How to integrate Purchasing with the Sales and Operations Planning process

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Matilda Davidsson and Frida Hansson

Abstract

Sales and Operations Planning, S&OP, is a cross-functional, collaborative business management process where the goal is to balance demand and supply through an operational plan, aligned with the strategy of the company. Alfa Laval, a Swedish manufacturer founded 1883, has during the last year implemented Sales and Operations Planning at their business unit Gasketed Plate Heat Exchangers.

In order to balance demand and supply and to link strategic plans with day-to-day operations, the operations department at Alfa Laval has to work cross-functionally with the sales department. Currently, the demand plans are derived from the sales department and the supply capacity originates from the manufacturing only. To understand the complete supply capacity, and to fully balance supply and demand, the procurement capacity has to be reviewed in addition to the production capacity. Hence, the goal with this master thesis is to develop a process to include procurement in the S&OP collaboration.

A literature review was conducted to gain a deeper understanding of the theory behind S&OP, procurement and the relationship between the two areas. This was followed by a benchmarking study, conducted as a complement to the literature review. In addition, an empirical analysis at Alfa Laval was performed to fully understand the current prcoesses which the new processes has to be aligned with.

With knowledge gained from the literature review, benchmarking study and empirical analysis, it was possible to analyze how to connect the new sourcing processes with the S&OP process according to literature and how to adapt this to fulfill the needs at Alfa Laval. With the recent implementation of S&OP at Alfa Laval, the current maturity level of the process was analyzed and taken into consideration when creating the recommendation.

The recommended solution is built on two processes, where the primary process identifies supply risks by analyzing the current sourcing setup. With the collected data, it is possible to identify a number of keys which can be used in order to break down the demand plan to the same level of detail as the capacity. The second process is designed as a step by step process to be followed at the existing meetings in the S&OP process, to identify gaps between the supply capacity and the demand plan.

Sammanfattning

Sälj- och verksamhetsplanering, SVP, är en företagsstyrningsprocess som avser att balansera efterfrågan med utbud genom att integrera företagets olika avdelningar och tillhandahålla en produktionsplan som är i linje med företagets strategiska mål. Alfa Laval är ett svenskt företag grundat 1883, som implementerade SVP för ett år sedan på deras division som producerar plattvärmeväxlare.

Alfa Laval arbeter med SVP för att balansera utbud med efterfrågan. För att kunna bryta ner de strategiska målen till genomförbara handlingsplaner måste produktionen, säljenheten och andra stödfunktioner i företaget samarbeta över avdelningsgränserna. I dagsläget jämförs produktionskapaciteterna med produktionsplanen, som är nedbruten från förväntad säljplan, för att identifiera gap. För att erhålla en fullständig kapacitetsbild, bör även inköpskapaciteten analyseras. Målet med detta examensarbete är således att utveckla processer som fyller det nuvarande gapet mellan inköpsavdelning på Alfa Laval och resterande Sälj- och Verksamhetsplaneringssamarbete.

För att kunna utvecka de nya processerna har en litteraturstudie genomförts, med huvudsalkigen litteratur kopplat till SVP, inköp och relationen mellan dessa två områden. Som komplement till detta har även intervjuer med två andra producerande företag genomförts. Slutligen har en empirisk studie har genomförts för att förstå hur Alfa Laval arbetar idag och hur de nya processerna ska kopplas till deras nuvarande arbetssätt.

Teorin samt den empiriska datan analyserades sedan för att förstå hur inköp bör kopplas till Sälj - och Verksamhetsplaneringen i enlighet till teorin samt till exisrerande processer på Alfa Laval. I och med att denna företagsstyrningprocess implementerades nyligen, har det varit viktigt att både förstå och anpassa den slutgiltiga rekommendationen till Alfa Lavals mognadsnivå i deras SVP process.

Den rekommenderade lösningen består av två huvudsakliga processer, där den primära avser att samla in data om leverantörskapaciteter och potentiella risker. Datan ger också förståelse på vilken detaljnivå, säljprognoserna måste brytas ned på för att kunna jämföras med leverntörskapaciteterna. Den andra processen är en månadsvis process med syfte att identifiera gap mellan säljprognoser och den identifierade leverantörskapaciteten. Denna process kommer gå hand i hand med de existerande SVP processerna.

Acronyms

ATO - Assembly to Order
BU - Business Unit
DOT - Delivery on Time
ETO - Engineer to Order
GPHE - Gasketed Plate Heat Exchanger
GSRM - Global Supply Review Meeting
KPI - Key Performance Indicator
LSRM - Local Supply Review Meeting
MRP - Material Requirements Planning
MTO - Make to Order
MTS - Make to Stock
OD - Operations Development
PHE - Plate Heat Exchanger
S&OP - Sales and Operations Planning

Contents

Chapter 1

Introduction

This chapter will provide an introduction to the master thesis. The purpose will be explained, research questions presented and a brief explanation of the report structure will be provided. In addition, the introduction will include a short company description of Alfa Laval.

1.1 Background

The main goal with Sales and Operations Planning, S&OP, is to align demand and supply, and to create and implement a consistent operational plan aligned with the strategy of the company. The key feature of S&OP is the cross-functional collaboration between different departments in the organization, aligning towards a common goal (Småros & Falck, 2013).

One central part of S&OP is forecasting. This includes balancing supply and demand, aligning production capacity with future demand, and having the right balance between production competences. Key features of S&OP forecasting are long planning horizon, often 3-18 months, and up to a month long planning period. Some primary goals with S&OP are to obtain a high delivery service, keeping stock availability optimized and to have a short and reliable delivery lead time as well as keeping inventory low, resulting in reduced capital tied up in inventory (Wallace & Stahl, 2008).

To be able to balance supply and demand, sourcing needs to be integrated with the overall S&OP process and currently, this is not the case at Alfa Laval. Hence, this master thesis will focus on how to integrate purchasing with the S&OP process at Alfa Laval.

1.2 Company Summary

Alfa Laval is a Swedish company founded 1883 by Gustav De Laval with head quarter located i Lund. Alfa Laval is a global supplier of products within heat transfer, separators, and fluid handling. Their self-stated mission is to create better everyday conditions for people around the world with focus on protecting the environment and saving water through their products. (Alfa Laval, 2017). Alfa Laval has a large focus on innovation and hold over 2500 patents (Alfa Laval, 2018).

Alfa Laval is divided into three business divisions; *Energy*, *Food and Water*, and *Marine*, which are all supported by *Operations*, the group's shared supply organization with responsibility for procurement, manufacturing and distribution. Furthermore, the divisions are divided into business units, and Energy is separated into; *Gasketed Plate Heat Exchangers*, *Brazed and Fusion Bonded Plate Heat Exchangers*, *Welded Plate Heat Exchangers* and *Energy Separation*. Gasketed Plate Heat Exchangers, GPHE, is built on eight factories, where the largest one is located in Lund in close connection to the head quarter. A visualization of the company structure is provided in figure 1.1.

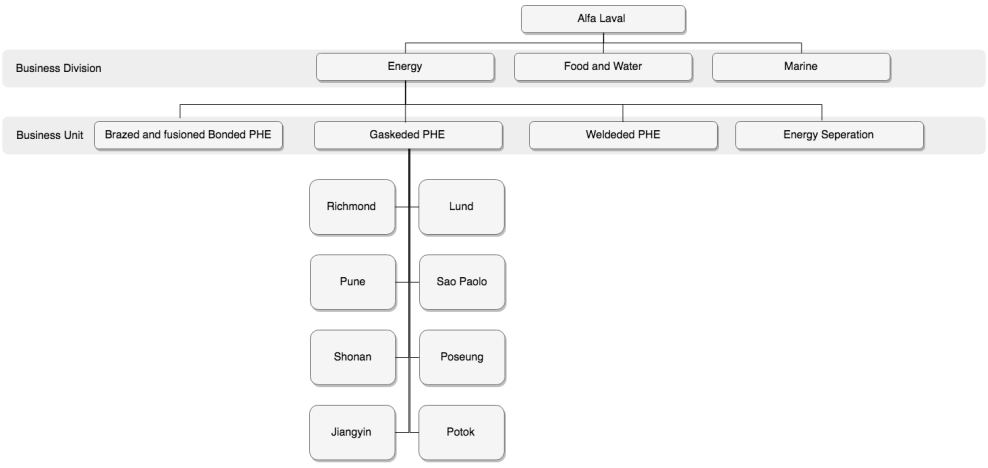


Figure 1.1: Company structure, based on Alfa Laval (2019)

The factory in Lund produces Gasketed Plate Heat Exchangers and as part of this, corrugated plates, a key component in Plate Heat Exchangers, PHE, to other manufacturing sites within the business unit. Alfa Laval provides a wide range of sizes and models of their heat exchangers, one example is shown in figure 1.2. GPHE mainly consist of Assembly to Order, ATO, production and a smaller part Make to Order, MTO. In some specific cases Engineer to Order, ETO, occur.

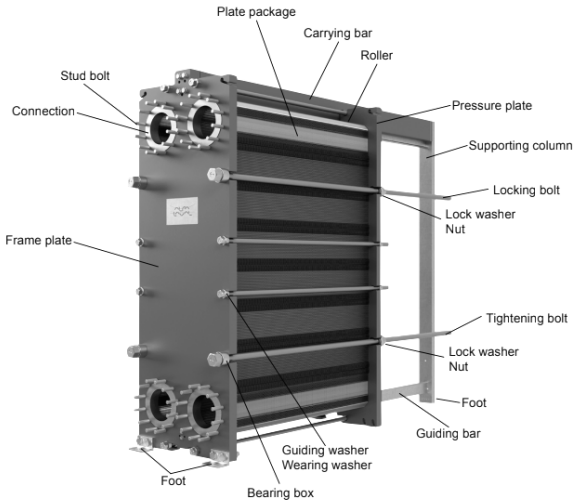


Figure 1.2: Gasketed Plate Heat Exchanger, by Alfa Laval (2019)

Alfa Laval performed an extensive re-organization approximately one year ago, resulting in a new work-structure built on the SCOR model. SCOR is built on the departments: *Source, Plan, Make and Deliver*, figure 1.3. Hence, the purchasing unit will further on be referred to as Source and the planning function as Plan. Source Lund is not only responsible for procuring materials to the production of gasketed plate heat exchangers but also materials to the production of plates. Sales and Operations Planning was implemented at Alfa Laval approximately one year ago with the goal to drive cross-functional collaboration and decision making to enable the supply chain to meet the demand and to ensure growth.

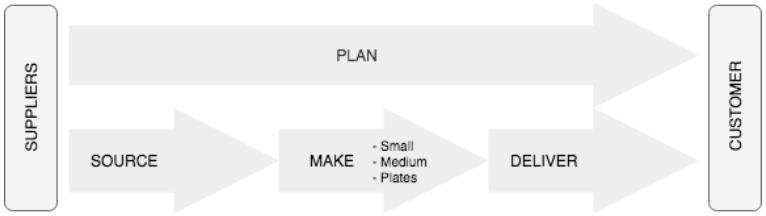


Figure 1.3: SCOR model at Alfa Laval, based on Alfa Laval (2019)

1.3 Problem Description

The goal with Sales and Operations Planning at Alfa Laval is, as previously mentioned, to drive cross-functional collaboration and decision making to enable the supply chain to meet the expected demand. In order to balance demand and supply and to link strategic plans with day-to-day operations, Operations has to work cross-functionally with Sales. Currently, the supply capacity origins from the manufacturing only. In order to understand the complete supply capacity and to fully balance supply and demand, the entire operations function has to be incorporated. The problem this master thesis aims to solve is the gap between procurement and the rest of the S&OP collaboration which limits the visibility of the actual supply capacity. By defining a bridge and establishing new processes to include Source in the S&OP process, a more comprehensive view of the supply capacity will be achieved. Hence, the new processes at Source will aim to; *secure material availability for future demand, improve forecast accuracy to suppliers* and *increase visibility through the supply chain.*

1.4 Purpose and Expected Deliverables

The purpose of this master thesis is to develop and implement sourcing processes which will integrate Source with the S&OP process at Alfa Laval, and to deliver a high-level road map on how to get there.

To fulfill the purpose, the following research questions will be answered:

- How should the sourcing process relate to the S&OP process according to literature on the topic?

- How should Alfa Laval integrate Source with the current S&OP process?
- How should Alfa Laval succeed with the integration considering their current maturity level of S&OP and how will an integration of Source affect the maturity level?

When completing the master thesis, the expected deliverable is a process which integrates the sourcing department into the S&OP process at Alfa Laval. The process will be applicable to the overall local processes GPHE, Lund. A long term goal will be presented, including a high-level road map on how to get there based on the current maturity level. In addition to this, a roll-out plan for the global GPHE will be suggested.

1.5 Focus and Delimitations

The main focus of the master thesis is to understand both the current processes at Source as well as the existing S&OP process to enable the development of new process which integrates the two. The primary scope will be limited to the Business Unit, Gasketed Plate Heat Exchangers and the factory in Lund. However, the master thesis will include a generic perspective in order to suggest a roll-out plan for the global GPHE. The process could be resembled by an hourglass, starting with a broad scope of understanding both Source and S&OP at Alfa Laval, successively narrowing it down to cover how Source Lund should be integrated with S&OP on a 3-18 month planning horizon. Then, widening the scope, creating a more generic picture which can be applied across the entire business unit.

1.6 Report Structure

Chapter 2 - *Methodology.* This chapter will describe the methodology applied to realize the objective of the master thesis, primarily based on the approach described by Höst, Regnell and Runesson (2006).

Chapter 3 - *Literature Review.* The literature review will provide a background and an overview of previously published material related to the problem description. The purpose is to compile results and applied methodologies from relevant literature on the subject.

Chapter 4 - *Empirical Study.* This chapter will describe the current S&OP process at Alfa Laval as well as the current planning process at the sourcing department. In addition to

this, the empirical study will also investigate the S&OP processes of two selected reference companies.

Chapter 5 - *Analysis*. This chapter consists of an analysis of the current S&OP process, both to understand what current issues the company are facing but also to find areas of improvement. Additionally, a comparison between the current situation and the theory will be provided. Finally, ideas and solutions will be generated in order to find a recommendation for Alfa Laval.

Chapter 6 - *Recommendation*. A recommendation will be presented of how to integrate Source with the current S&OP process. The main recommendation will be provided for Lund, but a suggested roll-out plan for global GPHE will also be presented.

Chapter 7 - *Conclusion*. This chapter will provide a summary of the report by answering the research questions. Finally, a brief description of limitations and contribution to theory will be provided.

Chapter 2

Methodology

The methodology is the basic work structure on which the master thesis is built on. It structures the principles of how to execute different tasks throughout the process. This chapter will describe what approaches and methods that will be used in this thesis.

2.1 Research Methods

The choice of methodology is based on the goal and the characteristics of the master thesis. A thesis may have various overall purposes;

- *Descriptive Studies* have the main purpose of resolving and describing how a phenomenon works or how it is executed.
- *Exploratory Studies* refers to the deep and complete understanding of how a phenomenon works or how it is executed.
- *Explanatory Studies* search for causality and explanations of how a phenomenon works or how it is executed.
- *Problem Solving Studies* aims at finding a solution to an identified problem.

(Höst, Regnell, & Runeson, 2006)

In this master thesis, the main purpose is to solve a problem. To identify this problem, a shorter descriptive and exploratory study will be performed. The current S&OP process, as well as the current planning process at the sourcing department, has to be *described* and *explored* to understand and identify the problem. Once the problem is identified, a solution can be created through a *Problem Solving Study*.

2.2 Research Approach

The research approach can be divided into three types; *Deductive, Inductive* and *Abductive*, where the third is a mixture of the previous two. The two main types are distinguished based on whether it is a *Qualitative* or a *Quantitative* path, where the deductive is considered to be the quantitative and the inductive the qualitative. In figure 2.1, an overview of the two main paths is visualized (Woodruff, 2003).

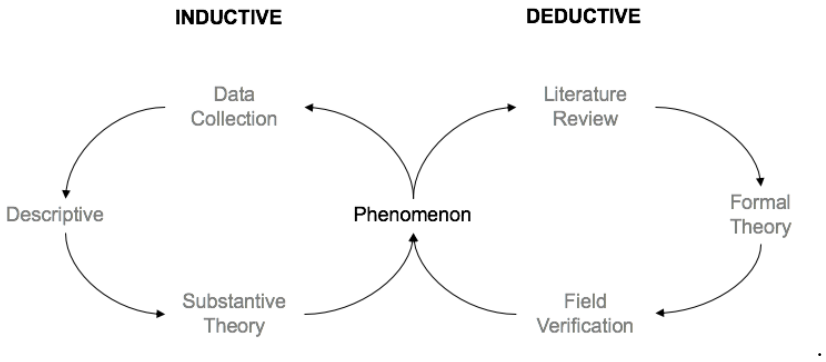


Figure 2.1: Research Approach, by Woodruff (2003)

2.2.1 Inductive

As visualized in figure 2.1, the inductive approach consist of three main steps which differentiate it from the deductive approach. These steps are; *Data Collection, Description* and *Substantive Theory* which all will be described further in this section.

1. *Data Collection.* A phenomenon is observed in its natural setting through field-trips, observations or first-hand learning on the phenomenon. Through this, knowledge is gathered and an understanding of the phenomenon is developed.

2. *Description.* This step aims at describing the phenomenon from the aspect of the person who supplies the information. The description should not only explore the depth of the phenomenon but also aim at understanding several dimensions of the phenomenon. Ergo, explore the phenomenon both vertically and horizontally. This can be performed through unstructured or semi-structured interviews. Another important aspect is to ensure credibility by incorporating several data sources.

3. *Substantive Theory.* The last step aims at analyzing qualitative data. The perspective is widened from a detailed level towards a more general position. In this step, it could be useful to create a process model, which describes the correlation between factors and includes feedback loops to illustrate the dynamic nature of the phenomenon. (Woodruff, 2003)

2.2.2 Deductive

The deductive approach, also called the quantitative path originates from the opposite side of figure 2.1. The three main steps, differentiating this approach from the inductive approach, are; *Literature Review, Formal Theory* and *Field Verification* all which will be further described.

1. *Literature Review.* This step aims at developing a framework which declares relevant factors and then identifies the correlation between them. This step could include field trips to develop and improve measures and to clarify the foundation of the framework.

2. *Formal Theory.* This step emerges from the previous step of research. However, the formal theory is a more general concept which could be applied to several phenomena in several places. It is a logical process in which a conclusion derives from the correspondence of multiple hypotheses which are generally assumed to be true.

3. *Field Verification.* Data is now collected to verify the formal theory by challenging the hypotheses. (Woodruff, 2003)

2.2.3 Abductive

The abductive approach is a hybrid between the inductive and deductive approach, which is created to address the flaws connected to these former approaches. The main weakness of the deductive reasoning is the lack of clarity in how the theory, on which the hypothesis is based, should be selected. The critique aimed at the inductive reasoning, on the other hand, is that regardless of the amount of empirical data, it will not necessarily be theory-building. The abductive approach aims at moving past these issues by adopting a balanced approach (Saunders, Lewis, & Thornhill, 2012). One can achieve this balance by moving back and forth between the inductive and deductive approaches. When initially understanding and generating essential theory about a new or complex phenomenon, the inductive approach is useful. The deductive approach, on the other hand, is preferred when developing and testing a formal theory. In other words, the abductive approach lets one cross over between the two circles in figure 2.1 (Kotzab, Seuring, Müller, & Reiner, 2006).

2.2.4 Selected Approach

The problem this master thesis aims to solve is complex, not only due to the fact that it involves different functions within the company as well as it incorporates suppliers from other companies, but also since it is a relatively new research area with limited articles published on the subject. With these prerequisites, Kotzab (2006), implies that relying on one research approach will limit the depth of understanding. Hence, it is suggested to initially gain a deep understanding of the chosen phenomenon by starting with the inductive approach and then cross-reference and evaluate this with formal theory by applying the deductive approach. This will end up in a balanced approach.

The abductive approach is the chosen method to solve the particular problem in this master thesis. A specific phenomenon is chosen, which will be both analyzed with an empirical-study in addition to the theoretical study, moving between the two circles in figure 2.1.

2.3 Research Strategy

When performing a master thesis there are four main types of research strategies; *Case Study, Experiment, Survey* and *Action Research.*

2.3.1 Research Strategies

The four research strategies and when to use them are described below. The strategies can be used by itself, called a *Fixed Method*, or a mix of strategies, referred to as a *Flexible Strategy* (Robson, 2002).

- *Case Study* is used when the purpose is to deeply describe a phenomenon and is often used when the purpose is to describe a phenomenon in an organization. The primary data in a case study is qualitative data.

- *Experiment* is preferably used when the aim is to find the causes of a specific phenomenon. The primary data in an experimental study is quantitative data.

- *Survey* is used when the purpose is to describe a phenomenon. A survey is carried out to a sample of people, who will represent the population or a group of people. The primary data in a survey is quantitative data (Höst et al., 2006).

- *Action Research* is used when the goal is to improve a specific situation or process, and at the same time studying it. The primary data in action research is qualitative data (Robson, 2002).

2.3.2 Selected Research Strategy

Case study is selected as the research strategy since the master thesis focuses on one phenomenon which is deeply examined. Due to the information above, the case study is chosen because a known phenomenon will be further investigated (Leonard-Barton, 1990). To receive a comprehensive solution the phenomena will be investigated with data from observations and interviews, refereed to data triangulation (Robson, 2002).

2.4 Theoretical Review

The theoretical review is an important part of the master thesis, to receive a comprehensive picture of the subject and to get a deep understanding of theoretical concepts and terminology. Since there is a great amount of literature connected to S&OP, a successive fraction strategy has been chosen as a search strategy. The successive fraction approach will make

it possible to reduce a large set of literature by successively introducing new sub-keywords into the searching to find relevant documents and to eliminate useless literature (Rowley & Slack, 2004).

The literature review will be an iterative process throughout the entire project. In the starting phase of the project, a broad range of literature on the subject will be read and reviewed. Throughout the project, the literature review will be narrowed down to more specific literature (Höst et al., 2006). To find relevant and reliable literature the following aspects will be pursued; *Relevance to the Topic, Authoritative Author, Up-to-date* and *Reputable Publisher*.

How the literature will be collected depends on the type of literature, books will mainly be searched for in library catalogs with help from LUBsearch and articles will be conducted from online databases, both general and publisher databases. Examples of databases which will be used are Web of Science, EBSCO Host, and Emerald.

2.5 Empirical Data

According to Leonard-Barton (1990), a case study includes data from systematical interviews, direct observations and archives. In the sections below, the different ways of data collection will be further described. There are two types of data which will be collected in this master thesis; *Quantitative* and *Qualitative*. The quantitative data is composed of measurable data. Qualitative data consist of descriptions and words and is often conducted from interviews (Höst et al., 2006). In accordance with the chosen research approach, most of the data needed will be qualitative data.

2.5.1 Qualitative Data

In accordance with the chosen research approach, most of the data needed will be qualitative data. The qualitative data will be conducted through interviews and observations.

Interviews

The goal with the interviews in this master thesis is to qualitatively explore and understand the phenomenon deeply and to not draw general conclusions. There are three types

of interviews, which all have different goals, setups, and purposes, see table 2.1. (Lantz, 1993)

Table 2.1: Levels of Interview Structure

	Structured	**Semi Structured**	**Unstructured**
Goal	The individual's experiences of the quantities of a phenomenon	The individuals experiences of quantities and qualities	Knowledge of the relation between concepts
Setup	Interview guide	Mixed of set and open questions	Set questions
Purpose	Exploring	Descriptive	Descriptive

Due to the nature of the master thesis, the majority of the interviews will be semi-structured whereas some of the interviews will be unstructured. Unstructured interviews will mainly be used in the initial phase of the project to collect information to build a foundation for further research.

The interview will be divided as follows:

- *Context.* Explain the purpose of the interviewee and how and why the person will contribute.
- *Initial questions.* To get the interviewee in the right context and to receive some general information.
- *Main questions.* Focus on the main purpose of the interview, important with a logical order of the questions.
- *Summary.* The interviewee will have time to elaborate on selected areas or add areas which may have been missed during the interview. (Höst et al., 2006)

There are two ways of documentation of the interviews; recording and taking notes. If recording the interview, the following step is to transcribe the interview, which is a time-consuming activity. It could also result in a less outspoken interviewee, adding the risk of not receiving all information needed (Höst et al., 2006). Due to this, it is decided to take notes instead. The two interviewers will together take notes and the interview will be summarized when the interview is finished. The summary will then be approved by the interviewee, to make sure everything was understood correctly. A list of all interviewees and their roles is found in Appendix A.

Observations

An important way of collecting data for a master thesis is observations (Robson, 2002). There are four different ways of observations depending of which interaction level the ob-

server has; *Observing Participant, Fully Participating, Participating Observer* and *Fully Observer* (Rosengren & Arvidson, 2002).

An advantage with participating in the observation is that the observer is a part of the group and can build trust within the group. However, there is a disadvantage as well, which is the risk of losing the connection to the studying objective. If the observer is not participating, it is harder to build trust and therefore get the right information (Robson, 2002; Rosengren & Arvidson, 2002).

In this master thesis, the writers will mainly be observing participants and participating observers, to be able to build trust in the groups and to participate.

2.5.2 Quantitative Data

In addition to the previously described qualitative data, selected quantitative data will be collected. This data will mainly consist of spreadsheets from excel, providing information regarding current sourcing processes at Alfa Laval.

2.5.3 Benchmarking

Benchmarking may be described as the process of comparing a certain organization, plant or process to a reference company with the ambition to decide how well it is performing compared to others who perform the same type of activity. Another aspect is to be able to identify what is best practice and then to use this as an improvement plan (Daniels, 1996).

Benchmarking can be categorized into three primary categories; *Internal Benchmarking, Competitive Benchmarking* and *Strategic Benchmarking*. Internal benchmarking is applicable when a company already has established a best practice, it could also come in use if there are no comparable industries to use. Competitive benchmarking, on the other hand, is used to determine a company's position within an industry. When performing strategic benchmarking, a company tries to identify world-class performance by moving outside of its own industry (Stroud, 2004).

2.6 Credibility

To ensure the result of the master thesis and to achieve high quality, there are three commonly used criteria; validity, reliability, and representativity, which are all described in the sections below (Rosengren & Arvidson, 2002).

2.6.1 Reliability

This category refers to the reliability of the data gathered, as well as random variations in the analysis. To achieve good reliability, it is crucial to be accurate when gathering data and performing the analysis. This can be performed in several ways, of which the following methods will be used in this master thesis;

- The data gathering, as well as the analysis, will be carefully documented, which will allow the reader to evaluate the execution.
- The data and analysis will be examined by a colleague or supervisor to reveal weaknesses.
- Interviews will be carefully documented and the data gathered will be reviewed by the interviewee to ensure reliability. This is an important factor since a majority of the empirical data will be received through interviews.
  (Höst et al., 2006)

2.6.2 Validity

Validity refers to the ability to measure systematical problems. In this case, the connection between the object which the study aims to examine and what is actually measured (Höst et al., 2006). To improve the validity of this study, triangulation will be applied when applicable. Both data triangulation, to gather data from different sources but also, by interviewing several people to receive a comprehensive picture.

2.6.3 Representativity

Representativity aims at generalizing the conclusion. Representativity of the result is highly correlated with the sample. The principle of case studies and action research is that they are not generalizable. However, if the context to which one wants to generalize is similar to the one where the case study or action research is conducted, the likelihood of the object to act similarly is higher. Detailed and informative documentation of the context where the case study or action research is performed will increase the representativity (Höst et al., 2006). Hence, the context is be comprehensively described in the introduction to improve the representativity of this master thesis.

2.7 Execution

This section will describe the approach chosen to execute the master thesis. Initially, general information regarding S&OP processes and planning processes connected to sourcing will be reviewed. In parallel to this, the current S&OP process and the current planning process at sourcing at Alfa Laval will be reviewed. Finally, gaps and improvement areas in the planning processes will be identified and based on this a solution will be suggested.

2.7.1 Gain Knowledge of S&OP and Purchasing

Through the literature review, the general concept of S&OP will be examined. In addition to this, industrial purchasing will be investigated closer. This knowledge will later provide a foundation when finding a suitable solution on how to incorporate the sourcing department into the S&OP process.

2.7.2 Understand the Current S&OP and Sourcing Processes at Alfa Laval

Before finding a solution it is of major importance to understand the current state. Hence, the current S&OP process at Alfa Laval will be described through the empirical analysis. This knowledge of how S&OP is applied at Alfa Laval today will work as one tool in the toolbox used to incorporate sourcing into the company-wide S&OP process.

To be able to include sourcing into the S&OP process, the current state of planning at Source also has to be described. This will provide a deeper understanding of the planning process conducted at the moment and adding one additional tool into the toolbox which will help to solve the current problem. In this stage, benchmarking with other companies will also be conducted to understand their S&OP process and how to integrate Source with it.

2.7.3 Identify Gaps and Improvement Areas in the Planning Processes

Finally, gaps and improvement areas will be identified based on the foundation built on theoretical information as well as company-specific empirical data and benchmarking. When the problem is clearly stated, a solution can be created. This iterative process of how the solution is generated is illustrated in figure 2.2. This solution will hopefully lead to a clear road map of upcoming actions needed, to incorporate sourcing into the S&OP process.

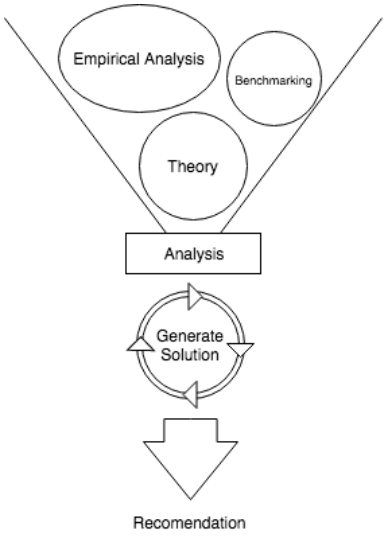


Figure 2.2: Illustration of execution, by Davidsson & Hansson (2019)

Chapter 3

Literature Review

This chapter will initially provide a review of literature connected to S&OP and sourcing. This will be followed by literature on the topic, Sourcing within the S&Op process, mainly focusing on supply risks and how to connect the supplier to the S&OP process. Finally, a short introduction on how to successfully implement a transformation will be provided.

3.1 Sales and Operations Planning

Sales and Operations Planning, S&OP, is a decision making process with the purpose to match customer demand and supply capabilities. S&OP is a cross-functional process which aligns financial planning with operational planning and furthermore strategic planning with operational activities, to fill the gap between strategic and operational planning (Wallace & Stahl, 2008; Thomé, Scavarda, Fernandez, & Scavarda, 2012). The planning horizon is typically 3-18 months but varies between different industries and products. Industries with long lead time will strive for longer planning horizons. The S&OP team must be cross-functional with staff from different departments and include employees from sales and marketing, operations and finance (Grimson & Pyke, 2007). S&OP is planning at a high level, where suppliers and customers are included through forecasts and long-term contracts, see figure 3.1 (Olhager, 1999).

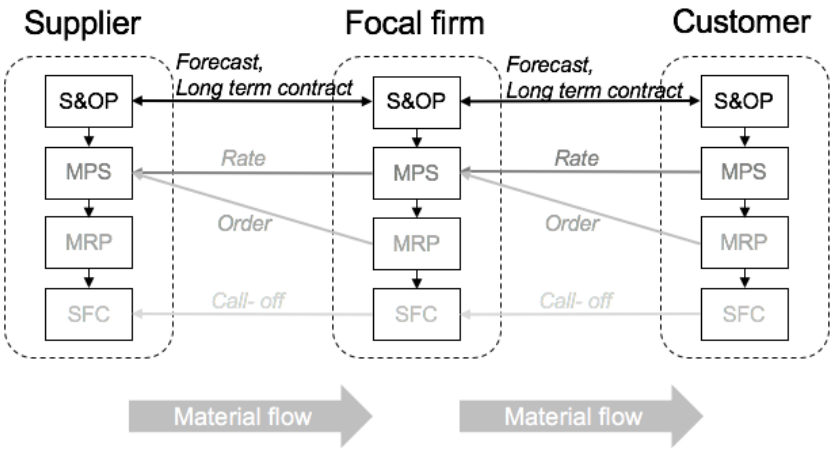


Figure 3.1: Linkages between planning levels along a supply chain, by Olhager (1999)

3.1.1 Goals with S&OP

The goal with Sales and Operations Planning is to balance demand and supply and to connect the strategic plan to the operational plan, to mitigate the risk of the demand exceeding the supply or the other way around, and further on achieving a better business performance (Vollmann, Berry, Whybark, & Jacobs, 2005).

3.1.2 The S&OP Process

Sales and Operations planning can be performed in a wide range of ways and different processes can be followed. Wallace (2008) describes the S&OP process as a monthly process with five steps, figure 3.2. Alfa Laval is following Wallace's process, hence, this process is chosen as the main source, and the steps in this process will be described further below.

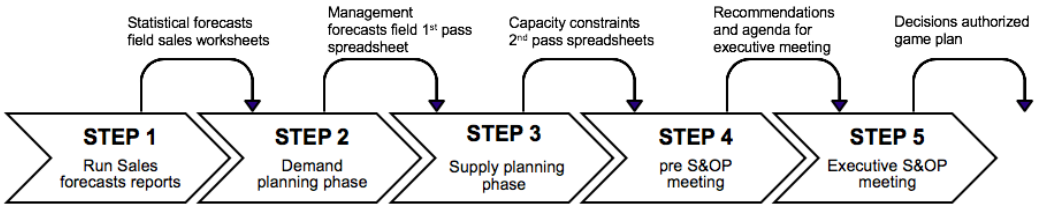


Figure 3.2: The S&OP Process, based on Wallace and Stahl (2008)

Run sales forecast reports

In the first phase, relevant data is collected. This could include both historical data and data regarding sales and marketing. The data is used to create a sales forecast for the coming month, which is then shared with the appropriate people within the organization (Wallace & Stahl, 2008).

Demand planning

In the second phase, sales and marketing employees review the sales forecast established in phase 1 and develop an updated forecast. The forecast should include product families and product life cycle changes for the time covered by the planning horizon. The updated forecast is then sent to the operation department, and will further on be refereed to as the demand plan. (Wallace & Stahl, 2008; Wagner, Ullrich, & Transchel, 2014)

Supply planning

In this phase, the employees responsible for operations compare actual performance and capacity with the demand plan (Wagner et al., 2014). Potential deviations and changes are analyzed and capacity gaps are identified. Based on the demand plan and this analysis, the supply plans are developed and modified to balance the current operations plan with the demand (Wallace & Stahl, 2008).

Pre S&OP meeting

In this step, a cross-functional team with people from both the demand and supply teams together with the S&OP project owner discuss, adjust and validate the supply and demand plans. Different scenarios are analyzed and discussed. An aligned recommendation and plan is decided on, which will be presented at the executive Sales and Operations meeting. (Wallace & Stahl, 2008; Wagner et al., 2014)

Executive S&OP meeting

In this last step, all the members of the executive board and the S&OP process owner have

a meeting to review and modify the decisions from the pre-meeting. A final plan is validated and approved from top management. (Wallace & Stahl, 2008; Wagner et al., 2014)

3.1.3 Supply Planning Phase

The supply phase will be further described since the master thesis mainly focuses on supply and sourcing in relation to S&OP. Wallace and Stahl (2008) describes the supply planning phase in the S&OP process with five steps, figure 3.3

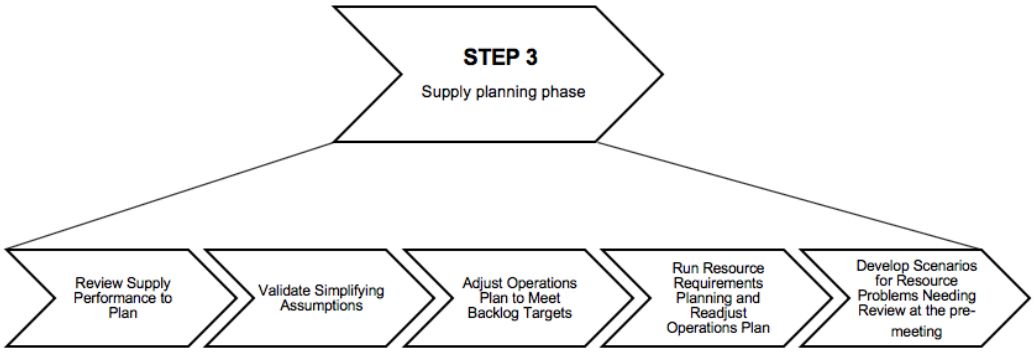


Figure 3.3: The Supply Planning Phase, based on Wallace and Stahl (2008)

Review supply performance to plan
In the first step, actual performance is compared to the operations plan from the previous month. This comparison is performed both for internal supply and outsourced products to find and analyze gaps. When the gaps are analyzed the actions can vary depending on the situation. The first action is to find the root cause, and if possible eliminate the problem. If this is not possible, ways to work around the project should be identified. The second action is to reassess future capacity (Wallace & Stahl, 2008).

Validate and modify simplifying assumptions
In this step, several simplifying assumptions are validated and modified. A control chart can be used to show the actual data for the last months, with mean and trend lines. By updating this data each month, it can be validated or modified if needed (Wallace & Stahl, 2008).

Adjust operations plan to meet inventory and backlogs targets
This step is performed in the S&OP spreadsheets and the operations plans from the previous month are reviewed and reflected upon. The new data of inventory together with actual sales and production from the prior month is added to the sheet and a new forecasts is entered. This makes it possible to visualize where the operations plan causes inventory or backlog compared to the target (Wallace & Stahl, 2008).

Run resources requirements planning and readjust operations plan where needed
The resource requirements planning is conducted by using a matrix, called *Bills of resources*, connecting key resources and product families. There are several inputs for developing the bills of resources; historical data from job cost records, estimations from employees, and finally analyzed routines and calculated averages for each product in each product family. By adding the operations plans to the bills of resources, the resources requirement plan can be calculated and will visualize the capacity and possibilities for the next month. To decide which resources to include in the resource requirements planning, there are several parameters and reasons to consider, and bottlenecks resources are one of them. The resources can be either production resources, material or warehouse space. In the resource requirements planning, assumptions must be made, but the goal is to minimize the number of assumptions to create a more accurate forecast. The more assumptions performed the more validation is needed (Wallace & Stahl, 2008).

Develop scenarios for resource problems needing review at the pre-meeting
When the resource problems are identified in the last phase, scenarios to handle it are developed. Solutions it could include increasing capacity by using overtime or add employees or decrease the demand, to meet the resource constraint (Wallace & Stahl, 2008).

3.1.4 Planning Strategy in S&OP

In order to balance the demand and supply, there are two typical ways of strategies on how to make decisions; *modifying the demand to balance the production* or *modifying the supply to balance the sales plan.* The strategy of modifying the supply is further divided into three levels of production; *level production*, *chase sales* and finally a mix of the two defined as a *hybrid.* Level production aims for constant output rates through the planning horizon. In the chase strategy, output rates are adjusted to match sales. Level and chase is not commonly used exclusively, however a mix is often used. It is of great importance to understand the production strategy; *Make to Order*, *Make to Stock* or *Assembly to Order*, which all are connected to different approaches when the supply is modified. In the level

production in a Make to order, MTO, environment, changes in order backlog are used to keep a constant output. The goal when using a chases strategy in a MTO environment is to minimize the order backlog by matching the production with the sales plan (Olhager, Rudberg, & Wikner, 2001).

3.1.5 Maturity Levels in S&OP Process

To evaluate the maturity level in a S&OP process, several frameworks, which may be found in various literature, have been established during the years. Grimson and Pyke established one of the most cited maturity frameworks in 2007. Due to the frequent citing of this framework, it will be used as a foundation for the maturity reasoning in this thesis. The framework is visualized in figure 3.4. The framework consists of five different dimensions, with a ranking of 1-5 of each dimension. The first three dimensions are primarily business processes and the fourth and fifth are information processes. A company will receive the ranking one if there is no S&OP practices at all, and the top-ranking is five (Grimson & Pyke, 2007).

Meetings and collaboration

The first business process, *Meetings and Collaboration*, evaluates the effectiveness of human participation in the S&OP process. In stage 1, there are silos between the different departments and a lack of planning meetings and collaboration between the sales department and operations department. In stage 2, there are meetings between sales and operations, but only at senior management level. There are still silos around the departments and the focus during the meetings is more on a financial level rather than integrating the planning cross-functionally. In stage 3, a S&OP process is established through pre-meetings with personnel from sales and operations where they discuss their individual plans. Data from major supplier and customer are included in the process. In stage 4, customers and suppliers have expanded their participation during the meeting and more customer and supply data is incorporated in this stage. In stage 5, in addition to the previous processes in stage 4, the company also has event-driven meetings instead of scheduled ones. Companies classified in stage 5 also provide their supply chain partners with real-time access to internal and external data (Grimson & Pyke, 2007).

Organization

The Organization dimension focuses on the sales and operations structure. In the first stage, there is a lack of S&OP function in the company. In the next step, there is no formal S&OP function, but some tasks are performed in a S&OP manner. In stage 3, there is not a formal

S&OP function or a formal S&OP team either. However, there are people responsible for the tasks. In stage 4, a formal S&OP team is established, with clear descriptions for each role. In stage five, in addition to the formal team, all employees involved in the process understand the S&OP process and is aware of the decisions taken at the meetings (Grimson & Pyke, 2007).

Measurements

The third dimension, *Measurements*, refers both to company performance and the effectiveness of the S&OP process. In stage 1, there are no measurements other than standard financial accounting systems. In stage 2, companies assess the performance of the operations and how well it meets the sales plan. Stage 3 is an extension of stage 2, where sales compared to sales forecasts are measured as well. In the fourth stage, the effectiveness of the company's S&OP process is measured together with a new product introduction metric. According to the Grimson and Pyke article, S&OP processes are rarely measured. The measurement should include detailed feedback from peers, supervisors, and subordinates, but also suppliers and customers should evaluate the process. In stage 5, profitability is added to the measurements (Grimson & Pyke, 2007).

Information technology

The focus of the *Information Technology* is the information process instead of the business processes. In the first stage, there is a lack of information sharing the managers own their spreadsheets and are not sharing them with the rest of the organization. In stage 2, spreadsheets and data are owned by individuals but are consolidated manually. In the next stage, information consolidating is automated. Companies at this stage deploy revenue or operations planning software, for example, MRP systems. In stage 4, the company has software both to optimize the operations planning sequentially and to optimize the revenue by analyzing historical data. In this stage, companies are also using a tool for sharing information regarding the S&OP process, between the team members. In stage 5, IT is even more sophisticated and additional real time data is used. Information is shared seamlessly within the organization (Grimson & Pyke, 2007).

S&OP plan integration

The last dimension, *S&OP Plan Integration*, measures the integration of sales planning and operations planning, and how effectively the planning process is. The integration between the two planning processes is the main goal of the other dimensions. In the first stage, the company has no S&OP planning at all. In stage 2 the operational plan is driven by the sales plan and the operational plan is not used in order to set up or make changes in the sales plan, hence, it could be seen as a one-way process. In the third stage, on the

other hand, operational planning is starting to be integrated with sales planning. This improved integration results in a better and more realistic plan. In the fourth stage, the planning process is concurrent instead of sequential. The planning process in this stage is collaborative with both sales and operations. In the last stage, the firm integrate operation plans seamlessly within the company and the process is focused on profit optimization for the whole company (Grimson & Pyke, 2007).

The framework can be used by companies to understand the maturity in their S&OP process and to understand what actions to take to achieve a more advanced process (Grimson & Pyke, 2007). It is in the later maturity stages where companies acquire value from the S&OP process (Barrett & Uskert, 2010).

	Stage 1 No S&OP Processes	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	• Silo Culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	• No S&OP organization	• No formal S&OP function • Components of S&OP are in other positions	• S&OP function is part of other position: Product Manager, Supply Chain Manager	• Formal S&OP team • Executive participation	• Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	• No measurements	• Measure how well Operations meets the sales plan	• Stage 2 plus: • Sales measured on forecast accuracy	• Stage3 plus: • New Product Introduction • S&OP effectiveness	• Stage 4 plus: • Company profitability
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralized information • Revenue or operations planning software	• Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench	• Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimization for whole company

Figure 3.4: Maturity Framework, by Grimson and Pyke (2007)

3.1.6 Benefits of using S&OP

The list of benefits when using S&OP is long. For Make to Order companies, a S&OP process results in higher customer service and smaller customer order backlogs, and therefore shorter lead times. S&OP also result in more stable production rates, a better balance between sales demand and supply, better visibility into future resource problems and fewer surprises, which makes it easier to handle changes. Other benefits from a well-implemented process are enhanced teamwork both among the executive group and the middle-management employees

(Wallace & Stahl, 2008; Thomé et al., 2012).

3.2 Sourcing

To create a suggsted plan on how to incorporate Source with the S&OP process at Alfa Laval, knowledge regarding procurement is required in addition to knowledge of S&OP. This chapter will provide a review of selected areas within procurement which are relevant to the problem formulation. The main source of information for this chapter is van Weele (2014), due to his comprehensive description of purchasing and supply management.

Van Weele (2014) explains the increased importance of purchasing with the current business climate which has become highly competitive. As a result, both purchasing and supply chain management has been escalated up to key business drivers.

3.2.1 The Purchasing Process

The activities performed within the purchasing function can be illustrated as a process (van Weele, 2014), as visualized in figure 3.5. The initial stage of the process is to determine the specification of the goods to be purchased. The following step includes evaluating and selecting a supplier. When a supplier is selected it is time to negotiate terms and issue a contract. These first three steps are considered tactical purchasing. The fourth step is ordering, which includes establishing ordering routines as well as handling of orders. When the ordering is finished, the purchasing function should expedite the orders and ensure proper delivery and payment. Finally, the purchasing function should evaluate and follow-up with the suppliers (van Weele, 2014).

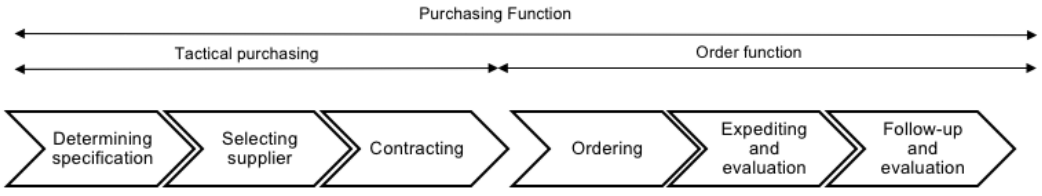


Figure 3.5: The Purchasing Process, by van Weele (2014)

3.2.2 The Purchasing Management Process

"Purchasing management refers to all activities necessary to manage supplier relationships in such a way that their activities are aligned with the company's overall business strategies and interests" (van Weele, 2014, p. 10).

The purchasing policies and strategies vary depending on the company's overall objective and strategy. A company operating in a highly competitive market needs to have a high focus on innovation and cost reduction. A high-tech company selling unique products, on the other hand, need to have purchasing focus on early supplier involvement, reducing time to market and securing proprietary knowledge. However, the purchasing strategy needs to be aligned with the overall interests of the company in a dynamic way. Mainly due to the supplier market being dynamic, some suppliers may go through the learning curve earlier than their competitors and some technology might be outdated within 1-2 years (van Weele, 2014). Van Weele (2014) argues that to be able to align the purchasing strategy with the overall objectives of the company, managers need to continuously adapt their purchasing management process. The activities, suggested to be included in the purchasing management process are: *Market Research*, *Purchasing Objectives*, *Purchasing Strategy*, *Purchasing Planning*, *Policy Implementation* as well as *Control and Evaluation*.

The purchasing and supply management process has developed over time. Over the last decades, new concepts have been introduced in the world of purchasing. Concepts like total cost of ownership, early supplier involvement, and cross-functional buying teams to name a few. This is refereed to as the professional development of the purchasing function and a step-wise model is suggested to visualize the development. This model is called the purchasing development model and is visualized in figure 3.6. When professionalizing the purchasing function, a company moves further to the right in the figure. However, all companies do not need to transfer all the way to the last step due to diverse interests as previously discussed (van Weele, 2014).

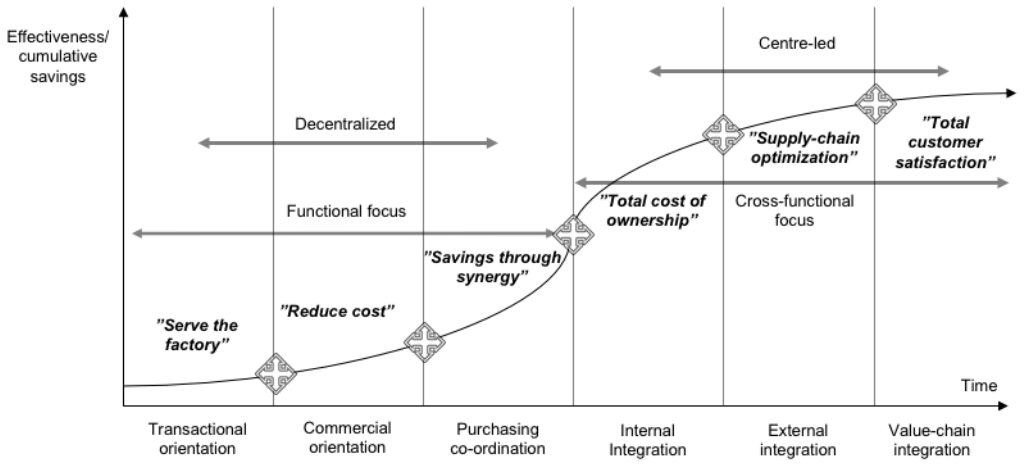


Figure 3.6: The Development Model, by van Weele (2014)

The six stages, which the model identifies as development steps towards a professionalized purchasing function, are; *Transaction Orientation, Commercial Orientation, Co-ordinated Purchasing, Internal Integration, External Integration*, and *Value-chain Integration.* All steps will be further explained in the following section.

Stage 1: *Transaction Orientation: serve the factory.* The main goal of the purchasing function is to secure supplies to enable the operating processes. This includes to maintain the right levels of raw materials and components as well as securing the availability of the right materials. However, there is no purchasing strategy to align actions. The characteristic of the organization structure is a decentralized department at the business unit level which is reporting to either a logistics or production manager. The core of the purchasing function originates from operational and administrative activities. A key characteristic of this stage is that it is reactive, management derives from complaints and as long as there is no complaints, purchasing is assumed to be doing well. The staff at the purchasing department are seldom professionally qualified, nor do they have an information system which aligns them with other departments in the organization (van Weele, 2014).

Stage 2: *Commercial Orientation: lowest unit price.* A purchasing manager is now employed with the goal of negotiating with suppliers to receive lower prices. The purchasing manager tries to receive the lowest unit cost. To achieve this, the purchasing function needs to be independent of other functions including product development, manufacturing, and

engineering. This leads to a more independent purchasing unit. The main focus of the purchasing function is to receive lower prices. The purchasing function is now a department of its own at the business unit level and reports to the business unit manager directly, instead of the logistics or production manager. The main focus of the business unit manager is to lower cost in the purchasing function. Another characteristic of this stage is how the purchasing function moves towards more of a specialist function. Buyers focus on certain product groups and the goal is to negotiate good deals, and hard negotiations are common. Performance is mainly measured on price, cost savings and delivery performance of suppliers (van Weele, 2014).

Stage 3: *Co-ordinated Purchasing*, is the first time a purchasing strategy is formulated. The strategy aims at highlighting and capturing the advantages and synergies generated from internal co-operation. Aligned buying policies are implemented across business units with help from the central purchasing department. The focus is on cross-unit coordination and contracts are negotiated on a central level. The purchasing function is starting to have an impact on the quality level of purchased products in addition to price and costs. Top management starts to pay attention to the purchasing function and the organizational structure is a centralized department at the corporate level. This is the initial phase of incorporating computerized information systems, however, these are not integrated between different business units (van Weele, 2014).

Stage 4: *Internal Integration: cross-functional purchasing.* The focus in this stage is to solve cross-functional problems aiming at reducing the total life-cycle cost and not only the unit cost. Key suppliers are now involved in an earlier stage and the supplier relationship evolves from confrontational to partnership based. Processes are set up with the objective to organize the purchasing function around internal customers. Purchasing is lifted to a strategic level in the company and the structure is center-led. Information systems are integrated between functions, however not yet with key suppliers. The education level and business perspective of the people employed in the purchasing function are now high. Performance is measured with benchmarking and internal customer satisfaction surveys (van Weele, 2014).

Stage 5: *External Integration: supply-chain management.* The key characteristics of stage five are the integration with supply-chain partners as well as a distinct outsourcing strategy, which have not been present in the previous stages. Suppliers are now incorporated into the product development, and residential engineering teams, as well as improvement teams, are established. Information systems are highly developed, purchasing is putting a lot of effort into facilitating for internal customers by applying system contracting or EDI. In

addition to this, partner suppliers are also integrated into information systems. Management derives from a business and performance perspective. Knowledge regarding the total cost of ownership, cost models and supply-chain management is highly rewarded (van Weele, 2014).

Stage 6: *Value-chain Orientation*, where the main focus is to deliver value to the end-customer. Suppliers are highly involved in product development, and it is expected from them to support the company's product and market strategy. Focus lays on designing an effective and efficient value-chain in order to deliver high value to the end-customer. The purchasing strategy is incorporated into the overall business strategy of the company. It is a highly entrepreneurial culture in the company and there is a shared vision between the functions (van Weele, 2014).

3.2.3 Strategy and Planning

According to Kraljic (1983), there are two main variables which determine the need for a supply strategy in a company. The first one is the strategic importance of purchasing, which can be based on the amount of value added by the product line, the percent of raw material in relation to total cost or the impact on profitability.

The second variable is the complexity of the supply market, which is determined by the supply scarcity, how fast the technology is developing, the possibility of material substitution, the entry barriers onto the specific market, the cost of logistics or the complexity of logistics.

Top management and senior purchasing managers may use these two factors to determine the supply strategy of the company by positioning the purchased parts into the Kraljic matrix, figure 3.7. The matrix separates the products into four different categories; *Strategic, Bottleneck Products, Leverage Parts, and Non-critical Parts* (Kraljic, 1983). The strategy should not only take the purchasing power of the company into account but also the importance of the suppliers. To acquire all benefits from such a strategy, Kraljic proposes a couple of topics which should be discussed while developing the purchasing strategy. The company should discuss whether they could increase synergies by combining supply requirements from different divisions, if it is possible to avoid supply bottlenecks, how high risk the company is willing to accept and to what level suppliers should be integrated to establish long-term relationships (Kraljic, 1983). When the products are placed in the matrix, the next step is to decide on actions for each of the products in the matrix. There are various actions

for each position in the matrix and there are strategies for keeping a product in a specific section, and also ways for moving it to another position in the matrix. To improve the positioning of the products, the first step is to analyze and understand if a move is feasible for the product in mind. If it is not feasible with a change of position of the strategic part, it is important to improve the current situation. Examples of actions could be to build long term relationships with the supplier. Non-critical parts, on the other hand, should stay in their position, with the goal to improve the efficiency of the purchasing process by gathering and placing the parts in supply agreements. For bottleneck products, the goal is to ensure the supply of the products by introducing an agreement with the suppliers (Gangurde & Chavan, 2016).

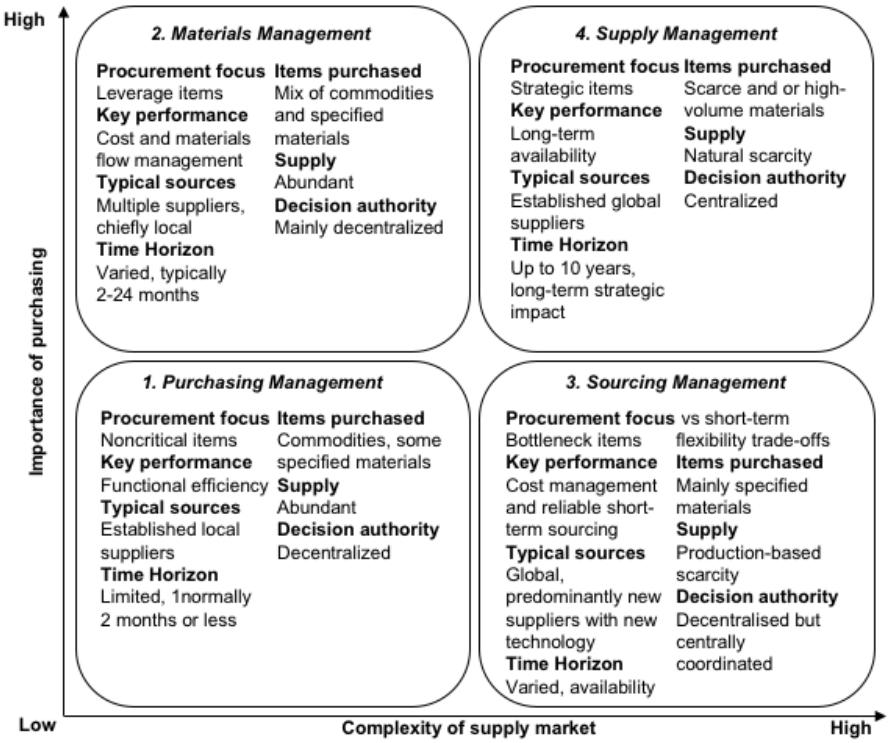


Figure 3.7: The Kraljic Matrix, based on Kraljic (1983)

3.2.4 Organization and Structure of Purchasing

The organizational structure for purchasing can be categorized into two main structures, decentralized and centralized purchasing. If combining the two, one will receive the third

category which is center-led purchasing.

Decentralized purchasing

The business unit is responsible for all purchasing related decisions. This structure is visualized in figure 3.8. Each business unit is financially responsible which also includes the purchasing function (van Weele, 2018). The advantages of a decentralized purchasing organization are the direct responsibility of the operating companies, a possibility to build stronger customer orientation towards internal users, decreased bureaucracy, higher flexibility, less costs related to coordination as well as increased possibilities through direct communication with the suppliers. However, the disadvantages of a decentralized purchasing organization is lack of economies of scale, dis-alignment in the handling of suppliers, difficulties to perform a uniform supply market research, limitations in the upbringing of specific expertise as well as a lack of standardization (van Weele, 2018).

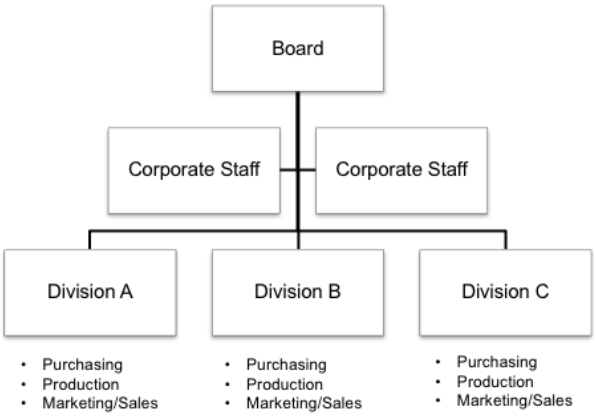


Figure 3.8: Decentralized structure, based on van Weele (2014)

Centralized purchasing

Centralized purchasing is when all tactical and strategic purchasing decisions are performed through a central purchasing department, figure 3.9. The advantages and disadvantages of a centralized purchasing function are the reversed compared to the ones described in the previous section (van Weele, 2018).

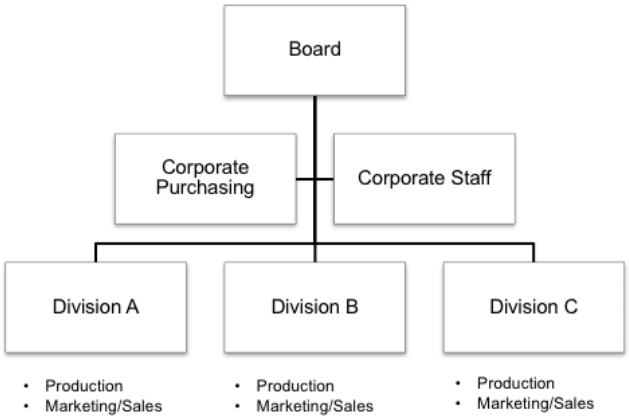


Figure 3.9: Centralized structure, based on van Weele (2014)

Center-led purchasing

Center-led purchasing can be divided into two groups; hybrid structure and category sourcing. The primary one, the hybrid structure also called pooling, can be described as a combination of centralized and decentralized purchasing where the aim is to combine mutual requirements between units. The pooling may be performed in various ways, it can be voluntary coordination, lead buyership and lead design concept. The second center-led purchasing strategy is category sourcing, which also refereed to as cross-functional sourcing teams. Category teams or commodity teams perform contracting centrally while all operational purchasing activities are performed decentralized (van Weele, 2018).

3.2.5 Single and Multiple Sourcing

The question of whether to use *Single Sourcing* or *Multiple Sourcing* for a certain product or product group is considered to be a strategic purchasing decision (van Weele, 2014).

Single sourcing

Single sourcing provides the opportunity of stronger relations and a possibility of higher quality through closer quality work with that single supplier (Manuj & Mentzer, 2008). The high dependence provides a possibility of higher commitment (Berger & Zeng, 2006). By only working with one supplier, the communication is improved as well as it facilitates for joint processes on product innovation (van Weele, 2014). Single sourcing allows lower

costs through economy of scale, hence a stronger negotiation position (Manuj & Mentzer, 2008). However, the availability is more sensitive to delivery problems and the supplier becomes more affected by volume fluctuations. The dependence of the supplier is higher, which increases the risk. If the supplier increases prices, there is no alternative on suppliers and the knowledge on the supply marked decreases when using single sourcing (van Weele, 2014).

Multiple sourcing
Multiple sourcing provides the purchaser with the opportunity to increase the price competition among suppliers (van Weele, 2014). If problems occur with one supplier, this supplier may easily be replaced (Manuj & Mentzer, 2008). In addition to this, a broad base of competence is created by using several suppliers (Berger & Zeng, 2006). The downside of applying multiple sourcing is that it might decrease the commitment from the suppliers. It can also be hard to perform quality assessment work over time and the suppliers are most likely not as interested in long term investments. It is hard to keep the same level of communication with all suppliers and the cost benefits through economies of scale disappear when comparing to single sourcing (van Weele, 2014).

3.2.6 Co-ordination Problems between Purchasing and Logistics

Van Weele (2014), has identified a number of common issues in the interaction between purchasing and logistics which will be further described in the following section.

Frequent changes in material planning based on late changes in the production planning could interrupt or disturb the delivery schedules with suppliers. This could lead to either canceled delivery agreements or that deliveries have to be performed before the initial date which increases the cost due to rush-orders.

Unreliable planning information due to problems to keep the data in the information systems up-to-date and correct. This is crucial in order to eliminate the risk of unnecessary orders to be placed last minute due to incorrect stock or delivery information.

Lack of well-defined specifications is a problem which often arises if specifications and bills of material are ambiguous or incomplete. If specification sheets are absent or incomplete, it will be almost impossible to supply materials of the right quality since the term ”right quality” can be defined differently among stakeholders. This could then impact the rejection rate of incoming materials.

Lack of standardization if specifications are too complex or specific in cases where more standardized products could be used, it could impede the purchasing process and result in an unnecessary variety of products. This increases the complexity of the logistics, hence increases the cost as well as the administrative work.

Insufficient integration of purchasing in logistics management generates problems when automating the production and logistics systems. If purchasing is not taken into consideration at an early stage, the risk of delays increases due to specific requirements for descriptions of material and articles.

3.3 Sourcing within the S&OP Process

Due to limited literature written on the topic sourcing within the S&OP process, this chapter will focus on the bridge between sourcing and S&OP which is to review the sourcing limitations in the supply phase in order to cover all potential capacity issues. This chapter will cover supply chain risks and expand on the risks touched upon in chapter 3.2.5, as well as review sources which describes the link between suppliers and the S&OP process at the focal company. This is a topic of increasing importance since companies today, especially looking at developed economies, has scientifically increased the amount of components and services purchased from suppliers compared to earlier. (Liker & Choi, 2004)

3.3.1 Connecting the Suppliers to the S&OP Process

In order to improve the supply chain management, information sharing in the supply chain has to increase. By understanding the inventory strategy of critical suppliers, risk mitigating may be incorporated in the S&OP process. Increased understanding of these factors will facilitate the discussion and decision making on an aggregated level, such as the S&OP process. (Sheldon, 2006)

Flexibility connected to the planning horizon
According to Sheldon (2006), suppliers normally supply a limited number of product families at the focal company. Hence, it is the information regarding these product families which needs to be shared to the supplier in order to secure supply. The information should be detailed looking at a shorter planning horizon whereas the 4-12 month range only need bucket forecasts (Sheldon, 2006).

Sheldon (2006) suggests time fence norms which changes along the planning horizon, as well as a certain level of flexibility built into the planning horizon. The length of each planning phase varies depending on industry and the model visualized in figure 3.10 can be adjusted to the specific requirements of the concerned company. The main message of the model presented by Sheldon (2006) is to describe how the time fence norms expand over time at the same time as the flexibility increases. On a short time horizon, the fence is fixed and no changes can be made. While moving further down the planning horizon, the level of detail of the scheduling at the supplier decreases which increases the flexibility, allowing the focal firm to make larger adjustments to the original order quantity.

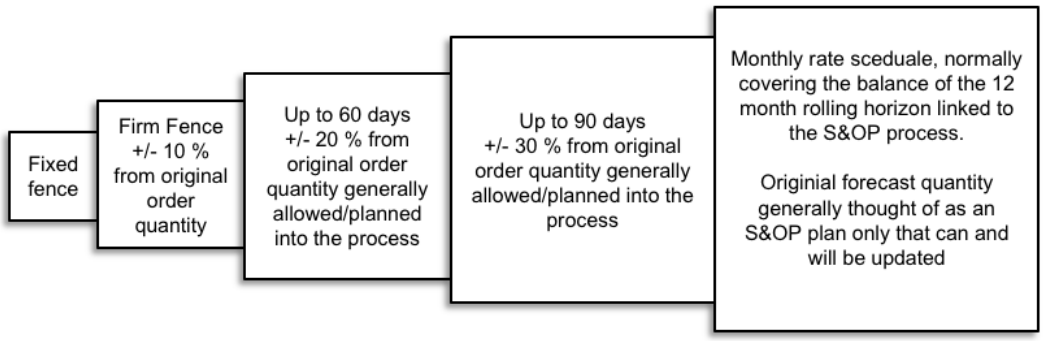


Figure 3.10: Flexibility connected to the time horizon, based on Sheldon (2006)

Rules of engagement

With a monthly S&OP process, the long term plan is adjusted each month. Sheldon (2006), expresses the importance of sharing these changes with suppliers in order to improve the supply management. To ensure credibility, the suppliers need to understand that the changes are validated by top-management at the focal firm. This will allow the suppliers to incorporate the information into their S&OP processes. These change and flexibility agreements are referred to as *Rules of Engagement*, and the information shared through these agreements is the same information which is shared internally to balance supply and demand. Examples of *Rules of Engagement* are visualized in figure 3.11.

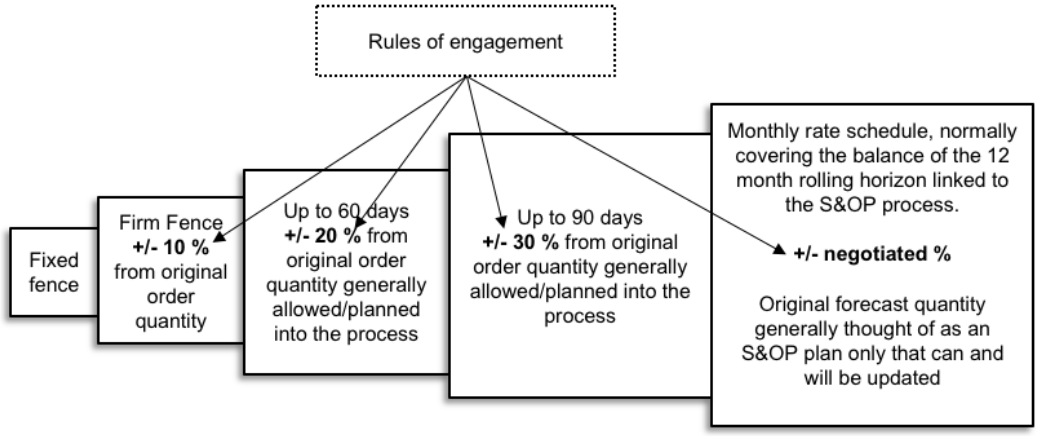


Figure 3.11: Rules of engagement connected to the planning horizon, based on Sheldon (2006)

3.3.2 Risk

According to Manuj and Mentzer (2008), there are three components to consider when conceptualizing risk. The primary one is to define the potential losses of the risk and the second one is to define how likely those losses are. In other words, what is the probability of the occurrence of an event which will realize the risk. The third and final component is to define the significance of the consequences of the potential losses.

It is possible to group supply chain risks in two categories, *Qualitative Risks* and *Quantitative Risks*. Quantitative risks refers to stock-outs and lost sales due to stock-out, overstocking and inadequate availability of components and materials throughout the supply chain. Qualitative risks on the other hand refers to lack of accuracy, reliability and precision of the materials or components throughout the supply chain. (Manuj & Mentzer, 2008)

Risk management

Manuj and Mentzer (2008), suggest a five step process to manage risk. The primary step in the risk management process is to identify the risk. This could be done through classifying the risks into the eight categories described in table 3.1. The second step is risk assessment and evaluation, which could be performed through decision analysis, case study or be perception-based. In the third step, appropriate risk management should be se-

lected. Proposed strategies are avoidance, postponement, speculation, hedging, control, sharing/transferring and security. The fourth step is the implementation of the supply chain risk management strategy. The fifth and final step in the risk management process is mitigation of supply chain risks. All steps in the process should maintain interactive and interdependent and there should be a constant flow of information between the different steps (Manuj & Mentzer, 2008).

Table 3.1: Categorization of Risk by: Manuj and Mentzer (2008)

Type of Risk	Source
Supply Risks	Disruption of supply, inventory, schedules, and technology access; price escalation; quality issues; technology uncertainty; product complexity; frequency of material design changes
Operational Risks	Breakdown of operations; inadequate manufacturing or processing capability; high levels of process variations; changes in technology; changes in operating exposure
Demand Risk	New products introductions; variation in demand; chaos in the system (the Bullwhip effect)
Security Risks	Information system security; infrastructure security; freight breaches from terrorism, vandalism, crime, and sabotage
Macro Risks	Economic shifts in wage rates, interest rates, exchange rates and price

Range forecasting

In an article written by Norrman (2008), supply chain risk-sharing contracts are analyzed trough two case-studies. This section will provide a description of risk sharing contracts based on range forecasting and present potential benefits and disadvantages based on the two case studies.

What is risk-sharing contracts based on range forecasting?

By conducting contracts based on an internal range forecast of the expected demand, the risk can be shared between the supplier and the focal firm. An example of such a forecast is visualized in figure 3.12. The forecast is communicated with the suppliers in order to guarantee supply and availability, lead time and prices. One important factor in the range forecasting contracts is liability. The focal firm must commit to a specified minimum purchase while the supplier commits to a certain level of availability. The time-horizon of these commitments vary, often between 3-12 months (Norrman, 2008).

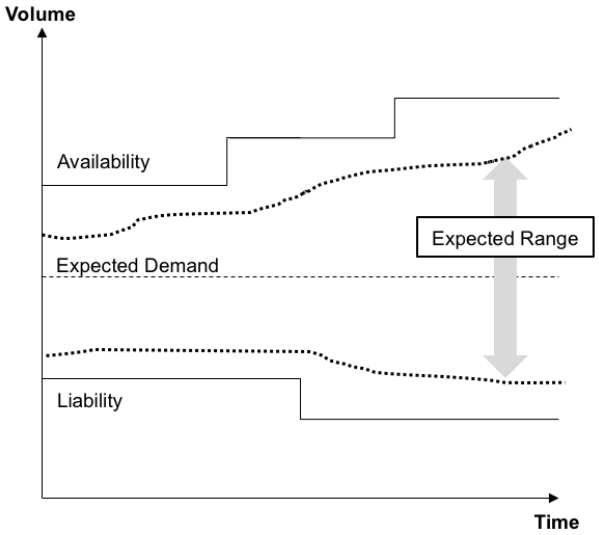


Figure 3.12: Range Forecasting, based on Norrman (2008)

Benefits of risk-sharing contracts based on range forecasting
Benefits identified during the case studies are, among others; *Increased flexibility, Improved visibility from the supplier's point of view, Better predictability of supply chain performance* and *Risk assessment due to more explicit commitments* (Norrman, 2008).

Disadvantages with risk-sharing contracts based on range forecasting
Range forecasting can increase the complexity of the contracts resulting in higher costs to develop contracts. Still, the suppliers in the case study believes that the benefits outweighs the increased cost (Norrman, 2008).

3.4 Successful Implementation of a Transformation

Implementing a new transformation is connected to a risk of failure and 50-70 % of all change efforts fail (Craumer & Shanahan, 2013). Hence, when facing any organizational change, critical success factors and change management should be reviewed to improve the transformation odds.

3.4.1 Critical Success Factors

Näslund (2013) has compared several change methods in order to review critical success factors. His findings can be summarized into four reflections, where the primary one is the similarity of critical success factors connected to the change initiative. Only small variations are identified between the different methods. The second reflection refers to the lack of variation over time, and the third refers to how the success factors seem to be more related to how an organization approaches the change rather than to the change method itself. The last reflection refers to the most critical factors when approaching a change; *Management Support* and *Organizational Culture* (Näslund, 2013).

Näslund (2018) describes three categories of critical success factors which are visualized in figure 3.13. In the top of the pyramid, one will find the success factors connected to the strategic goals, the purpose. Below this, is the tactical level which holds the success factors connected to the process. The operational level, containing success factors related to people, are located in the bottom of the pyramid (Näslund, 2018).

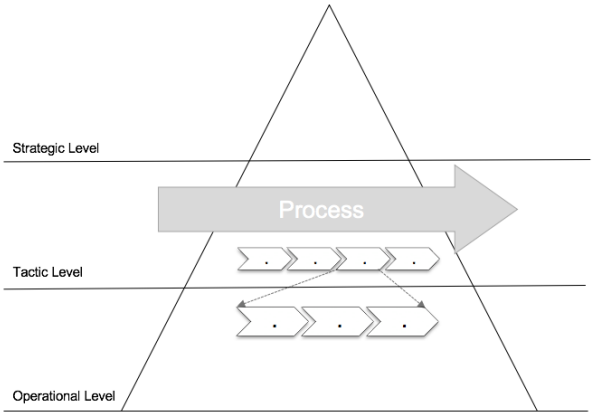


Figure 3.13: Categories of Critical Success Factors, by Näslund (2018)

Purpose

This category holds factors which are connected to the reason to start a transformation, to ensure alignment with the overall strategic goals of the company. It also contains factors which are connected to the communication of the purpose through top management involvement (Näslund, 2018). McKinsey performed a survey in 2015 with the purpose to determine

the most critical actions of transformation. The top-ranked actions connected to this level are; *Top management is openly communicating the progress and success of the transformation*, *Managers perform the same change which they ask their employees to make* and *Top management is openly communicating the impact of the transformation on the employees day-to-day work* (Jacquemont, Maor, & Reich, 2015).

Process

The process refers to the ability to connect strategy, operations, change initiatives and performance measurement systems to each other in order to improve cross-functional integration and process orientation (Näslund, 2018). Actions connected to this level are; *To systematically identify, share and improve upon best practices, To clearly define roles and responsibilities in the transformation, Ensuring sufficient personnel to support the implementation* and *To ensure key roles of every level of the organization are held by employees who believe in and support the transformation* (Jacquemont et al., 2015).

People

At the operational level, critical success factors are connected to organizational culture, change management and peoples ability to change (Näslund, 2018). Important actions of transformation are: *All employees need to see how their work relates to the vision of the company, The organization need to develop its people so they are able to perform according to the new expectations* and *All employees need to be committed to their individual goals and targets* (Jacquemont et al., 2015).

3.4.2 McKinsey's 7s Framework

"*The framework maps a constellation of interrelated factors that influence an organization's ability to change.*" (Bryan, 2008)

The 7s framework is built upon the following seven factors; *Strategy, Structure, Systems, Staff, Skills, Style* and *Shared values*. In order to develop the organization, all seven factors have to be taken into consideration. Only focusing on a selected few, will not take the organization to the next level, since all factors are crucial for development (Bryan, 2008). According to this model, an organization is successful when all seven factors are integrated in harmony. The factors may be categorized into two categories; the hard S's which consist of strategy, structure, and systems and the soft S's which are skills, staff, style and shared values (Kaplan, 2005). The hard S's could be defined as organizational theory while the soft ones can be defined as organizational behavior, hence of more cultural nature (Grant,

2008). The model, as described by Bryan (2008), is visualized in figure 3.14.

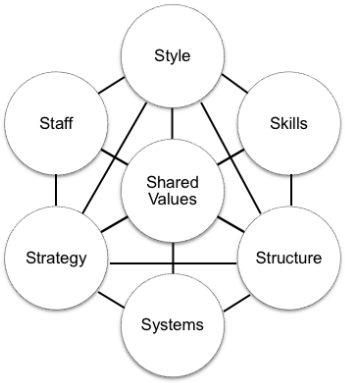


Figure 3.14: McKinsey's 7s model, by Bryan (2008)

3.5 Synthesis

To conclude and summarize the findings of the literature review, it could be said that there is a large amount of information available on both the S&OP as well as on the purchasing processes. However, there is quite limited literature written on the topic sourcing within the S&OP process. Hence, a framework on how to include sourcing within the S&OP process will be developed in the upcoming chapters based on knowledge regarding purchasing, S&OP, sourcing within S&OP, reference companies, and the current processes at Alfa Laval, which will be further described in the next chapter.

Chapter 4

Empirical Study

In this chapter, the empirical data will be presented, mainly focusing on the S&OP process and the sourcing processes at Alfa Laval. The information is acquired through interviews with employees, observations and internal documents at Alfa Laval. In addition to this, a benchmarking part describing the S&OP process at two reference companies will be provided.

4.1 Sales and Operations Planning at Alfa Laval

Alfa Laval, and the business unit Gasketed Plate Heat Exchangers, GPHE, started their journey of implementing Sales and Operations Planning approximately one year ago. The design of the S&OP process was developed globally for the business unit GPHE by the Operation Development department. The framework for the S&OP process is defined and Alfa Laval is now in the phase of implementing it across the eight GPHE sites. The goal of implementing S&OP is to fill the gap between the strategic and operational planning to support the strategy of Alfa Laval, this is illustrated in figure 4.1. The S&OP process will not only fill the gap between the operational and strategic planning but also create a tighter collaboration and generate synergies cross business areas.

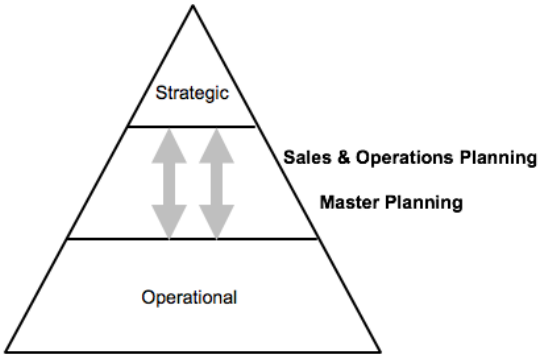


Figure 4.1: Gap between strategic and operational planning, based on Alfa Laval (2019)

4.1.1 The S&OP Process

Alfa Laval follows Wallace's S&OP process, described in chapter 3. However, Alfa Laval has merged step 1 and 2 from Wallace's process and created one step called *Demand Planning*, figure 4.2

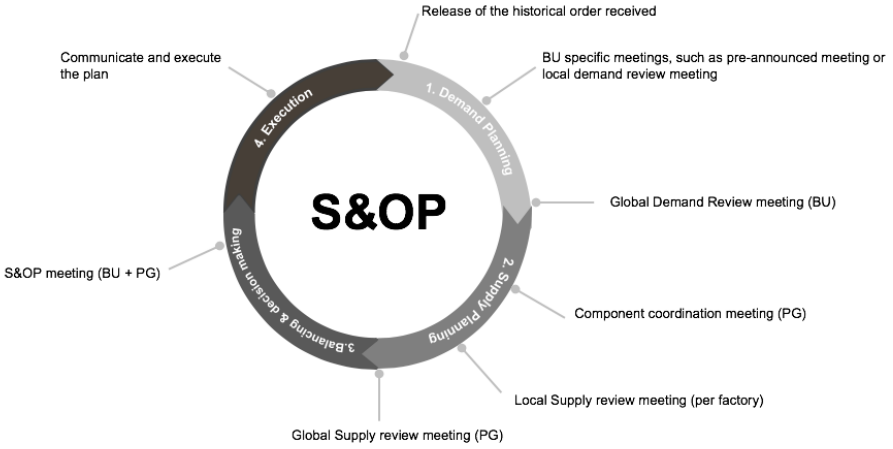


Figure 4.2: S&OP Process at Alfa Laval, based on Alfa Laval (2019)

The S&OP process at Alfa Laval is built upon a monthly cycle where step 1-3 are conducted over a 4-week period and the last step, *Execution*, is performed using the necessary time

needed. The four steps are described briefly below.

Demand planning
In the first step a sales forecast is created and validated with relevant persons from sales, product management, and service. When needed, the process includes an overview of large upcoming sales projects which also are discussed at pre-meetings. Finally, the sales forecast is released to operations.

Supply planning
In the second step, the sales forecast is translated into demand plans for each factory. These demand plans include the requirements for each factory. The supply situation, concluded capacity and inventory, is reviewed and gaps are identified to synchronize the supply chain.

Balancing and decision making
To receive a global overview of the business units, all local plans are consolidated. What-if scenarios are conducted and analyzed to support the overall risk assessment of the plan. Relevant issues are discussed at executive meetings with representatives from senior management.

Execution
In the last phase, the output from the decision meeting and the final plan is communicated and executed.

4.1.2 Supply Planning Phase

The main focus of this master thesis is supply and sourcing, hence, the supply phase will be further investigated. The purpose of the supply planning phase is to balance local demand and supply plans, in order to align the need for components between factories within the network and to create supply forecasts towards suppliers. The supply phase at Alfa Laval consist of four steps, figure 4.3. The supply planner for the product group is responsible for preparing the data and to create a factory split. The component forecast is then evaluated and confirmed locally before the component coordination meeting for the whole product group is taken place. The purpose of this coordination meeting is to visualize the total need for the supplying factories and to understand the need, to coordinate the components between the factories. In the gap analysis, the local plans are updated and gaps are identified. Capacity gaps are then discussed at the Local Supply Review Meeting, LSRM, where the

local supply planner, factory manager, operation managers, and source manager are participating. The local supply planner is responsible to prepare the material for the meeting and to visualize the gaps. The output from this step is a demand-capacity outlook for the coming 2-15 months including gaps, local recommendations, and actions for how to close the gaps. With the current processes, it is only the manufacturing capacity which is reviewed during the LSRM. In order to understand the full supply capacity, the sourcing capacity has to be reviewed as well.

Figure 4.3: Supply phase at Alfa Laval, based on Alfa Laval (2019)

4.1.3 Maturity Level

Alfa Laval is still quite immature in their S&OP process, currently located in stage two in the Grimson and Pyke's maturity framework. However, they are moving toward stage 3. Alfa Laval's position is visualized in figure 4.4. The positioning in each dimensions are performed by the local supply planner and the sales and operation manager for GPHE, and each position will be described further below.

Meetings and collaboration
Alfa Laval has a well defined S&OP process and well-defined agendas for each meeting. However, they are still in an early stage and the planned agendas often differ from the actual agenda. Currently, it is only the customer data which is discussed during the meetings and not the supplier data.

Organization

There is a well defined S&OP organization with top management support, but Alfa Laval is still in an early phase and is working towards getting the right roles and the right routines. The roles in the S&OP are defined and the formal S&OP team is created, however, Alfa Laval still need to assure that all roles are filled.

Measurements

Measurements are defined, but not used or followed up. Today Alfa Laval Lund is not measuring forecast accuracy, but the goal is to do it. Since they are in the developing phase, they are heading to the next stage in the framework.

Information technology

Today there is no system support when it comes to sharing information, instead, everything is done in spreadsheets resulting in extensive manual work.

S&OP plan integration

Today, the sales plan drives operations, however there is some planning integration, the capacity is checked to balance the demand. The planning integration is currently improving, therefore they are moving to the next stage in the framework.

	Stage 1 No S&OP Processes	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	• Silo Culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	• No S&OP organization	• No formal S&OP function • Components of S&OP are in other positions	• S&OP function is part of other position: Product Manager, Supply Chain Manager	• Formal S&OP team • Executive participation	• Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	• No measurements	• Measure how well Operations meets the sales plan	• Stage 2 plus: • Sales measured on forecast accuracy	• Stage3 plus: • New Product Introduction • S&OP effectiveness	• Stage 4 plus: • Company profitability
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralized information • Revenue or operations planning software	• Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench	• Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimization for whole company

Figure 4.4: S&OP integration at Alfa Laval, by Hansson & Davidsson (2019)

4.2 Source at Alfa Laval

The following section will contain the empirical analysis of the sourcing department at Alfa Laval including the organizational structure as well as communication, categorization and planning processes.

4.2.1 Organizational Structure

The organizational structure for purchasing at Alfa Laval could be described as a center-led structure, explained in chapter 3. As visualized in figure 4.5, the purchasing organization is built upon three blocks; *Global Purchasing, Strategic purchasing*, and *Operational Purchasing.*

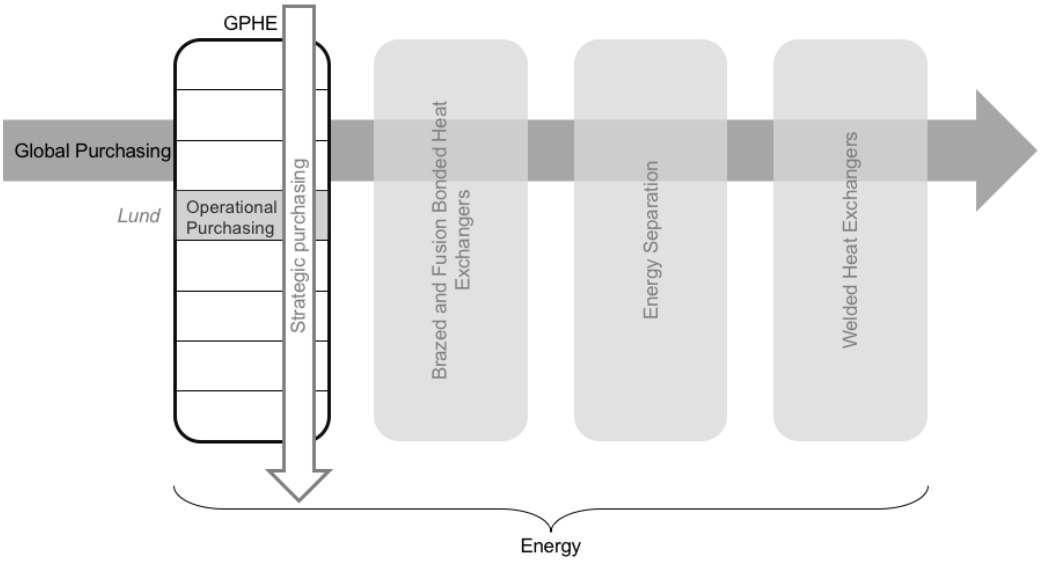


Figure 4.5: Purchasing structure at Alfa Laval, by Hansson & Davidsson (2019)

Global purchasing
Global purchasing is divided into eight commodity groups which reach horizontally cross all business units, visualized in figure 4.5. Each commodity group focuses on certain component groups. They are responsible for all global purchases connected to their component group regardless of business unit affiliation. The global purchasers have similar tasks as the strate-

gic purchasers, with the difference of the global purchasers focusing on global contracts and the strategic purchasers on local contracts. The time horizon on which the global purchasers are supposed to work is 1-5 years.

Strategic purchasing
The strategic purchasers are responsible for strategic purchasing decisions cross all factories in one business unit, see figure 4.5. For the strategic purchasers in Lund, this refers to all eight factories within GPHE. The strategic decisions include the first three steps in the purchasing process, described in chapter 3; determining specification, selecting the supplier and contracting as well as the final step which is follow-up and evaluation. In contrary to the global purchasers they focus on local suppliers, only serving factories within the business unit. Currently, the factory in Lund attracts the main focus from the strategic purchasers within the business unit. However, the ambition is to increase focus on the other factories as well to gain synergies through economies of scale. The goal for the strategic purchasers is to work on a time horizon reaching 1-5 years into the future.

Operational purchasing
The operational purchasers are mainly responsible for the day to day work, focusing on step four and five in the purchasing process; *Ordering* and, *Expediting and Evaluation*. They receive contracts and pricing information from either strategic purchasers or global purchasers and use this as input to the operational purchasing. The time horizon on which the focus is on is 0-18 months and they secure supply for the Lund factory only. The operational purchasers all have certain focus areas and are all responsible for certain components, increasing the knowledge and customer relations for these specific products.

4.2.2 Supply Situation

Alfa Laval Lund orders a substantial amount of order specific items with unique order numbers and they have over 100 individual suppliers. The approximately numbers for components purchased in Lund 2018 are displayed in table 4.1. Approximately 10 percentage of the items are order specific.

Table 4.1: Supply situation at Alfa Laval Lund 2018

No of items	20000
No of suppliers	115
No of component groups	100

4.2.3 Planning Process at Source

Previously, it has been described how S&OP will close the gap between strategic decisions and operational decisions, facilitating the work of breaking down the strategic goals into operational tasks. Similar to the gap in the organization as a whole, purchasing is also facing a gap between the strategic and operational purchasers. Currently, there are no plans performed on a tactical level, building a bridge between the strategic plans and the operational tasks. In figure 4.6, Alfa Laval's purchasing process is described. The upstream tasks are performed by the strategic purchasers whereas the downstream tasks are performed by the operational purchasers.

Figure 4.6: Alfa Laval's Procurement Process, based on Alfa Laval (2019)

The strategic purchasers, including the global purchasers, are looking at a 1-5 year horizon with the aim to secure supply through contracting. They need to look into if the current suppliers have enough capacity to cover strategic expansion or if there is a need for an alternative supplier in order to secure supply. The downstream activities, performed by the operational purchasers, are performed on a 0-18 months time horizon.

As the sourcing department have gone through a reorganization recently, the plan of actions just described is the goal. Currently the strategic purchasers work a lot with support on

operational issues concerning suppliers.

4.2.4 Cross-functional and Cross-organizational Communication

This section will describe three areas of communication with and within Source. The three areas are; communication between *Operational and Strategic purchasers*, communication between *Operational purchasers and Plan*, as well as the communication between *Source and their suppliers*.

Communication between operational and strategic purchasers
As described in the previous section, there is a gap between the strategic purchasers and the operational purchasers. With improved communication, this transit could be facilitated. The gap is not only defined by lacking communication but also a lack of a forum to discuss these matters. Resulting in a lack of responsibility for the planning defined as tactical as well as a place to handle issues on a 3-18 months horizon. Currently, the operational purchasers handle all actions concerning 0-18 month into the future, however, this does not include planning on a 3-18 month horizon.

Communication between operational purchasers and Plan
The main exchange of communication between Source and Plan are performed through the operational purchasers. Plan provides the operational purchasers with monthly supply forecasts and these forecasts are mainly based on historical data. However, large changes in demand are broken down into articles based on historical variations and used to make manual changes to the supply forecasts. This results in forecast which are mainly based on historical data, but with some manual modifications.

Communication between Source and suppliers
The continuous communication between Source Lund and the existing suppliers are performed through the operational purchasers. They provide their suppliers with monthly forecasts reaching over either 3 or 12 months. The supply forecasts, provided by Plan, are based on historical sales data and are performed at item level. Supplying forecasts are mainly shared with large suppliers with stable consumption. Forecast are only performed on stocked items and not on order specific items, which stands for approximately 10 percent of the total volume and 60 percent of the value.

4.2.5 Categorization of Components

Currently, there is no unanimous way of categorizing components cross the strategic, operational and global purchasers. A lot of the categorization is performed individually based on experience, making it difficult to track. There is no documentation performed to compile previous decisions to single or dual source, shorten the lead times by keeping stock at the supplier or other strategic or tactical decisions.

Different methods of categorization i used between global, strategic and operational purchasing. Strategic purchasing uses the Kraljic matrix, described in chapter 3 to categories their articles and decide on how to source them. Not a lot of documentation is performed and the matrix is rather used as a stepping stone for an individual decision regarding suppliers. Operational purchasing, on the other hand, uses ABC categorization as support when ordering. The ABC categorization used is based on value spent, and categorizes the suppliers into three groups. It is similar to the Pareto principle, which divides items or suppliers into two groups where 20 percent of the quantity stands for 80 percent of the value spent. The ABC categorization has the same intention but divides the items or suppliers into three groups where the A group equals the 80 percent of the value spent. Group B equals 15 percent and group C, 5 percent. The value equals the total value spent on a component group. Based on these groups different strategies of ordering are applied. Similar to the Kraljic matrix, it is not documented how it is used but rather used as a guiding tool.

4.2.6 Single and Multiple Sourcing

The main goal at Alfa Laval is to strive for multiple sourcing for the majority of the components. Several components have either long lead time from the suppliers or long lead time to acquire raw material which increases the importance of obtaining several options through multiple suppliers or multiple supplying factories. Multiple sourcing allow larger fluctuations in demand, which improves the availability om components. However, for certain products, the suppliers need to have Alfa Laval specific production with unique tools. This could impede the strive for multiple sourcing and multiple supplying factories due to high investments. Other components have specific quality restrictions and this is another factor which makes it hard to multiple source. Hence, even tough the ambition is to have multiple sources, certain specifications may interfere with this goal resulting in dual sourcing instead.

4.2.7 Scalability at Suppliers

Scalability at the suppliers, in this point of reference, refers to the capability of the suppliers to scale up or down their production to align with changes in demand from Alfa Laval. Similar to the categorization, knowledge of the scalability at the suppliers are kept individually by the operational, strategic and global purchasers. There is currently no documentation on what kind of demand fluctuations the suppliers can handle. However, each purchaser has knowledge regarding this in the aspect of the product groups they are responsible for.

There is no communication loop where suppliers confirm forecasts and agree on the demand set by Alfa Laval. However, it does not seem as the capacity at the suppliers is the main bottleneck but rather the raw material used at the suppliers. In some instances the capacity of the Alfa Laval specific tools used by the suppliers is a constraint. However, it is mainly the second tier supplier which is the limiting factor.

4.2.8 The Development Model

Alfa Laval's position in the development model has been identified together with the source manager, Lund. Alfa Laval positions themselves quite far to the left in the model, indicating on immaturity in the development towards an professionalized purchasing function. As illustrated in figure 4.7, they are currently located between the transactional and commercial orientation which implies focus on securing availability as well as focusing on low unit costs.

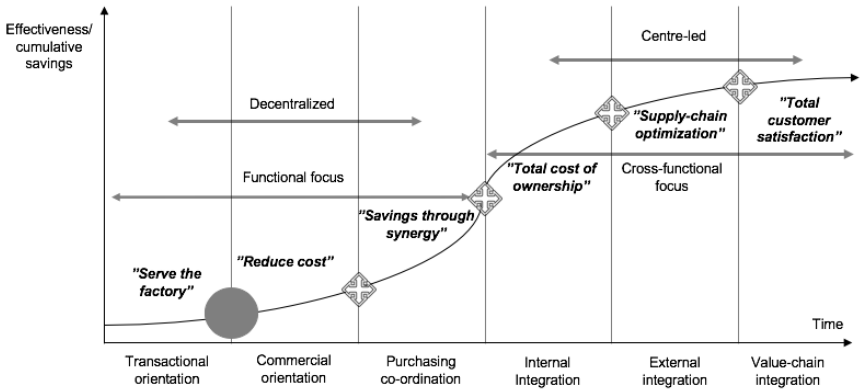


Figure 4.7: Development model, Alfa Laval, by Hansson & Davidsson (2019)

4.3 Benchmarking

As a complement to the limited information published on the topic sourcing within S&OP, strategic benchmarking has been performed. This will generate an understanding of how other companies work with S&OP and how they have integrated Source in the process. Two reference companies have been interviewed, interview questions are found in B. Both of the companies were identified as companies with Source integrated in their S&OP process during a Plan networking meeting. Plan is an expertise network for everyone who works with logistics, supply chain, lean and change management focused on production flows. Plan is an non profit organization, established in 1963 with 1900 members from 700 different organizations making them the largest organization in Sweden focusing on logistics. (Plan, 2019)

4.3.1 Reference Company A

Reference company A is a global manufacturing company with a couple of divisions located in Sweden. The global supply chain manager, responsible for supply chain questions and strategic sourcing for one of these divisions was interviewed. Reference company A has three separate factories, which all are manufacturing electronic devices. All of the products produced are make to order. Company A has worked with S&OP for approximately 20 years and S&OP is their way to balance supply and demand and to even out the demand between the three factories.

S&OP process
The S&OP process at company A consist of two main steps;

1. *Pre-S&OP meeting.* The main goal with this meeting is to identify gaps between the capacity and the demand plan. At the pre-S&OP meeting, operative supply representatives, the operations manager, operations specialists, market specialists and the order manager attend.

2. *Executive meeting.* During this meeting, the capacity constraints are discussed and decisions regarding changes in the demand plan are taken. At the executive meeting, the factory manager, financial manager, market manager, aftermarket manager, supply manager, operations manager, operations specialist, and market specialist attend.

In addition to these meetings, pre-activities are executed to facilitate the discussions. These activities include data preparation for execution of forecasts and future scenarios.

Source integrated in S&OP

Representatives from both operational as well as strategic purchasing are participating at the pre-S&OP meeting. However, these representatives does not share any information regarding the suppliers capacity at these meeting and the main focus during the meeting is still production capacity in relation to the demand plan. The interviewee expresses that Company A is aware of the capacity at some of their suppliers, but does not believe that capacity constraints at the suppliers is the main concern.

The actual integration with Source is rather after the executive meeting when Source receive the final demand plan and share selected parts of this with the suppliers. Currently, there is no confirmation from the suppliers whether they can handle the supply plan, which result in one-way communication from company A to the suppliers. The lack of standardized processes of how to collect the feedback confirmation from the suppliers is expressed as a main constraint by the interviewee. The supply forecasts, based on the final demand plan, sent to the suppliers cover the following 12 months.

Categorization of critical suppliers

Company A does only send forecasts to critical suppliers, and to identify critical suppliers Company A uses the Pareto principle. The suppliers where they spend the most are defined to be critical. 80 percentage of their spend is found at 15-20 suppliers.

Maturity level

According to the supply chain manager and the S&OP manager at Company A, they are still immature in their S&OP process and places themselves at stage 2, leaning towards stage 3 in some instances, figure 4.8.

	Stage 1 No S&OP Processes	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	• Silo Culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	• No S&OP organization	• No formal S&OP function • Components of S&OP are in other positions	• S&OP function is part of other position: Product Manager, Supply Chain Manager	• Formal S&OP team • Executive participation	• Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	• No measurements	• Measure how well Operations meets the sales plan	• Stage 2 plus: • Sales measured on forecast accuracy	• Stage3 plus: • New Product Introduction • S&OP effectiveness	• Stage 4 plus: • Company profitability
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralized information • Revenue or operations planning software	• Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench	• Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimization for whole company

Figure 4.8: S&OP Integration at Company A, by Hansson & Davidsson (2019)

4.3.2 Reference Company B

Reference company B is a global manufacturing company providing construction equipment. They provide a wide range of products and services in more than 140 countries through their global distribution network. The company is divided into six product groups which all run their own S&OP process. The interview was conducted with the purchasing site manager who is responsible for the purchasing for seven factories, of which six are located in Sweden. Reference company B has worked with S&OP for several years and has a well-implemented process with Source integrated. Reference company B is a make to order company and they work with dealers and not directly to end customer. The dealers are responsible for making sales forecast with a time horizon of 18 months, which are executed once a year.

S&OP process

The S&OP process at company B is a monthly cycle and parallel processes run for the six product groups. The process consist of two main steps which will be further described in this section;

1. *Pre-S&OP meeting.* Before this meeting, demand plans for each of the production sites are consolidated and broken down from the sales forecasts. The demand plan is

discussed at the pre-meeting with attending personnel from four production units; the inbound logistic managers, purchasing managers, and strategic buyers. The demand plan is discussed in a long term supply perspective and possible limitations of material supply are discussed. If a limitation is identified, the potential risks are analyzed and possible changes in the demand plan are discussed.

2. *Executive meeting.* During the executive meeting the factory managers, production planner and their managers, and global source manager attend. At this meeting, the demand plans are compared to the supply capacity to identify gaps. This meeting is executed at the same time for all production groups and the decisions are consolidated. Finally, the confirmed demand plan is communicated throughout the organization.

Source integrated in S&OP

As described above, purchasing is well integrated in the S&OP process. However, purchasing is considered as a support function implying that they are always expected to supply material to support the demand plan. Hence, supply limitation must be extensive in order for purchasing to say no to a demand plan. The main reason behind this is the cost of lost sales, and therefore they rather take the risk to not be able to deliver in time.

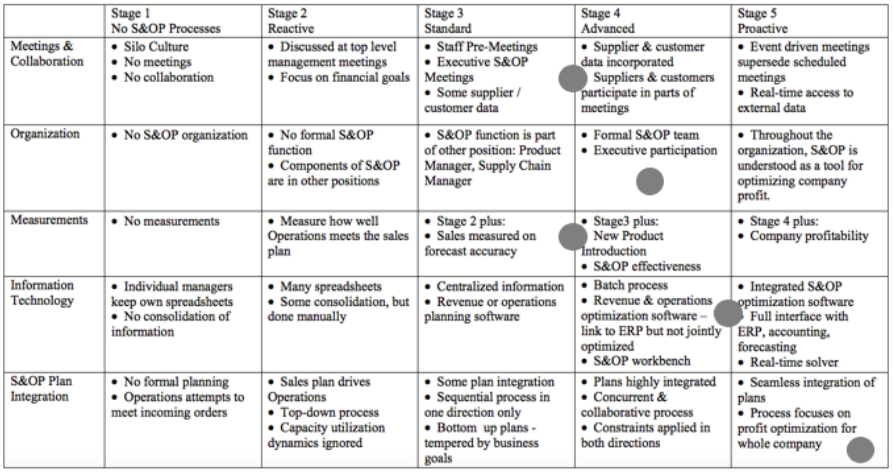
Company B believe that the most complex part when integrating Source into the S&OP process, is to make the connection of which supplier who is delivering to each product. They have more than 400 suppliers and a wide range of SKUs, which implies many different combinations.

Categorization of critical suppliers

Company B has approximately 400 suppliers and due to the large amount, it is important to identify critical suppliers. The critical suppliers are decided with help from historical data of the supplier, for example, deliveries on time. The categorization is made for critical suppliers and not for critical products. Company B have two discussion forums where approximately 20 critical suppliers are discussed and plans on how to handle them are confirmed. There are two risk forums each week; one consolidating meeting for all seven factories and one meeting for the four Swedish factories. The decisions from the risk forum meetings are then used as input at the meetings in the S&OP process.

Maturity level

Together with the purchasing site manager, the level of maturity of the S&OP process was mapped into the maturity framework, figure 4.9.



	Stage 1 No S&OP Processes	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	• Silo Culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	• No S&OP organization	• No formal S&OP function • Components of S&OP are in other positions	• S&OP function is part of other position: Product Manager, Supply Chain Manager	• Formal S&OP team • Executive participation	• Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	• No measurements	• Measure how well Operations meets the sales plan	• Stage 2 plus: • Sales measured on forecast accuracy	• Stage3 plus: • New Product Introduction • S&OP effectiveness	• Stage 4 plus: • Company profitability
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralized information • Revenue or operations planning software	• Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench	• Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimization for whole company

Figure 4.9: S&OP Integration at Company B, by Hansson & Davidsson (2019)

4.3.3 Benchmarking overview

To receive an overview of the reference companies and their S&OP process the key take-aways are summarized in table 4.2.

Table 4.2: Benchmarking

Reference company	**A**	**B**
Product type	Electronic devices	Construction equipment
Company Strategy	MTO	MTO
No of factories included in the S&OP process	3	7
S&OP process	1. Pre S&OP meeting 2. Executive meeting	1. Pre S&OP meeting 2. Executive meeting
Forecast time horizon	12 months	18 months
Forecast to	Critical suppliers	All suppliers
Maturity level	2	4
System support	No	Yes
Key take away	Pareto to identify critical suppliers	Risk forum to discuss critical suppliers

Chapter 5

Analysis

In this chapter, an analysis of the Sales and Operations Planning process at Alfa Laval will be provided. The current state will be compared to theory, in order to answer the research question and to find the optimal solution for Alfa Laval on how to integrate Source in the S&OP process.

5.1 Connecting the Empirical Analysis to Theory

The process Alfa Laval is working according to is, as previously mentioned, based on the S&OP process defined by Wallace and Stahl (2008). Due to the recent implementation of S&OP, they are still in an early stage of the implementation, which implies many improvement areas, including the integration of Source. This chapter will expand on how Alfa Laval is working today and compare it to current literature on the topic.

5.1.1 Supply Planning

The lack of supplier review in the supply planning phase implies a non-comprehensive review of the supply in the current state. An integration of Source will provide a more thorough

review of the supply situation. According to van Weele (2014), it is of great importance to integrate purchasing at an early stage to avoid problems with material and articles. Wallace and Stahl (2008) describes the importance to include bottleneck resources into the resources requirement plan, in the supply planning phase. Examples of resources to include are material and warehousing. Hence, the integration of Source in S&OP is essential.

One challenge with the Source integration is to decide what suppliers or what kind of products to include at the S&OP meetings, and how to match them with the demand plans. Due to the great amount of supplied components and the level of aggregation in the S&OP process, it is not possible to review all components. Therefore, it is decided to only incorporate strategic component groups.

As described in chapter 4, the sales forecast from the demand planning phase is translated into demand plans for each factory at the beginning of the supply planning phase. There is currently a set of keys, updated each year, which are used to translate the factory demand plans into production splits. In order to incorporate Source into the S&OP process, the demand has to be broken down to another level based on critical components and suppliers. Hence, a new set of keys need to be created in order to analyze the demand from a sourcing point of view.

5.1.2 Maturity Level

Due to the recent implementation of S&OP, Alfa Laval is transitioning from an immature stage of the S&OP process, towards a more advanced setup, see figure 4.4. Each dimension of Grimson and Pyke's maturity framework will be further analyzed in order to understand Alfa Laval's current maturity level and how it will be affected by the integration of Source. According to McKinsey's 7s, there are seven factors which will influence the ability to change. To be able to move to a more advanced S&OP process, it is important to understand and take these factors into consideration.

Meetings and collaboration
During the last four months, the S&OP meetings have been observed and improvement of the S&OP meetings has been identified. The purpose of the meetings has been improved and the agendas have been followed even better, resulting in increased collaboration. By incorporating Source in the S&OP process the collaboration will increase additionally. Another expected result when incorporate Source in the process, is improved review of the supplier data. Alfa Laval will, therefore, move towards stage 4. According to McKinsey's

7s, it is important to have the systems, including processes, in place to be able to change. Hence, it is essential to define a clear process for the integration.

Organization

Alfa Laval is moving towards an advanced S&OP organization with a, soon to be, formal S&OP team. Due to the importance of formal roles for the S&OP process, it is essential to also identify roles for the sourcing incorporation. Kaplan (2005), mention the importance of structure in order to have well-defined roles and coordination of the activities. Hence, it is crucial to define clear Sourcing roles for the S&OP process. When succeeding with this, it is possible to move into stage four and to achieve an advanced stage in this dimension.

Measurements

To achieve a more advanced phase in this dimension Alfa Laval needs to measure and follow up their process. When designing the solution, it is important to also measure and follow up the source capacity. By doing this, the understanding of the previous months' performance will increase, and Alfa Laval will be able to improve their performance.

Information technology

Alfa Laval is currently not using any systems to support their S&OP process, instead, they are working manually by using spreadsheets in Excel. Even the keys used to aggregate the detailed demand plans to product families are developed manually. These keys are renewed once a year and it is a time-consuming activity. Without a system, the keys, that break down the product families to component groups, must also be created manually. If implementing a planning system, this step will be less time consuming, the keys can be developed more frequent and the accuracy will improve. Another benefit from this would be increased forecast accuracy.

S&OP plan integration

In order to move further to the right in this dimension, increased cross-collaboration in the S&OP process is needed. Integrating Source in the S&OP process will increase the collaboration and it is an example of S&OP plan integration, described in chapter 3. Therefore, inclusion of Source in the process will transfer Alfa Laval to the next stage in the framework.

5.1.3 Purchasing Process

Looking at the purchasing process at Alfa Laval, described in figure 4.6, the main content is similar to the purchasing process defined by van Weele (2014), chapter 3. A connection between the two processes is visualized in figure 5.1.

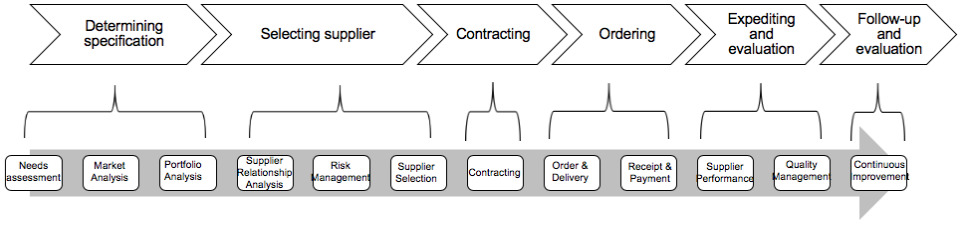


Figure 5.1: Comparison of Alfa Laval's and Van Veles's Purchasing processes, by Hansson & Davidsson (2019)

For the final solution, it is important to be familiar with the entire purchasing process in order to align the solution with the current processes. However, the upstream activities performed by the strategic suppliers are most critical since they are performed on a longer horizon and their strategic importance affect the decisions in the S&OP process. Currently, the operational purchasers handle the downstream tasks performed on a 0-18 month horizon. The reason why the operational purchasers handle tasks reaching up to 18 months ahead derives from a lack of tactical responsibility at Source. Due to this, it is important to cooperate with both strategic and operational purchasers when developing the solution.

Portfolio analysis, supplier relationship analysis, risk management, supplier selection and contracting are all steps in the purchasing process which are affected by the S&OP process. However, risk management and contracting are the steps which are most critical and the ones which will be further discussed in this chapter through communication, single versus multiple sourcing and supplier scalability.

5.1.4 The Development Model

In chapter 4, Alfa Laval's position in the development model, identified by the local source manager, is quite early along the development curve, visualized in figure 4.7. When analyzing

this position, it reflects the complexity of the purchasing function at Alfa Laval. To the left in the development model, more operational behavior is described where the goal is to secure supply and achieve low unit costs. Since the local Source team consists of operational purchasers it is natural to place the local Source team far to the left. Looking at Alfa Laval as a global company the position changes further to the right, to reflect their more professionalized purchasing function. As described in chapter 4, the strategic purchasers are responsible of the business unit GPHE and the focus is changed to highlighting and capturing the advantages and synergies generated from internal cooperation, placing them in stage three in the development model. Moving to the global purchasers, purchasing is heading towards a more strategic level in the company and the structure is center-led. The focus is to solve cross-functional problems which place them in stage four in the development model. Looking at this stage, where the aim is to solve cross-functional problems, the need of incorporating Source in the S&OP process becomes clear, it might even help the local function to move further to the right in the figure. For certain commodity groups, integration with supply-chain partners is developed together with a distinct outsourcing strategy, which is key characteristics for stage five in the development model. This is, however, a very small number of components but it displays the potential of the current purchasing function.

Due to the complexity of the purchasing function, it is hard to position Alfa Laval in one place in the model. However, one can say that the global organization performs on stage four but to be able to do that, support functions such as the local purchasing function in Lund has to act on a more operational level. This complexity in the purchasing function is important to consider when implementing a roll-out plan globally at GPHE.

5.1.5 Communication

In chapter 4, a lack of communication within the company was identified and described. Initially, the lack of communication cross-functionally between business areas was identified. In order to achieve a more mature S&OP process, improved communication to decrease these silos within the company is crucial. In addition to this, limited communication between Source and the suppliers was also identified. The primary concern is that the current supply forecasts are performed on a detailed level, which implies a more uncertain forecast. Due to the uncertainty of the forecasts on a longer planning horizon, some of the suppliers do not use the forecasts at all. The second concern is that it is only forecasts based on historical data which is shared with the suppliers. Currently, the final plan from the S&OP process is not shared with Source, hence, the supply forecast shared with the suppliers does not

include demand variations which are not based on historical data. In order to ensure better availability of the components, increased visibility throughout the supply chain is needed. This could be compared to the results described by Norrman (2008) when implementing range forecasting.

Sheldon (2006), mentions the importance of sharing the final validated forecast from the S&OP process with the suppliers. By integrating Source in the S&OP process, selected parts of the supply forecast which derives from the validated demand forecast can be shared with the suppliers. Sheldon (2006) also mentions the importance of communicating that the forecasts have been validated of top management, in order to ensure creditably. By communicating this, it will hopefully increase the usage of the forecast at the suppliers and potential resource problems can be identified earlier. Another factor which will improve the usability of the forecasts at the suppliers is improved forecast accuracy. When creating the supply forecasts it is important to understand what kind of information the suppliers are interested in, and on what level they want the supply forecasts on, to facilitate the usage.

5.1.6 Benchmarking

In table 5.1, which summarizes the main output from the benchmarking, one can see that Company A, Company B, and Alfa Laval are all global MTO companies where the S&OP process is implemented in order to balance demand and supply. Company B has a mature process where they have incorporated Source in order to improve the forecasting, which, in MTO companies generally is more difficult. Reference Company B and Alfa Laval also have a similar amount of factories included in the S&OP process. Reference company A, on the other hand, has worked with S&OP in 20 years but are still immature in their process, which implies how hard it can be to implement a good S&OP process.

When developing a solution for Alfa Laval, Company B could be looked upon as inspiration. However, it is important to be aware that an advanced process such as this takes time to develop. Company B has systems to support their process, and without any system, it is hard to achieve such an advanced process. Their planning system has improved their forecast accuracy as well as made it possible to share forecasts more frequent with suppliers.

Table 5.1: Benchmarking analysis

Reference Company	**A**	**B**	**Alfa Laval**
Product type	Electronic devices	Construction equipment	Gasketed plate heat exchangers
Company Strategy	MTO	MTO	ATO, MTO & ETO
No of factories included in the S&OP process	3	7	8
S&OP process	1. pre S&OP meeting 2. Executive meeting	1. pre S&OP meeting 2. Executive meeting	1. Demand planning 2. Supply planning 3. Balancing and decision making 4. Execution
Forecast time horizon	12 months	18 months	3 & 12 months
Forecast to	Critical suppliers	All suppliers	Critical suppliers
Maturity level	2	4	2,5

5.2 Elements to Consider when Integrating Source in the S&OP Process

In order to balance supply and demand, the full supply capacity check has to be evaluated. As mentioned earlier, Alfa Laval is currently looking at the production capacity only. By integrating Source, the sourcing capacity will complement the production capacity and generate a full supply capacity review.

To understand the sourcing capacity and to compare it to the demand, the two dimensions have to be on the same level of detail. The demand has to be broken down and the sourcing capacity has to be aggregated from item and supplier level. Once they are in the same unit, and level of detail, it will be possible to balance the demand and supply. This following section will analyze what that right level is, and what unit to perform this comparison on.

5.2.1 Determining Strategic Component Groups

There is a very limited amount of litterateur written on the topic of what and how many components to include in the S&OP process in order to analyze the sourcing capacity. Hence, strategic component groups have been selected based on the Kraljic matrix together with the global source manager. According to Wallace and Stahl (2008), S&OP should be performed on an aggregated level and therefore the sourcing capacity will be aggregated to component groups instead of individual components. As stated in chapter 4, table 4.1, the number of items and component groups are very high and due to this, it was decided to select five component groups to be integrated into the S&OP process. The number five

was selected to ensure the amount to be manageable to track during the S&OP meetings. This is aligned with the number of planning items Plan, Alfa Laval aims at when planning on a longer horizon. This number could be increased or decreased in the future, when the process is in place, in order to receive an improved view of the supply capacity. The exact number is not the critical aspect but rather the essence of the component groups, assuring that potential capacity issues which could affect delivery to customers are highlighted. The strategic component groups consist of component A, B, C, D, and E, see Appendix C.

5.2.2 Single and Multiple Sourcing

The five component groups have been further analyzed in order to understand how to track them in the S&OP process. Two of the factors which have been analyzed are the number of suppliers as well as the capacity constraints when sourcing the component group, visualized in table 6.1. The correlation between the two factors has also been analyzed. Component group A, C, and E have more than four suppliers each, hence, considered as multiple sourced. Component group B and D on the other hand, are both dual sourced. Similar results, like the ones discussed by van Weele (2014), have been visible when analyzing the five component groups. When reducing the number of suppliers, the component group is more sensitive to volume fluctuations in the demand. The capacity constraints increases, making it more important to notify large variations of demand in an early stage. Hence, the S&OP process becomes critical as a forum to discuss these questions. It should also be mentioned that it must not only be the number of suppliers that determine the risk when single or multiple sources but rather the number of supplying factories.

Component group B is dependent on the suppliers to have Alfa Laval specific production, and more specific Alfa Laval specific tools, which have a direct impact on the low amount of supplying factories. Increasing the number of supplying factories would result in large investments. The unique tools increase the capacity constraints, due to decreased flexibility. Component group D on the other hand has a low number of suppliers due to the need of close quality work with the supplier. Which is another factor discussed by Manuj & Mentzer (2008) in chapter 3, limiting the number of suppliers.

One can see that, depending on the specifications of the components, the number of suppliers varies. There is not one correct way to source, even though many of the strategic suppliers interviewed state that a higher number of suppliers are preferable since it minimizes the supply risk. However, this is not always possible due to high investments in specific tools or high-quality requirements.

5.2.3 Scalability at the Suppliers

As mentioned in chapter 4, the scalability at the suppliers is not documented. Scalability in this sense refers to the flexibility to increase or decrease supply in reference to the contracted volume. Despite not having the scalability documented, the purchasers possess information of the suppliers they are responsible for. When integrating Source in the S&OP process, the supplier capacity will be compared to the demand plans to identify gaps. Therefore, the supplier capacity for each component group will be documented together with the scalability over time. Sheldon (2006) expresses the importance of understanding the inventory strategy of critical suppliers, but due to the substantial amount of suppliers and the goal of using multiple supplying factories, it is more interesting to understand the total capacity for the component group. Sheldon (2006) also mention flexibility connected to the planning horizon, and the importance to understand the time fence and on what level of detail the information must be shared with suppliers. As mentioned in chapter 3, there is no standard time fence applicable for all suppliers, and therefore the time fences must be identified for each strategic component group, depending on the characteristics of the component group. The flexibility will then be identified and connected to the time horizon in order to understand how the flexibility changes over time.

5.2.4 Analyzing Selected Strategic Component Groups

The selected strategic component groups will, in this section, be further analyzed. A summary of the data gathered for the analysis of these component groups is visualized in table 6.1. The dimensions which the analysis is built upon are; *Number of suppliers, Constraints at the supplier's, Characteristics connected to the planning horizon, Lead time, Risk information*, and the *Scalability* with the current supplier set-up. Strategic component groups and subcategories can be found in Appendix C.

As discussed in previous sections, the number of suppliers have a direct correlation to the capacity constraints and this is also visualized in the table. The characteristics of the component group have been mapped connected to the planning horizon. The main reason behind the categorization is to understand on what level the demand has to be broken down to in order to compare it to the capacity at the suppliers. With this categorization, it will be possible to connect the flexibility to the planning horizon in a similar way as the models presented by Sheldon (2006).

The lead time is important in order to understand the flexibility and how this affects the visualization of the component groups in the S&OP process. If the lead time of a component group exceeds 3 months, the level of detail in the supply forecast has to be higher in order to secure supply.

Table 5.2: Strategic component group overview

Component group	A	B	C	D	E
Number of suppliers	**5 suppliers** Some suppliers can only provide certain materials. these are handled through buffer storage	**2 suppliers** Both are able to supply all items in this segment	**5 suppliers** 3 of them stand for 80 % of the volume. All suppliers can provide all items	**3 suppliers** One is negligible	**4 suppliers** Currently a 50/50 split between subcategory x and y
Capacity limiting factors	Raw material	Capacity constraints at supplier	No capacity constraints	Raw material	x: raw material y: capacity at supplier
Characteristics	3 subcategories: x, y, z. 9-18 month forecast not applicable, 3-9 month forecast split in the three subcategories	12-18 months not applicable, 3-12 months divided in S, M, L	12-18 months not applicable, 6-12 months tonnage per material, 3-6 month is an important horizon due to long lead times of raw material, focus on tonnage per material	Forecast on 3-18 months should be weight per month per material	12-18 not applicable, 3-12 months split on subcategory x and y in tonnage
Lead Time	2-3 weeks if forecasted, 8-12 weeks with no forecast	Raw material to finished product, 6 weeks	3-4 months for raw material	7-9 months for raw material	x: 12-16 weeks from raw material to finished component, few days if material is in place. y: 4 weeks
Scalability	0-3 months, 20% deviation ok. x, no capacity constraints at all. y, with 4.5 months forward planning no capacity constraints. z, with 5 months forward planning no capacity constraints	10% deviation from forecast ok	No capacity constraints	0-3 months, deviation of 10% is not an issue. 6-12 months 20-30% ok, above 12 months unlimited	No capacity constraints for subcategory x, maximum 40% immediate increase possible for subcategory y

5.2.5 Change Management

With the implementation of new processes, connecting Source with S&OP, it is important not to make radical changes instantly, but to take small steps in order to succeed with the change and to receive all the possible benefits. The three pillars, suggested by Näslund (2018); *Purpose, Process* and *People* has to be examined in this transformation. In addition to these pillars, all seven factors in the McKinsey 7s model should be evaluated in order to succeed with the change and achieve a mature process. In the solution, the critical success factors will be taken into consideration to improve the transformation odds.

Building on the three pillars suggested by Näslund (2018), a workshop was held to ensure

that the new solution will be aligned with the overall strategic goals of the company. A selected group of people was invited to discuss a draft of the final solution. The group was selected based on their involvement in the process, either by being affected by the output or involved in managing the process. A full list of participants can be found in Appendix D.

The workshop was divided into two sections, where the primary one was a detailed presentation of the solution and the second one a group discussions based on a number of prepared questions. These questions can be found in Appendix D. By involving management in the iterative process of creating the solution they will easily be able to communicate the impact of the transformation on the employee's day-to-day work which is a critical success factor suggested by Jacquemont et al. (2015). The participants were divided into groups based on their knowledge of S&OP, local sourcing knowledge or their global sourcing experience. Each group had at least one person operating as an expert in each field. Collaborating cross-functionally at this early stage in the development of a new process will hopefully improve the cross-functional integration when facing the transformation. The increased understanding of other perspectives might also encourage people to change and commit to the change early on. These are all critical success factors, discussed by Jacquemont et al. (2015), when facing a transformation.

5.2.6 Output from Workshop

During the workshop, it was discussed what factors to consider in order to expand the solution from Alfa Laval Lund to the global business unit GPHE. It was also discussions about what output from the S&OP process Source would benefit from. These topics were chosen since most of the previous literature and empirical data is based on the input Source will provide to the process. However, in order to ensure incentives for Source to change, they have to receive benefits from the process as well. The main output from the workshop will be further discussed in the following sections.

Factors to consider when expanding globally
The purchasing function at Alfa Laval is, as previously mentioned, quite complex. When expanding the process globally, this complexity will affect the solution. Hence, it is important to evaluate the output from the workshop in order to design an implementable solution.

The primary factor to consider is whether there are additional strategic component groups

with increased importance globally. An example of this could be components which are produced at one or two sites and then purchased internally by the other sites.

The second factor to consider is whether to implement a function who can consolidate the demand from the different sites centrally. By creating a consolidating function, the purchasing function at Alfa Laval would be more professionalized which would position Alfa Laval further to the right in the development model. This could also facilitate the handling of component groups distributed internally.

Beneficial output from the S&OP process

By receiving the right output from the S&OP process, Source will be able to provide suppliers with an improved forecast which will lead to improved DOT and lead time accuracy from suppliers, and decreased inventory at Alfa Laval. Hence, Source would benefit from receiving the next 15 months supply plan in monthly buckets highlighting specific projects or large changes. Receiving early notifications about market indications such as lead time, trends or specific requirements would also improve the sourcing situation. Additionally, Source would benefit from receiving the final plan from the S&OP process, with the total demand including priorities, to understand in what order to prioritize the orders.

Chapter 6

Recommendation

This chapter will provide a recommendation of how Alfa Laval should incorporate Source into their current S&OP process. The solution will, as stated in the purpose of this master thesis, consist of both a solution which is aligned with the current processes at Alfa Laval, as well as long term suggestions of how to refine the recommended solution to match the long term goals of Alfa Laval.

6.1 Processes to Integrate Source in the S&OP

Based on the analysis, it has been concluded that two main factors have to be considered in order to integrate Source with the S&OP process. The primary factor is the *input* Source need to provide in order to enable a full review of the supply situation. The second factor, is *how* to review the sourcing capacity in the S&OP process. Two separate processes have been designed in order to address these factors; *The Sourcing Capacity Process* and the *Monthly Supplier Capacity Check*. Figure 6.1 provides a visualization of how the two processes integrate with the current S&OP process. The purpose of the sourcing capacity process is to understand the sourcing situation and potential constraints by looking at selected component groups on an aggregated level, and to understand what *input* Source need to provide. The purpose of the monthly supplier capacity check is to identify gaps by comparing

the sourcing capacity to the demand plan. This comparison should be performed by using the output from the sourcing capacity process at the S&OP meetings. In addition to this, Source will receive supplementary information regarding sales forecasts and market trends as an output from the process.

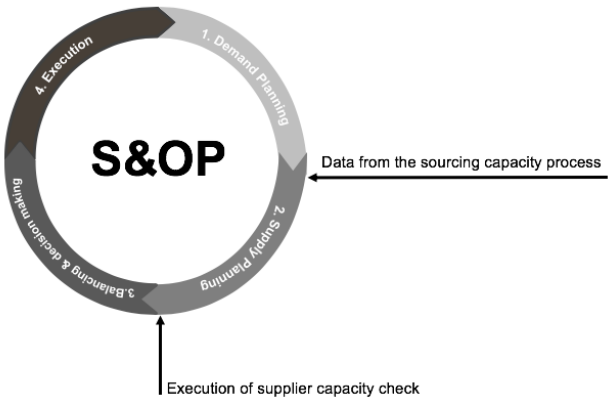


Figure 6.1: How to integrate Source into the S&OP process, by Hansson & Davidsson (2019)

6.1.1 The Sourcing Capacity Process

In order to understand the supplier capacity, a sourcing capacity process has been developed. This process consists of four steps and is visualized in figure 6.2. Based on the conducted information from the workshop, it is recommended to perform step one once a year and review the data in the other steps quarterly. When the process is in place, the frequency of the process should be reviewed and changed if needed. One factor which could affect the frequency of the process is if a planning system is to be implemented. This would facilitate the data collection, hence, making it possible to increase the frequency of the process.

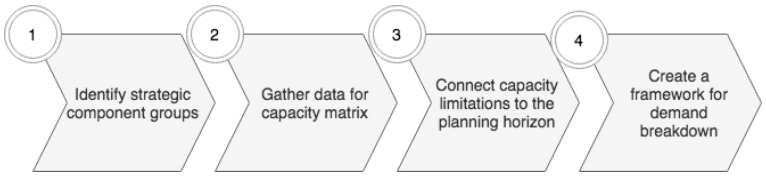


Figure 6.2: The Sourcing Capacity Process, by Hansson & Davidsson (2019)

Identify strategic component groups

In the first step, strategic component groups are identified. As discussed in the analysis, the current recommendation is to identify five groups. The main argument of selecting five is to maintain an aggregated level and to be able to discuss them all at the supplier review. This number is recommended to be reviewed when the process is in place. The strategic component groups identified can be found in Appendix C.

Gather data for the capacity matrix

In order to understand the supply capacity for the selected component groups, a *Capacity Matrix* has been developed, visualized in table 6.1. The goal of the matrix is to provide a comprehensive overview of the current supply situation, focusing on the scalability and risks connected to the five component groups. The matrix should, with help from strategic suppliers, be completed with applicable data. The dimensions have been chosen based on their impact when identifying capacity issues which should be reviewed in the S&OP process. Based on output from the workshop held at Alfa Laval, small modifications have been made to the capacity matrix, compared to the one presented in the analysis. The first five dimensions provide information necessary to define the scalability, which is the last dimension in the matrix. This dimension will be used in the next step of the process.

Table 6.1: The capacity matrix

Component group	A			B			C			D			E		
Number of suppliers	2														
Risk Mitigation	Each supplier have 4 supplying factories														
Total Lead Time															
Planning Horizon															
Production Lead Time															
Transportation Lead Time															
Time Horizon (months)	**3-6**	**6-12**	**12-18**	**3-6**	**6-12**	**12-18**	**3-6**	**6-12**	**12-18**	**3-6**	**6-12**	**12-18**	**3-6**	**6-12**	**12-18**
Capacity limiting factors	Constraints in production	Raw material	Raw material												
Charecteristics	Thickness	S/M/L	Total nbr. of units												
Scalability	+/- 5 %	+/- 25 %	Unlimited												

In table 6.1, a couple of examples for component group A have been included to provide a deeper understanding of how to use the table. The number of suppliers is included to provide an understanding of whether the component group is single, dual or multiple sourced. The second dimension *Risk mitigation* is included as a possibility to provide extra information

regarding the risks in the table. An example of this could be to describe that even though component group A is dual sourced, this is not looked upon as a major concern due to the high number of supplying factories. This has been further discussed in the analysis.

The *Lead Time* is divided into; *Total Lead Time*, *Planning Horizon*, *Production Lead Time* and *Transportation Lead Time*. This division is performed to highlight the different dimension of the lead time and how these affect the total lead time. This information could be used when performing the gap closure analysis, which will be further described in the next process, the monthly capacity check process.

The last three dimensions are the foundation of the framework for demand breakdown, which will be described below. As mentioned in the analysis, the supply has to be aggregated in order to compare the supply situation with the demand plan. It is difficult to decide the capacity for an entire component group since the supply often derives from several suppliers and multiple factories. Hence, the component groups have to be broken down in order to confirm the supply capacity. This breakdown will be performed based on the characteristics which will decide which components that can be grouped together. This information will initially be based on information shared with the strategic purchaser. However, when refining the process, the supplier should be included in the discussions since the categorization is also the basis of the forecast they will receive.

The *Capacity Limiting Factors* will provide information on where the bottleneck is, whether it is raw material or the production capacity at the suppliers. This will be useful knowledge in order to determine the *Characteristics* which will group the components together. The characteristics should, as visualized in table 6.1, preferably differentiate based on the time horizon to facilitate the forecasting. In a long term, the total number of a component group can be forecasted with high accuracy. As the time horizon gets shorter, an increased level of detail will be needed at the suppliers in order to plan production and secure the right raw material, hence, the categorization will be more detailed. When forecasting on a shorter time horizon, it will also be easier to secure a high forecast accuracy on a more detailed level. After deciding the capacity limiting factor and categorizing the components on different time horizons it will be possible to determine the *Scalability* of the suppliers connected to the time horizon.

Connect capacity limitations to the planning horizon

By using the last dimension in the capacity matrix, a framework visualizing the scalability over time has been developed to understand the capacity constraints. This framework can be found in figure 6.3. The visualization shows the scalability in capacity for each

component group with different time horizons. The planning horizon of 3-18 months, which derives from the S&OP process, is displayed on the x-axis. On the y-axis, the possibility to deviate from the original supply forecast is displayed. The lines show the boundaries of how munch the capacity can increase or decrease in relation to the time horizon. The capacity limitations for each component group should be connected to the planning horizon in separate visualizations, based on the data from the capacity matrix. Visualizations of the current situation can be found in Appendix E.

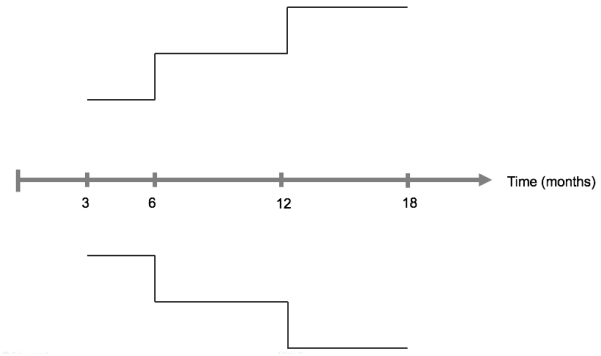


Figure 6.3: Scalability, by Hansson & Davidsson (2019)

Create a framework for demand breakdown

In order to identify capacity issues, the supply capacity has to be on the same level and in the same unit as the demand plan. Hence, a framework for the demand breakdown is needed to match the supply capacity with the demand plan. This framework is visualized in figure 6.4. The recommended framework is based on the characteristics and time horizons determined in the capacity matrix, visualized in table 6.1. By defining categories for the different time horizons, based on the characteristics of the component group, it will be possible to break down the demand to the same level and unit to which the supply capacity has been aggregated to. The current categories which have been defined for Alfa Laval can be found in Appendix C. These categories will be used as keys in order to break down the monthly demand plan.

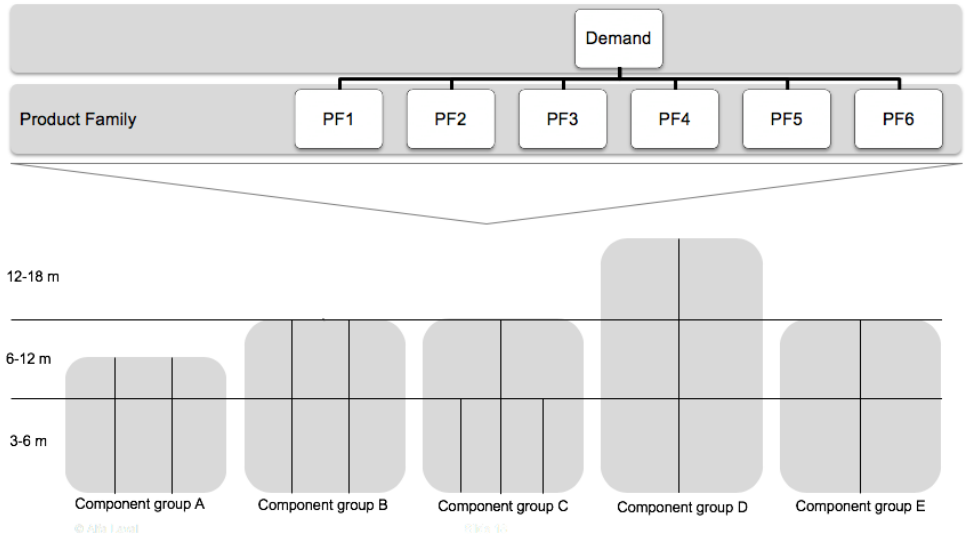


Figure 6.4: Framework for demand breakdown, by Hansson & Davidsson (2019)

Summarizing the sourcing capacity process

In order to determine the sourcing capacity, a limited number of strategic component groups are defined. Information regarding these component groups are gathered based on the framework in the capacity matrix, table 6.1. The scalability determined in the framework is connected to the time horizon and visualized in the same manner as figure 6.3. Based on the capacity matrix, the framework for demand break down can be created based on the example in figure 6.3.

This process derives from the literature connected to the bridge between sourcing and S&OP, which includes reviewing the sourcing limitations in the supply phase in order to cover all potential capacity issues. This literature included both supply chain risks, and ideas on how to connect the scalability at the suppliers to the planning horizon. Looking at the supply chain risks, a five step process by Manuj and Mentzer (2008) was discussed as a possible way to mitigate risks. This process, together with suggested approaches by Sheldon (2006), have been used as inspiration when creating the sourcing capacity process.

In order to achieve a more mature S&OP process, Kaplan (2005) mentions the importance of well defined roles and process structure. Hence, recommended responsibilities for the different steps is presented in 6.2, together with the frequency of the validation of the data.

Table 6.2: Roles for the Sourcing Capacity Process

Step	Responsible	Validation
1	Local source manager	1 time/year
2	Local source manager	4 times/year
3	Local source manager	4 times/year
4	Supply planner	4 times/year

6.1.2 Monthly Supplier Capacity Check

This process will describe how to use the output from the sourcing capacity process as input in the S&OP process in order to compare the demand plan with the supply capacity. The monthly supplier capacity check consist of four steps which will be conducted during the supply planning phase in the S&OP process, see figure 6.5. In order to make the suggested process applicable with the current supply review process, it will follow the same set-up and provide the same kind of output as the current production capacity review. It will consist of a demand-capacity outlook for the coming months, including gaps, recommendations and actions for how to close the gaps.

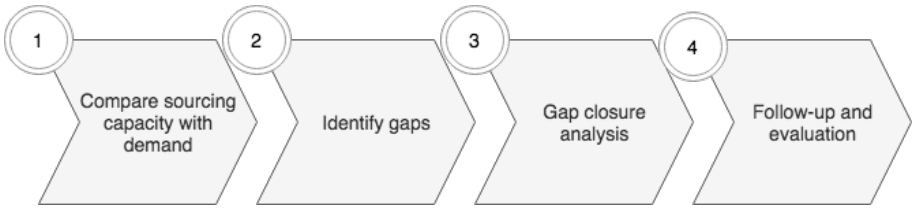


Figure 6.5: The monthly supplier capacity check process, by Hansson & Davidsson (2019)

Compare sourcing capacity with demand

In the first step, conducted during the Local Supply Review Meeting, the scalability at the suppliers will be compared to the monthly demand plan using the matrix in figure 6.6. This figure is inspired by the current matrix for comparison of the production capacity in relation to the demand. By including the supplier capacity check in addition to the production capacity check, the full supply capacity can be reviewed during the LSRM. The matrix displays the demand as a percentage of the supplier capacity. If the boxes are green there is no gap between supplier capacity and the demand plan. If a box is red, a gap is identified and step two in the process is conducted. The matrix shows the months 3-18 months ahead and figure 6.6 is a simplification of the matrix, only showing 3-12 months ahead.

Critical Component Groups	1909	1910	1911	1912	2001	2002	2003	2004	2005	2006
Plates	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%
Gaskets	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%
Frames	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%
Tightening Bolts	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%
Carrying Bars	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%	xx%

Figure 6.6: Capacity-demand matrix, by Hansson & Davidsson (2019)

Identify gaps

The *gap identification* is performed by looking at aggregated supply and demand data. The reason to this level of aggregation is to provide a holistic view of the supply situation and align with the current level of aggregation in the S&OP process. By performing the sourcing capacity process thoroughly, the foundation to this aggregated level will be detailed and easy to follow. This will be helpful in the next step of the process which is gap closure analysis.

Gap closure analysis

If identifying a gap, the *gap closure analysis* will be performed to analyze the source behind the gap and how it can be closed. The capacity matrix in table 6.1, will be helpful in order to identify what have caused the gap. Initially, the local factory will try to close the gap but if unresolved, the issue will be lifted to the global supply review meeting where the capacity can be balanced between different factories.

Follow-up and evaluation

The last step, which is to *follow-up and evaluate* last months decisions, could be performed both during the LSRM, GSRM or during the execution phase. Where the follow up should be performed is determined by where the gap closure analysis was performed. If the gap was closed locally, the follow up should be conducted during the next LSRM. If the gap was a global concern on the other hand, the follow up should be performed at the next GSRM. If an issue have occurred multiple times, or if it is a concern which could affect other component groups or factories as well, the issue will be lifted globally. It will then be evaluated and followed up in the execution phase instead of the supply planning phase.

In order to determine the total supplier capacity for the component groups, assumptions are made. To understand if and how the assumptions in the the sourcing capacity affects the gaps identified, a further investigation is performed through follow ups. The goal according to Wallace and Stahl (2008), is to reduce the numbers of assumptions and to improve the accuracy of the assumptions. Hence, it is important to follow up the assumptions in order to understand the affects and in order to continuously improve the process.

6.2 Output of the S&OP Process

To increase the incentives for Source to implement the new processes, the benefits for Source must be identified. Therefore, the output of the S&OP process will be reviewed in order to understand the benefits for Source. The primary output will be improved communication which, during the empirical analysis, has been identified as a constraint. It is both the internal cross-functional communication, as well as the communication with suppliers which will improve when integrating Source in S&OP.

Internally, the communication will increase due to additional interactions between Source and Plan throughout the S&OP process. Primarily, sourcing constraints will be reviewed but in addition to this, the LSRM will function as a forum for direct exchange of information between Source and Plan. Trends, market changes and other variations will be directly communicated from Plan to Source. In addition to this, Source will have a forum where concerns regarding demand fluctuations can be lifted. To fully take advantage of this forum, it is recommended for Source to provide information on how different decisions can affects the various departments at Source. One example is to distribute information regarding additional costs of additional warehousing.

Externally, the communication will increase through more frequently shared supply forecasts. The forecasts are recommended to be shared with the suppliers in the execution phase, based on the final demand plans. The characteristics described in the capacity matrix, table 6.1, is recommended to be the foundation for the supplier forecasts. Hence, the forecasts will be adjusted to align with the level of detail needed depending on the planning horizon. On a short term, 0-3 months, the level of detail will remain on item level. However, moving further down the planning horizon, the level of detail will decrease and on 12-18 months it is only the total number of a component group which is shared. An example is visualized in table 6.1. By adjusting the level of detail depending on the planning horizon, the supply forecasts will improve. With improved forecasts, the delivery accuracy will improve and the need of safety stock will decrease. Hence, inventory will decrease. This is supported by the theories regarding expected outcome of S&OP implementation.

6.3 Long term goals

This section will provide possible adjustments to the suggested processes, in order to achieve a more mature S&OP process, as well as a global roll-out plan for GPHE.

6.3.1 Further Improvements of the Recommendation

When implementing the suggested processes, the supply risks will be reviewed in addition to the operational risks. However, in order to receive a more comprehensive review of all supply risks presented in table 3.1, the suppliers should be incorporated in the categorization of the component groups. If including the suppliers in this categorization, the forecast for each component group would be customized depending on the characteristics. Hence, the usability of the forecast would increase and the visibility throughout the supply chain would improve. This would not only improve the availability of components but also help Alfa Laval to achieve a more mature S&OP process as well as a more professionalized purchasing function, as discussed in the analysis. However, before incorporating the suppliers in the categorization, the sourcing capacity process shall be implemented internally at Alfa Laval. Then, once the process is in place and is well functioning, the suppliers could be incorporated to align with more long term goals of improving the visibility throughout the supply chain.

In addition to this, the assumptions made when determining the supplier capacity need to be reduced in order to improve the accuracy. This should, as mentioned earlier, be conducted through a thorough review of decisions made the previous month together with the supplier capacity constraints. By continuously adjusting the way supplier data is consolidated, the assumptions will be more precise and align better with reality.

6.3.2 Global roll-out plan for GPHE

The processes stated above derives from the empirical data at Alfa Laval Lund, hence, the recommendation is developed with this site in mind. The goal, however, is to find a generic solution applicable for the global GPHE. Therefore, a number of recommendations on how to succeed with a global roll-out will be presented in this section.

The both processes suggested in this recommendation are applicable for the global GPHE.

However, some minor changes would be necessary in order to achieve a more generic solution. The main difference when looking at this globally as opposed to locally, is the possibility of adding a function which will consolidate the supply globally, and achieve synergies from the other sites. Locally, on the other hand, one will be able to include smaller, local suppliers which could be critical for the local site.

As discussed in the analysis, one component group is produced at two of the eight GPHE sites and then distributed to the others. With this extra complexity, this component group need to be included in the global process. Therefore, the roles defined in table 6.2 should be updated when expanding the process globally. In step 1, the global source manager should be responsible for defining critical component groups instead of the local source manager. Adding a forum where this complex component group can be discussed, will hopefully improve the availability at all sites. This consolidating function will also have the possibility to consolidate supply forecasts from all factories and forward this to the suppliers together with market indications.

Chapter 7

Conclusion

This chapter will provide the answers to the research questions, a short description of the limitations during the master thesis as well as examples of future research. Finally, there is a section regarding contribution to theory.

7.1 Research Questions

In this section, the research questions presented in chapter 1, will be answered. The answers are based on the previous chapters; *Literature Review, Empirical Study* and finally *The Analysis.*

7.1.1 Research Question 1

How should the sourcing process relate to the S&OP process according to literature on the topic?

Goals with the S&OP process
According to literature, the goal with S&OP is to balance supply and demand and to connect the strategic plan to the operational plan, to mitigate the risk of demand exceeding the

supply or the other way around. S&OP is referred to as a forecast based long term contract between the supplier, focal firm and customer, figure 3.1.

Supply strategy

When integrating Source into the S&OP process, the current sourcing processes have to be taken into consideration since they, according to van Weele (2008) are highly affected by the overall objectives of the company. Hence, the new process has to be aligned with current processes as well as the supply strategy of the company. The supply strategy should, according to Kraljic (1983) be based on the strategic importance of purchase in relation to the complexity of the supply market. It is the products with both high strategic importance and a highly complex supply market which are considered as products in need of supply management. Key factors for supply management, according to Gangurde & Chavan (2016), are long term availability and centralized decision authority which implies that these are items to be include in the global S&OP process.

Flexibility connected to the planning horizon

Due to the limited literature on the specific topic of how to integrate Source in the S&OP process, focus has been put on the bridge between sourcing and S&OP which is to review the sourcing limitations in the supply phase to cover all potential capacity issues. Hence, the target has been to cover supply chain risks as well as review sources which describes the link between suppliers and the S&OP process at the focal firm.

According to Sheldon (2006), risk-mitigation may be incorporated in the S&OP process by understanding the inventory strategy of critical suppliers. Increased understanding of these factors will facilitate the discussion and decision making at an aggregated level. Flexibility connected to the planning horizon is another concept discussed by Sheldon (2006). The key take away of his model, *Flexibility Connected to the Time Horizon* visualized in figure 3.10, is the description of how the time fence norms expand over time at the same time as the flexibility increases. In addition to this, Sheldon (2006) also describes how a higher level of detail is needed when looking at a shorter planning horizon whereas at a longer horizon there is only a need of buckets forecasts. With a monthly S&OP process cycle, the long term plan is adjusted each month. Sheldon (2006) expresses the importance of sharing these changes with suppliers in order to improve supply management.

Key take-aways when integrating Source in the S&OP process

- *Use forecasts to communicate between suppliers, focal firm and customer*

- *Align new process with current processes and with the supply strategy*
- *Include the components from Kraljic's top right corner in the S&OP process*
- *Understand the inventory strategy of critical suppliers*
- *Connect the scalability at the suppliers to the planning horizon*
- *Adapt a level of detail of the forecast related to the planning horizon*
- *Share monthly adjustments of long term demand plan with suppliers*

All of these key takeaways have been taken into consideration when developing the final recommendation for Alfa Laval.

7.1.2 Research Question 2

How should Alfa Laval integrate Source with the current S&OP process?

It is recommended for Alfa Laval to integrate Source with the current S&OP process by implementing the two processes described in the recommendation; *The Source Capacity Process* and *The Monthly Capacity Check*. In addition to these processes, a global roll-out plan has been suggested in order to provide a more general recommendation applicable for the entire business unit GPHE. A full review of the processes, together with the global roll-out plan, can be found in chapter 6.

7.1.3 Research Question 3

How should Alfa Laval succeed with the integration considering their current maturity level of S&OP and how will an integration of Source affect the maturity level?

Considering the current level of maturity of the S&OP process, it is critical not to make drastic changes instantly but to perform the new process implementation step by step over time. Therefore, it is recommended to start the implementation locally at the Lund site and follow up with an evaluation and applicable improvements. When the process is in place and performing according to plan, a global roll out to the remaining GPHE sites can be executed.

When integrating Source in the S&OP process, the maturity level is expected to increase. The evolvement of the maturity level can, as discussed in the analysis, be explained by the following factors;

- *Incorporating supplier data in the process*
- *Establishing a formal S&OP team with well defines roles, including the roles for each step in the Sourcing Capacity Process*
- *Increasing the usage of measurements and improve the follow up of previous months*
- *Increasing the collaboration within the company, through cross-functional collaboration*

In order to achieve a more mature S&OP process, it is recommended to implement a planning system. A new planning system would enable a more frequent renewal of the keys which are used to break down the demand to component groups. Hence, a system would not affect the recommended processes but rather simplify the data gathering, reduce the manual work and facilitate the execution of the new processes.

7.2 Limitations

In this section, three limitations identified during this master thesis will be presented in descending order based on impact on the final result.

The primary limitation is the limited time frame. With more time, a more comprehensive study would have been made possible. The extent of the study would have been widened using the following two actions;

1. *Additional Global Interviews.* With more time, additional global interviews could have been conducted. The global source manager was identified as the most critical person, hence, he was the priority for interviews and the workshop. However, without time being a constraint, operational purchasers as well as supply planners at other GPHE sites would have been interviewed. This would have added another perspective to the global roll-out plan, hence, increasing the transformation odds of a global roll out.

2. *Additional Benchmarking Companies.* Benchmarking with other companies is a time-consuming activity and therefore only two benchmarking companies were selected.

With more time, additional benchmarking could have been executed, contribution to additional information and inspiration on how to integrate Source.

The second limitation is the limited amount of literature on the topic. This came as quite a surprise since both purchasing as well as Sales and Operations Planning are both well-documented areas whereas the bridge between the two topics is not as explored. With additional literature, a more comprehensive literature review would have been conducted and no benchmarking would have been needed. This would have freed up more time to conduct global interviews as previously discussed.

The third limitation is the lack of quantitative data. By including more quantitative data, a more objective result would have been made possible. However, not enough applicable data was recorded to conduct a quantitative study.

7.3 Future Research

When performing the empirical study, a number of issues were brought to attention. These included non-functioning ABC categorization which results in exceeded warehouse capacity, lacking short-term communication, both between operational and strategic purchasers as well as between operational purchasers and warehouse managers. In addition to this, delays on calling of orders to specific suppliers was identified. These issues are too detailed to be solved from a S&OP perspective and due to the shorter planning horizon, they are more suitable for master planning. Hence, this can be an interesting topic for future research and future improvements at Alfa Laval.

7.4 Contribution to Theory

With a large amount of literature regarding S&OP, it can be concluded that it has been an interesting and popular topic during the last decades. Despite this, there is a lack of literature on the topic of how to integrate the purchasing function in the S&OP process. Therefore, this master thesis will help to fill this gap by suggesting processes and frameworks used for integration. The recommended processes and frameworks are developed for a Make to Order company. However, the authors argue that the solution is generic, and therefore applicable for other companies to use as inspiration as well.

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Appendix A

Conducted Interviews

Table A.1: Interview objects at Alfa Laval

Name	Title	Date
Alexandra Kristenson	Sales and Operations Manager, GPHE	2019-02-08
Emma Husberg	Global Process Manager, Finance Operations Business Control	2019-02-08
Peter Persson	Unit Manager Source, GPHE Lund	2019-02-28
Hanna Åhnell	Supply Planner, GPHE Lund	2019-02-28
Lars Hedberg	Team Manager Source, GPHE Lund	2019-03-04
Alexander Wrange	Key User Source, GPHE Lund	2019-03-04
Ulrika Weber	Operational Purchaser, GPHE Lund	2019-03-05
Robert Andersson	Global Strategic Purchaser	2019-03-13
Susanne Adler	Strategic Purchaser, Sourcing PHE	2019-03-14
Hanna Åhnell	Supply Planner, GPHE Lund	2019-03-14
Shrikrishna Tiwari	Global Process Owner Supply Chain PHE, OD PHE	2019-03-14
Ernesto Zulueta	Sourcing Manager PHE	2019-03-20
Ola Jöryd	Strategic Buyer NPD/EPD & Process	2019-03-21
Anders Ekstedt	Project Manager ETO, GPHE Lund	2019-03-21
Karin Cederlund	Product Group Planner, GPHE	2019-04-08
Tommy Eklund	Project Manager, Projects	2019-04-09
Eszter Dean	Manager Global Sourcing, Sourcing Office	2019-04-10
Robert Andersson	Global Strategic Purchaser	2019-04-12
Susanne Adler	Strategic Purchaser, Sourcing PHE	2019-04-15
Ulf Lindström	Global Strategic Purchaser	2019-04-16

Appendix B

Interview Question at Reference Companies

Short introduction, explaining the purpose of the master thesis.

- Integrate Source in the S&OP process by mapping critical resources.
- Limited literature on the topic sourcing within the S&OP process.

Goals with the Interview

- Reaching out to reference companies in order to understand how other companies are working with the integration of source in the S&OP process.
- Want to understand the collaboration between the sourcing department and the rest of the S&OP collaboration. Both regarding which information is shared as well as the process which the collaboration is built upon.

Introduction
What is your role at Company A?

The S&OP process
How is the S&OP process coordinated at Company A?

- Which steps are included?
- Resemblance with Wallace?

How long have you worked with S&OP at Company A?

We have looked into maturity levels connected to the S&OP process, and we want to understand how this affects the current process and the integration with source? We have looked into the framework created by Grimson & Pyke, could you place Company A in the framework?

How many product families/planning items do you have?

How is the demand plan broken down to items?

Do you use a planning system in order to support this process?

Sourcing in relation to S&OP
What is the main reason to why Company A chose to integrate Source in the S&OP process?

Where in the S&OP process is Source integrated?

- Demand review or Supply review?

How is Source integrated?

- What meetings do they attend?

How is information shared with Source?

- Through meetings or in a system?

Which roles at Source are working with the S&OP process?

- How are they working with the S&OP process?

How is the collaboration executed?

- Is there a pre-planning meeting before the Supply Review or is all information communicated digitally?

How are critical components or suppliers identified?

How are critical components matched with the product families/planning items?

What information does Source share with the S&OP process?

- Communication with suppliers?
- Capacity planning?
- Resource planning?
- Who is the information shared with?
- How is the information shared?

What information from the S&OP process is shared with Source?

- On what time horizon do you share information?
- How often?

What information is shared with the suppliers?

- On what level of detail?
- How is this performed? Do you have a specific process for this?
- Do you receive feedback in this information from the suppliers?

Do you have any KPI:s connected to Source in relation to the S&OP process?

Can we use your name or the company name in our report?

Appendix C

Component groups

Confidential information, only avalible for Alfa Laval.

Appendix D

Workshop

Table D.1: Workshop Interviewees

Name	**Title**
Robert Andersson	Global Strategic Purchaser
Karin Cederlund	Product Group Planner, GPHE
Lars Hedberg	Team Manager Source, GPHE Lund
Ola Jöryd	Strategic Buyer NPD/EPD & Process
Alexandra Kristenssen	Sales and Operations Manager, GPHE
Ulf Lindström	Global Strategic Purchaser
Erik O'Meara	Master Thesis student
Peter Persson	Unit Manager Source, GPHE Lund
Jennifer Roos	Master Thesis student
Ulrika Weber	Operational Purchaser, GPHE Lund
Alexander Wrange	Key User, Source, GPHE Lund
Ernesto Zulueta	Sourcing Manager PHE
Hanna Åhnell	Supply Planner, Plan & Deliver, Lund

Discussion topics

Topic 1 - Discuss the steps in the Source capacity process

Topic 2- What output from the S&OP process would Source benefit from

Topic 3 – Review the capacity matrix

Appendix E

Scalability

Confidential information, only avalible for Alfa Laval.