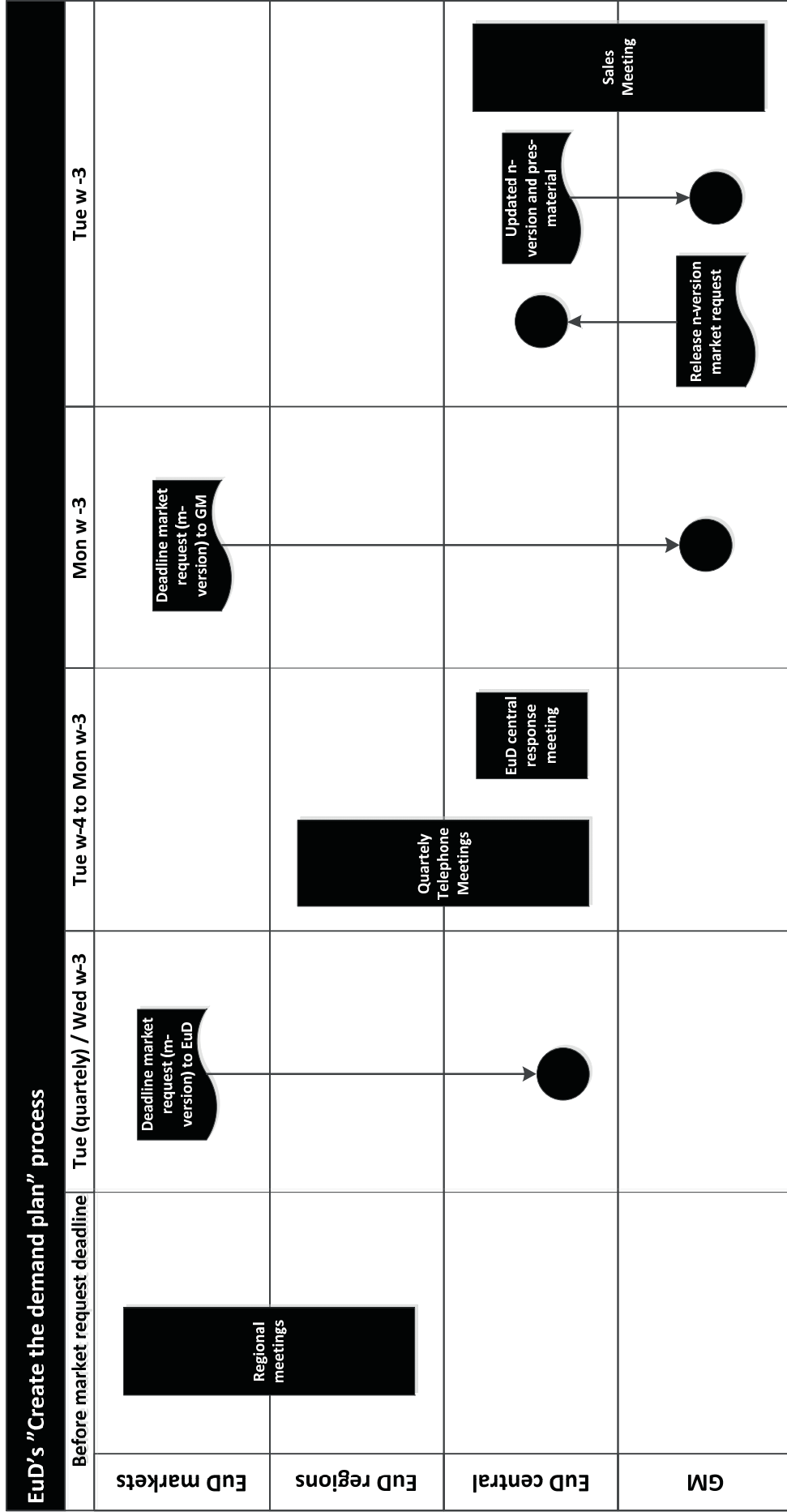


Figure 22. EuD's "Create demand plan" process.

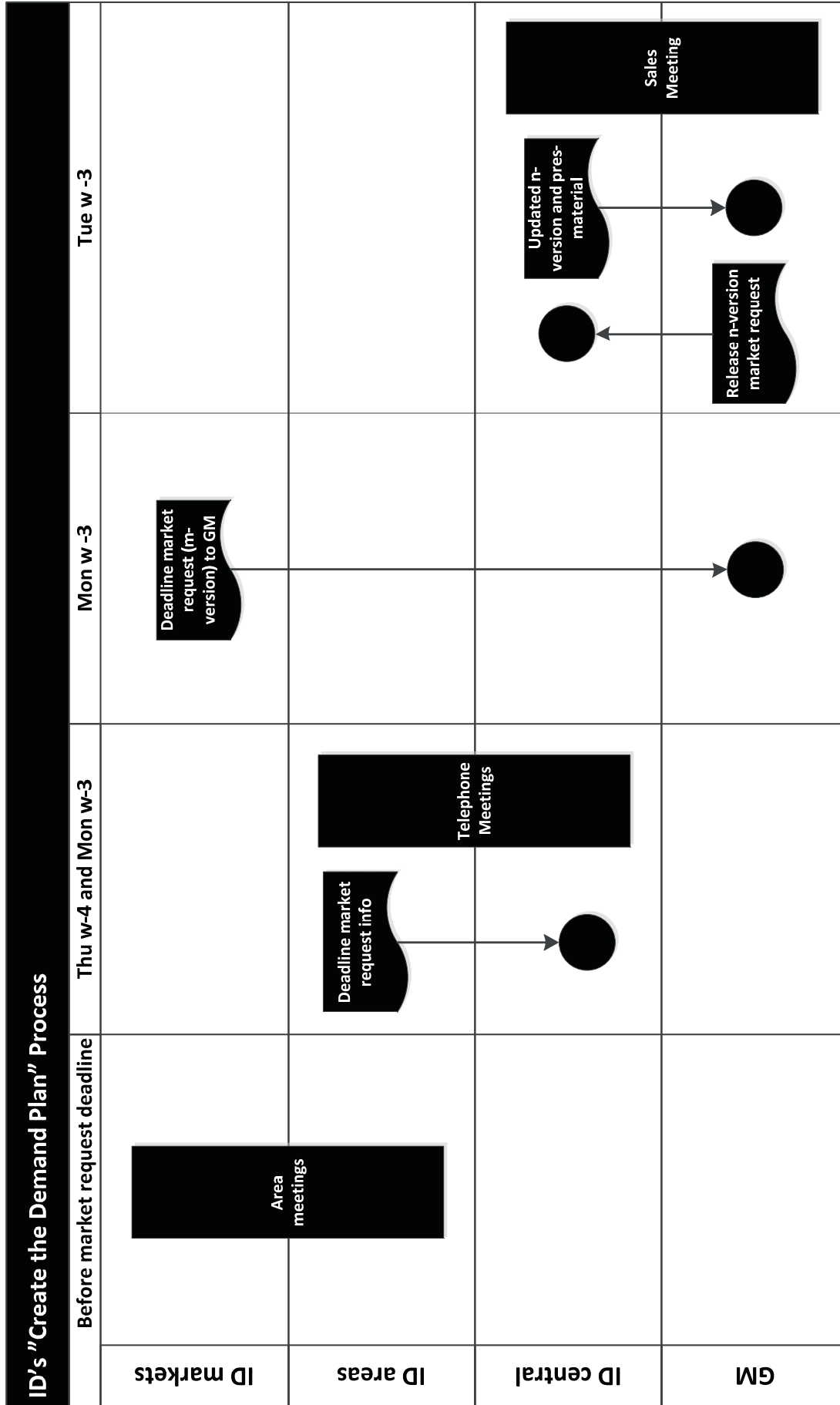


Figure 23. ID's "Create demand plan" process.

APPENDIX 17 - ADDITIONAL EMPIRICAL FINDINGS CONCERNING THE DEVELOP THE SUPPLY PLAN PROCESS STEP

This appendix presents additional empirical findings concerning the Develop the supply plan process steps to what was presented in the Empirical Findings in chapter 4.

GM-BUFFER

As presented in the Empirical Findings, GM may add a so called “GM-buffer” in the Program proposal. This buffer may have different purposes. At occasions with limited capacity and where the requests are constrained, GM may put in a buffer at some plants which means that it is planned to be produced but it is not yet decided which commercial divisions that will get the volumes. This is a way of ensuring that profitable deals are supplied. At other occasions, a buffer may be added, especially in the last periods of the rolling 12 months, if GM believes that the commercials have not looked over those volumes enough. For example, if the requests are decreasing in the long-term even though GM and also the commercials believe that the total market is stable, GM may choose to even out the Program plan in order to not send the wrong signals to the suppliers.

EM’S DEVELOP THE SUPPLY PLAN PROCESS

EM’s process to create the supply answer is illustrated in Figure 24. After the Program proposal has been released the proposed program for each plant is sent to the plants. The plants hold internal meetings, called “Plant response meetings” on Tuesday and Wednesday week-2. Wednesday week-2, the EM assembly conference moreover takes place. As previously been presented, the output is used as a basis for the decision making in the next step and includes what capacity constraints exist and what changes therefore are suggested either in the proposal or in available capacity. Moreover, a proposed working calendar is set. The calendar is updated in each period.

Later Wednesday week-2, the EM Management assembly conference is moreover held which is thus the day before the Program conference, as illustrated in Figure 24.

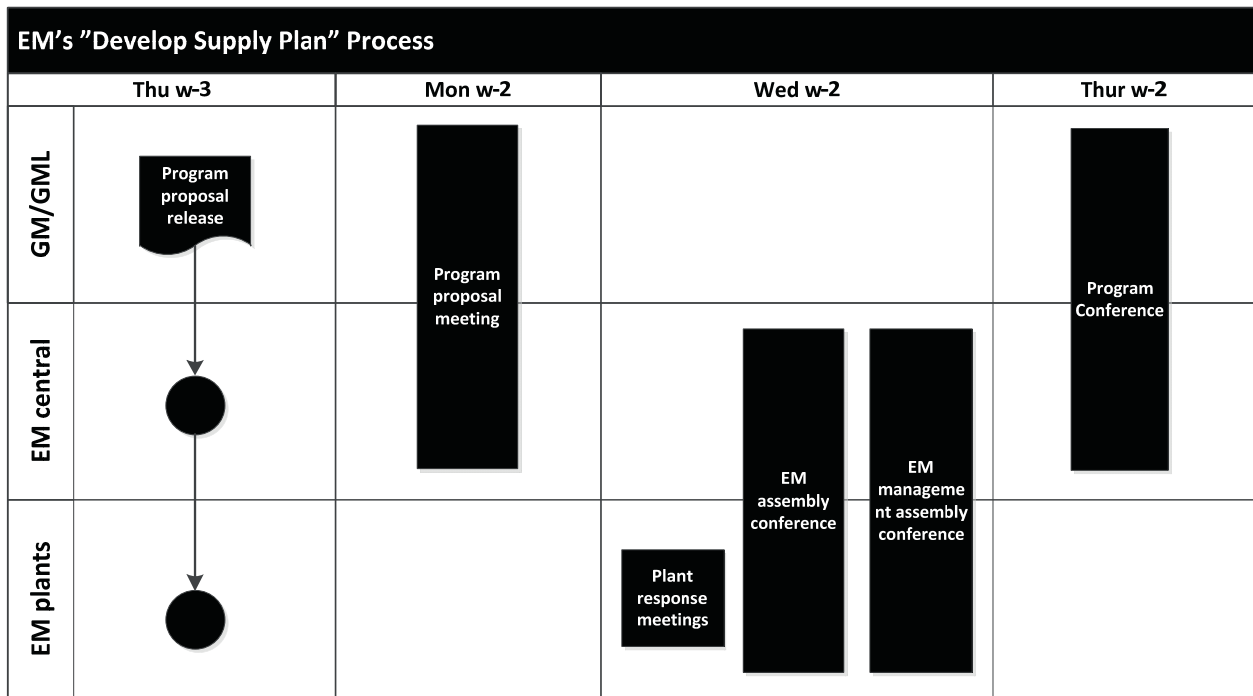


Figure 24. EM's "Develop supply plan" process.

IM'S DEVELOP THE SUPPLY PLAN PROCESS

As explained in the Empirical Findings and further presented in the flowchart in Figure 25, IM has more continuous response discussions concerning available capacity and how to respond to the Program proposal. Also, IM is involved in ID's local markets' work as IM helps the market concerning where to place the request depending on the lead times. These local market and info meetings presented in Figure 25 are thus the same meetings as ID's markets (those supplied by IM) hold before they place the market requests. Since IM is involved at such an early stage in the process, the plants and thus IM centrally already at this stage get insights into the markets' requests. IM can thus start investigating early in the process how to respond to the requests.

As the requests that the local markets place may be changed, either by ID centrally or constrained in the proposal, IM analyzes the volumes again after the Program proposal has been released and moreover communicates the proposed volumes to the plants. IM centrally then makes sure that it has the information needed about available capacity and inventory levels in order to respond to the proposal, what capacity changes may be needed and moreover, if the market requests are placed correctly according to the lead time adjustments. EM is responsible for the packing capacity in the Gothenburg plant and thus the proposal may be constrained by the packing even though IM has assembly capacity to cover the proposal. However, this constraint is mainly highlighted during the final Program conference.

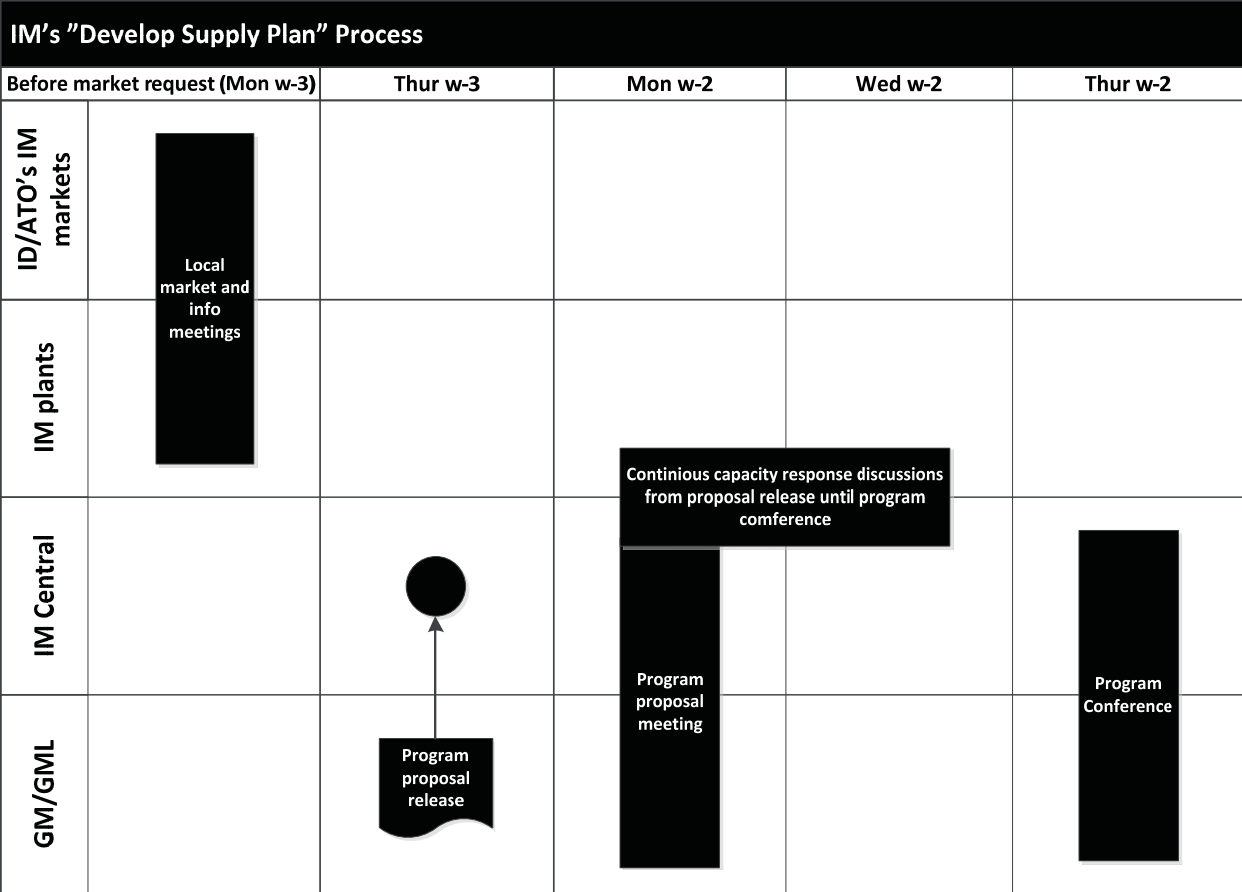


Figure 25. IM's "Develop supply plan process".

SAM'S DEVELOP THE SUPPLY PLAN PROCESS

The final production unit SAM's process is illustrated in Figure 26. SAM is, in the same sense as IM, involved in the commercial pre-meeting, in this case for the ID Latin America area, as discussed above. Therefore, SAM mainly uses the markets requests as input in its supply answers. Moreover, SAM's production meeting takes place one week before the Program conference, thus Thursday week-3, and hence before the release of the Program proposal. However, SAM also takes the Program proposal into account before its actual answer at the Program conference.

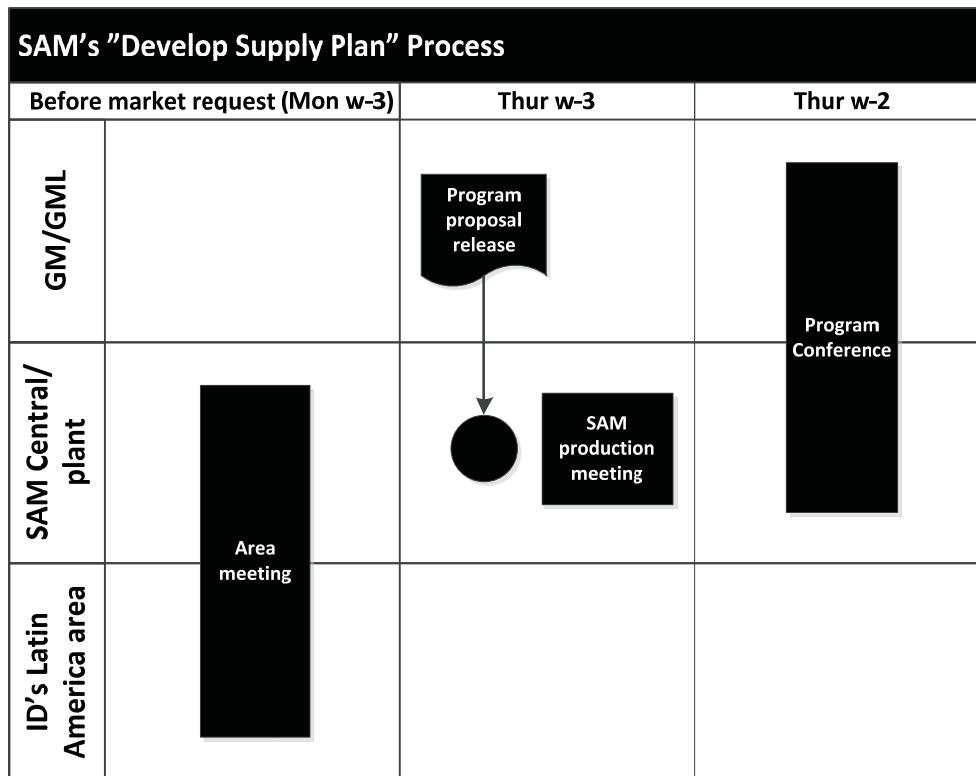


Figure 26. SAM's "Develop Supply Plan" Process.

VPT'S DEVELOP THE SUPPLY PLAN PROCESS

VTC is attending VPT's conference as a customer and explains its Program proposal which has been broken down to the components supplied by VPT, e.g. number of heavy engines for FH/FM.

The VPT conference is useful for creating transparency between the business areas within the group as most business areas attend the meeting as customers and also for VTC to get first-hand information if big changes are needed.

VOLVO 3P'S DEVELOP THE SUPPLY PLAN PROCESS

As stressed in the Empirical Findings, Volvo 3P finds it troublesome to answer to the Program proposal as it concerns volumes on product group level. Instead, Volvo 3P needs the item numbers to validate if there is enough available capacity in the supply chain. Volvo 3P gets the information concerning what item numbers the Program proposal requires from the EDIs sent out from the plants. As this information is not sent out daily, Volvo 3P has limited time to validate the suppliers' capacities. As Volvo 3P is also handling suppliers supplying VPT, Volvo 3P is indirectly answering to VTC through VPT but also directly in VTC's Program conference. Because of the short time frame for validating the Program proposal, Volvo 3P prepares itself by looking closer into suppliers and item numbers that it believes may have difficulties to deliver. Volvo 3P is moreover working with a priority list in order to focus on the most important issues. Because Vehicle Dynamics accounts for most suppliers it is of great importance for the person at Volvo 3P who is responsible for the S&OP process to have close discussions with this group.

APPENDIX 18 – VTC PROGRAM PROCESS MEETINGS CALENDAR

Figure 27 shows the scheduled S&OP meetings for 2011. VTC always schedule the meetings well in advance in order for everyone to book it into their calendars.

VTC, PROGRAM PERIODS 2011 ***PREL***

Program	Month	Week	Norm	Day							
Period No.	Month	Week No.	Work.	M	T	W	T	F	S"	S"	
1	JAN	1	4		3	4	5	6"	7	8	9
		2	5		10	11	12	13	14	15	16
		3	5		17	18	19	20	21	22	23
		4	5		24	25	26	27	28	29	30
2	FEB	5	5		31	1	2	3	4	5	6
		6	5		7	8	9	10	11	12	13
		7	5		14	15	16	17	18	19	20
		8	5		21	22	23	24	25	26	27
3	MAR	9	5		28	1	2	3	4	5	6
		10	5		7	8	9	10	11	12	13
		11	5		14	15	16	17	18	19	20
	12	5		21	22	23	24	25	26	27	
4	APR	13	5		28	29	30	31	1	2	3
	MAY	14	5		4	5	6	7	8	9	10
15		5		11	12	13	14	15	16	17	
16		4		18	19	20	21	22"	23	24	
17		4		25"	26	27	28	29	30	1	
5		18	5		2	3	4	5	6	7	8
		19	5		9	10	11	12	13	14	15
		20	5		16	17	18	19	20	21	22
		21	5		23	24	25	26	27	28	29
6	JUNE	22	4		30	31	1	2"	3	4	5
		23	4		6"	7	8	9	10	11	12
		24	5		13	14	15	16	17	18	19
	25	5		20	21	22	23	24	25"	26	
7	JULY	26	5		27	28	29	30	1	2	3
	8	AUG	27	5		4	5	6	7	8	9
28			5		11	12	13	14	15	16	17
29			0		18	19	20	21	22	23	24
30		0		25	26	27	28	29	30	31	
9	SEPT	31	0		1	2	3	4	5	6	7
		32	0		8	9	10	11	12	13	14
		33	5		15	16	17	18	19	20	21
	34	5		22	23	24	25	26	27	28	
10	OCT	35	5		29	30	31	1	2	3	4
		36	5		5	6	7	8	9	10	11
		37	5		12	13	14	15	16	17	18
	38	5		19	20	21	22	23	24	25	
11	NOV	39	5		26	27	28	29	30	1	2
		40	5		3	4	5	6	7	8	9
		41	5		10	11	12	13	14	15	16
	42	5		17	18	19	20	21	22	23	
12	DEC	43	5		24	25	26	27	28	29	30
		44	5		31	1	2	3	4	5"	6
		45	5		7	8	9	10	11	12	13
	46	5		14	15	16	17	18	19	20	
12		47	5		21	22	23	24	25	26	27
		48	5		28	29	30	1	2	3	4
		49	5		5	6	7	8	9	10	11
	50	5		12	13	14	15	16	17	18	
12		51	5		19	20	21	22	23	24	25
		52	4		26"	27	28	29	30	31	1

PROGR.CONF.

VPT & PROD CONF

CONFIRMED PROGR.

SALES MEETING

HANDING IN DATE

Figure 27. VTC's calendar for S&OP meetings in 2011

APPENDIX 19 – ADDITIONAL EMPIRICAL FINDINGS AND ANALYSIS CONCERNING THE MEASUREMENTS DIMENSION

GIB SUPPLY CHAIN KPIS

GIB Supply Chain presents the KPIS in Table 42 as important for the business.

Table 42. GIB Supply Chain group presents the following KPIS, divided into the three groups Customer view, efficiency, and secure input, as important for the business.

Customer view	Efficiency	Secure input
Delivery precision	VPS	Forecast accuracy
Lead time from order to delivery to final customer	Logistics cost	Order quality
Quality performance	Production cost	Supplier capability
	Direct runners	Capacity flexibility
	Inventory	
	Process harmonization	

PROGRAM PROCESS EFFECTIVENESS MEASUREMENTS

The Request quality is measured by comparing the actual forecast (more exact the last request) with what the market requested for that month in the previous periods. When measuring the Request quality, the absolute values, actual compared to request, are put into relation with the actual value. This measurement is conducted on a market-by-market basis. Two advantages with this measurement are that it is easy to work with and that it captures if the markets adapt to the confirmed Program plan volumes. This measurement is the responsibility of the commercial divisions and is discussed during EuD’s telephone meetings with the regions. However, questions may still be raised around if this measurement is the best way of measuring the forecast quality. For example, when there is limited capacity and the market requests are not confirmed, it is impossible to say if VTC would actually have been able to sell what the markets requested.

The Program quality is believed to measure how well the Program plan is set and does so by comparing the actual volume for a specific month with the confirmed volumes for that month in the previous five periods. Program quality is measured in a similar way as the Request quality. It is also measured on a rolling six months and it compares the actual volume for a specific month with the confirmed volumes for that month in the previous five months. The Program plan volumes in that month is used as the actual volume because this value is almost the same as what is actually produced and it is much easier to get access to the confirmed Program plan volumes than to number of produced units. A drawback with this measure is that it only measures in one direction, whether the confirmed volumes are consumed or not, and it does not measure if the markets could have sold more than the confirmed volumes. However, it is difficult to capture this in a measure since it would be hard to estimate what the markets could have sold.

The Truck type quality is the responsibility of the S&OP Manager and it is measured in a similar way as Program quality but on a lower level. The Truck type quality measurement can be questioned as a measurement for S&OP as it measures quality on a variant level and since

S&OP should focus on aggregated product family level.

The Customer response lead time, also called guideline, is defined as the number of weeks until the accumulated number of free slots in production adds up to one day of production. The guideline measures manufacturing's efficiency and if it becomes too long, manufacturing might have to ramp up its production capacity.

FUNCTIONAL MEASUREMENTS

There are global KPIs for the plants which for example include delivery precision, direct runners, product audit, inventory days, productivity, and deltaQ. The commercial divisions' two result measures are operating income and market earnings. Market earnings is defined as the difference between income and the results from the cost driving units such as GM, Quality and Technical Support, HR, Finance et cetera which is allocated on the three commercial units. Consequently, if ID's request is too high, and GM therefore ends up with overcapacity, ID will notice the consequences in its market earnings. As mentioned before, there is no measurement which picks up GM's ability to provide enough capacity for the requested volumes. The commercial divisions have many other measurements which are presented in the monthly report from business control, among others; invoiced units, gross profit margin, selling administrative expenses, inventory value and inventory in days. The logistics report is released once a month and includes measurements, among others; Total pipeline, total throughput time, age of trucks, industry delivery precision to market, and market delivery precision to customer.

APPENDIX 20 – THE 26 IDENTIFIED GAPS

Table 43 presents a complete list of the 26 consolidated gaps including their id:s.

Table 43. List of the 26 identified gaps.

ID	Gaps
1	The Program process has not as a formal goal to, and is nor partially accountable for, integrating plans in a way that reaches overall business and strategic goals
2	No optimization against the overall business goals, targets and strategies in the Program process and no tools to support such methods
3	Finance is little involved in the Program process, the budget is not used as input to the process, and plans are neither translated to monetary terms nor compared or tempered by financial goals
4	Limited what-if and scenario analysis in the Program process and there is no tool to support such analysis
5	Limited discussion of consequences, risks, and opportunities in relation to the Program plans
6	The results of the Program plan is not followed up in relation to the Program process
7	Limited cross-functional measurements used to evaluate S&OP efficiency
8	Low consolidation and centralization of S&OP information in an automated way
9	No S&OP workbench and low integration of supply, demand, and S&OP workbench systems
10	Prices are not set in the Program process
11	The planning horizon is shorter than the lead time for technical capacity changes
12	Time fences for allowed changes are not used
13	Limited use of quantitative forecasting methods and there is no tool to support such methods
14	No clear separation of unconstrained forecast and demand plan and market request not in accordance with theoretical demand plan definition
15	Limited event-driven S&OP meetings which supersedes scheduled meetings and include the whole S&OP team
16	Product management review meeting not part of the Program process
17	No consolidated demand or supply review meetings
18	No final Program plan is set during the Program conference
19	S&OP efficiency measures do not include 360 degree feedback, meeting preparedness, meeting attendance, action plan follow-up, efficiency of review meetings, and suppliers and customers are not asked to evaluate the Program process
20	Limited executive participation (team and meeting) and participants at the Program conference do not have the full authority to make decisions
21	No formal S&OP team
22	The Program process is not organized under an independent function
23	No formal training program about S&OP
24	Not all aspects of supply considered in the Program process
25	Customers are little involved in the Program process, limited customer data is incorporated, and no demand collaborator is used
26	A broad range of supplier data is not incorporated in the Program process and there is no supply collaborator