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**IMPACT OF SALES AND OPERATIONS PLANNING ON  
COMPANY'S BUSINESS PERFORMANCE**

Master's Thesis in  
Industrial Management

**VAASA 2014**

<b>TABLE OF CONTENTS</b>	<b>page</b>
1. INTRODUCTION	7
2. LITERATURE REVIEW	10
2.1. Introduction of S&OP	10
2.1.1. Definition	10
2.1.2. Fundamentals of S&OP	12
2.1.3. Benefits of S&OP	13
2.1.4. Where to use	14
2.2. S&OP process	16
2.2.1. Overview	16
2.2.2. Step 1: Data gathering	17
2.2.3. Step 2: Demand planning	18
2.2.4. Step 3: Supply planning	19
2.2.5. Step 4: Pre-meeting	20
2.2.6. Step 5: Executive meeting	21
2.2.7. Complex environments	21
2.3. Implementation and financial integration	23
2.3.1. Essentials	24
2.3.2. Pilot phase	26
2.3.3. Expansion	28
2.3.4. Financial integration	28
2.4. Assessment of S&OP	31
2.5. Challenges	34

3. METHODOLOGY	37
3.1. Data collection	37
3.2. Data analysis	39
3.3. Quality	41
4. RESULTS	42
4.1. Company A	42
4.1.1. Company overview	42
4.1.2. Findings and analysis	42
4.1.3. Suggestions for improvements	47
4.2. Company B	48
4.2.1. Company overview	48
4.2.2. Findings and analysis	49
4.2.3. Suggestions for improvements	51
4.3. Company C	53
4.3.1. Company overview	53
4.3.2. Findings and analysis	53
4.3.3. Suggestions for improvements	56
4.4. Summary and discussion	57
4.4.1. Process	58
4.4.2. Performance	60
4.4.3. Challenges	62
4.4.4. Suggestions for improvements	63
5. CONCLUSIONS	66
LIST OF REFERENCES	72

APPENDICES	77
APPENDIX 1. Questionnaire	77
APPENDIX 2. Work titles and responsibilities of interviewees	80

<b>TABLE OF FIGURES</b>	<b>page</b>
Figure 1. S&OP process (adapted from Wallace & Stahl 2008: 54).	17
Figure 2. Global S&OP process (adapted from Wallace & Stahl 2008: 170).	23
Figure 3. Implementation path (Wallace & Stahl 2008: 72).	25
Figure 4. Solution making through financial metrics (adapted from Singh 2010: 26).	29
Figure 5. Finance involvement in S&OP (adapted from Viswanathan 2009: 13–14).	30
Figure 6. Company A’s monthly OTD of one of the product families.	43
Figure 7. Company A’s inventory turnover and inventory value of a product family.	44
Figure 8. Company A’s value of scrapped items.	45
Figure 9. Form of data during the forecast process of company B.	49
Figure 10. Company C’s Operative S&OP process.	54
Figure 11. Improvements after the S&OP implementation.	68
Figure 12. Checklist for S&OP implementation, expansion and maintenance.	70

<b>LIST OF TABLES</b>	<b>page</b>
Table 1. Benefits of S&OP.	13
Table 2. Summary of case companies’ S&OP processes.	59

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**VAASAN YLIOPISTO****Teknillinen tiedekunta**

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<b>Oppiaine:</b>	Tuotantotalous	
<b>Opintojen aloitusvuosi:</b>	2009	
<b>Tutkielman valmistumisvuosi:</b>	2014	<b>Sivumäärä: 80</b>

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**TIIVISTELMÄ:**

Tämän tutkimuksen tarkoituksena on selvittää onko integroidulla myynnin ja toimintojen suunnitteluprosessilla (Sales and Operations Planning, S&OP) ollut vaikutusta yrityksen liiketoimintakykyyn ja mitkä asiat ovat parantaneet tai heikentäneet prosessin tehokkuutta. Lisäksi selvitetään kuinka käytössä olevaa prosessia voidaan entisestään parantaa. Tämän toimeksiantona tehdyn tutkimuksen kautta esiin tuodut asiat antavat toimeksiantajayritykselle paremmat valmiudet laajentaa S&OP-prosessi yrityksen muihin liiketoimintayksiköihin. Tavoitteiden saavuttamiseksi tutkimuksessa tutustutaan aiheesta julkaistuun kirjallisuuteen ja tutkitaan kolmen yrityksen kokemuksia S&OP-prosessista. Empiirinen tutkimus on suoritettu haastatteleamalla kunkin yrityksen S&OP-prosessin tärkeimpiä henkilöitä.

S&OP on strateginen liiketoimintaprosessi, jonka tavoitteena on tasapainottaa kysyntä ja tarjonta parantamalla yrityksen näkymää tulevaisuuteen ja tehostamalla suunnittelua sekä organisaation funktioiden välistä yhteistyötä. Prosessi auttaa yrityksen strategisten suunnitelmien toteuttamisessa yhdistämällä ne operatiivisiin toimintoihin. Yleensä S&OP suoritetaan kuukausittain viisivaiheisena prosessina. Vaiheet ovat datan keruu, kysynnän suunnittelu, tarjonnan suunnittelu, valmistava tapaaminen ja johdon kesken käytävä S&OP-tapaaminen.

Tutkimuksessa havaittiin että jokaisella kolmella tutkittavalla yrityksellä oli koettu S&OP-prosessilla olevan positiivisia vaikutuksia liiketoimintakykyyn. Mitattavissa olevista asioista parannuksia havaittiin etenkin toimituskyvyssä, varaston kierrossa ja ennustetarkkuudessa. Muita parannuksia olivat muun muassa kommunikoinnin, tiedonjaon ja yhteistyön lisääntyminen sekä päätöksenteon tehostuminen. Merkittävimpiä haasteita koettiin olevan kysynnän ennustamisessa, strategisten suunnitelmien integroinnissa ja suorituskyvyn mittaamisessa. Yleisimmät tutkimuksessa annetut parannusehdotukset koskivat tavoitteiden asettamista, prosessin mittaamista sekä ennusteiden tuottamista.

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**AVAINSANAT: Integroitu myynnin ja toimintojen suunnittelu, Sales and operations planning, S&OP, toimitusketju**

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**Topic of the Master's Thesis:**

Impact of Sales and Operations Planning on company's business performance

**Instructor:**

Petri Helo

**Degree:**

Master of Science in Economics and Business Administration

**Major subject:**

Industrial Management

**Year of Entering the University:**

2009

**Year of Completing the Master's Thesis:** 2014**Pages:** 80

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**ABSTRACT:**

The purpose of this research is to investigate whether the Sales and Operations Planning process (S&OP) has had an impact on the company's business performance, and which factors have increased or decreased the efficiency of the process. In addition, this study examines how the process could be improved. This research is conducted as an assignment from a client company and the findings aim to support the client company when expanding its S&OP process to its other business units.

To obtain the required information for achieving the objectives of this research, a broad literacy review on the subject is presented and experiences from three case companies are studied. The empirical part of the study was done by interviewing the key players of S&OP process from each case company.

S&OP is a strategic business process which objective is to establish a balance between demand and supply by providing the company with a better knowledge of customers' demand and by enhancing planning and cooperation between functions of the organization. The process facilitates the linkage of strategic plans to the day-to-day operations. Generally S&OP is performed as a monthly process, as a cycle with five phases. These phases are as follows: data gathering, demand planning, supply planning, pre-meeting and executive S&OP-meeting.

The findings clearly indicate that the S&OP had positive impacts on the business performance for each case company. Measurable performance indicators such as on-time delivery, inventory turnover and forecast accuracy had improved. Additionally, the use of S&OP had led to improvements in other areas as well, such as in the communication, information sharing and cooperation between organizational functions. The most remarkable challenges were discovered in demand forecasting, integrating strategic planning and measuring the performance. Suggestions for improvements given to the case companies concerned areas such as the setting of objectives, measuring the process and producing forecasts.

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**KEYWORDS:** Sales and Operations planning, S&OP, Supply chain management

## 1. INTRODUCTION

These days one of companies' problems is the lack of collaboration between the organization's functional units, such as sales, finance, R&D, operations and marketing. As the size of the organization grows, communication between these functions gets harder and harder. Growing number of companies have started to use Sales & Operations Planning (S&OP), which was created to get all the internal functions of a company cooperate efficiently. Success stories have set the reputation of the S&OP very high. Still, there are numerous challenges that have to be conquered before the process starts to pay off.

According to John Boyer's (2009: 4) definition, the S&OP is a top management's handle on business. By that he means that the top management has the ability to make quick resource based decisions on up to date facts. Thomas Wallace (2008: 9) states that one of the most important objectives of the S&OP is to balance demand and supply. He also adds that through demand planning and systematic forecasting, S&OP will give a window into the future. According to Apics (2013) the S&OP is a process which gives a competitive advantage to company's business, by integrating customer-focused marketing plans for new and existing products with supply chain management. Additionally, S&OP's objective is to link high-level strategic plans with day-to-day operations.

This study is conducted as an assignment to give the client more knowledge to appropriately carry out the implementation of the S&OP process at its other business units, and to sustain the efficiency of the process after the implementation. The client is a global manufacturer of power products, with two additional, and somewhat similar, business units locating at different continents. S&OP process has been in use for 18 months at one of these business units. Recently they have decided to implement the process into their two other sites as well. However, prior to that, the client wants to know whether the S&OP has improved their own business performance since the implementation. Furthermore, client wants to be aware of all possible problems and challenges that may occur during the S&OP process, to avoid them in the future.

The purpose of this thesis is to find out whether the S&OP process has an impact on company's business performance. Additionally, the most significant problems and

challenges that occur during the S&OP process will be discovered. As the status of S&OP process of the company has been defined, suggestions for improvements will be provided. Consequently, three research questions can be asked:

1. Has S&OP had an impact on company's business performance?
2. What challenges and problems occur during the S&OP process?
3. How can the S&OP process be improved?

The objective will be achieved by reviewing existing literature, and by studying three case companies which consist of the client company A and two external companies B and C. The theoretical part of this thesis includes fundamentals of S&OP and essential things to be noted to properly implement, develop and maintain the process. First background and definition of the S&OP will be introduced in chapter 2.1. After that, five process phases of the S&OP will be presented. Chapters 2.3 and 2.4 will focus on implementation and assessment of the process. The most common problems and challenges of S&OP will be discussed in the end of the chapter 2.

The empirical part consists of examination of three companies, two power product manufacturers and one pharmaceutical manufacturer. These companies' performance will be assessed by analyzing the KPIs from monthly reports and by interviewing key players of each case company's S&OP process. Interviews will give a solid understanding of the status of the process within the organization, and provide information about the challenges and problems. Chapter 3 will explain general rules of research methodology, and how the empirical part of this study was conducted. Then, in chapter 4, the findings, analysis and suggestions for improvements are presented separately for each case company. Summary of the whole research, its limitations and suggestions for future research are presented in chapter 5.

There are a lot of research and many articles that bring up challenges and best practices of S&OP. But, there are only few studies that take also the success of S&OP in an organization into account. This study strives to bring up all the benefits and challenges of

the S&OP that are relevant especially for Finnish, globally operating, power product manufacturer, and at the same time, it takes the success of the process into consideration.

## 2. LITERATURE REVIEW

This chapter will give a comprehensive look into the literature of S&OP. The information of the S&OP is gathered from numerous handbooks and the newest articles of scientific journals. This chapter consists of five different parts. The first part will answer to the question: “What is the sales and operations planning?” The second part will focus on the steps of the monthly S&OP process cycle which is the backbone of a well performed decision-making process. Third part will determine the principles of implementing the S&OP into the organization. Many of the new process implementations fail in companies due to a missing visible proof of the results. To get the support from the top management it has to be assessed continuously. The fourth part will give the most important numbers and performance indicators to be followed. S&OP’s different challenges are discussed in the last part.

### 2.1. Introduction of S&OP

S&OP is a wide concept with various aspects which need to be understood before exploring the details of the process. This chapter will introduce S&OP’s main features and fundamentals. S&OP’s potential to improve business performance is also discussed. Additionally the usability of the S&OP with different manufacturing strategies is addressed in the end of the chapter.

#### 2.1.1. Definition

Companies have had problems with collaboration between organizations functional units, information flow, linking strategic plans with operational plans, decision making, ability to see what is coming in near future and so on. To fight these problems, experts have created the sales and operations planning. After a successful implementation and appropriate use, this process has helped numerous companies all over the world (see e.g. Wallace & Stahl 2008: 6–7; Sodhi & Tang 2011: 526; Bower 2006: 20–21; and Alexander 2013: 16–17).

S&OP is a cross-functional, multi-level process to balance supply and demand on aggregate and detailed level. It links strategic plans and business plans to detailed processes, i.e. the strategic and tactical plans are brought to daily operations. S&OP also gives managers a holistic view on the business by gathering updated information from each functional unit (Wallace & Stahl 2008: 9). Palmatier & Crum (2003: 93–95) state that the S&OP is a management process to ensure that the whole company is focused, aligned and engaged to the collectively made decisions by the top management. It allows a company to apply a new strategy or direction, same time with well aligned processes and responsibilities (Goncu 2011: 8). By its monthly cycle the process aims to deal with continuous change that occurs in the business. Due to S&OP's demand-driven characteristics, forecasting plays an important role. Reyman (2005: 20) states that demand planning should work well before making any attempt to optimize production planning. Therefore, efforts to improve forecast accuracy are recommended.

Planning horizon of S&OP's forecast varies from 6 months to 3 years. According to a study, the most common planning horizon is from 6 to 18 months. Differences between the horizon lengths are defined by industry and product seasonality. Industries with high seasonality or long production lead time tend to have longer planning horizon. Apparel, automotive and boat businesses are examples of high seasonal products, while plane and cruiser businesses are long production lead time industries. (Grimson & Pyke 2007: 324.)

S&OP roots start from 1950s, when similar characteristics of the present model were spotted from a literature about a process called aggregate production planning, which was formed by authors Holt, Modigliani, Muth, and Simon (Singhal & Singhal 2007: 300–301). S&OP as a term was originally found in articles of manufacturing resource planning (MRP). S&OP's current meaning started to form in 1980s when it was extended to cover also sales planning. At the earlier stage it focused only on production planning (Feng, D'Amours & Beauregard 2008: 188–189).

It is important to acknowledge that different authors understand the term S&OP differently. For example Wallace and Stahl (2008) use a term *executive S&OP* to emphasize its strategic characteristics and participation of top management in the process. Sometimes S&OP refers to *operational* level sales and operational planning which excludes strategic

planning. In this study the term *S&OP* refer to S&OP process where strategic planning and top management are included.

### 2.1.2. Fundamentals of S&OP

There are two pairs of fundamentals that should be familiar to profoundly assimilate the S&OP process. These are supply and demand, and volume and mix. Actually, Burrows (2012: 1–3) have pointed out, that supply and demand have traded places. The business is turning from an old supply-driven model towards newer market-driven, customer-centric model. Demand and supply, as they are known in today's on-demand business, are discussed first in this chapter. After that the focus will be on volume and mix.

Knowing the relationship between supply and demand is vital for understanding the S&OP process. S&OP's objective is to get these two in balance, since a continuous mismatch results to numerous unwanted consequences. When the supply exceeds demand, inventories start to increase and carrying costs grow. Consequently cash flow becomes a problem, due to capital tied to inventory. Additionally too high supply will lead to decreased production rate which eventually result in layoffs. Moreover workers start to slow down and efficiency suffers. All these come out as squeezed profit margins and more frequent discounts and promotions. (Wallace & Stahl 2008: 6.)

Too high demand may lead to troubles as well. When the capacity is not sufficient, customer service and customer lead time suffer. Desperate attempts to fulfill customers' needs lead to long order backlog, expediting costs and extra capacity costs. Workers start to burn out and eventually quality suffers. At the end of the day, these problems drive customers off and business is lost. (Wallace & Stahl 2008: 6–7.) In addition Esper, Ellinger, Stank, Flint & Moon (2010: 6–7) state that, when planning, supply and demand should not be thought separately. Integrated thinking reduces the mismatch of these two. S&OP sees these two somewhat separately in the beginning of the monthly cycle, but brings them together in the end.

Volume and mix should be treated separately as well. Volume is a bigger picture of planning. Volume defines how many products need to be manufactured and how big

product families' sales rates are. Mix goes to more detailed level. It tells how many individual products are needed. Typically companies spend too much time focusing on mix, because mix is what they sell to customer. Experience has shown that when the volume is well planned in the beginning, the mix is much easier to handle. So, in S&OP, the main priority should be on the volume before focusing on the mix. (Wallace & Stahl 2008: 7–8.)

### 2.1.3. Benefits of S&OP

Benefits of S&OP are widely known in business. Next table concludes benefits of well used S&OP, by categorizing them by the area where the benefits tend to occur in the business.

**Table 1.** Benefits of S&OP. (Wallace & Stahl 2008: 9–11; Thomé, Scavarda, Fernandez and A. Scavarda 2012: 365; Palmatier & Crum 2003: 90–100 and Burrows 2012: 196).

<b>Category</b>	<b>Improvements</b>
Demand	Forecast accuracy, visibility in future
Supply	Procurement cost efficiency, supplier management, supplier integration, inventory optimization, suppliers' delivery performance
Operational	Strategy alignment, production planning, capacity planning, service level, on-time delivery, production scheduling
Financial	Cash flow, inventory turnover, cash conversion cycle (CCC), budgeting, ROI, EBIT
New product	Responsiveness, product launching process, product release planning, product development, product life cycle management
End results	Order fill, information flow, gross margin, cross-functional cooperation, customer satisfaction, market share

As presented in the Table 1, promises of S&OP seem to be somewhat compelling. Still, important thing to be noticed is that the S&OP will not necessarily improve each of these mentioned things directly, but indirectly through each other. For example, great forecast accuracy inevitably enhances inventory management which helps reducing costs. Consequently reduced inventory costs leads to better gross margin.

Here are some examples of common challenges where S&OP would be a helping hand. Constantly growing amount of stock keeping units (SKU) makes material planning difficult, which is consequence of poor product life cycle and inventory management. Promotional activities are chocking the supply chain, which results from growing amount of old or obsoleted items. Stakeholders are demanding for more value, better cash flow, less inventory, better productivity. Customers are leaving, reacting is more common than planning and inability to explain why things are not going as planned. (Bower 2006: 32.)

Properly used S&OP process will give real benefits and results. One of the most important benefits, but difficult to measure is the improved atmosphere of collaboration. Problems are fought together and improvements are seen as a result of cooperation. In addition, S&OP's visible results give its participants an urge to constantly improve and develop company's performance.

#### 2.1.4. Where to use

S&OP can be used in almost all kind of businesses from small domestic firms to large global corporations, regardless of a manufacturing strategy. Still there are limitations and differences depending on the environment of the business (Wallace & Stahl 2008: 25–31, 165–170). There are three types of manufacturing strategies, which are discussed in this paper: make-to-stock (MTS), make-to-order (MTO) and finish-to-order (FTO). S&OP can be used in each, with only some minor differences in the operations' side of the S&OP process (Wallace & Stahl 2008: 59). The differences of the manufacturing strategies will be presented first, and then the differences of S&OP process on each strategy. Then the major differences of S&OP in small and large companies are discussed. Important to note, in this paper a term *operations* consists of supply side functions which are production, sourcing, purchasing and logistics.

Make-to-stock is the most traditional way to serve customer. Products are first made to stock to wait for customers' orders. In business of make-to-order, products are manufactured only when ordered. In the most optimal case, products are shipped immediately to customer after finishing, so there is no need for finished products inventory. In finish-to-order, also known as assembly-to-order, configure-to-order, customize-to-order or postponement, product customization is postponed till order. Usually in this type of manufacturing, end product is manufactured by assembling all needed components. Finish-to-order is suitable when product customization is high and customer lead time has to be short. The most notable difference in S&OP between these business strategies is the focus of inventory planning. In MTS the focus is on finished goods inventory, which too low levels impact directly to customers. MTO's planning focus is more on order backlog, since finished goods' inventory level is close to zero because of instant shipping when products are finished. FTO's focus of the inventory planning is on a component inventory. When a customer wants his or her customized product, all the components have to be readily accessible. S&OP can be used in a mixture of these manufacturing strategies as well. In that case the planning just has to be performed separately on each manufacturing strategy. However, in the end of the process, all plans are reviewed together for a holistic picture. (Wallace & Stahl 2008: 27–32, 165.)

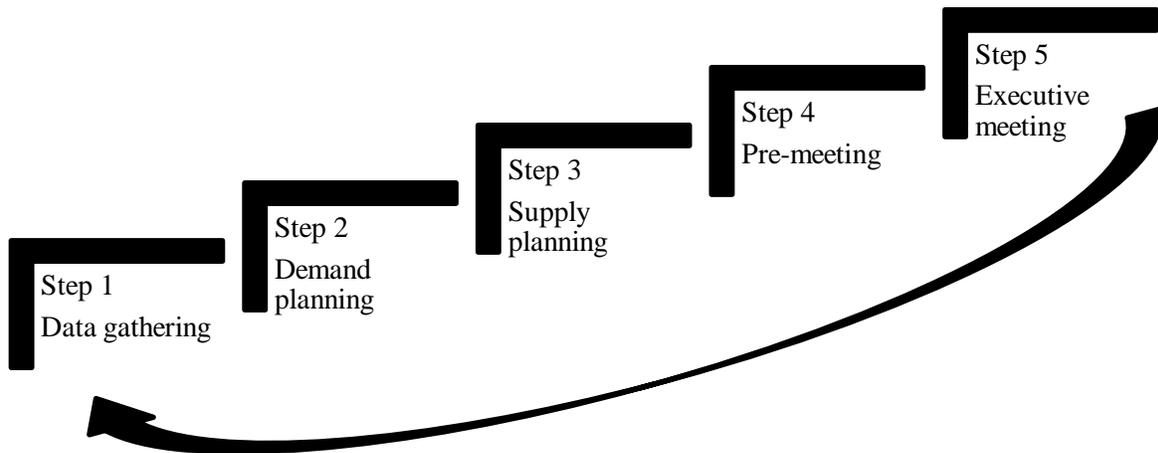
In large and global, multi-site business S&OP process is not that simple. When sites and functions are thousands of miles away, collaborative planning becomes trickier. Wallace and Stahl (2008: 164) state that a locally used S&OP process cannot be used the same way in a wide global organization. Centralized decision making does not work from the distance, especially when senior managers at headquarters do not have sufficient knowledge of businesses their sites are practicing. Wallace's and Stahl's message is that S&OP needs to occur at that level in the organization where demand and supply encounter. That is also the level where the responsibility for the bottom line of the business resides. More of global S&OP will be discussed in the chapter 2.2.7.

## 2.2. S&OP process

According to a research by Manoj (2010: 22), a third of all S&OP programs fail or produce unclear results. There are various reasons for lack of success. Sometimes S&OP misses the support of top management and sometimes the process is not taken seriously enough. A poorly performed program is waste of time and money. This chapter will go through how to perform an S&OP process correctly. The S&OP process will be presented on general level before focusing on each step separately. Also a global S&OP process will be presented.

### 2.2.1. Overview

The S&OP works in a monthly five steps cycle. Each month there are four meetings with different participants from different functions. Participants gather data from their functions to share with others at the meetings. The cycle starts from a lower level and ends up in executive top management meeting, where new directions are chosen and decisions made. The first step is data gathering, where last month's actions and actuals are usually reviewed by the process owner and entered into a supporting S&OP tool. Second step, demand planning, is where forecasts are made by sales people. At the next step people from operations make a supply and production plan to meet the demand. At the fourth step, called pre-meeting, managers and specialists of participating functions establish a plan for possible changes and decisions. In final meeting senior managers make decisions and actions based on data from pre-S&OP meeting. Then the process starts again from the step one. (Wallace & Stahl 2008: 53–65.)



**Figure 1.** S&OP process (adapted from Wallace & Stahl 2008: 54).

Generally, characteristics of these five steps are equivalent regardless of the author (compare Gray 2007; Wallace & Stahl 2008; and Palmatier & Crum 2003). But still some differences exist. For example names of the steps can be different, and some differences in the agendas or participant lists of each meeting occur. Nevertheless, the differences are small and usually the process owner of the S&OP shapes the details of the process to fit in the current environment.

### 2.2.2. Step 1: Data gathering

Idea of data gathering step is to collect data from the previous S&OP cycle. This phase should be performed in maximum of two days after the final phase, so the data is up to date. The data collected should include numbers such as actual sales, production, inventories, forecast accuracy and so on. All kind of information of situation of the company and the decisions that has been made at the final step should be gathered during this step. (Wallace & Stahl 2008: 55.) For example, information of actual sales and forecast accuracy is very valuable for the sales and marketing department which is going to produce new forecasts and demand plans. Boyer (2009: 3) emphasizes that the first step is not a financial closing of S&OP process, but only a check to the last month. Gathering of the data should be easy

and should not need too much effort or analyzing. Palmatier & Crum (2003: 107–108) add that product review should also be done at the first step, which differs a little from Wallace's and Stahl's process. The product review consists of review of possible changes to product ramp-up/down plans, when Wallace and Stahl include product development topics to the next step.

### 2.2.3. Step 2: Demand planning

At this phase, all the data from the previous step is discussed and analyzed. People from sales, marketing and product management have to be present. The goal is to generate a new short- and long-term forecast, i.e. forecast from one week to 18 months. These forecasts should include new products as well. It is important to understand that the idea is not only to forecast how much sales will be with each product family, but to predict different events, seasonal changes, regulatory changes, product ramp-ups and -downs and so on. Demand forecasting is also predicting customer behavior and new trends. (Wallace & Stahl 2008: 55–57; Palmatier & Crum 2003: 108–109.)

When the objective is to balance demand and supply, forecasting plays a very important role. Forecasts define the way for the rest of the process. Forecasting is a very wide and challenging task, which needs knowledge of the market, products, and individual customers. Additionally, forecasting is performed differently depending on which kind of markets the company plays at. Due to the high number of different forecasting techniques and their business-dependent characteristics, advanced forecast techniques are not discussed in this study. Forecasting will be discussed only on general level.

As Burrows (2013: 3) stated, best persons to produce accurate forecasts are sales managers. They are close to customers and have a good picture of coming events. Demand managers and forecast analysts know how to process forecast data but they do not know about customers. Wallace & Stahl emphasize that the input of forecasting should not only be historical demand data. Historical data alone does not take into account for example potential new customers, new products, promotion plans, open bids, price changes, market dynamics and so on. Sales managers have the best knowledge of these constraints and variables. Additionally, it is very important to make the forecasts first in quantities of

products, rather than in money. When the forecast is in dollars or euros, it lacks the utility that operations department needs. Forecast in units gives much more accurate information of needs of supply, moreover, it is easily converted to dollars, when an accurate conversion from dollars to units is impossible. (Wallace & Stahl 2008: 56–58.)

After the demand plan phase, all participants have an adequate picture of company's demand status, which includes that sales managers are well informed of changes of products. Accurate forecasts are made for the next step, where Supply side will make plans to meet the demand.

#### 2.2.4. Step 3: Supply planning

A supply planning meeting should be started by analyzing last month's figures. Participants have to check how did the supply meet the demand, and if not, reasons have to be given. Additionally, participants look over, if the actions are accomplished from the last month's S&OP. Next thing to do is to make sure that the operations department is able to bring enough products to customers i.e. to fulfill the demand. All the possible problems, such as production bottlenecks, suppliers' delivery problems and so forth should be addressed and discussed. When problems are pointed out, it is time to plan corrective actions. A flexible company can quickly react to changes in demand. (Palmatier & Crum 2003: 116–123.)

As discussed earlier, manufacturing strategy defines which factors are the ones to focus on. Some companies focus more on finished goods inventory and some focus on order backlog. However, production plan, supply plan, shipment plan and other operational plans have to be made. In addition, it is important to acknowledge that the shipment plan is also a revenue plan, and therefore it has valuable information for financial planning (Boyer 2009: 8). The better the deliveries, invoicing and invoice-paying process are performed, the better is the cash conversion cycle (CCC). CCC tells the average of days required to convert a euro invested in raw material into a euro collected from a customer. I.e. the lower is the CCC, the more cash is available for investing (Tangsucheeva & Prabhu 2013: 431–432). As the supply review has a lot of information for finance department, people from accounting should be present at this meeting (Boyer 2009: 5; Wallace & Stahl 2008: 60; Palmatier & Crum 2003: 137–139).

Output of supply planning consists of inventory and backlog plan, production plan and capacity plan for new and existing products. Output for the next S&OP meeting should not be too detailed (Gray 2007: 9–10). Wallace and Stahl (2008: 60) add that sometimes to acquire the necessary resources to meet the demand needs the authorization of the top management. Therefore these kinds of topics are typical output of the supply planning meetings.

#### 2.2.5. Step 4: Pre-meeting

This is a phase where people from different functions get together and discuss about plans on a product family level. They will review the updated plans which are made in demand and supply planning meetings. Together they will try to figure out how to solve occurred problems in a way that takes all the company's functions into account. This meeting should not be a brainstorming session, but a decision making, and on the other hand, preparing meeting for the executive meeting. All decisions of S&OP should be made in this or in the executive meeting. (Wallace 2008: 60–62.) Main objectives of this meeting are presented below.

- Review, discuss and reconcile differences between plans generated during earlier steps,
- make decisions to balance demand and supply,
- match financial plans to business plans
- make demand priorities if some supply constraints have occurred. Usually done by sales,
- discuss of suggestions for decisions which need permission from the top management. For example strategic changes or high cost investments, ramp-downs and the like. Usually, there is not a single solution for a problem, therefore, various alternates with explanations should be prepared, so the top management can decide how to act,
- discuss how to present their requests for changes to the top management
- prepare agenda for the executive meeting. (Wallace & Stahl 2008: 60–62; Gray 2007: 11–12; Palmatier & Crum 2003: 126–130.)

Some authors have other names for this meeting. For example Gray (2007: 11) states this meeting is also called consensus meeting or compromise meeting, but Gray himself calls it partnership meeting, which is also very descriptive name for the meeting.

#### 2.2.6. Step 5: Executive meeting

This is the final meeting of the monthly S&OP process cycle. CEO or general manager and each function's sales, marketing, operations, product development, finance and human resource managers should be presented. Additionally, some important key players from the previous meetings should participate, due to possible emerging questions from the managers. At the executive meeting, managers review the decisions made at pre-meeting and then accept or modify them. Pre-meeting team has possibly made suggestions for changes in demand or supply strategies, policies etc., which may be outside the scope of their authority. Executive team discusses these issues and ends up in decision or action. Also the most important KPIs are reviewed. Output of this meeting is minutes of the meeting, which include new decisions and changes made during the meetings. The minutes of the meeting should be available for all people involved in the process, otherwise the desirable rapid information flow suffers. (Wallace & Stahl 2008: 62–65; Gray 2007: 12–13.)

#### 2.2.7. Complex environments

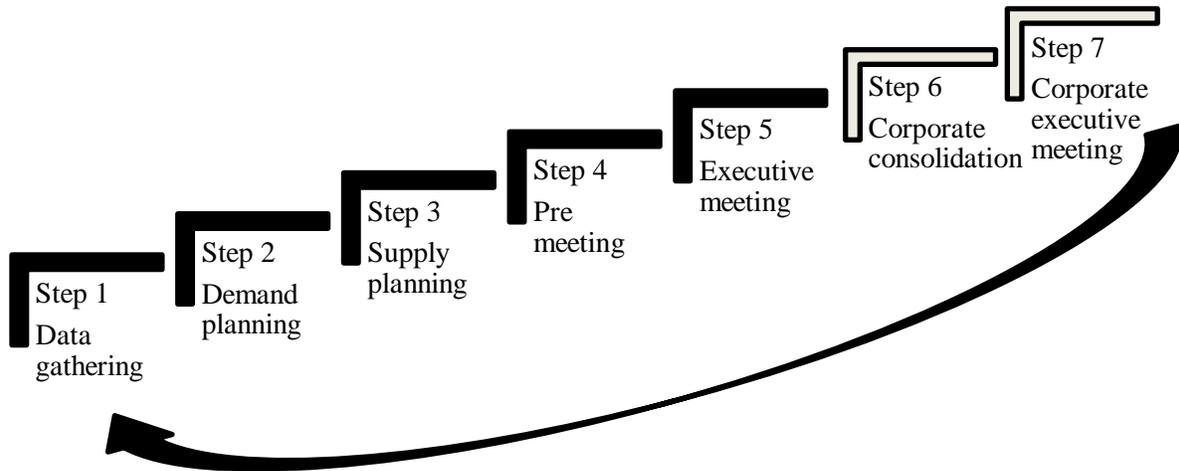
Previous discussion of the process cycle viewed S&OP from a point of view of a single business unit, where all functions locate at the same spot. However, S&OP can be used in more complex environments as well. Environment becomes complex when there are multiple business units, plants and sites, which use different or combined manufacturing strategies – and not to mention – completely different businesses.

Nowadays it is not rare to have a company with more than one manufacturing plant. At the same time sales and headquarters can be located elsewhere. Where the S&OP should take place? According to Wallace & Stahl S&OP's place is where the demand and supply comes together and where the responsibility for the business resides. In conditions as described above, the center point is impossible to define. Wallace and Stahl state that demand and

supply review meetings are easily set in their own locations, and later the outputs are combined for the next phase. But pre-meetings and executive meetings are trickier. As said before, forecasts and plans should be viewed at product family level. If there is a possibility to divide product families or even sub families between the plants, it makes the planning much easier. Thus, it does not matter even though different plants share same product families. It is the same with manufacturing strategies. In a product family, some products may be built as make-to-stock and others make-to-order. The product families just have to be divided in subfamilies by the manufacturing strategy. This sounds complicated, but there is no other way to efficiently plan complex industries. After the supply review, data is gathered and combined for the pre-meeting. People from distant locations can attend pre-meetings and executive S&OP meetings electronically. (Wallace & Stahl 2008: 163–169.)

In very large and global corporations with various businesses, the S&OP process is an efficient tool to bring more visibility and control through the whole organization. In a company with several units in different countries, the normal S&OP process should first perform locally and separately at each business unit. Goncu (2011: 8–9) adds that it is important to standardize local S&OP processes to better support the global S&OP.

After each unit's local executive meeting, there will be two phases called corporate consolidation and corporate executive meeting. The idea of the corporate consolidation is to collectively bring together and discuss the output from each business unit, and to prepare the information for the final phase. At the corporation executive meeting, participants review the data from the previous step and make decisions and actions if needed. The global S&OP process is presented in Figure 2. (Wallace & Stahl 2008: 167–170.)



**Figure 2.** Global S&OP process (adapted from Wallace & Stahl 2008: 170).

Miller (2002: 206–207) adds that sometimes a regional consolidation and executive meetings may be appropriate before the corporate executive meeting. By regional Miller means a combined set of business units for example in Europe or Asia. These regional meetings add even more steps to the global S&OP process.

### 2.3. Implementation and financial integration

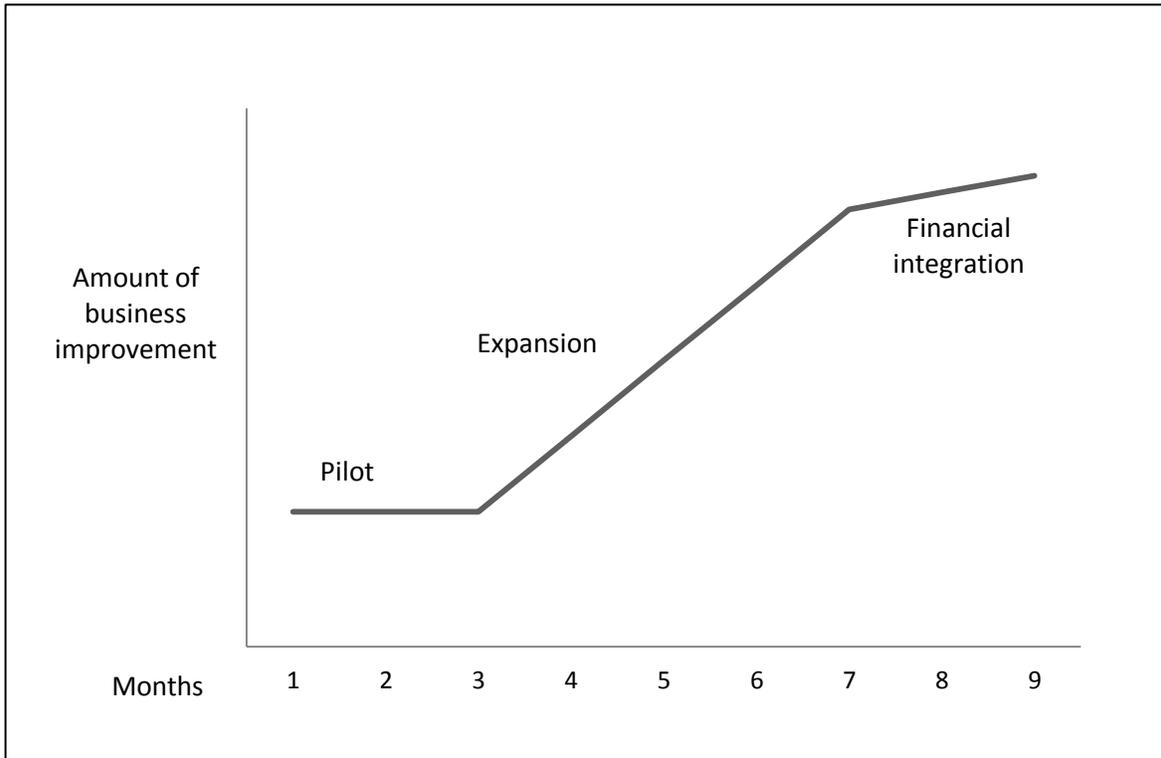
Despite of S&OP's simple and easily understandable process, it is very difficult to implement. There are four main factors which make it challenging (Wallace & Stahl 2008: 71). First, it is a new process for the company, and it is different than earlier processes. Second, there will be changes in the way of working. People may get offended when old habits are questioned. Third, required changes cannot be made without support and leadership of top management. People at that level are usually very busy, and they might assume too quick results with little effort. Therefore they have to be entirely committed and must have a sufficient understanding of S&OP. Fourth, all participants need a solid understanding of the process and the benefits it can provide. Otherwise needed changes will not happen. Palmatier & Crum (2003: 219) add that changes in the ways of working are not

the only things to change. There will be a completely new way of managing business. This chapter will explain the most important things that have to be considered before and during the S&OP implementation. Additionally, the role of finance in S&OP process will be discussed.

### 2.3.1. Essentials

Wallace and Stahl (2008: 75–78) advise that the owner of the implementation process should be an experienced and relentless worker, who has a skill to encourage people. Preferably he or she has been involved at least in one successful S&OP implementation. The person who is responsible for the implementation should take a few things into account before starting the process. As in any other new process which changes employees' way of working, there will be resistance for change. Gallucci (2008: 4) has noticed that during his every S&OP implementation, without exception, sales and marketing departments resist the whole process. Sometimes people from sales regard the S&OP process as a tool of supply chain management, which, on top of that, needs a significant commitment of sales department. If the commercial attendance at meetings is not going to be on required level, the S&OP will not be taken seriously, and eventually, the process becomes useless. Consequently, the key for the success of the implementation is people. Therefore, all participants should have a profound understanding of the process before starting the implementation (Wallace & Stahl 2008: 71). Participants have to acknowledge all the benefits the process provides and the amount of effort it takes.

After the participants are convinced, the process (see Figure 3) should be started by performing a live pilot phase. The idea of the pilot is to minimize risk and make people familiar with the new process. The next phase will be expansion, where all product families are taken into the process and improvements in business start to occur. Final phase is the full financial integration which should not take place until the process is stable and trustworthy. Usually the duration of a well-done implementation process is about nine months. It may sound a long time, but in fact, each meeting occurs only once a month. (Wallace & Stahl 2008: 72.)



**Figure 3.** Implementation path (Wallace & Stahl 2008: 72).

Before starting the implementation process, the most important thing to do, is to make sure that the top management accepts and supports the S&OP even though there will be tough times (e.g. Boyer 2009: 4–5; Mello & Stahl 2011: 38; Palmatier & Crum 2003: 217–219; Wallace & Stahl 2008: 71–73). So the process starts by convincing at least one highly authorized person from the top management, who should also be one of the participants in the S&OP process (Boyer 2009: 4–5). Obviously, before meeting senior managers, it is vital for the implementation to be well prepared. The briefing session should take a few hours, and it should include all capabilities of S&OP, how it works and what it does (Wallace & Stahl 2008: 78). Recommendable way to present capabilities is to address some of company's problems and tell them how they are fixed with the S&OP.

S&OP will not function without a good team. A desirable S&OP team is diverse and it consists of managers or key players from each function. Most important is that the

representatives of each function have possibility to execute the changes done in S&OP within their own area. These people will also introduce the S&OP to their own department. Moreover, it is vital for the process to have a skilled IT expert to use and edit the spreadsheets or software supporting the S&OP. When the team is ready, it is time to move on and start the live pilot. (Wallace & Stahl 2008: 81–86.)

### 2.3.2. Pilot phase

The live pilot phase takes usually 3 months. The ultimate idea of the pilot phase is not to improve business, but to educate participants to see and decide how the S&OP works, and to show to the top management how it generates results. During this phase, following things should be discussed: assigning of responsibilities, setting schedule for the process, determining units and figures to be measured, determining planning horizon, selection of product families and setting demand and supply strategies. The first month should be reserved for planning and education. During the second month, details of demand and supply plans are determined. The final, third month, is for executing the whole S&OP process with all its steps. Decision whether to stop or continue the implementation is made in the end of the third month. (Wallace & Stahl 2008: 91–93.)

The number of product families should not be too high. When the amount goes above 12, it is definitely too much and the management starts to lose grip and interest. On the other hand, when there are too few product families in S&OP, it does not pay back all the effort it takes. (Wallace & Stahl 2008: 95–96.) How should the products be categorized into groups? Palmatier & Crum (2003: 159–160) state that usually product grouping is done in a manner similar to how they are presented in product catalogs for customers. This is the most pleasant way for the Sales. At the same time, manufacturing wants to group them by production lines or by the way how they are produced, make to stock or make to orders and so on. Sometimes finance would group the products by site or country. They add that for S&OP, most preferable event would be when the user of the S&OP software has the possibility to choose how the figures are presented. It allows management to view the holistic picture, and at the same time, supply planners view the detailed, product by product picture. The primary objective of grouping is to share right kind of information to right people, so decisions can be made at the wanted level and scope.

To improve the possibility to achieve the strategic goals, there is one thing that cannot be emphasized enough. One day, the S&OP has to be a one-plan process, not multi-plan process. The latter in practice is when sales, procurement, production and finance have all different estimates for sales of three coming months. When S&OP is implemented correctly and fully in action, there will be a one set of numbers. Everyone from each functional department can go to the S&OP document and find the shared answer from there. This is the way how everyone is talking the same language within the organization. (Boyer 2009: 8–10.)

Data requirements, sources and the way how they are shown have to be considered. Actuals of sales, production etc. are basic data but still should be considered how to use them efficiently. It is important to define units, quantities, currencies, which are used to ensure that everyone is talking same language. The data should come from as trustworthy source as possible, for example forecast data from sales, budget from finance and actual productions from manufacturing. Enterprise software system (ERP) is a valid source to get data. S&OP software or spreadsheet should support company's ERP and vice versa. It is desirable to have an automated data feeding, so manual feeding would not take anyone's time. (Boyer 2009: 5–9.)

As stated earlier, operations department is planning the supply and manufacturing according to Sales forecast. The forecasts are never right, but there is a possibility to improve the accuracy. Variances of forecasts should be analyzed, to find possible biases, also in the early steps of the implementation. The idea is to find a continuous too high or too low forecasts. Sales tend to be too optimistic with their estimations, especially in long horizon. New products have to be considered as early as possible. Supply has to be aware of possible high demand of new products, since they have to be prepared. On the other hand, too optimistic new product forecasting may lead to huge obsolescence if sales stall. Therefore new product demand forecasting need high amount of attention. Operations will answer to sales department's plans by providing all needed products, still focusing to keep inventories as low as possible. Another objective of the supply planning process is to find out, why the last month's demand was not fulfilled or why there was over supply. There might have been problems adapting the supply plan to the work schedule or the like. (Wallace & Stahl 2008: 116–132.)

After everything needed is set, the real live pilot may start. Actually, this is the first time when the whole five step S&OP process is performed. It is recommendable to take only one or two product families to this, so there will not be too many new things to handle. It is advisable to deal with a simple product family, since one of the main objectives of the pilot is to show top management how the S&OP works and benefits the company. (Stahl & Shedlawski 2012: 40.)

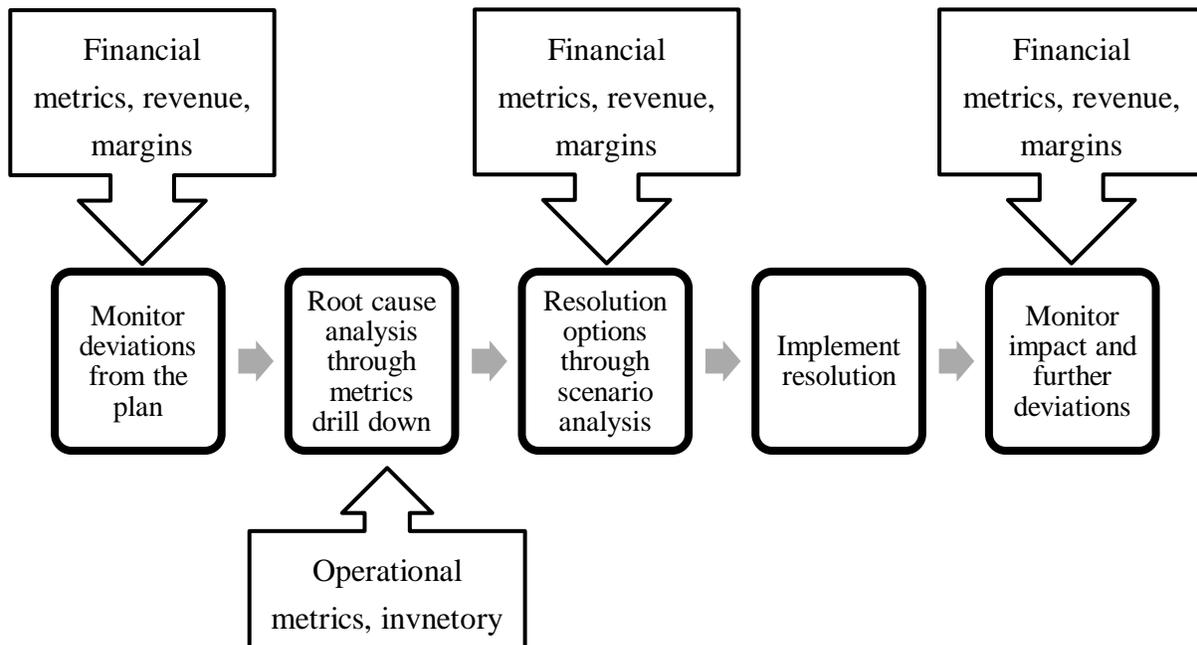
### 2.3.3. Expansion

After a successful pilot phase and top management's approval, it is time to implement the S&OP deeper to the organization. Rest of the product families are taken in during this phase and therefore it is recommendable to make a schedule. There is no need to rush in all the families at the same time, because it only leads to overload of work and information, which probably eats the S&OP's efficiency. It is better to start with small amount, for example one product family per month, and later, with more experience, more than one per month can be added. As seen in Figure 3, financial planning has not been integrated at the pilot phase. Still it is advisable to start with an initial financial planning. For example, an appropriate way to start is to convert the long horizon forecasts, which are made in units, to dollars or euros and compare it to the business plan made by finance department. Converting is easily done by using an average selling price of the product. If there are remarkable differences, something is wrong. (Wallace & Stahl 2008: 145–150). During the expansion phase, many things are going on which may lead to forgetting the main objectives of the S&OP. Reminding people of rules e.g. responsibilities, meeting agendas and policies, is not inappropriate.

### 2.3.4. Financial integration

According to Wallace and Stahl (2008: 158) financial integration is better to bring into the process after the process has become stable and has received a full confidence of the top management. The reason for not to take it in the beginning, is because sometimes financial department makes their own forecasts and projections which are disconnected from the S&OP's demand and supply plans. Executives may end up in situation where they do not know which forecasts to follow when making plans. On the other hand, even though

financial planning is not playing a big role in the beginning of the implementation, Palmatier & Crum (2003: 137–144) point, that the financial measuring is very important during the whole process. They add that during these three steps, demand plan, supply plan and pre-meeting, financial calculations of the effects of different scenarios and changes should be generated. Quantitative output from those steps should be taken for the pro forma income statement, balance sheet and cash flow analysis. Additionally, Singh (2010: 25–26) emphasizes the importance of analyzing financial impacts when finding solution for a problem (see Figure 4). According to Singh, financial metrics should be considered when facing deviations from the plan, when establishing optional solutions and after the decision have been made. When financial impacts of different scenarios are calculated, the support of the top management is achieved easier.

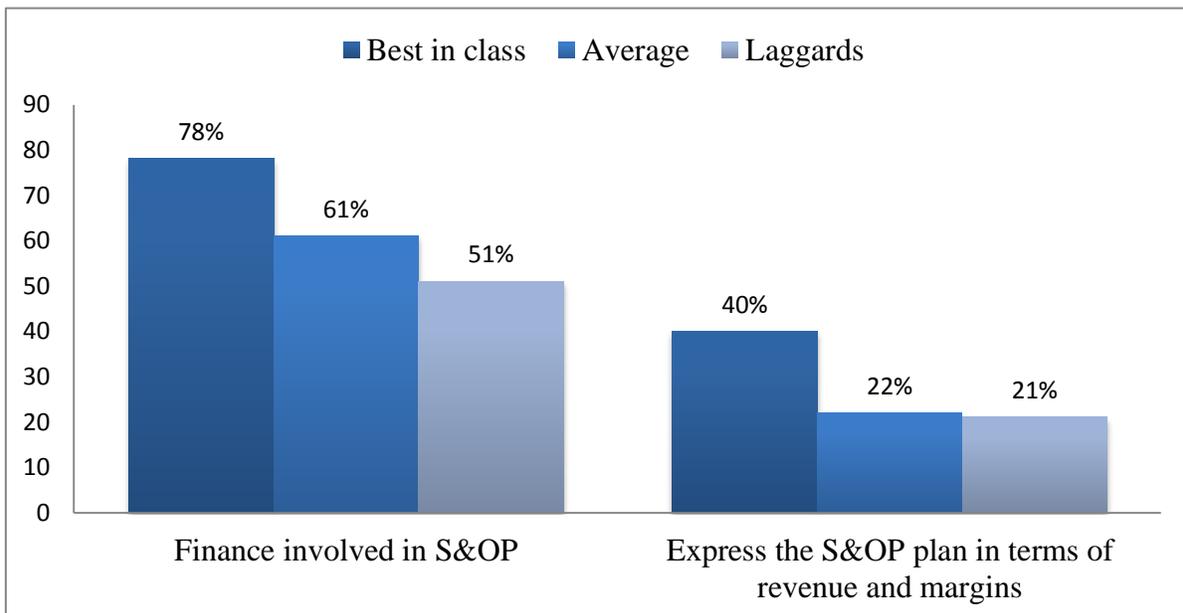


**Figure 4.** Solution making through financial metrics (adapted from Singh 2010: 26).

Maybe the most important thing, when it comes to financial integration, is to have the possibility to compare S&OP changes to the fiscal business plan. As stated earlier, forecasts are easily converted in dollars or euros, what makes the comparison simpler. The S&OP does not always include all the product families, which means that S&OP output can be

difficult to compare with the overall business plan. Nevertheless, the business plan usually has budget of individual families, and thus, most important figures are comparable. Often the product families in S&OP are financially the most significant ones, so it is easy to see where the business is going, which can dramatically improve the company's decision-making capabilities. (Wallace & Stahl 2008: 159–161.)

A research by Abardeen Group, which studied performance of 214 companies' S&OP processes, found that best-in-class companies have included finance in their S&OP process more often than average and laggard companies. Best-in-class companies consist of the top 20% performers of the studied 214 companies, while average companies were 50% and laggards 30%. All best-in-class companies have their customer service level above 97,5%, CCC less than 15 days and forecast accuracy at product family level above 82%. According to the research, 78% of the best-in-class companies have the finance department involved in S&OP process. Additionally, best-in-class companies express their S&OP plan in terms of revenue and margins almost two times more often than average and laggard companies. See chart below. (Viswanathan 2009: 13–14.)



**Figure 5.** Finance involvement in S&OP (adapted from Viswanathan 2009: 13–14).

Ventana Research (2011) reported, that 42 % of the 470 companies that took part in their study, had finance department involved in their S&OP process. Later, in the year 2009 Abardeen Group's study (Viswanathan 2009: 4) including 220 companies, addressed that the percentage was 63%. According to these studies, it can be concluded that firstly, the financial involvement is a recommendable decision, and secondly, it seems to be a rising trend.

#### 2.4. Assessment of S&OP

As with any business management process, measuring is required to achieve maximum performance (Milliken 2008: 10). He mentions two important things. First, measuring should include multiple perspectives, for example financial, customer and internal. Second, key performance indicators (KPI) should have a target, tolerance range and an owner responsible for follow-up. According to Grimsom and Pyke (2007: 333) the effectiveness of S&OP is measured too rarely.

Key performance indicators help organizations to measure their business performance. KPI's are simple numbers to be followed to see the progress and changes of the company between periods of time. User of KPIs has to understand what practices affect to the result and especially how they are affecting. So when a manager is familiar with causes, he or she has the possibility to point out what is wrong and how it should be fixed. According to Mangan, Lalwani, Butcher and Javadpour (2012: 266–274) the idea of KPIs is to measure results, not activities. Measurement of activities gives too specific information when the purpose is to meter the success of the business. For example number of receipts from a supplier is an activity. Measuring activities is important for calculating KPIs, but alone they do not support S&OP's objectives. The environment of the business determines which KPIs to use.

It is important to make the measurements on product family level or even product level rather than measuring all at once. When the scope is narrow, causes of problems or positive results are pointed out easier. Consequently, the way how these metrics are presented in the

meetings plays a big role. Sometimes at the meetings companies prefer summary scorecards, which may completely hide some product family's problems, therefore all important details should be highlighted. (Gray 2007: 75–78.)

Next the most important KPIs will be presented and discussed why they are right ones for measuring the success of S&OP process. It is good to notice that many usable KPIs are left out from this research due to a limited scope. All of the following KPIs are part of a widely used SCOR model (Supply Chain Council 2010), which supports their selection to be valid for measuring the performance. **Inventory turnover** is an important key performance indicator which tells how quickly a company sells its goods. The higher is the turn the more often the material in stock changes, i.e. stock level remains lower because there are less slow moving inventory. When the turn is high, less cash is tied to materials. (Graham & Smart 2012: 42–43). Mathematical formula is shown below.

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Inventory}} \quad (1)$$

Graham & Smart (2012: 43) state that when the purpose of analysis is to find seasonal patterns, the denominator should be yearly average of inventory. Also ending inventory is used as a denominator. The numerator is rather cost of goods sold than sales, because the latter includes also margins of the goods sold and hence, gives a distorted result (Graham & Smart 2012: 42; Dent 2011: 288). Inventory turn can also be expressed in days by dividing 365 by the turnover ratio. With a high inventory turnover the costs of inventory are low, but on the other hand, with low inventory, there is a risk of shortage of goods which may result in lost sales and eventually in loss of customers (e.g. Weil, Schipper & Francis 2012: 230). Furthermore, it is worth noting, that in short lead time business, flexibility in customer lead time, even if it is unprofitable in short term, can deliver results in a long term (Kärki 2012: 137–138). This is explained by customer satisfaction and gained competitive advantage. Companies have to balance between these two considerations when planning their inventory levels.

Order promising is an essential part of demand fulfillment. Late deliveries deteriorate supplier's reliability and thereby a high degree of focus is required. **On-time delivery**

(OTD) measures the percentage of orders that are fulfilled as promised. If the delivery is late one day, OTD is marked as zero for that line. Poor OTD percentage indicates problems in production scheduling, inventory management, order promising and sourcing. Today's dynamic markets insist a short customer lead time which easily leads to too optimistic delivery promises. Failing the customer even once may result in loss of customers. Therefore delivery promises should be realistic, so the capacity of the supply and production has to be well considered. (Stadtler & Kilger 2008: 53–54, 181)

In an effective S&OP process, inventory turnover and OTD are highly dependent on **forecast accuracy**. An accurate demand forecast allows better planning which usually leads to supply chain savings. A primary measure for forecast accuracy is a forecast error. (Gattorna 1998: 134–135.)

$$\text{MAPE} = \frac{1}{n} \sum \frac{|\text{Forecast}-\text{Actual}|}{|\text{Actual}|} \quad (2)$$

This calculation gives the mean absolute percentage of how much did the forecast differ from the actual sales (Chen & Wu 2010: 710). It can be positive or negative. Too optimistic forecasts lead to high inventory level and increase the risk of obsolete inventory. On the other hand, too low forecasts lead to low inventory level, which raises the risk of shortage. In case of supply shortage, purchasers may have to resort to spot buying which can be very expensive. (Simchi-Levi, Kaminsky, Simchi-Levi 2008: 289.)

Obsolete inventory consists of all the goods that are not going to be sold or used. According to Pay (2010: 69–70), it is one of the largest inventory costs, and often larger than managers think. Pay states that the number one tool to avoid obsolete inventory is S&OP. Especially accurate forecasts and product ramp-up/down planning help the situation. Obsolete inventory is realized when the obsolete items are scrapped and marked as write-offs. Therefore, by following the **value of scrapped items** is a valid way to measure the performance.

## 2.5. Challenges

Even though S&OP sounds very simple, it does not stay alive by itself. As said before, sales and operations planning is dependent on people around it. The whole process is managed by people, so it can go wrong at every phase. Correctly used tools, such as software and spreadsheets, make the process easier and better, but they can also be a pitfall. This chapter addresses most common challenges and problems of the S&OP process. Ignoring these issues usually leads to consequences that have negative impact on the performance of S&OP.

As discussed before, correctly performed implementation improves the odds to get a successful S&OP process and to gain benefits faster. Even though the implementation is in the past, maintaining of the process needs effort. Boyer (2009: 4–10) points out, that one of the most typical problems that can arise is the lack of participation. Low level of participation tells others that meetings are optional, which even aggravate the situation. Consequently, process's credibility vanishes. This issue can be overcome with an adequate organizational discipline and by setting the dates early enough into the calendar. Boyer adds that a poor preparation before meetings is also a common problem. Especially forecasts, which are the most important metrics, are not made well enough. It is unreasonable to try to balance demand and supply by establishing material and production plan based on distorted forecasts.

Baumann (2010: 26–27) states that many companies find challenging to link the executive planning to operational execution. Plans are determined accurately but still there are troubles to put them into practice. Firstly, S&OP's output is often printed in a form that managers of operations cannot decode. Correctly used, versatile S&OP software helps to overcome this problem. When all the needed data is entered into system, in most cases, documents can be printed out in a wanted format, which eases acting according to plans. For example supply manager gets detailed data of needed components and CFO gets aggregate data to see how the business is meeting the budget. Moreover, data sharing with suppliers and customers becomes easier, since filtering of confidential data is simpler with software. Secondly, Baumann points that a culture of continuous improvement should be part of the organization. Sometimes employees postpone solving of occurred problems to

the next month's meeting, since they do not know how to solve them. Therefore the company should have playbooks for different scenarios (see e.g. Singh 2010: 27) so that corrective actions can be taken immediately. Playbooks give suggestions how to act for example when revenues are not at the desired level. This hastens problem solving and consequently helps taking organization towards its strategic objectives.

Wallace and Stahl (2008: 77–78) point out, that old organization cultures might hold back the progress of the S&OP process. Especially conflict aversion, which appears as unwillingness to raise problems and discuss them. This derives from people's assumption that the person who brings out the problem is regarded as a problem. Additionally, the resistance to change can last over the implementation phase. With S&OP process, there is constantly something changing and usually there is some level of resistance. Wallace's and Stahl's solution for these problems is to deal these issues openly every time something occurs. That is how the organization culture gets better and more tolerant.

On the other hand, sometimes S&OP's impacts on business remain too much only on operational level, and do not have connection with strategic plans. This is also seen as a significant problem. This issue is defeated by bringing the finance in to the process, as discussed in chapter 2.3.4. All of the S&OP's processes should be connected with strategic objectives and financial metrics. People working with S&OP, should know what financial and business related implications different decisions have. In other words, they should have the knowledge of what actions should be taken to achieve the financial plans, and what actions may worsen the situation. All decisions must be supported by an analysis of the financial implications. (Singh 2010: 25–26.)

Often the supply chain management is the driver of the S&OP process. Therefore, people from sales might feel that they do not benefit of the process. Alexander (2013: 17) says that the problem is in the one-sided focus of the S&OP process. He states that topics of the meetings should be taken from forecast accuracy and inventory levels to revenues, brands and channels, which are more strategic topics, and thus closer to salespersons interests. Singh (2010: 26–27) solution for this problem is more engaging. According to his article, best way to get salespersons to focus better on S&OP process and accuracy of forecasts is to make them accountable for expedites and other inventory related costs, that are typical

consequences of poor demand planning. Some companies have tied their salespeople's compensation to the margins after S&OP executions. This practice has to be well planned before implementation, to avoid unwanted results.

To actively spot problems and challenges Wallace & Stahl (2008:153–154) suggest to place an extra topic, critique of the meeting, on the agenda of the executive S&OP meeting. The critique can be collected quickly by interviewing participants or by asking them to fill a checklist that contains different items which can be rated from 1 to 4 according to the feelings. The items can consist of questions about elements of the S&OP process and its meetings. For example items of the checklist could be like “Participants stayed on the topic during the meeting” or “Progress of important KPIs is reviewed at the meetings”.

### 3. METHODOLOGY

After the exploration of the literature regarding S&OP and its fundamentals, an empirical research has been conducted to better meet the purpose of the study. To strengthen the validity and reliability of a research, it is important to introduce the design of the research and the methods used. This study is a qualitative research that studies experiences of three companies. Although the main focus is on the client company, this research studies also two other companies to better disclose all requisite information of S&OP and its qualities. Eskola & Suoranta (1998: 18) stated that in qualitative research the focus is usually on a small amount of cases which are intended to be analyzed as profoundly as possible, and therefore the scientific criterion of the research is not quantity but quality. This is a combination of exploratory and descriptive study. Saunders, Lewis & Thornhill (2012: 171) state that typical characteristic of a descriptive study is that the researcher wants to gain an accurate profile of events and situations. Additionally they state that exploratory study is efficient when there are open questions to answer and the researcher wants to clarify his or her understanding of a problem. This chapter starts by explaining the process of collecting the data. Next the used methods of data analysis are introduced. The quality of the research is discussed in the end of this chapter.

#### 3.1. Data collection

Primary data of this research was collected by interviewing the key players of each case company's S&OP process. According to Saunders et al. interviews help to gather valid and reliable data that is relevant for the research questions and objectives. To go further in detail, the data was gathered by semi-structured interviews. In semi-structured interviews the researcher has usually a list of themes and key questions to be covered. Still asked questions and the order may vary from interview to interview depending on the flow of the conversation. Furthermore, additional questions can be added to get more detailed information. The communicative and open-ended character of the semi-structured interviewing often requires audio-recording for the later analysis. (Saunders et al. 2012: 372–375.)

The most efficient way to get answers to one's questions is to ask directly. Therefore interviewing is a commonly used method in qualitative studies and is an event with interaction between the participants. There are five essential things to know before interviewing. First, the interview is planned in advance. Second, the interview is initiated and guided by the interviewer. Third, the interviewer often has to motivate the interviewee to maintain the flow of the interview. Fourth, the interviewer, as well as interviewee, knows his or her own role. Fifth, the interviewee has to feel confident about the anonymity and that the discussed information is processed confidentially. (Eskola & Suoranta 1998: 86.)

Also secondary data was collected to better answer to the research questions. Secondary data consists of documents and publications that are not produced by the researcher. For example companies' reports such as financial statement, income statement, production schedules or even raw data of inventory and material planning are secondary data. Difficulty of gathering the information varies. Some of the data can be confidential and therefore requires company's permission for accessing. On the contrary, useful secondary data can be easily found from Internet. The secondary data can be analyzed to provide additional and different knowledge of the topic. (Saunders et al. 2012: 304–307.)

Primary data of this research was gathered by interviewing persons involved in the S&OP process of three case companies. The case companies were selected having two main conditions in mind. First, one of the external case companies has to be more experienced with the S&OP than the client company, and share somewhat similar business environment. Second, one of the external case companies has to do business on completely different business environment. Selecting the case companies under these conditions, would same time, give a possibility to find best practices for the client, and give a chance to look the S&OP process from a completely new angle. Both of these conditions were met in this research.

The objective was to interview three persons from different work areas: the process owner of the S&OP, a person that works within the area of operations department and a person that is responsible for demand planning. Interviewing persons from each of these three areas gives an understanding of the whole process from the input of the demand plan to the point where the goods are delivered to the customer. Company's forecasting methods and

ramp-up/down plans can be explored by interviewing the demand planner. The S&OP process owner has the best knowledge of the process and its status, and additionally, he or she is the connection point between demand data and supply planning. Interviewing the supply planner, logistics manager or operations manager provides information about how the company implements its plans. In addition, by interviewing people from different areas may reveal things that for example the S&OP owner has not even thought about. The objective was achieved apart from one exception. Company C's interviewees consisted of only two persons. One was responsible for demand forecasting and the other shared the responsibility of managing the S&OP process and planning of the supply chain, i.e. he represented two areas. Interviews were conducted face-to-face with representatives of company A. Other interviews were conducted over the phone. Interviewees' titles and responsibilities within the area of S&OP are presented in Appendix 2. The semi-structured interview followed a questionnaire form (Appendix 1). Some questions were different depending on the area the interviewee was working. Some additional questions were asked during the interviews to better understand the events. Interviews were conducted in Finnish or English and recorded for later use. Finnish recordings were translated into English to better support the purpose of this thesis. The data and results of the study were sent to the representatives of the case companies for approval before the publication of this paper.

Secondary data was gathered by asking case companies to provide supporting charts, tables and data sheets regarding the S&OP process and assessed KPIs. Compared to companies B and C, more data was available from company A, since the researcher was working at the case company during the time the research was conducted. This allowed the researcher to participate in the S&OP meetings and access company's confidential data. Additional knowledge of the case companies was gathered from their websites and published reports.

### 3.2. Data analysis

To generate results and findings from the collected data, it has to be analyzed. Often the analyzing of the qualitative data is a challenging task, and deciding the way how the findings are represented makes the task even more challenging (Creswell 2007: 150).

According to Eskola & Suoranta (1998: 138) purpose of the analysis is to defragment the data without excluding any relevant information and to convert the data into a form that is easily understandable. According to Creswell (2007: 150) a general data analyzing process includes four phases as follows:

1. Data managing
2. Reading and memoing
3. Describing, classifying and interpreting
4. Representing and visualizing

These represented phases are not recommended to be performed in this order but rather in cycles so that they can be performed simultaneously to get the best output. The first phase, data managing, covers the organizing and converting of the data in files or documents so that they are easily browsed during the analysis. At the second phase, the researcher makes him or herself familiar with the whole database. Usually the researcher reads the documents through several times. By the verb memoing, Creswell means writing of memos and comments in the margins of the documents to get more efficiency in the learning process. The third part, which is the heart of the qualitative data analysis, consists of describing, combining, comparing and questioning of the data. Data is also classified to help to interpret data and to establish an overall picture. Well classified data and findings facilitate the work in the final phase, where the researcher finds a way to present the findings. Usually the findings are presented in conclusion or visual graphs, such as tables, matrixes or figures. (Creswell 2007: 147–154.)

Data of the interviews was analyzed according to the presented data analysis process. The most relevant information was highlighted in the documents before starting the analyzing. Available additional reports and documents were compared to the statements of the interviewees. A significant attention was paid to reduce the subjectivism of the researcher. Therefore deductions and conclusions were made extremely carefully without individual assumptions. Tables and figures were produced to better present and summarize the findings.

### 3.3. Quality

It is difficult to define are the results of a research correct or do the findings have enough evidence behind them. Therefore the possibility of getting the results wrong has to be reduced as low as possible. According to Saunders et al. (2012: 191–192), the risk is reduced by conducting the research in a way that takes reliability and validity into account. These two concepts are explained in this chapter. Eskola & Suoranta (1998: 211) address that there have been a lot of argument between different authors regarding the criteria of the reliability especially in qualitative studies. They add that the arguments derive from the difficulty to separate the research from the researcher, since, with qualitative studies, the tool for the research is the researcher himself.

Reliability refers to the repeatability of the study. Would the findings of the research be the same if the research was repeated by a different researcher using the same collection methods and analytic procedures? Reliability can be enhanced by being methodologically rigorous when planning and conducting the research. Research must not include leaps of logic or false assumptions. Additionally each part of the research has to be reported to allow others make their own judgments and conclusions. (Saunders et al. 2012: 192–193.)

Validity of the research can be divided in three different forms: construct validity, internal validity and external validity. The construct validity determines whether the selected measurement tools assess things that were intended to be assessed. Internal validity is established when the causal relationship between two variables is demonstrated. The result is internally valid for example in case where the relationship of variables can be shown statistically. External validity stands for the possibility to generalize the findings. For example, if the research is conducted in one organization, are the findings applicable to another organization? Therefore it is important to choose the sample carefully so that it would certainly represent the population that the researcher wants to study. (Saunders et al. 2012: 193–194.)

## 4. RESULTS

The results of the study are presented in this chapter. First the findings are presented separately company by company in an identical structure. General information is provided about the company followed by the findings of the study. Suggestions for improvements are addressed in the end of each sub chapter. The overall findings are summarized and discussed in the end of this chapter.

### 4.1. Company A

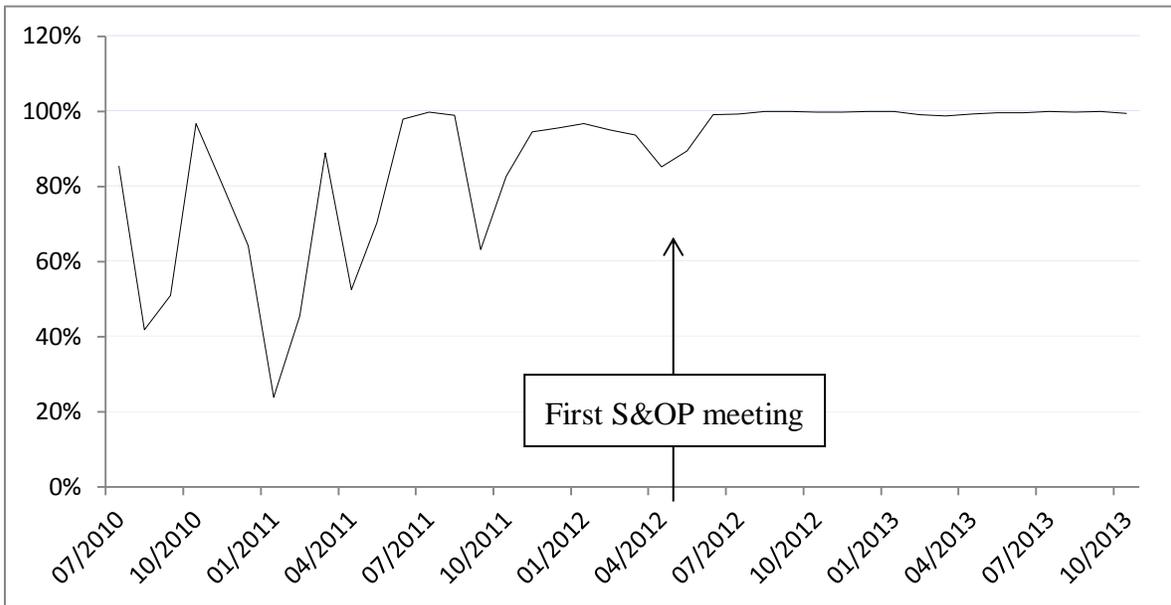
#### 4.1.1. Company overview

Company A manufactures protection and control products and applications mainly for factories and power plants. Manufacturing is mainly assembly-to-order, due to the very high product variation and short lead time. Products consist of complex and customized components, which are mainly shipped from different continents. Stock space at the production site is very limited, which emphasizes the importance of material planning. Customers' orders are usually large projects, and therefore Company A aims to establish long lasting partnerships. Due to orders of high volume and wide customization, forecasting of demand play a significant role. High quality and delivering on time are essential matters in this business.

#### 4.1.2. Findings and analysis

First S&OP meetings were held on May 2012, so the monthly process cycle has been rolling now for over one and a half years. Currently there are three out of seven product families included in the S&OP process. One of these product families is the most important product with the highest volume. Two others are recently launched and the company has high expectations of them. These three product families cover approximately 50% of the total volume. The S&OP process follows closely the same path which was seen earlier in Figure 1. The biggest difference is that the third phase, supply review, is not held as a

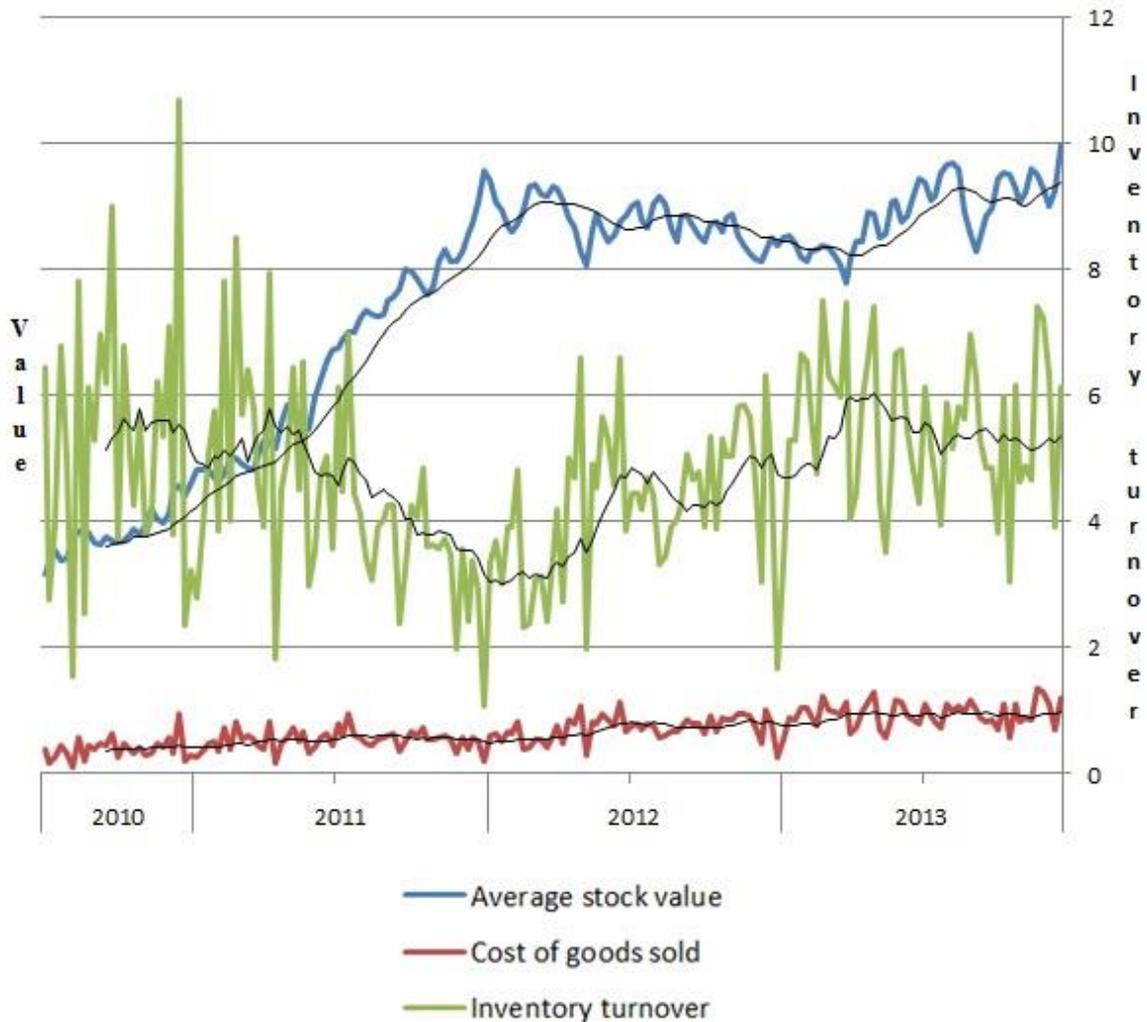
formal S&OP meeting. S&OP process owner uses approximately 20% of his work time on S&OP. Purchasers and people of operations make their product availability estimations and other supply side notes by themselves, after they have received the sales forecasts. The status of the supply and demand is discussed in the pre-S&OP meeting and all possible problems are pointed out.



**Figure 6.** Company A's monthly OTD of one of the product families.

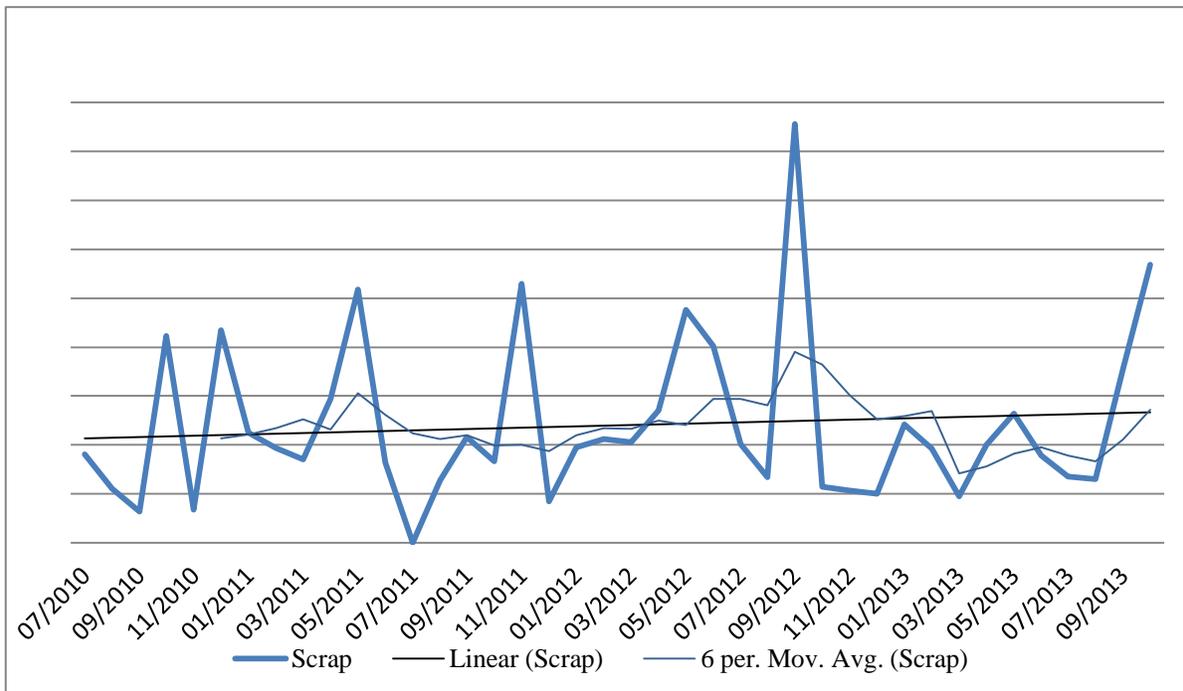
Company A has struggled with a poor OTD during 2010 and 2011. Worldwide component shortages and volcanic ash clouds made the situation even more difficult. After the OTD was gotten under control in 2012, monthly rates were above 80%. The S&OP process was taken in the organization during second quarter year, and the OTD has been very good ever since (see Figure 6). Of course, S&OP alone is not the reason for the high performance, but still has a significant influence. Company A has managed to keep OTD at a desirable level even without increasing inventory levels. Therefore it can be concluded, that there have been right amount of components available in the inventory. As discussed in chapter

2.4, low inventory level and high volume of sales result to high inventory turnover. When looking Figure 7, a positive development of inventory turnover can be seen during the year 2012, which is the year of S&OP implementation. Additionally, the annual average of company A's inventory turnover has risen 28,9% from 2012's average 4,27 to 5,5 in 2013. Despite the low inventory level, even lower inventory is reachable.



**Figure 7.** Company A's inventory turnover and inventory value of a product family.

The linear trend line of the volume of scrapped items is slightly upward, but the rising is not critical when increased sales volume is taken into account. When annual totals are compared, there has been a rise of 6,7% in scrapped items volume between 2011 and 2012. But, between years 2012 and 2013 the volume has decreased 13,5%. Therefore, it can be concluded that the development with the volume of scrapped items has improved. It must be noticed that in the business of long lifespan products, results of better planning of supply and demand may begin to show on scrap volume in much longer time period than one or two years.



**Figure 8.** Company A's value of scrapped items.

Forecasts are made each month by salesmen. To support forecasting, they use a project funnel tool, which is updated continuously according to possible upcoming projects. First the forecasts are made in euros on product family level. The S&OP tool transfers euros to quantities by dividing the sum of euros by the average sales price. After the amount of products is known, the S&OP tool calculates the split of specific product codes by utilizing 6 months' production history. As the product codes are known, the material plan can be made according to products' bill of materials. For new products, the mix is determined by

product management in cooperation with sales management. This mix is not updated on monthly basis. Top and flop list is used at S&OP meetings to point out best and worst regional forecasts.

Company A has planned to start global S&OP process after all the units have implemented their local S&OP processes. Before implementing the global S&OP, company A has decided to get better software for managing the process more efficiently. Currently they are using an Excel-based S&OP tool, which may prove very time-consuming and complex to maintain as the amount of data increases.

According to the interviews, one of the success factors has been a systematic and clear planning process. Data is presented in an easily understandable form so that everyone knows what the concerns are. Additionally KPIs are visualized which helps to spot the changes and possible problems. Cooperation and the flow of information have improved which also have clarified division of work and thus decreased overlapping between activities. Actions that are set during previous meetings are reviewed every month, which has been found useful.

Company A's S&OP has been successful, but still some considerable challenges exist. First, forecast accuracy is not at adequate level. On product family level, forecasts are sufficient, but on detailed component level they need more attention. Furthermore, euros are converted to product quantities by the total average price, even though the products are priced differently at each country. At the moment, purchasers cannot fully trust on component level forecasts. Second, the process lacks the financial planning. People from finance are present in the meetings, but still goals, possible decisions and scenarios are not reflected to financial plans. This kind of planning is done at different meetings, but not usually brought to the S&OP.

Third, participants' appreciation of S&OP's is not at a sufficient level. It seems that, even though people show up to the meetings, everybody does not understand the main objectives of the S&OP. There are still people that are not putting enough effort to produce sufficient input, what consequently leads to distorted output. Occasionally meetings slip to conversations of operational issues, rather than tactical or strategic planning, especially in

the pre-S&OP meetings. Sales people are used to have needed products available for customer, so they may find operational topics to be out of their interest. This undermines the S&OP's credibility even more in the eyes of sales and marketing. Regardless of the fact that S&OP has been in use for almost two years, there are only three product families included. Excluding product families lack profound planning. For instance, their forecasts are made only once a year.

#### 4.1.3. Suggestions for improvements

Forecasts are decent at product family level, but detailed component forecasts are not reliable. At the moment, there is no follow-up for the component level forecasts. To improve the reliability, follow-up should be started to spot distortions. As the becoming deals are often large projects and prone to changes, information flow between sales people and purchasing should be more frequent. Since updating of the project funnel is ongoing, it could also be available for purchasers to check the updated status of the upcoming projects to better react on changes. As a result, the whole supply side becomes more flexible. Furthermore, the S&OP tool's average prices of products should be updated, since there are significant differences in average prices between regions and countries. Wrong prices distort the amount of forecasted products. As the company A owns an efficient ERP system, the possibility of direct communication should be utilized within the area of informing suppliers. Furthermore, salesmen do not want to spend too much their time on forecasting, which results to delayed and rushed forecasts. An efficient way to motivate salesmen to better focus on forecasting is to tie their incentives to the forecast accuracy. But before doing so, it is important to go the rewarding system perfectly through to avoid unwanted consequences.

Company A takes financial impacts into account when making plans for changes. Still, financial calculations and scenarios are not presented in the meetings. Including easily understandable information of financial impacts into the meeting, may have a positive influence on motivation of participants. For example, salesmen do not necessarily care of inventory levels as long as customers are served, and therefore they may not find motivation to put effort on forecasting. By showing exact amounts of dollars that are wasted in scrapped items or obsolete inventory, could change perceptions. Integration of

finance is an important part of an S&OP process's implementation. Furthermore, Company A should shape up and bring the rest of the product families into the S&OP, despite the momentary extra workload that comes along the implementation.

To improve the credibility and status of the S&OP, they have to rethink the performing of the whole process. They have committed themselves to one of the most typical mistakes of S&OP. Too much time of pre-S&OP meeting is used for supply side issues, which has sometimes led to absence of sales people in pre-S&OP meetings. At the same time, there is not any formal supply review meeting held for the S&OP. Without a sufficient pre-S&OP meeting, there will not be much output for the executive meeting. This has happened occasionally, and eventually it may lead to absence of top management. To get the attention of sales and senior managers, topics have to be interesting. By bringing up the strategic goals and questions how to get there, generates more important and more interesting topics.

Developing of the S&OP is one of the process owner's responsibilities. Therefore the measuring of S&OP's performance should get more attention. Important KPIs are reviewed but the causes for the changes are not identified. Credit of the hard work should be given to the S&OP and its owner, and hence the owner should be able to point out which of the achievements are due to S&OP's efforts. The S&OP is an investment which takes time and money and therefore it should be possible to determine has the investment paid out.

## 4.2. Company B

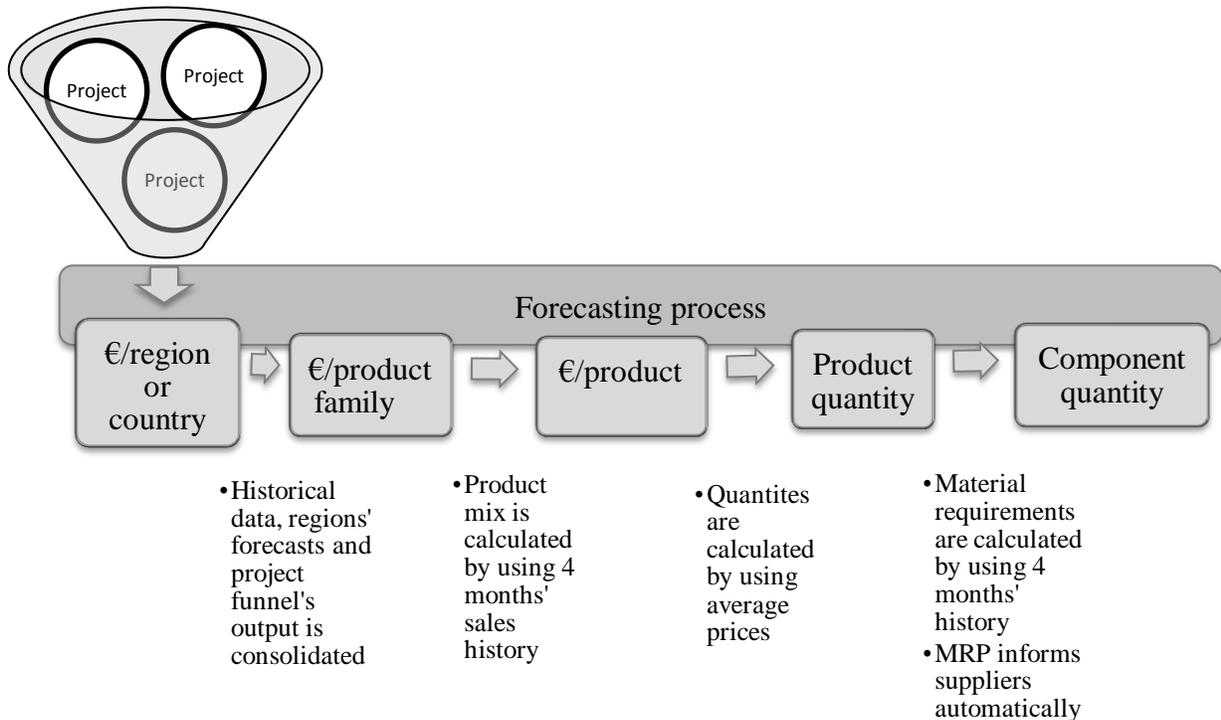
### 4.2.1. Company overview

Company B is a large Finnish manufacturer of power control products. Customers vary from end-users and manufacturing plants to original equipment manufacturers (OEM). Customer relationships are usually long-term, but also single purchases occur. Company B's competence relies on the quality of the product and its high amount of available features. The production strategy is mainly make-to-order but there are also smaller

portions of make-to-stock production and trading goods. Product availability is a priority number one, which emphasizes the importance of adequate inventory.

#### 4.2.2. Findings and analysis

Company B started the implementation of the S&OP in the fall 2011 by including all the 12 product families into the process. Implementation was executed with help of an external consultant company which is specialized in S&OP. The implementation went as planned since all product families were included by the summer 2012. The process flow is exactly as described in the Figure 1. Company B has a process owner whose main task is to focus on S&OP and its sub processes. Additionally there are two part time workers helping in data gathering, entering and analyzing.



**Figure 9.** Form of data during the forecast process of company B.

The overall average of OTD has been over 99% during past years, and there have not been any significant shortages. 2013's OTD increased from 2012's 99,3% to 99,6%. OTD has been at this level even before the implementation of S&OP, so it is difficult to say has the S&OP had any impact on OTD. Inventory turnover has significantly improved from 2011. Average inventory turnover was 4,9 in 2011 and remained the same during 2012. But, 2013 it speeded up to 6,4 which means that now on average they have inventory on hand 57 days. They have had annual actions to decrease inventory level which have been successful.

One of the area sales managers has been appointed to be responsible for the demand planning. She collects data from regional and areal sales managers, analyzes the market situation and consolidates them into a demand plan. Analyzing historical data is important, since the demand has seasonal patterns. In addition, it is influenced by economic fluctuation. An Excel-based S&OP tool utilizes past 4 months' mix to divide euros per product family into euros per product. At this point, euros are converted to quantities by using the average price of each product. Inventory and production plans are made on a product level. Next forecast are taken to more detailed level by using 4 months' production mix. Now the forecasts are on a product code level, which allows making the material plan according to a bill of materials. Visibility through supply chain is improved by giving suppliers a possibility to see company B's active purchase requisitions from the system. Forecasting on product family level has been very successful. According to the demand planner, during the last S&OP cycle, the highest MAPE of a product family was around 5%. Because of the high volume, even higher single orders do not have a significant impact on demand. Therefore it can be concluded that the demand is somewhat predictable. According to the demand planner, forecast accuracy at product family level has improved since the S&OP implementation. Accurate forecasting at product family level helps especially people in finance since they are monthly reflecting actual and forecasted sales to yearly budget to better predict the future. Additionally, monetary impacts of possible upcoming changes are calculated and discussed at meetings.

Interviewees pointed out several benefits that S&OP has given to the organization. Foremost among these was the common and clear language at the meetings. In practice it means that topics, charts and figures are presented in a way that all participants understand. Everyone could point out how much the forecast has differed from actuals and how much

there is capacity left in the production. Also separation of euros and quantities has brought clarity. Sales figures are dealt in euros and production rates in quantities. Secondly, systematic S&OP process has improved the information flow within the organization and even supply chain. As the purchase requisitions of company B are available for suppliers, also their visibility into the future has improved which has led to better OTD of suppliers.

Their most remarkable challenge is to deal with the component level forecast. First, the forecasted mix does not match with actuals. Even though the forecast accuracy is not poor, purchasers are still skeptical and regard the component forecasts only as directional information, and therefore they make the purchasing according to their own estimations. The root problem resides, most probably at the input data of forecasts. The data for the forecast consists mainly of historical demand data and salesmen's estimations of changes in demand of high volume products. At the moment, salesmen's effort to forecasting has been low because the task is entrusted to a single sales manager. Consequently she has been very busy with the forecast, since it should be made along with selling, which is her main task. On top of this, the responsibility of the demand planning has just been transferred to a new person, whose workload is even heavier. Second, the forecast cycle of one month is not frequent enough. An unexpected spike in demand in the beginning of the month eats the whole month's planned forecast, and therefore the system falsely assumes that there will not be any consumption later.

Additionally, product ramp-up/down plans are not integrated into the S&OP process well enough. Company B has a separate forum for these topics and therefore information is not openly shared. There are people present from product management at S&OP meetings, but currently they have been there only as listeners. Furthermore, company B has had problems in optimizing the inventory during new product launches, which has led to scrap of inventory. What can be said in any event is that there is a clear need for better ramp-up/down planning.

#### 4.2.3. Suggestions for improvements

The most feasible improvement to better balance demand and supply is to start to update the forecasts more often into the system. As discussed in previous chapter the forecasting

frequency of once a month is not enough especially with material with high volatility of demand. Therefore, every time a new unexpected change rises in demand, the forecast should be immediately updated into the material and production plan. This does not mean that the whole forecasting process should be made more frequently, but only updating it during the cycle. This helps the system to normally continue as planned while it still takes changes into account. As the system is updateable, this improvement takes only one minute of someone's time when changes arise in the demand.

In addition, the origin of the data for the forecast should be changed, at least partially, more from historical data to real market knowledge. This takes salespeople's time, which is out from their time for selling, but this will eventually improve the forecast accuracy. Furthermore, both, historical data and leads from markets are easier managed and analyzed with sufficient software. Actually company B is going to change their S&OP tool to more advanced software, which allows better planning and analytics.

Ramp-up/down planning should better be integrated into the S&OP as well. Even though the planning is done well at separate meetings and responsibilities are shared wisely, distribution of information within the organization is not sufficient. Therefore Company B should take a visualized ramp-up/down roadmap plan into the meeting and discuss the updates monthly. This is important especially for purchasing department, since they are responsible for inventory and possible scrapping. Additionally, the company B does not monitor their volume of scrapped items. It would give valuable information of inventory's efficiency, since volume of scrapped items is dependent on material planning.

Even though the important KPIs are measured during the S&OP process in company B, the changes of them are not followed actively enough. It is important to spot the changes and recognize the causes. As the S&OP's objective is to be an efficient and reliable decision-making tool, it requires a lot of effort and development. Therefore it needs all possible credit to deserve the appreciation of the management. Consequently, it is important to be aware of which benefits are resulted from a well performed S&OP process. The follow-up task suits best for the S&OP owner, since she is responsible for the maintenance and development of the S&OP process.

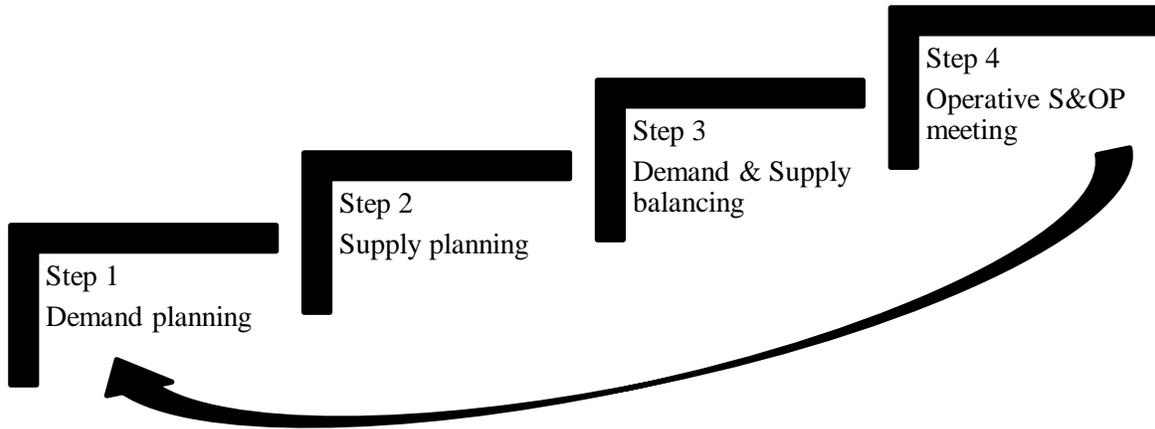
### 4.3. Company C

#### 4.3.1. Company overview

Company C is a Finnish pharmaceuticals manufacturer. In addition to medicines, they also offer some services and diagnostic test products. Their manufacturing strategies for medicines are mainly make-to-stock and make-to-order. Pharmaceuticals are chiefly produced at their own plants in Finland, but they do have outsourced production as well. These outsourced products are delivered via Finland to their numerous consignment stocks all over the Europe. Their strengths are the quality of their products and a wide range of variety in their product portfolio. Their demand varies from highly seasonal products to very unpredictable products. Strict laws, restrictions and standards play a big role at the pharmaceutical industry. Therefore development and launch of a new product is very expensive.

#### 4.3.2. Findings and analysis

Company C has used an *operative S&OP* for almost five years. Implementation was done without consultants, since the needed information was gained by benchmarking several companies which had experience with S&OP. The biggest difference of the operational S&OP to the S&OP discussed in this thesis is that the operational S&OP excludes participation of top management and strategic planning. The diagram of the process is shown in Figure 10. Therefore the focus is mainly on the operational side of the business. The main objective is to balance their supply and demand with the current capacity. Responsibility of running the operational S&OP is given to supply chain planning department. Tasks of the operational S&OP are divided between supply chain planning managers who are responsible for certain countries or regions. Their task is to collect demand information from their area that they are responsible for, and make an adjusted supply plan before the final step, operative S&OP meeting. S&OP related work takes only a small portion of supply chain planning managers' work time. However, their main work tasks are hand in hand with S&OP's processes. Responsibility for the success of the whole operative S&OP belongs, in principle, to one of the supply chain planning managers.



**Figure 10.** Company C's Operative S&OP process.

The first step of the process is for forecast making. Each business unit that has a consignment stock has a person who is responsible for the forecasting. To make the forecast this person uses history data, marketing department's information of upcoming events and sales manager's knowledge of the market's situation and future. Then he or she enters the forecasts into their MRP system, for the step 2, where the supply chain planning manager in Finland can make an aggregate supply plan for the next six months. Company C's MRP system is able to make automatic and ongoing forecasting, so there is necessarily no need to update the forecast manually every month. Then at the step 3, supply chain planners make a day to day production plan according to the aggregate supply plan. At the fourth step, past months' actuals and KPIs are reviewed and the supply plans are accepted or revised. Usually at the final meeting there are regional sales managers, supply chain planning managers, controller and occasionally the manager of the business unit. Topics concern mainly operational issues. The fourth step is the only formal meeting during the operational S&OP process. However, the supply chain planning manager in Finland has monthly conversations with sales managers and demand planners of each country that he is responsible for to get a holistic and updated view of the demand. Additionally, the forecasts and supply plans are updated immediately if some changes in demand occur.

According to the interviewees there has been nothing than help since the S&OP was implemented. The process clarifies responsibilities and keeps the planning in schedule which have improved efficiency and reduced overlapping tasks. Reputation of the S&OP has enhanced during the years since people especially in sales have realized that the S&OP is the forum to get their voice heard. Adequate forecast accuracy has allowed more efficient supply management and therefore service level and inventory turnover have improved. Forecast accuracy has been at such a level that supply planning managers have a complete trust in the forecasts and therefore supply plans are made completely according to them. Demand planners' business units are responsible for inventory write-offs that are resulted from poor forecasts. As pharmaceuticals are perishable, special attention is given to the inventory turnover and volume of scrapped items. S&OP has strengthened the cooperation and communication between the business units in different countries. For example this has allowed that surplus inventory of a product at one country can be sold in another, and consequently this has decreased the volume of scrapped items.

Company C's biggest challenge with their S&OP process is that it is actually only for short term supply planning. It lacks the strategic decision making, since the participants are mainly dealing with operational issues. Moreover, financial planning is done in separate meetings, so the plans are only reviewed but not analyzed at S&OP meetings. Any bigger changes will not happen since the top management is not involved in the process. According to the interviewees, there have been situations where senior managers' opinions and authority would have been needed.

Lack of time has also been a problem. Since there is no any pre-S&OP meeting held before the final meeting, responsibility for the preparation rests on busy participants' shoulders. This has caused that some participants start their preparation at the meeting, and therefore, valuable shared time goes to waste which impairs the reputation of the process. Time is a problem for the demand planner as well. Analyzing the forecast data for tens of products takes often so much time that the forecasts are not systematically made monthly, as the demand planners have intended. Forecasts are still updated every time there is a foreseen change in the demand.

The supply chain planning department conducted a small survey about the experiences of participants of operational S&OP in company C. It indicated that the majority of participants were satisfied with the way the existing S&OP process is performed. Still there were a few things worth taking into consideration. First, there have often been times when all needed people have not attended. The idea of collaboration and collective decision making suffers if there is constantly someone missing. Second, there is no follow-up done for actions made during previous S&OP meetings. Minor actions need sometimes pushing and reviewing to be accomplished since they are often easily forgotten and skipped. Moreover, company C measures important KPIs, but they are regarded more as supporting information for S&OP, i.e. they do not see the connection between successful S&OP process and business performance. S&OP's reputation and credibility will not develop if achievements are not seen as a result of S&OP.

#### 4.3.3. Suggestions for improvements

Company C's operational S&OP process should be turned into the strategic and more comprehensive process, which is actually being planned at the moment. Company C has already chosen a consult company to help to upgrade the operational S&OP to executive S&OP. Still there are numerous things worth paying attention to. First, senior managers have to be involved to fully take advantage of the process. As mentioned in the chapter 2, often it takes higher authorities to accept decisions and execute corrective actions. Bringing senior managers to meetings improves management's awareness of the current situation which consequently shortens the response time for different issues. This gives a better possibility to rather fix upcoming problems by extensive actions than daily firefighting.

The new S&OP process should definitely include a pre-meeting before the final S&OP meeting. When same topics are discussed more than once by different representatives from different levels of hierarchy the data for decisions will become more refined which leads to better decisions. This also urges participants to be more familiar with the current topics.

Even though the demand planner has done valuable work with the forecast accuracy, as mentioned, the frequency is not at the best possible level. Company C should consider linking demand planners incentives to their monthly forecasting accuracy. This would make

sure that the forecasts are made on time and they would be as accurate in the future as well. Better forecasts also decrease the need of constant updating. Additionally, as one of the demand planners was interviewed he rated his own familiarity with S&OP process to be 4 out of 10. The more participants are familiar with the process the better they can support it and give more precise input. Better introduction of S&OP for the demand planners could also improve their motivation to work within the process.

Company C's attitude towards the S&OP and its KPIs can be enhanced by pointing out the causes that have improved business performance, and by giving the credit to the S&OP. It is true that S&OP process itself has necessarily not been the direct cause to the improvements on business performance. Often S&OP works as radar to spot for example OTD or inventory turnover issues. Then the possible corrective actions are discussed and executed. Even though the corrective action itself was not part of the S&OP and the credit was given deservedly to the action's executor, the problem would have not been fixed without the S&OP. When reporting to the top management, situation like this should be reported as an achievement of S&OP to strengthen its credibility. This is one of the reasons there should be a clearly named process owner, who is responsible of the maintenance and development of the whole S&OP process.

#### 4.4. Summary and discussion

Studying of these three case companies proofed that the S&OP can be used efficiently in very different circumstances. Two of the companies were manufacturing power products with assembly-to-order strategy while the third was producing pharmaceuticals with make-to-stock and make-to-order strategies. The basic idea of their S&OP was the same but for example the way to perform the process differed between companies. Research questions concerned S&OP's impact on company's performance, arising challenges during the process and how the process can be improved. The results of the research are summarized and discussed below.

#### 4.4.1. Process

All the case companies stated that they did not have any major problems during the implementation. Two companies experienced some suspiciousness with S&OP's usefulness from the sales people point of view, but as the process matured also attitudes improved. Unlike Companies B and C, Company A's S&OP process did not include all the product families at the time of the research. Two of the companies used almost identical S&OP process as was visualized in the Figure 1, while the pharmaceuticals manufacturer used an operational S&OP which does not include top management, and thus, strategic planning and strategic decision making were excluded. Quantity of formal S&OP meetings during the month varied from 1 to 4: company A had 3 meetings, company B had 4 meetings and company C had only one meeting during the S&OP cycle. Responsibilities had also differences. Only one of the case companies had an S&OP process owner that focused solely on S&OP while the others had managing of S&OP as shared or as an extra work. It appeared that the more advanced the process was the more it took hours from the persons who were responsible.

As the case companies' products and customers were different also forecasting processes varied. The divergences were mainly in the input data of forecasts and the way the forecasting was conducted. Two of the companies used primarily historical demand data while the company A, with the most unpredictable demand, trusted more on sales peoples' vision for the future. Unlike companies B and C, Company A had not appointed demand planner since all needed data for the forecasts were entered by sales people into an excel sheet which automatically calculated the whole demand estimation product by product. All the case companies did the demand planning in euros and supply planning in quantities.

**Table 2.** Summary of case companies' S&OP processes.

	<b>Company A</b>	<b>Company B</b>	<b>Company C</b>
<b>Manufacturing strategy</b>	Make-to-order, assembly-to-order	Make-to-order, make-to-stock	Make-to-order, make-to-stock
<b>S&amp;OP meetings</b>	Demand review, pre-S&OP, executive S&OP	Demand review, supply review, pre-S&OP, executive S&OP	Operational S&OP meeting
<b>S&amp;OP in use</b>	18 months	2 years	5 years
<b>S&amp;OP was implemented</b>	With help of consultancy company	With help of consultancy company	Independently
<b>Product families in S&amp;OP</b>	50%	100%	100%
<b>Financial integration</b>	Partial	Yes	No
<b>S&amp;OP process owner</b>	Strategic operations manager	Production planning specialist	Shared responsibility between supply chain planning managers
<b>S&amp;OP's portion of the process owner's work time</b>	20%	100%	50%
<b>Origin of forecast data</b>	Sales people and customers	Mainly historical demand data	Mainly historical demand data
<b>S&amp;OP's next step</b>	Global rollout, new S&OP software	New S&OP software	Implementation of executive S&OP process

#### 4.4.2. Performance

To better indicate the relationship between S&OP and companies' performance, four most important KPIs were selected and introduced. The objective of the research was to find out has there been improvements in these KPIs. In addition, non-measurable qualitative benefits are discussed as well.

According to case companies' statistics and interviewees' statements, every case company had experienced improvements or a continuance of a great OTD since S&OP's implementation. During the research, OTD of the every case company was very close to 100%, and at the same time inventory levels had not increased. It was stated that changes, such as changing from a supplier to another or a new configuration of a product, are the most likely causes for shortages. What is worth noting is that these times have been somewhat easy for the OTD, since there have not been remarkable catastrophes or strikes of aircraft industry. S&OP had also had impact on inventory turnover, since every case company reported that their inventory turnover had improved. S&OP's monthly cycle has shortened reaction times for changes, which has allowed more efficient material planning.

There has also been a positive impact on case companies' forecast accuracy. The role of forecasting has been emphasized by the S&OP process and therefore the quality of forecasts has gotten more attention. For instance prior to the implementation of S&OP, company A did not even try to make sales forecasts. The follow-up of the forecast accuracy has revealed distortions which are actively fixed. Still, company C is the only one of the case companies where purchasing department makes the material planning completely according to the sales forecast. Systematic forecasting and long-term planning have brought transparency into the supply chain, which have helped suppliers as well.

An interesting note was that the volume of scrapped items was not reviewed at S&OP meetings of companies A and B. Company C did business with perishable products which may be the reason why they paid more attention to volume of scrapped items. Still, according to the data and interviewees the volume of scrapped items has reduced at two case companies since the S&OP implementation. One of the companies did not provide information regarding the volume of scrapped items. Company A was the only company

which provided statistical data to verify the improvement. As mentioned earlier in this study, well performed planning decreases the amount of scrapped items and therefore every company should pay attention on it. The case companies gained benefits through S&OP's better communication, which have helped for example in finding use for items that would otherwise be scrapped. It is important to notice that not only perishable goods but also poor ramp-up/down planning and poor revision management increase the risk of write-offs.

Additionally, there are many non-measurable benefits that the case companies have gained directly from the S&OP. All case companies mentioned that their cooperation between functional departments has improved. People are better aware how the business is going and what is happening in the organization. S&OP has brought simplicity and efficiency especially in information sharing. Time at monthly meetings is limited and therefore the presentation of the topics has to be compact and simple. Actuals, indicators, forecasts, capacities etc. are presented in graphical charts what makes comparison between the past and future easier. Interviewees pointed out that S&OP has also brought improvements in decision making. During the systematic S&OP process, issues are discussed several times by people from different levels of hierarchy. In addition decision making is based more on calculations than on a gut feeling. Users have found the S&OP meetings to be an excellent forum to get one's voice heard. For example capacity and production problems immediately get the needed attention of the top management which has remarkably shortened reaction times.

When the representatives of the case companies were asked to name things that have weakened since the S&OP implementation, nothing came out. Interviews created an overall impression that the implementation of S&OP has been a positive thing for every case company. On the basis of the results of this research it can be concluded that S&OP has had a positive impact on case companies' business performance.

#### 4.4.3. Challenges

According to the S&OP-related literature people and especially their attitudes are the most common force to weaken the efficiency of the S&OP process. In this research, participants' attitudes were discovered to be a degrading factor but not as strong as expected. There were no problems with the support of top management. One of the case companies suffered from a minor lack of sales people's participation in S&OP. Reason for this was most likely that the sales people were used to have all the needed products available, and thus someone did not understand why to put effort in the S&OP. Additionally, topics of the S&OP meetings may have been regarded too operational. This was reflected in participants' absences from meetings and delayed forecasts.

According to the research, it is a false assumption to believe that by decreasing the amount of meetings would make the process more efficient. Two of the companies had fewer meetings than is suggested in the literature, and both had faced problems. One of these companies did not have supply review meeting at all, and therefore topics of pre-S&OP meetings were occasionally very supply-related. Company C had only one formal S&OP meeting which resulted in wasted time as well. Participants did not start the preparation until the meeting so a significant portion of the shared time was used to get familiar with the updated information. What can be concluded is that time management and discipline were the reasons for the problems. One of the case companies did not have a clearly named person who is responsible for the development and maintenance of the whole S&OP process. At the same time another case company had a full-time S&OP process owner. It was clear that the latter had much more time for developing the process and its objectives were set higher.

All of the case companies reported that their forecast accuracy is not at desired level. Even though there have been clear improvements in the forecast accuracy since the S&OP implementation, supply-side interviewees of companies A and B did not fully trust in the forecasts. This means that they spent part of their work time in analyzing the demand as well, i.e. there were overlapping tasks. Since there was a wide range of different products and variations, even a minor distortion in the product family level forecast caused a significant distortion on component level forecast. Additionally, it was not rare to face large

unexpected changes in demand. The root problem for these was the input data of the forecasts. Companies B and C made the forecast by mainly analyzing the past instead of acquiring customers' real future needs. Some of the distortion was caused by wrongly converted data during the forecast process. For example company A converted forecasted euros to quantities by dividing the euros by average prices, even though different regions and countries had completely different prices for a same product.

All case companies reported that they did not have problems during the implementation of S&OP. As it was discussed in the literature review in chapter 2.3, the whole implementation is not finished until all product families and finance are integrated into the process. For example company A had only about a half of its product families implemented even though the S&OP had been rolling for over one and a half years. Only company B had integrated finance into the S&OP while other case companies' finance representatives were mainly listeners at the meetings. As Singh (2010: 25–26) stated, linking strategic plans to operative actions is a common challenge among companies using S&OP. Especially company C's integration of strategic plans was very limited.

In addition, none of the case companies did not measure the success of S&OP as recommended. The measuring of the success is even emphasized since none of the case companies' S&OP processes were at the desired level of maturity. It is important to be able to indicate what impacts S&OP has had on the business performance to better get the support of the top management. For example case companies did not regard improvements in inventory turnover or volume of scrapped items as achievements of S&OP. At the same time in general it seemed that case companies' objectives regarding the S&OP were not set high enough. A reason for this could be the limited time of the S&OP process owner or the other people who are involved.

#### 4.4.4. Suggestions for improvements

According to this study there were many areas within the S&OP process that need to be improved. As the forecasting is the most important part of the planning process, the forecast accuracy has to be at a sufficient level. Case companies were suggested to rethink how to base their forecast more on the future needs of the customers rather than only analyzing the

past and expecting the demand. This would help predicting sudden changes in demand and therefore shorten reaction times. Regardless of the origin of the forecast data, the persons who are responsible for the final forecast, usually demand planners or sales managers, should be eligible for compensation that is linked to the forecast accuracy. Before the incentives are put to use, it is important to think carefully how they are linked. In an ideal situation the incentives were linked to the component level forecasts, so that the functionality of the whole forecasting process would be emphasized. At the same time case companies were suggested to improve the information flow between demand and supply planning functions. As the duration of forecasting cycle is usually one month, it is recommendable to keep the frequency of updating of the forecasts as high as possible. Furthermore, purchasers should be authorized to have a real-time view into the project funnel software which is updated every time changes in demand occur.

The topics of pre-meetings and executive meetings tended to be sometimes too operational, and therefore the case companies should focus on how the process is performed. First, any S&OP meeting should not be left out from the process. For example without a supply or pre-meeting, all topics have to be discussed at the final meeting which result to too tight agenda and eventually to reduced interest of the top management. Second, finance should be better integrated into the S&OP process. This would bring strategic aspects into the decision making. Financial planning is more efficient if all product families are integrated into the S&OP process. To get better understanding of the current situation it is recommended to reflect the actuals to the budget. Moreover, as stated in chapter 2.5, financial implications should be analyzed every time before making decisions.

Despite of well managed implementation, development of the S&OP process does not happen by itself. The process that does not deliver results is not worth investing. Therefore it is important to measure KPIs and detect whether the benefits are results of well performed S&OP process. It is important to notice that often the S&OP itself has not improved the KPIs, but it has helped to spot the problems by its systematical reviewing process. Moreover, companies using S&OP should have a person who is completely focusing on S&OP only. If the responsibility for managing the S&OP is shared between too many persons the development of the process can be fragmented which makes achieving of strategic goals more difficult. Additionally, the S&OP responsibility should not be only a

part of someone's workload since the development and maintenance of S&OP needs more time. Studying the case companies left an impression that their objectives for their S&OP processes were not set high enough. If the potential of S&OP were more widely known in these organizations, the demands to the S&OP would be higher which consequently would increase the amount of effort expended on it.

## 5. CONCLUSIONS

The aim of the final chapter is to sum up the conducted research and its findings. The chapter starts by explaining the purpose of the study and how the objectives were achieved. Next the results are summarized and guidelines for the client company presented. Suggestions for future research and limitations of the study are discussed in the end of this chapter

The purpose of this research was to investigate, if S&OP has had an impact on company's business performance, and to point out all possible problems and challenges that may occur during the process. Additionally, suggestions for improvements were to be provided. Information about these subjects was collected to give more knowledge to the client company to appropriately carry out the implementation of the S&OP process at its other business units, and to sustain the efficiency of the process after the implementation.

The objective was achieved by reviewing existing literature, and by studying three case companies which consist of the client company A and two external companies B and C. The literature review was started by introducing the S&OP process and its fundamentals. Usability and potential benefits of the process were also addressed. Next, a general five-phase S&OP process was introduced. The phases of the monthly process cycle are as follows: data gathering, demand planning, supply planning, pre-meeting and executive S&OP-meeting. The most critical part of a successful S&OP process is the implementation, and hence, it was discussed in chapter 2.3. To gain the required information for measuring the success of the S&OP process and its impacts on business performance, most essential KPIs were introduced. The literature review ended in a chapter where possible challenges of the S&OP were addressed. Exploration of the literature gave a strong baseline for studying the subject in more detail on a practical level.

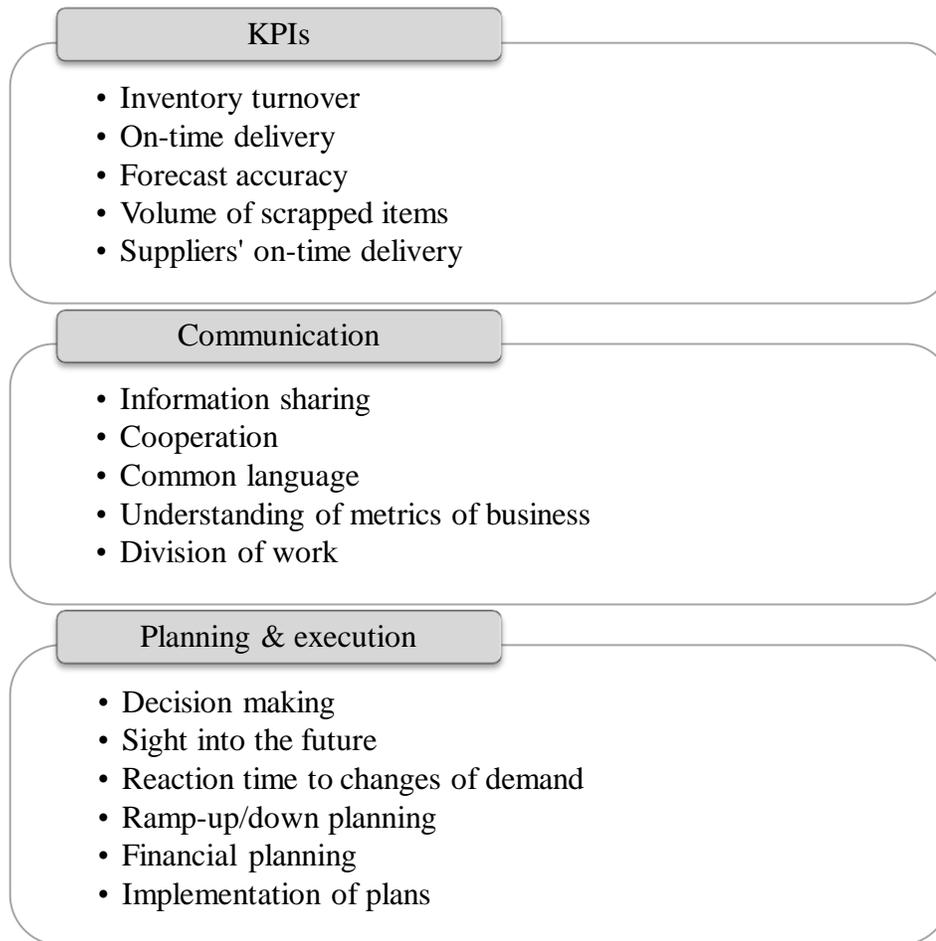
This study was conducted as a qualitative research. Primary data of this research was collected by interviewing the key players of each three case company's S&OP process. To get the understanding of the process on both general and detailed level, semi-structured interviews were conducted. By combining and analyzing the data from the literature and

empirical study, required knowledge was gained to answer the research questions. Since the aim of this chapter is to summarize, only the most essential findings are addressed.

Research question 1: Has S&OP had an impact on company's business performance?

According to the study, each case company had experienced positive impacts on their business performance. Companies had improvements in measurable KPIs such as inventory turnover, on-time delivery, forecast accuracy and volume of scrapped items. S&OP's systematic and continuous follow-up of the KPIs had forced the participants to put more effort into improving the metrics. Therefore problems were more often identified and corrective actions executed. As already mentioned in the study, it is important to notice that often the S&OP itself do not improve the KPIs, but it helps to spot the problems.

Additional non-measurable improvements were experienced especially in planning and communication within the organization. Better information sharing and cooperation had decreased the amount of overlapping work tasks. Participants of S&OP found the visual graphs of different metrics of business to be helpful in understanding the current situation of the company. Decision making had improved, since due to meetings of S&OP, the topics are discussed more than once by representatives from different levels of hierarchy. Additionally the decisions are based on facts rather than guesswork. Reaction times to changes of demand were shortened due to more frequent forecasting and better communication. None of the case companies had experienced any negative impacts caused by S&OP. Below is a list of the things that were identified to have improved since the implementation of S&OP.



**Figure 11.** Improvements after the S&OP implementation.

Research question 2: What challenges and problems occur during the S&OP process?

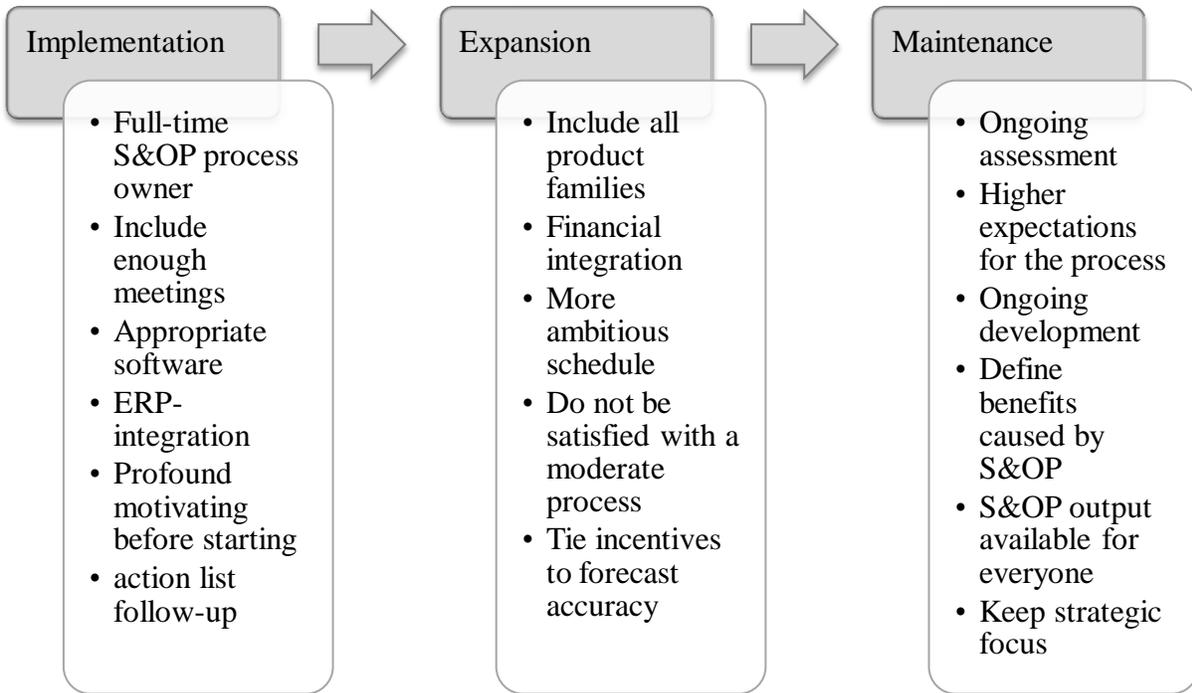
Case companies had challenges in forecast accuracy, especially on component-level forcing purchasers to establish their own estimates of demand. They also had shortcomings in integration of product families and finance, sharing of responsibilities and measuring S&OP process and its achievements. If all of the product families are not in the S&OP process, financial planning suffers, since there are parts missing from the overall picture. Additionally, having too few meetings led to situation where meetings were used discussing operational issues instead of strategic plans and decisions. Two of the case

companies had entrusted the responsibility for managing the S&OP process to a person or persons who were responsible for many other things as well. This decreases the efficiency to maintain and develop the process since the owners cannot be fully committed to the S&OP process. None of the case companies had identified which improvements of the company were results of the S&OP process. If the results cannot be identified, S&OP's credibility suffers, and eventually top management stops investing into it.

Research question 3: How can the S&OP process be improved?

Companies were suggested to improve their forecasting by focusing more on the future needs of the customers rather than analyzing the past and expecting the demand. Companies should also link the incentives of persons who are responsible for forecasting to forecast accuracy. This would motivate the planners to continuously develop the accuracy. As discussed in the chapter of literature review, there is a lot of potential in S&OP. Therefore companies should set the goals of S&OP higher and improve the assessment of the process. As a consequence, it is important to have a full-time S&OP owner who continuously develops the process.

The findings of the study allowed a checklist (Figure 12) to be made for the client company for future implementation, expansion and maintenance of the S&OP process. The notes listed on the checklist consist of things that the client company should pay special attention. It is recommendable that the persons who participated in the first implementation of the S&OP would act as mentors for the other business units during their implementation.



**Figure 12.** Checklist for S&OP implementation, expansion and maintenance.

As with every other study, there are limitations to be addressed. First, in the empirical study, the statistical data was limited, so for certain things, the researcher had to completely rely on interviewees' statements. Additionally, a significant portion of the interviews was conducted over the phone which increases the risk of misunderstandings. Despite the use of a questionnaire during the interviews, the interviews were somewhat open-ended conversations with numerous additional questions. This lowers the repeatability and thus, the reliability of the research. Moreover, due to the small sample size and differences between case companies, wide generalizations should not be made. Additionally, despite of the similarity of the client company and its other business units where the S&OP is about to be implemented, there might be remarkable differences in processing and managing the data that is essential for the S&OP. Additionally the cultural differences of people between the locations of the business units can differ a lot, and consequently, the applicability of the findings of this study can suffer.

Future research should cover a bigger sample and have a deeper focus on the case companies' S&OP processes. In optimal situation the researcher could participate in the S&OP meetings of case companies to gain a better understanding and more specific information about the usage of S&OP in different circumstances. Implementation and maintenance of a global S&OP should also be studied in empirical level. More attention should be given to study the connection of local S&OP processes a global higher level process. Additionally the relationship between the S&OP and the business performance should be studied more in detail. As the forecasting is an essential part of the S&OP, additional attention should be given to find the most suitable forecasting technique for companies with different businesses.

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## APPENDICES

### APPENDIX 1. Questionnaire

#### S&OP owner only

1. How long have you used S&OP?
2. Did you use a consultant when implementing? If yes, which one?
3. How do you run your S&OP?
4. Do you have a formal meeting for each step?
5. Who are represented in each step?
6. Do you have a process owner who focuses only on S&OP?
7. Do you have an S&OP software in use?
8. Who is responsible of data entering? Automatized?
9. What portion the S&OP takes from your work time?
10. How do you measure the performance of the process?
11. Financial participation? How about Marketing?
12. Is the participation at a wanted level in meetings?
13. Are you going to add something to your S&OP process in near future?

#### S&OP owner, Sales, Operations/Sourcing

1. Have you noticed any results since the implementation of S&OP?
2. What should be fixed?
3. What should be improved?
4. What is the next step improving S&OP process?
5. What are the challenges?
6. Is the S&OP the only decision making process or is it just an extra process?

## Operations/Sourcing only

1. Are you sitting down for supply review meeting?
2. Do you plan the supply according to sales' forecasts?
3. Have you made any actions to reduce inventory?
4. Have you focused on obsolete material?
5. Have you had improvements in OTD, inventory turnover and volume of scrapped items?
6. Should the OTD be improved?
7. Is the customer lead time short enough?
8. What actions have you taken to improve the supply chain performance?

## Sales only

1. How do you make the forecasts?
2. What are the biggest challenges in forecast making?
3. Have you had improvements in forecast accuracy?
4. What should be improved in forecasting?
5. What is the contribution of marketing department and product management?
6. Are there any incentives set for salesmen to better focus on forecasts?

## S&amp;OP owner, Sales, Operations/Sourcing

Rate from 1 to 10. 1 is poor and 10 is excellent.

1. How efficiently is the S&OP performed? \_\_\_\_\_
2. How familiar you are with the whole S&OP process? \_\_\_\_\_
3. How do you feel how well participants from different functions understand the S&OP? \_\_\_\_\_
4. How well do the participants stay in topic? \_\_\_\_\_

- 5. How well have the S&OP achieved its goals? \_\_\_\_\_
- 6. How well are the demand and supply balanced in your company? \_\_\_\_\_
- 7. Which overall grade would you give to your S&OP process? \_\_\_\_\_

## APPENDIX 2. Work titles and responsibilities of interviewees

<b>Interviewee's area of work</b>	<b>Company A</b>	<b>Company B</b>	<b>Company C</b>
<b>S&amp;OP owner</b>	Strategic operations manager: maintenance and development of S&OP, data entering and analysis	Production planning specialist: maintenance and development of S&OP, data entering and analysis	Supply chain planning manager*: maintenance and development of S&OP
<b>Operations</b>	Operations manager: chair of pre-meeting, represents supply and operations departments at executive meeting	Logistics manager: Represents supply department at meetings, sourcing	Supply chain planning manager*: Production planning and sourcing
<b>Demand</b>	Vice president of marketing and sales department: represents marketing and sales departments at executive meetings, responsible of demand plan	Area sales manager: Alone responsible for the overall demand forecast	Logistics coordinator: responsible for demand forecasting of one country

\*Supply chain planning manager was responsible for managing the S&OP and for the Operations side processes concerning the S&OP.