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Improvement of Demand Planning in Support of S&OP Process

Case Company

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ABSTRACT :

This thesis studies the improvement of demand planning in the sales and operations planning (S&OP) process, focusing on a case company business unit, a global leader in its industry. The study addresses the critical role of demand planning in aligning supply chain functions and organizational strategy, particularly in an environment characterized by external sourcing and rapidly fluctuating demand.

A comprehensive literature review provides a theoretical foundation that highlights the importance of demand planning as a key step and base of effective S&OP. The review presents the best practices in forecasting to be cross-functional collaboration as well as data accuracy. The empirical study is conducted through qualitative interviews and quantitative analysis of historical project data derived from the case company, allowing for a comprehensive understanding of current practices and challenges.

Research questions of the thesis are: 1. What are the factors that affect demand planning to support the S&OP process in a company? 2. How to forecast the most probable projects in the demand planning phase to support the S&OP process in the case company? 3. How to control and improve the uncertainty in demand planning to support the S&OP process in the case company? The first characterizes demand planning in a general S&OP process and creates a basis for the study of case company demand planning. The second research question provides a methodology for improving forecasting within the case company. The third explains how to minimize the effects of uncertainty in demand planning within the case company.

The results show that the case company's S&OP process has room for improvement in terms of data accuracy, tool flexibility, and visibility of supplier capacity. The interview data highlights the importance of active knowledge sharing and organization-wide collaboration, which is consistent with the literature that sees these factors as essential for S&OP effectiveness (Kolassa & Siemsen, 2016; Roscoe et al., 2020).

The thesis offers practical suggestions to enhance demand planning at the case company, such as adopting agile forecasting tools, improving data management, and establishing comprehensive KPIs. These changes aim to boost forecast accuracy, reduce uncertainty, and align strategic goals with operations. Despite limitations like limited historical data, the research provides valuable insights for both academic discussions and real-world applications in global organizations.

KEYWORDS: Demand Planning, Sales and Operations Planning (S&OP), Forecasting, Supply Chain management, Demand uncertainty

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TIIVISTELMÄ:

Tutkielmassa tutkitaan kysynnän suunnittelun parantamista Sales and Operations Planning -prosessissa (S&OP) keskittyen case-yrityksen liiketoimintayksikköön, joka on merkittävä globaali toimija. Tutkimuksessa tarkastellaan kysynnän suunnittelun keskeistä roolia toimitusketjun toimintojen ja organisaation strategian yhteensovittamisessa ympäristössä, jossa on ulkoinen hankinta ja nopeasti vaihteleva kysyntä.

Kirjallisuuskatsaus korostaa kysynnän suunnittelun merkitystä S&OP-prosessissa ja parhaita ennustamisen menetelmiä, jotka perustuvat yhteistyöhön ja tietojen tarkkuuteen. Empiirinen tutkimus yhdistää kvalitatiiviset haastattelut ja kvantitatiivisen datan menneistä case-yrityksen projekteista, tarjoten kattavan kuvan yrityksen nykyisistä käytännöistä ja haasteista.

Tutkimuskysymykset ovat: 1. Mitkä tekijät vaikuttavat kysynnän suunnitteluun osana S&OP-prosessia? 2. Miten kysynnän suunnitteluvaiheessa ennustetaan todennäköisimmät projektit S&OP-prosessin tukemiseksi case-yrityksessä? 3. Miten hallita epävarmuutta kysynnän suunnittelussa S&OP-prosessin tukemiseksi case-yrityksessä? Ensimmäinen kysymys pyrkii kuvaamaan kysynnän suunnittelua yleisessä S&OP-prosessissa ja luo siten perustan case-yrityksen kysynnän suunnittelun tutkimukselle. Toinen tutkimuskysymys tarjoaa menetelmiä ennusteiden parantamiseen case-yrityksessä, ja kolmas selvittää, miten epävarmuuden vaikutuksia voidaan minimoida kysynnän suunnittelussa.

Tulokset osoittavat, että case-yrityksen S&OP-prosessissa on parannettavaa datan tarkkuudessa, työkalujen joustavuudessa ja toimittajakapasiteetin näkyvyydessä. Haastatteluaineisto korostaa aktiivisen tiedon jakamisen ja organisaation laajuisen yhteistyön merkitystä, mikä on linjassa kirjallisuuden kanssa, jossa nämä tekijät nähdään S&OP:n tehokkuuden kannalta olennaisina (Kolassa & Siemsen, 2016; Roscoe et al., 2020).

Tutkielma suosittelee joustavampien suunnittelutyökalujen käyttöönottoa, parempia tiedonhallintakäytäntöjä ja suorituskykymittareita (KPI) kysynnän suunnittelun parantamiseksi case-yrityksessä. Suositusten odotetaan lisäävän ennusteiden tarkkuutta, vähentävän epävarmuutta ja vahvistavan strategisten tavoitteiden ja operatiivisen toteutuksen yhdistämistä. Tutkimusta rajoittaa case-yrityksen ulkoinen toimitusketju ja rajallinen data. Tutkimus edistää akateemista keskustelua ja käytännön sovelluksia antamalla ehdotuksia kysynnän suunnittelun parantamiseksi monimutkaisissa, maailmanlaajuisesti hajautetuissa organisaatioissa.

KEYWORDS: Kysynnän suunnittelu, S&OP, Ennustaminen, Toimitusketjun hallinta, Kysynnän epävarmuus

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Abbreviations

S&OP – Sales and Operations Planning
KPI – Key Performance Indicator
BDM – Business Development Manager
AFEU – Africa and Europe sales region
AMER – Americas sales region
MEA – Middle East, Asia and Australia sales region

1 Introduction

The Sales and Operations planning (S&OP) process aims to combine different parts of an organization to create a coherent plan that balances planned demand and supply. If executed well, it can lead to measurable economic advances for an organization as well as increase overall efficiency in operations. The aim of this thesis is to create suggestions for a global industry leading company on how to improve their demand planning, focusing on the objective of improving overall S&OP. The scope of this study includes a detailed review of demand planning within S&OP, interviews with sales personnel from the case company, and analysis of past project data from the case company. The study is limited only to one case study company and its business unit.

1.1 Background

The objective of the study aligns with the case company's business unit's developmental goals, specifically focusing on the young and growing S&OP process. This has been determined together with internal stakeholders. This alignment highlights the significance of the thesis topic, making it crucial for both academic and practical relevance. The purpose of the study is to advance the case company demand planning as a part of its S&OP process.

1.3 Objectives, research questions and limitations

Here are the Research Questions determined for this thesis work and the objectives presented in a table. They are set to compliment the overall objective of this thesis work which is to provide actionable information for the case company business unit to improve their demand planning process and therefore overall S&OP process. These have been approved by the case company supervisor as well as university supervisor.

1.3.1 Research Questions

To reach these objectives set by the author and thesis supervisor, the research questions are set as follows:

1. What are the factors that affect demand planning to support S&OP process in a company?
2. How to forecast the most probable pro-jects in demand planning phase to support S&OP process in the case company?
3. How to control and improve the uncertainty in demand planning to support S&OP process in the case company?

The first question is focused on the literature review and the aim is to provide a list of factors that are in general mostly used for evaluating demand planning as a part of the S&OP process. This will create a basis for studying case company methods in demand planning and the whole S&OP process. The second objective aims to improve the methodology for evaluating and identifying the most probable projects in the project pipeline based on historical data and key business indicators specific to the case company. The third research question aims to propose strategies that can minimize uncertainty in the demand planning phase of the case company by enhancing visibility of possible project pipeline and improving forecast accuracy.

By answering these questions, this study provides a comprehended view of a Sales and Operations general process with a focus on demand planning as a step, as well as give insight to more accurate and effective forecasting. This will provide the thesis case company with concrete examples on how to improve their demand planning as a part of their S&OP process. These suggestions can then be implemented and valued within the case company.

1.4 Structure of the thesis

The structure of the thesis is done in five sections. First section is an introduction to the thesis work as well as the case company background. Second Section consists of a literature review, which is followed by an empirical research study. The empirical study is presented in two parts: Research methods, which is referred to as Section 3 and research results which is Section 4. The thesis concludes with Section 5, which provides Discussion and Conclusion of the thesis. Aim of Section 2, literature review, is to answer Research Question 1. And this includes a comprehensive explanation of a general S&OP process and demand planning as a part of it. It also focuses on presenting usual key performance indicators (KPIs) as well as forecasting which are key activities in the completion of an S&OP process. In Sections 3-5 data is gathered from the case company about their functions during demand planning phase of their S&OP project as well as metrics regarding historical data of past S&OP cycles. The aim of the research study is to answer Research Question 2 & 3. It focuses on the case company type of business and presents concrete examples on how the case company can better their demand planning compared with Section 2 results.

By combining these Section 1-5 the case company's request and research questions determined can be fulfilled and answered. In the end, in Sections 1-5 results are gathered and presented. Conclusions, limitations as well as future research suggestions are presented relating to the thesis work done in the field of S&OP. The results can be gathered by focusing on the views of a general S&OP process presented in Section 2 with empirical study data which gives a view of the case company way of working and their demand planning. This provides requested suggestions from the case company and fulfills the objectives of the thesis.

2 Literature Review

Demand planning is a critical process that involves forecasting customer demand to ensure that products are available when needed. Sales and Operations Planning (S&OP) is a strategic process that aligns production and distribution with sales forecasts, ensuring that all departments work cohesively towards common goals. Both demand planning and S&OP are essential for optimizing supply chain efficiency, improving customer satisfaction, and enhancing overall business performance. When Demand planning as a part of an S&OP process is done effectively it enables cost saving measures for a company.

2.1 Demand Planning: its importance and characteristics

Demand planning is a process that gives an organization the ability to manage their supply chain processes by forecasting demand and balancing supply with demand (Nguyen et al., 2022). It is considered as a key step in Sales and operations planning (Wallace & Stahl, 2008). Accurate demand forecasts help a company to quickly adapt to changes in the market situation, therefore it is a vital concept in supply chain management (Niu et al., 2024). The Demand Planning process involves the following steps: Goal formulation, demand forecasting and communication of the demand predictions and synchronization of supply with demand (Nguyen et al., 2022). Demand forecasting is crucial for optimizing sales, efficiency, profitability, reducing costs, and ensuring stock availability (Mahin et al., 2025).

Identifying the goals of Demand planning includes understanding customer requirements, production capacity and company strategy (Nguyen et al., 2022). That is the starting point of demand planning and gives the base of demand forecasting which is the key part of demand planning process. Demand forecasting is the key part of demand planning process, because it involves making demand predictions/forecasts. They give visibility to the actual reality of demand. The last step describes the sharing of made predictions and the actual balancing with supply. This last part emphasizes cross-functional

and interorganizational coordination (Nguyen et al., 2022), as the information of demand planning must be shared across the organization and the input of supply can be received from outside of the organization. Sharing of supplier forecasts can also be included in this last step.

Demand forecasting includes concepts of Forecasting technique, source of information, role of forecasting in making decision (Nguyen et al., 2022). Most beneficial forecasting method of each organization depends on data availability, industry context, instability of demand and resource allocation, however the best practices for forecasting include multiple approaches (Singh et al., 2024). Demand planning models, techniques and theories can be divided into quantitative, qualitative and hybrid categories (Singh et al., 2024). These can also be interpreted as forecasting models, techniques and theories. New technologies like real-time demand sensing, artificial intelligence (AI), and big data analysis are often used to forecast demand and understand changing customer needs (Singh et al., 2024). Deploying Machine learning in supply chain management has also been proven to create more accurate demand forecasts (Mahin et al., 2025).

Quantitative models use numerical data or trends to create predictions and base forecast for example on historical data (Singh et al., 2024). This can also be called statistical forecasting. Qualitative approaches focus on more human inputs such as input from experienced professionals or knowledge of the market situation and predictions (Singh et al., 2024). Hybrid approach describes a method which mixes both statistical forecasting and expert judgement, which is common in organizations aiming to mitigate risk and better forecast accuracy (Singh et al., 2024). The information for forecast can be derived from sales estimates, promotions, market research, company goals, inventory and supplier information (Nguyen et al., 2022).

Demand planning is a key part of S&OP process. Completion of an effective Demand planning process as a part of an effective S&OP process requires data integration, advanced forecasting analytics, collaboration between business functions, continuous validation, effective integration with supply planning as well as ongoing process improvements (Basavaraju & Valilai, 2025). Effective demand planning also depends on broad

internal collaboration between marketing, operations, finance and supply chain, and external coordination with suppliers and logistic partners (Nguyen et al., 2022). This minimizes the misalignment of plans. Many companies are enhancing their demand planning processes, because companies that are able to conduct efficient demand planning can achieve competitive advantages by adapting to changing market conditions and delivering products to customers on time (Wibowo, 2024).

2.2 Sales & Operations Planning: Concepts and key steps

Sales and Operations planning (S&OP) is a top-management planning process (Sheldon, 2006). At its core it is a business process that aims to balance supply and Demand at an aggregate and detailed level (Ohlson et al., 2021). Any business that mitigates demand and aims to balance it with its resources, has a use for a well operating S&OP process (Sheldon, 2006). Four fundamentals of S&OP can be identified: Supply and Demand, volume, and mix (Wallace & Stahl, 2008). The key elements of a well performed S&OP process are balancing supply and demand, managing volume over right time periods, optimizing product mix with portfolio management (Shanahan et al., 2024).

Demand describes the external and internal customers' needs and supply describes how we can meet the needs (Wallace & Stahl, 2008). Balancing these is recognized as the general objective of the S&OP process (Kreuter et al., 2021; Shanahan et al., 2024). Volume refers to the big picture or aggregate volumes (product families and groups) and mix refers to issues that appear on a more detailed individual product and customer order level (Wallace & Stahl, 2008). Volume and mix are not to be balanced but more clearly volume is the level which S&OP operates, and mix is the level it creates benefit to (Wallace & Stahl, 2008).

As a process S&OP is cross functional and involves departments such as General Management, Sales, Operations, Finance and Product Development (Wallace & Stahl, 2008). Based on the type of business of the company S&OP can involve other stakeholders im-

portant in the process, such as suppliers. A successful S&OP process connects the company's Strategy and Business plan to its detailed processes (Wallace & Stahl, 2008) while creating financial and operational improvement.

S&OP Process is not similar for all companies and differs in its design based on multiple factors of company. Despite the increasing number of studies published and implementations in the industry, there is still no unified perception of what S&OP entails and how it works (Kreuter et al., 2021). The industry of a company as well as internal and external contexts such as organizational characteristics and resources as well as market conditions and social factors, create company specific problems to which S&OP is implemented (Kristensen & Jonsson, 2017). S&OP process can be used in trying to solve various company issues; therefore, its definition is unclear. The usual key elements of an S&OP process can however be identified and implemented for organization use whether it is referred to by a different name than S&OP

Sales and operations planning is important for companies because it helps manage change across the organisation, because it gives an opportunity for the organization to work proactively when problems arise (Keal & Hebert, 2010). With the help of S&OP a unified cross-organizational plan is created and communicated within key stakeholders, which aligns the organization, reduces confusion and reactive measures (Keal & Hebert, 2010). S&OP ensures that business objectives at the strategic level are translated into actionable operational plans, which is an essential step in effective resource utilisation (Fakhry et al., 2024).

2.3 S&OP as a process

Wallace and Stahl explain the S&OP process through five clear steps to achieve an authorized plan, which is also supported by Kolassa and Siemsen in 2016. As a first step Wallace and Stahl see Data Gathering which explains the activity of updating the planning files and platforms with the data gathered from the ended S&OP cycle. The second step they state is the Demand Planning phase, the main objective of which is to provide

a forecast of the current demand. Third step according to Wallace and Stahl is the Supply planning phase in which the capacity is matched with demand and changes are made if demand and supply are not balanced. Steps 4 and 5 presented by Wallace and Stahl described the two main meetings at the end of the S&OP cycle. The first mentioned is the pre-S&OP meeting where the decisions on balancing demand and supply are made and the agenda as well as recommendation for the Executive S&OP meeting (Step 5). Final decisions are made in the Executive S&OP Meeting according to Wallace and Stahl. It is the last step and provides a well revised Management level S&OP plan.

Avila et al. (2019) Describes the S&OP process in five steps, However the steps are divided differently from Wallace and Stahl (2008). Both Avila et al. and Wallace and Stahl describe that the S&OP process is executed with department collaboration. Avila et al. Mention five steps as follows: (1) Create unconstrained demand forecast, (2) Create initial supply plan, (3) Develop a final consensus operating plan, (4) Communicate and implement plan, and (5) Measure Process performance. These steps are reinforced by Benayiba et al., (2025).

The first step “Create unconstrained demand forecast” (Aliva et al., 2019) includes the Data gathering is differentiated as a singular step by Wallace and Stahl (2008). The outcome of this first phase is a forecast that is not yet affected by the constraints of supply or other capacity issues and is the basis for the S&OP process (Avila et al., 2019). In contrast, according to Wallace and Stahl (2008) the creating of a forecast presenting the demand of the organization is created in the second phase “Demand planning phase”. Secondly Avila et al. Explain the step “Create initial supply plan.” This includes collecting the data on capacity constraints and other factors that affect the available supply plan (Avila et al., 2019). According to Wallace and Stahl these actions are done in the supply planning phase. Third phase of the Avila et al. Presented process is called “Develop a final consensus operating plan”, which involves the gathering of representees from different departments of the organization and deciding of the final demand and supply plans. In Wallace and Stahl’s process the involvement of all departments is mentioned earlier.

The fourth step that is described by Avila et al. Is “Communicate and implement plan”, they explain it as communicating the made plans with all parties involved in S&OP. Wallace and Stahl also highlight the importance of S&OP info sharing, however in their official framework process they have included it as a part of existing steps. Last step in Avila et al. Describes the process of measuring the effectiveness of the process and the overall control of it. Avila et al. Explain that following Key performance indicators (KPIs) on both a commercial and operational level and sharing the relevant information with all the departments is a key part of this part in the process. This ensures the continuous improvement of the whole process.

Steps 1-3 include the same steps in each process; however, they are presented differently. Avila et al. Present the final supply plan and demand plan as a singular step. Suggestions for these final versions have been made in the previous steps. Also, Wallace and Stahl Data gathering has been created as a separate step, which in Avila et al. Is a part of preliminary demand and supply plan creation. As Wallace and Stahl focus their last two steps in S&OP Meetings, where the plans are officially decided and reviewed, Avila et al. Focus their last steps on overall process implementation and sharing of plans.

When S&OP was first created its objective was to balance sales and marketing plans with manufacturing, procurement, and finance plans so that there is enough supply, workforce and funds to match the optimized demand (Parravicini, 2015). The steps presented by Wallace and Stahl in 2008 aim to reach this objective of demand and supply balancing. However, this key objective is now considered a given in S&OP processes and the new main objectives have formed to be reaching business targets in sales and profit (Parravicini, 2015), which are based on the company’s strategy.

This revised list of key steps in the S&OP process presented by Massimo Parravicini in 2015 shows that S&OP includes a lot of activities and preliminary meetings outside of higher-level managements scope. Roscoe et al. (2020) highlight the importance of external stakeholder involvement in the S&OP process. Also, structural and operational characteristics of different industries have a remarkable in the effectiveness of a company S&OP process (Kim & Shin, 2024). The steps created by Parravicini focus on the steps and

actions that happen behind the scenes of the official S&OP meeting; therefore, it has a different approach to the making of a SOP process than others presented in this thesis. Parravicini's process includes ten steps, which also differs from the traditional five step process presented in for example Wallace and Stahl (2008). The steps created by Parravicini (2015) exclude the involvement of external stakeholders. Organizations should expand S&OP to external stakeholders, because only internal processes can become short-sighted and resistant to change (Roscoe et al., 2020).

The first step, as mentioned by Parravicini (2015), is creating sales forecasts. Parravicini presents three key steps that make a feasible forecast, which are: updating the sales forecasting system, sales forecasting, and sense checking the sales forecast. Updating the sales forecasting system enables the start of a S&OP process, with regularly needed updates in actuals, list prices, on-invoice discounts, new product lines, and deleted items (Parravicini, 2015). S&OP process begins with forming demand forecasts, this tactical planning is essential when balancing demand and supply (Roscoe et al., 2020). Typically, the demand forecasting process starts with a statistical forecast, which is then adjusted according to comments from sales or marketing function (Wibowo, 2024). The main objective of sense checking the forecast is to create a consensus forecast that is signed off by all functional department involved in the S&OP cycle (Parravicini, 2015). Sales, marketing, finance and operations work together to present various departmental priorities (Roscoe et al., 2020).

Next in the process presented by Parravicini, 2015 are the steps to identify gaps and

"Identifying gaps comparing the sales forecast to the annual operations plan" the aim of which is to specify the areas of underperformance that need corrective actions (Parravicini, 2015). Forecasts are translated into operational plans, and departments ensure that resources, capacity and supply chain management are synchronised with expected demand and long-term business objectives (Roscoe et al., 2020). The aim is to find activities that can balance out the gaps identified in the previous step. This is called "Planning gap filling activities", which can include for example enhancing sales by customer, new prod-

uct launches, enhancing sales on national level, and new special packs or displays (Parravicini, 2015). These activities must however be feasible and possible to be implemented. There are checks that must be done to make sure that the list of gap filling activities is realistic and financially viable (Parravicini, 2015). Also, excessive frequent and short-term changes, such as on weekly level, might affect negatively on supply chain stability (Wolfshorndl et al., 2020). Therefore, it is crucial to view the effect and necessity of gap filling activities, which translate to the need for demand accuracy.

Next phase of the Parravicini, 2015 presented process is to gain approval to the plan created. This includes the official S&OP meeting by company's department directors, which is done at least once a month (Parravicini, 2015). The aim of this is to review forecast, see if gap filling activities are needed, and as an outcome have the new plan and targets for the future (Parravicini, 2015). Regular (often monthly or periodic) reviews are carried out to assess performance, compare results with forecasts and business objectives, and make any necessary adjustments, which ensures a continuous match between supply and demand (Roscoe et al., 2020). Based on the information received from this official S&OP meeting planning system is updated, however this can be updated also in between the previous steps, for example some companies update the planning system after sense checking of forecast and receiving info from sales (Parravicini, 2015). This can be different based on each company's functions and company specified S&OP process.

The ending of Parravicini's S&OP process includes two critical steps: "measuring process effectiveness" and "Identifying improvement areas". These steps consist of different access metrics that are measured, not only based of forecast data but others related to performance, and identifying what needs to be done to enhance improvement of overall process (Parravicini, 2015). These steps are not mentioned as an official part of the other process frameworks presented by Wallace and Stahl (2008), and Avila et al. (2019). However, this is a crucial part of every business process implementation, because it creates a platform for continuous improvement of the process in question. Table 1. presents the key steps in the generalized S&OP process with description, key activities and objectives of the steps based on the provided literature.

Table 1. Generalized steps of an S&OP process.

Step	**Description**	**Key Activities**	**Objectives**	**References**
1. Data Gathering	Collect and update planning data from the previous S&OP cycle.	- Update planning files and platforms - Gather data from various departments	- Ensure accurate and up-to-date information for planning.	Wallace and Stahl (2008)
2. Demand Planning	Forecast current demand and create an unconstrained demand forecast.	- Create forecast, which is not yet affected by constraints to share and work as base.	- Provide a baseline forecast for demand.	Avila et al. (2019), Wallace and Stahl (2008), Benayiba et al., 2025), Roscoe et al., (2020), Wibowo (2024)
		- Update sales forecasting system - Sales forecasting - Sense checking the sales forecast	- Create accurate demand forecast	Parravicini (2015), Wibowo (2024)
3. Supply Planning	Match capacity with demand and identify gaps.	- Create initial supply plan	- Balance demand and supply.	Avila et al. (2019), Wallace and Stahl

				(2008), Benayiba et al., 2025).
		- Identify capacity constraints	- Plan gap-filling activities and balance demand and supply	Parravicini (2015)
4. Pre-S&OP Meeting	Review demand and supply plans, and make preliminary decisions.	- Review demand and supply plans - Set agenda and recommendations for the Executive S&OP meeting	- Make preliminary decisions on balancing demand and supply. - Prepare for the Executive S&OP meeting.	Wallace and Stahl (2008)
5. Executive S&OP Meeting	Finalize and approve the S&OP plan.	- Review and approve demand and supply plans - Set new targets and plans for the future	- Authorize the final S&OP plan. In other words, final consensus operating plan - Ensure alignment with business objectives.	Avila et al. (2019), Wallace and Stahl (2008), Benayiba et al., 2025).

6. Communication and Implementation	Communicate the approved plan to all stakeholders. External and Internal	- Communicate the plan to all departments and key stakeholders. - Update systems	- Ensure all parties are informed and aligned. - Update systems with the approved S&OP plan.	Avila et al. (2019), Roscoe et al. (2020), Benayiba et al.,(2025).
7. Performance Measurement	Measure the effectiveness of the S&OP process.	- Measure process performance - Use KPIs to track performance	- Identify areas for improvement. - Ensure continuous improvement.	Avila et al. (2019), Parravicini (2015), Benayiba et al., 2025).
8. Continuous Improvement	Identify and implement improvements based on performance measurement.	- Identify improvement areas - Implement improvements	- Enhance the overall S&OP process. - Adapt to changing environments.	Fakhry et al. (2022)

As a conventional S&OP refers to a process of connected stages that is defined by the level of collaboration within the organization (Roscoe et al., 2020), the steps it entails can differ from company to company. However, withing the organization employing S&OP, each stage in the S&OP process should be clearly defined and documented to

prevent any uncertainty, which ensures that practitioners know how to execute the process correctly (Fakhry et al., 2022). Also, continuously improving the process, especially in rapidly changing environments is crucial (Fakhry et al., 2022). This entails updating the process with the necessary steps in case collaboration level changes.

2.4 Demand Planning as a part of S&OP

Demand Planning is often referred to as the second step in the overall S&OP Plan (Wallace & Stahl, 2008). Demand Planning is a key part of the sales & operations process. The quality of an S&OP Process is determined by the quality of its core components, demand planning and operations planning (Vereecke et al., 2018). Therefore, the effective use of demand planning creates value in the overall business process and the organization implementing it. Demand Planning involves a set of activities the purpose of which is to forecast the future demand of a company's products or services (Cassettari et al., 2017) The end-goal of Demand Planning is to create accurate sales forecasts (Wallace & Stahl, 2008). Demand planning is often seen as one of the areas with the most significant performance deficiencies and is often misunderstood by supply chain and business leaders (Basson et. Al, 2019). Forecasts are important for financial planning and operational success (Wallace & Stahl, 2008).

A good S&OP process consists of sharing relevant information on created demand forecast (Kolassa & Siemsen, 2016). The base of information for a comprehensive demand plan is gathered from different areas of business, such as marketing and sales, and Operations (Kolassa & Siemsen, 2016). Marketing and Sales gives S&OP vital information on latest sales opportunities, product launches, new customers, and planned promotions (Kolassa & Siemsen, 2016). Operations give information on the current inventory availability and manufacturing capacity (Kolassa & Siemsen, 2016), so that demand can be balanced according to any limitations. A Company’s ability to leverage demand planning within S&OP can be seen as a key factor in its ability to achieve operational excellence and strategic success (Wolfshorndl et al., 2020).

In their book titled “Sales and Operations Planning: The How-to Handbook” (2008) Wallace and Stahl state that the goal of Demand Planning in an S&OP Process is to generate a management approved forecast. As this is also a goal of the S&OP process in general, it can be interpreted that forecasts are created and presented in the Demand Planning phase of the process. Wallace and Stahl determine Demand Planning to be the second phase in the process, after Data Gathering and before Supply planning phase. Demand planning is integrated with supply planning to create a balanced plan that aligns with the company’s strategic goals and therefore helps in managing uncertainties and adapting to market changes (Fakhry et al., 2024). Management forecasts, which consist of a statistical baseline forecast inputted with human judgement decisions, are usually lower in error than statistical forecasts because they tend to see the holistic view of the business (Wallace & Stahl, 2008). In this the key in the process is to capture the customer's view on their future demand and business progress (Wallace and Stahl, 2008).

Wallace and Stahl highlight in their book (2008) Some things to remember when executing demand planning. These are good to implement as a part of the process to make sure that these get done each S&OP round. The quality of these correlates directly to the quality of demand planning. Firstly, Wallace and Stahl point out the importance of documenting the assumptions made by management while creating the forecast. It is mentioned that it is important to keep documenting decisions made as the S&OP process goes forward. In a modern company environment, it is crucial to ensure that data flows correctly through all systems and all have the latest information. It is crucial that demand planning data is transferred seamlessly to other systems used in execution phase (Wolfshorndl et al., 2020). As data is documented and shared Wallace and Stahl mention that it gives the opportunity to defend the forecast if some decisions are questioned by upper management. This helps forecast creators to stay on top of things during all changes happening in each round. Wallace and Stahl highlight that it also provides a platform to review mistakes made in each round. This gives the possibility to learn from mistakes that have been made during each round. It supports continuous improvement of the overall process.

Second action Wallace and Stahl highlight is the involvement of new product Development in demand planning. They state that forecasts should include all new product launches and changes to the product family that is known for the forecasting range. It is important for the S&OP audience to see the future changes and make decisions based on them. Ramp-up / Ramp-down schedules are complex things to keep in mind when creating forecasts. It is also important to prioritize confirmed orders in demand planning (Wolfshorndl et al., 2020). Ramping a product down or up can be seen as confirmed demand as they are agreed manufacturing. Thirdly Wallace and Stahl point out the importance that management approval and sign-off has on the forecast and given demand plan. The more people sign off on it the more difficult it is to change. They point out that when the goal of a process is to produce a management level forecast, it is easier to approve when management has already been shown the forecasts and created demand plan. Wallace and Stahl also point out that forecasts are best made in unit measures rather than financial currents.

2.5 Benefits of S&OP

The most successfully operating supply chains aim for balance in success of each its area, improve their demand visibility and have more accurate forecasting, and isolate inflated costs to focus improvement techniques on (Blanchard, 2021). A well-executed S&OP process provides understanding of the current state, expected future demand and the supply as well as gives a basis for informed decisions (Logistiikanmaailma.fi). Companies often deal with costly mismatches in their supply and demand planning balancing, especially at the time of uncertainty, which causes necessary changes in an organization (Wagner et al., 2014). It is beneficial for an organization to implement singular parts of S&OP to their functions; however, this does not mean that S&OP should not be fully committed to (Wagner et al., 2014). Firms should continually improve the alignment process (Wagner et al., 2014).

The paper by Thomé et al. (2012) On Sales and operations planning and its relation to the firm performance, concludes that S&OP generally has a positive impact on company performance. Some positive impacts that an effective S&OP process gives to an organization are, controlling the negative effects of market uncertainty and improving performance by adding both internal and external collaboration (Olhager & Selldin, 2007; Nakano, 2009 as cited in Thomé et al. 2012).

Wallace and Stahl in 2008 list some benefits that result from executive S&OP process. The case company, business unit is often referred to as engineer-to-order which can be compared in Wallace and Stahl (2008) referred make-to-order. In case of make-to-order companies benefits of S&OP process are higher customer service, usually smaller customer order backlogs and therefore shorter leadtimes (Wallace and Stahl, 2008). Some other benefits include, higher productivity, better control of the business as well as better visibility to the future resource problems, in cases of too little or too much planned production (Wallace and Stahl, 2008).

A review of 55 papers indicates that Sales and Operations Planning (S&OP) generally has a positive impact on company performance. Key findings from the literature include that S&OP helps mitigate the negative effects of market uncertainty (Olhager & Selldin, 2007). Additionally, internal and external collaboration through S&OP improves performance, particularly with suppliers (Nakano, 2009). The use of inter-organizational information systems (IOISs) further enhances the benefits of S&OP, as these systems mediate the effects of collaboration planning actions and the strength of relationships on firm performance (Hadaya & Cassivi, 2007). Moreover, both formal and informal communication within the company is shown to boost performance (McCormack & Lockamy, 2005).

Overall, the S&OP provides the structure, process and tools to make sure that demand plan matches with other planning and executions processes in the organization (Gattorna, 2003). An effective S&OP process helps an organization to keep demand and supply in balance while achieving its business targets (Parravicini, 2015). As it is a very variable process it can be modified to fit organizations' needs. An S&OP process helps a company make decisions that are done based on the available existing information

whether it is hard facts or tactic knowledge (Logistiikanmaailma.fi). Table 2 presents the benefits of an S&OP process in a summarized table with corresponding literature.

Table 2. Summary of Benefits of S&OP

No.	**Benefit**	**Author(s)**
1.	Improved demand visibility and more accurate forecasting	Blanchard, 2021
2.	Understanding of current state, expected future demand and supply; provides a basis for informed decisions.	Logistiikanmaailma.fi
3.	Positive impact on company performance	Thomé et al., 2012
4.	Control of negative effects of market uncertainty	Olhager & Selldin, 2007
5.	Higher customer service; smaller customer order backlogs; shorter leadtimes; higher productivity; better control of the business; better visibility to the future resource problems	Wallace and Stahl, 2008
6.	Improved performance through internal and external collaboration	Nakano, 2009 (as cited in Thomé et al., 2012)

7.	Enhanced benefits through inter-organizational information systems (IOISs)	Hadaya & Cassivi, 2007
8.	Boost in performance through formal and informal communication	McCormack & Lockamy, 2005
9.	Keeping demand and supply in balance while achieving business targets	Parravicini, 2015

2.6 Key Performance Indicators to follow in S&OP

It is important to measure the performance of S&OP continuously as well as develop is as a process (Logistiikanmaailma.fi). Key Performance Indicators (KPIs) are important in creating a sales strategy and by implementing them, demonstrate leadership and help build a culture, which is focused on performance and continuous improvement (Parravicini, 2015). The aim of chosen performance indicators is to give a complete picture of a facility's performance (Cable and Davis, 2004; Varcoe, 1996; Brackertz, 2006; Amaratunga et al., 2000a; Amaratunga et al., 2000b; Lebas, 1995, as cited in Lavy, Garcia, & Dixit, 2014). It is important to recognize a set of KPIs that create effective performance evaluation metrics for the target facility (Lavy, Garcia, & Dixit, 2014). Developing KPIs to follow during execution can be identified as a key part of implementing and creating an S&OP process (Tchokogué, Ngniatedema, & Pache, 2022).

Chae in 2009 presents that defined KPI's are linked to the whole organization based on business units: Sales and Marketing, Production, Purchasing, Operation Strategy. However, he highlights that even though different business units work as a link, the combining factor for following organizational performance is sales and operation planning team. S&OP team should lead the monitoring of performance indicators (Chae, 2009). Based on a literature review done in 2015 by Anand and Grover, performance indicators can be

categorized into different levels of performance measurement. These categories include hierarchy-based categories, performance measurement system levels, financial and non-financial measures, primary and secondary metrics, supply chain levels, manufacturing and logistics, facility management and environmental performance, flexibility and innovativeness, and collaboration efficiency (Anand & Grover, 2015).

Key Performance indicators should not only measure financial performance but should also consider other important aspects such as the effectiveness of field sales, customer service, in-store execution and business planning (Parravicini, 2015). It is also good to consider "soft" factors, such as employee's behaviours, in following performance of an S&OP process or any other company functions. Key Behavioural Indicators (KBIs) are determined as a tool to highlight and encourage behaviours that can improve the performance of individuals and teams, as well as align with company values (Stentoft, Freytag, & Mikkelsen, 2021). By concentrating on their KBIs, companies can better achieve their determined KPIs (Stentoft, Freytag, & Mikkelsen, 2021).

Stentoft, Freytag, and Mikkelsen (2021) and Tchokogué, Ngniatedema, and Pache (2022) provide valuable insights into the key performance indicators (KPIs) essential for an effective Sales and Operations Planning (S&OP) process. These KPIs can be related to: Forecast accuracy, Productivity (Overall equipment effectiveness), Delivery, customer complaints, inventory levels and management and supply chain performance (Stentoft, Freytag, & Mikkelsen, 2021; Tchokogué, Ngniatedema, & Pache, 2022). KPI's in S&OP focus on providing information of and maintaining organizations operational costs (logistics cost) and customer experience level (delayed orders and lost sales) (Aiassi et al., 2020).

Tchokogué, Ngniatedema, and Pache (2022) provide examples of the KPIs implemented in creation of a new S&OP process for a certain case company. Forecast accuracy is followed by different metrics in Tchokogué et al.'s article comparing the expected or forecasted sales with the actual sales, per customer segment, per area of sales and in stock keeping units (Tchokogué, Ngniatedema, & Pache, 2022). Better accuracy in forecasts leads to more efficient planning, lower costs, higher customer satisfaction and greater

agility, while also serving as a beneficial KPI to help companies benchmark, monitor and continuously improve their performance (Dal Forno et al., 2024).

Stentoft, Freytag, and Mikkelsen (2021) also highlight following of forecast accuracy as a key performance indicator, to support the implementation they present KBIs, such as proactively asking forecasts from customers, having effective communication if there are issues identified in delivery as well as use of proven tools that give basis for the decisions that have been made. Stentoft, Freytag, and Mikkelsen (2021) mention that Staying open-minded and seeing the big picture are also an asset when striving towards better forecast accuracy. It can be said that these behaviours benefit all areas of business functions as well, especially when operating with external stakeholders. The success of S&OP depends on integration of different areas of organization, which requires strong behavioural commitment (Dal Forno et al., 2024).

Tchokogué et al.'s article presents on-time shipping, fill rates and average date late as examples of how to follow customer service levels. With the help of these the case company presented in the article was able to follow if and how much were late when delivering products to customers. Stentoft, Freytag, and Mikkelsen (2021) present behaviours to complement the Delivery on time in fully focused KPIs such as Proactive maintenance planning, Analysis of assortment and prioritization. Stentoft, Freytag, and Mikkelsen (2021) also mention the Keeping of promises and agreed lead-times, focusing on solutions not problems, and attending planned meetings being present and constructive.

Inventory management is presented as a value KPI to follow in the S&OP process (Stentoft, Freytag, & Mikkelsen, 2021; Tchokogué, Ngniatedema, & Pache, 2022). Inventory levels must be followed by levels of value and volume (Stentoft, Freytag, & Mikkelsen, 2021). The aim is to have full visibility of the inventory status in the supply chain (Tchokogué, Ngniatedema, & Pache, 2022). Effective follow-up of inventory levels provides profitable business. Aiassi et al. support that S&OP helps balance inventory levels with customer demand and ensure optimal production and delivery levels to meet market needs, while minimising costs and lost sales (Aiassi et al., 2020). Therefore, following

of inventory levels has been proven to be beneficial in following deploying an S&OP process. In support of inventory management Stentoft, Freytag, & Mikkelsen in (2021) present quality of work as an individual KBI. They elaborate the behaviour as considering the next recipient of inventoried products, by conducting this organization is creating more quality of work. E. “It has been pointed out that while financial performance measurements are important for strategic decisions and external reporting, day-to-day control operational activities like inventory management and distribution are better handled by non-financial measures.”

Supply chain performance is also a good factor to create KPIs based up-on (Tchokogué, Ngniatedema, & Pache, 2022). Choe 2009 presents primary KPIs to use in planning to be: Forecast accuracy, Planning cycle time, Total inventory Days of supply, and Cast-to-cash cycle time. He presents the Forecast Volatility, Forecast vs. Order, Days of Finished Goods at Sales and Manufacturing Subsidiaries, and Rate of Obsolete Inventory. The aim of this is to have overall supply chain visibility, agility and responsiveness (Tchokogué, Ngniatedema, & Pache, 2022). Table 3 presents the summary of KPIs to be used to measure a S&OP process with the corresponding literature.

Table 3. Summary of KPIs to follow in S&OP

Key Performance Indicators (KPIs)	**References**
Forecast Accuracy	Stentoft, Freytag, & Mikkelsen (2021), Tchokogué, Ngniatedema, & Pacheco (2022), Dal Forno et al. (2024), Chae (2009)
Forecast Volatility	Chae (2009)

Productivity (Overall Equipment Effectiveness)	Stentoft, Freytag, & Mikkelsen (2021), Tchokogué, Ngniatedema, & Pacheco (2022)
Delivery Performance	Stentoft, Freytag, & Mikkelsen (2021), Tchokogué, Ngniatedema, & Pacheco (2022)
Customer Complaints	Stentoft, Freytag, & Mikkelsen (2021), Tchokogué, Ngniatedema, & Pacheco (2022)
Inventory Levels and Management	Stentoft, Freytag, & Mikkelsen (2021), Tchokogué, Ngniatedema, & Pacheco (2022), Aiassi et al. (2020), Chae (2009)
Supply Chain Performance	Tchokogué, Ngniatedema, & Pacheco (2022), Chae (2009)
Logistics Cost	Aiassi et al. (2020)
Delayed Orders and Lost Sales	Aiassi et al. (2020)
Key Behavioral Indicators (KBIs)	Stentoft, Freytag, & Mikkelsen (2021)
Planning Cycle Time	Chae (2009)

2.7 Demand Forecasting in S&OP

Forecasts are predictions about what might occur in the future, such as timing or magnitude (Kumar, 2009). S&OP performed well can create a company a “window to the future” (Wallace & Stahl, 2008) and the overall goal of S&OP is to create a plan that is a more accurate reflection of a company’s supply and demand (Blanchard, 2021). This highlights the significance of reliable, well-justified forecasts. These forecasts are crucial for businesses because they help managers make decisions, better prepare for the future and work towards the goal of the organization (Kumar, 2009). Such forecasts can be used both internally and externally to project the future of a business. When accurately prepared they serve as a valuable tool for making informed financial decisions. Predicting future sales is very important for managing a company’s logistics and supply chain effectively (Fabianová, Kačmáry, Molnár, & Michalik, 2016). How accurate your forecasts are can impact how well your company plans, how well it meets its goals, how much it spends, and how well it satisfies its customers (Fabianová, Kačmáry, Molnár, & Michalik, 2016).

Forecasting can be described as both an organizational and a statistical process, the management of which is in the scope of S&OP (Kolassa & Siemsen, 2016). In product-based firms the most crucial objective of planning is to be able to provide the correct amount of the right product to the right customer, while avoiding excess inventory pile-up (Wagner et al., 2014). Based on Kolassa and Siemsen on their book “Demand Forecasting for Managers” published in 2016, they explain that forecasting can be divided to an input and output side, which are based on the same information from different areas of S&OP, marketing and sales, operations, Finance, and human resources. The variables which determine what type of market conditions for demand forecasting are Supply, Demand, Product characteristics and Competitive environment (Hugos, 2018). As the S&OP process may differ based on an organization’s characteristics so can the forecasts needed, and their creation process be different.

Supply Chain Management is based on demand; hence planning begins with current and expected customer orders (Stadtler, 2005). That information works as a basis for creating

forecasts to be shared with key stakeholders. Demand forecasting and demand planning aim to have the same goal, giving visibility for the future. The change to demand planning happens when the unexpected outside effects, such as changing market conditions or global catastrophes, are considered (Stadtler, 2005). While forecasts give input for more accurate planning, it Is also good to keep in mind that frequently made changes to demand forecasts can cause big shifts in plans and therefore create uncertainty as well as instability (Stadtler, 2005).

One of the crucial IT tools that need to be developed when creating an effective S&OP process are the tools that are meant to support the creation of more accurate forecasts and create probable scenarios of future sales (Tchokogué, Ngniatedema, & Pache, 2022). It is beneficial to use the help of IT tools in creating sales forecasts in the S&OP process. As the basis of the forecast is the sales demand phase of an S&OP process, the IT tools needed must be updated with the correct data regarding the organization's demand planning. Also, a forecast is created by using an S&OP process which consists of sales, marketing, and demand planning agreed numbers for a comprehensive plan, which is then confirmed by management (Blanchard, 2021). Therefore, the creation of a forecast does not require IT tools. However, it is mentioned in many literatures that the use of IT tools improves forecast accuracy. It is also possible to forecast given data using multiple methods and then choosing the one that gives the best results (Fabianová, Kačmáry, Molnár, & Michalik, 2016).

The study conducted in 2016 by Fabianová, Kačmáry, Molnár, & Michalik, presented two separate methods for forecasting sales demand. The first method presented in the study forecasted sales based on historical data and the fluctuation based on a time series (12 months). The second method presented in the 2016 study by Fabianová, Kačmáry, Molnár, & Michalik, forecasts sales based on seasonality as well as known events. In the second method it is possible to put more emphasis on some periods of the time series to increase forecast accuracy (Fabianová, Kačmáry, Molnár, & Michalik, 2016). There can be times of the year when it is possible to perceive that there is an increased or decreased amount of demand, for example closing bigger sales projects before the end of the year.

The second method was proven to be more accurate in this study (Fabianová, Kačmáry, Molnár, & Michalik, 2016).

Even though forecasting and plans have been made combining all areas the probability of a completely accurate forecast is low, therefore it is vital that effective communication practices are at place in the process (Blanchard, 2021). Or in other words even the most accurate and carefully created forecast cannot be fully trusted. A forecast is only a guess based on current knowledge.

2.8 Objective of literature Review

The aim of Section 2 (Literature Review) is to provide a comprehensive view of Demand planning as a part of an S&OP process and how to enable it in a company. Section 2 aims to answer this by providing background of a generalized S&OP process as well as Demand planning concepts. This Section also provides a list of Key Performance Indicators (KPIs) to follow in an S&OP process to follow its performance and continuous improvement. This provides a framework for a company using demand planning and an S&OP process as a base for forecasting and business planning.

3 Research methods

3.1 Research approach

The research was conducted using mixed methods. The first part of the study is conducted through qualitative study which includes semi structural interviews with 11 employees of the case company. Interviews are conducted within the sales team of business unit. This is seen as a key contact group for the researcher because the S&OP process and especially the demand planning process is done tightly together with the case company's sales team.

To complement the results gathered in the qualitative part of the study, also historical data of projects sold and completed by the case company was studied. This is compared to the results of interviews and used as a guide to help analyze the data received. The data is measured by metrics which are applied in the comparison. This gives the possibility to validate or contradict data derived from interviews as it is based on unique human insight and may differ based on the interviewee's opinion. The measures combined give a more fact-based understanding of the industry and case company business.

Together these two data points provide a comprehensive view of the current state of the case company process and the performance of it historically. As both data points and research methods are used it helps the researcher to compare results in a more comprehensive way. A Mixed method study widens the understanding of the complex issues that may arise (Adu et al., 2022). Fact based quantitative data is complemented by qualitative data and the human based factors can be analyzed better with historical results to minimize the effects in qualitative data. This is then used by the researcher to provide suggestions for the case company business unit process improvement and answers to the research questions.

3.2 Data Collection

The data in this thesis work was collected in two separate ways. Firstly, data was gathered by conducting interviews with internal personnel involved in the demand planning process. Secondly, a report was run from the case company internal CRM system. The collection of data was conducted using the Sales and Operations team's access to available case company systems and planning tools.

3.3 Interviews

The following table includes all the interviews listed by their role in the business unit as well as the region in which they work in. The interviewees have been divided as this to have insight into different roles and how they operate in different regions. The S&OP team has not been included in the interviews, because the researcher has knowledge on the S&OP team functions.

3.5 Data Analysis

Data is analyzed through results of literature review of the general S&OP process, which is combined with the author's knowledge of case company business unit S&OP. The thesis is done using mixed method, so the data analysis is done first in two separate parts. This includes first analyzing the results of qualitative study portion, the case company salespersons interviews as well as the second quantitative case company historical data study conducted with the "Closed Won" report. Interview results are compared with each other by region and role. Based on the role of interviewees the answer is compared to the corresponding answers in different regions. Quantitative data is analyzed using Figures, which display the market development over the report's lifespan. Some calculations are used to support the study of sales regions year by year.

After the methods have been analyzed separately the correlation between results is studied. This enables a comprehensive case company Demand planning study as the results of employees are compared with actual data from past sales at case company business unit. It is possible to analyze the impact of possible mismatches within the two-way method. This comprehensive approach provides suggested actions for the company in their demand planning process improvement objective.

3.6 Validity and reliability

The validity of interview results is ensured by choosing interviewees based on different roles and regions. The conducted thesis aims to study differences between regions within the case company business unit sales team. Interviewing the same roles in different regions enables this aspect of the study. However, interviewing people in the same company and working in the same role can create limitations to the studied data. The number of interviews were increased to aid in minimizing the effect of limitations. Also, one interview was considered more on the interviewees previous external experience in S&OP and demand planning. The author has considered this when conducting data analysis to further minimize the effects.

Qualitative data cannot be considered as only factual as it is affected by human nature. In combination with quantitative data the study results give an accurate description of the case company business unit's situation. Both parts of study complement each other as the quantitative part requires understanding of case company operations within the process, which the interviews provide. On the other hand, qualitative study needs to be supported by historical data to help accurately analyze the results and minimize effects of the interviewees being solely from the sales team of case company business unit. Data in quantitative part of study, Closed Won report, is derived by the author themselves using internal access of case company data.

4 Research results

The research results will be presented in two parts, qualitative data and quantitative data. First the Interview results will be presented by combining comments from case company employees' results on the questions presented on the template. This will be demonstrated by three tables, which present the views of interviewees and the ways of working in each area. The table is also visually built to present the distinct roles per area together so that they can be effectively compared. Historical data report is explained and the key metrics derived from it are presented by tables and Figures comparing different areas and the timeline of project execution. Both data points are studied using the knowledge presented in the literature review part of the thesis. They are also compared to support or contradict each other.

4.1 Qualitative Data – Interviews

The data from the interviews is presented in three separate sections that give the insights from the interviewees in a presentable and comparable format. The complete results are added as table appendices in the end of this thesis. Tables are divided and arranged by the interviewee's role and each table lists the comments, views and opinions of the interviewee based on the focus area of the study. Data validity and data management is the focus area of the first table. The second table focuses on planning activities and rules that affect S&OP team. The third table presents what is the status of collaboration and process, and presents insights related to roles and responsibilities of the case company. The results are summarized for this thesis.

4.1.1 Data validity and management

Data management is very important in the company business unit’s demand planning process as the main source of information comes from a different team than the S&OP

team. The aim of the interviews was to see how the data is determined and managed throughout the demand planning process. It was also studied that, who maintains the data and how different data points affect each other. The source of data is also studied in this part.

4.1.2 Planning rules and habits

In this part of the study different interview findings based on planning habits or rules are presented. These points give a base for the case company business unit S&OP team to deepen their understanding of the demand planning process. This is studied to see if there are some rules that can be applied to make demand planning more accurate. Also, it is studied if there are differences in ruler or habits among regions and could these be improved.

4.1.3 Collaboration and current process

The collaboration and process part of the interview results studies the current state of the process and if there are any improvement points to be applied. A wider understanding of what happens in the sales team demand planning process combined with the understanding of the S&OP process enables more fluent cooperation among the two teams. This, therefore, enables more accurate planning and forecasting done by S&OP team and more efficient data management and understanding of the meaning of planning by the sales team.

4.1.5 Improvement suggestions from interviewees

The interviewees pointed out areas for improvement that could enhance the demand planning process and the collaboration between the sales team and the S&OP team. One

of the key suggestions from the sales team was there is a need for simpler tools that allow them to easily see available capacity and other relevant information provided by the S&OP team. This would streamline their workflow and improve efficiency. In addition, the life cycle of different product versions is described by interviewees as short, so flexible tools that can adapt to constant changes are needed. This flexibility is crucial to adapt to product development and ensure accurate demand planning.

The previous simpler interface for tools translates to supplier information sharing which, as pointed out previously, needs improvement in the process. Supplier information related to, for example, their capacity, must reach the sales team because they are the team in charge of demand planning part of the S&OP process. Availability of data of what is available and when, was experienced to improve the overall planning of projects schedules, especially in cases of product or supplier ramp-up. It was also highlighted that earlier involvement of schedulers from both the project management team and S&OP team would enable anticipation of potential issues and easier transition between teams.

BDMs stressed the importance of having clear guidance on probability assessment in order to improve the accuracy of demand forecasts. The development of these guidelines would provide a more structured approach to estimating project probabilities and improve the reliability of forecasts. In contrast there is a need for probability to be the overall view of project likelihood. It was determined as a metric that can be affected by the general feeling of the project by the BDM.

Within the sales team recognizing experienced experts and best practices among the sales team and sharing these techniques across the team can help improve the overall process and the performance of the entire team. This was presented by multiple interviewees. This can also translate to more collaboration within the regions as well to establish a clear way of working. It was noted by an interviewee that it is presumable that data is managed in a similar way, however this is seen by the research that this is not always the case.

5 Discussion and Conclusions

As the study was conducted using two different methods, the results are expected to have both differences and similarities. Comparing these similarities and differences provides a view of why there are some difficulties within the case company business units demand planning. Literature review concludes the characteristics of demand planning and how it affects the overall S&OP process in general. Combining these views, it is possible to view the state of the case company business unit's demand planning and make suggestions for case company.

The probability of a project in case company business unit's demand planning defines whether or not a project will be added on the created forecast. Therefore, this is one of the key metrics that is used by sales and planning teams. Qualitative study results indicate that sales members frequently rely on their "gut-feeling" to estimate the probability of the project. This subjective approach is seen as useful, especially when historical data is limited or when market conditions change rapidly. However, some interviewees contradicted this. It can be determined that there are differences in how this is evaluated by region. Others claim to have clear criteria to add consistency across salespersons, while others see this as an opportunity to provide a more human aspect to planning. This suggests that when each region or salesperson uses their own methods or judgment, results become less standardized and harder to compare, therefore it can be argued that there should be clearer criteria in place to increase consistency. However, there should also be a possibility to affect demand planning with a more comprehensive human aspect. The literature supports this and points out that the best results often come from integrating both approaches where human expertise fine-tunes data-driven forecasts.

Interviews revealed that regions have developed their own planning habits, such as differing templates for Go/No-Go decisions, which can also lead to inconsistency in planning in different regions. The quantitative review also reveals the number of projects signed and their capacity. According to analysis MEA region stands out for larger average project size, however AMER has the overall largest volume. The AFEU region is seen as

more stable. Therefore, the regions have very different markets, which requires some differences in planning activities. Literature supports the need for harmonizing processes while maintaining enough local flexibility to account for market conditions (Kolassa & Siemsen, 2016). Differences in planning habits across regions, which do not support forecast and planning accuracy, are one determined improvement point. An active information sharing culture and organization-wide collaboration can be seen as a solution. It is concluded from interviews that determining best-practices and sharing them across sales team spreads expertise internally. This was supported in the literature part of the thesis to be an aspect necessary for an effective S&OP process. Therefore, improvement in these points of demand planning can be seen to have a clear effect on case company business units S&OP.

In both results it was clear that there is an on-going need for continuous improvement of the process. Interviewees advocated for simpler interfaces and more dynamically adaptable tools, while the quantitative trends indicated periods where data was not applicable for study. Quantitative data inaccuracy prevents its usage, for example some KPIs, while supporting these human aspects, which limits the accuracy of overall demand planning. It was supported also in literature review that on-going process improvement is a key part of S&OP process (Fakhry et al., 2022).

5.1 Development suggestions for Case Company

Suggestions for development were gathered from interviews, which were related to all aspects of demand planning within the S&OP and Sales teams of the case company. These included the need for simpler and more flexible tools to provide more accessible insights into available capacity and other relevant S&OP information. The increasing need for supplier capacity data was also highlighted. The aim of broader data sharing was determined to help sales with more accurate project scheduling with more frequent product changes and supplier ramp-up planning. An active information sharing culture

and organization-wide collaboration was also determined in the literature part of the thesis to be an aspect necessary for an effective S&OP process.

For data management the suggestions for case company can be identified both from interviews as well as the historical data report analysis. The study found that improving the accuracy and consistency of data is crucial. Data in the study was derived from the system used to document and manage data in current demand planning. Therefore, accuracy of the historical data correlates to the accuracy of current demand data of projects. Project data should be regularly cleaned and validated to ensure that forecasts are created from dependable data. Data accuracy is concluded to be a key factor in overall S&OP excellence; therefore, it is vital for the case company to validate it often.

From interviews it can be concluded that the sales team would require clearer guidelines to assess project probability as the determination method currently is seen as subjective. However, this can also be seen as an advantage as it is seen as indication of the "gut-feeling" of salespersons, which can be beneficial when considering overall probability of project. With this probability set as subjective measure, there is a possibility and risk to increase differences between region and salespersons within the same team. Which can decrease the trustworthiness of this metric. In other hand the overall accuracy of the probability metric increases when there is possibility to have human consideration and sales expertise affect it. Identification and sharing of best practices internally in the sales team could aid in also increasing consistency regarding this metric within regions and roles. Recognizing some of the practices of experts within the sales was concluded to be one of the improvement suggestions of interviews.

From literature review we can conclude that using of KPIs in breaking down performance of S&OP or demand planning is beneficial for an organization. Key KPI to measure performance of forecasts can be concluded as forecast accuracy, this is also highlighted in interviews. Following this metric provides a way of objectively assessing the effectiveness of planning and collaboration. Other quantitative KPIs to follow are performance

and forecast trends by region as well as project closing rates and scope changes. These can provide more objective feedback to use in determining best practices and the overall situation of the business unit industry. Integrating these quantitative monitoring practices will make demand planning not only more efficient, but also measurably more accurate and reliable. To add, if discrepancies are found between forecasted and actual results, it should lead to active measures in process development and data management changes to ensure results lead to noticeable improvements.

5.2 KPI suggestions for the case company S&OP Process

It can be determined that one of the key improvement points for the case company's S&OP process is the creation of new effective key performance indicators. As mentioned previously, developing KPIs can be identified as a key part of implementing and creating an S&OP process (Tchokogué, Ngniatedema, & Pache, 2022). For the case company one of the main points also to consider is that in what forum and broadness the developed KPIs are shared.

Forecast accuracy is usually one of the first KPIs implemented in a company S&OP process as described in the literature part of this thesis. This can be shared with key stakeholders internally and externally. The suggestion is that forecast accuracy is measured in (1) Number of projects expected to be sold divided by regions, and (2) Equipment capacity expected to be sold divided also by regions. These metrics are then compared with the contracted projects data.

The aim of adding KPIs to the case company business unit S&OP process is to provide metrics that provide insight of the completion of projects and how the market operates. For this reason, it is beneficial to see how and how many times a project's scope changes during its signing timeline. These metrics can be then applied to future projects to ensure that the team is prepared for any changes which are likely to occur, and the team

makes informed planning decisions. To view the change in equipment capacity that happened per each project the equipment capacity can be compared to the equipment capacity presented in the first offer to the customer vs. What the equipment capacity was at the time of closing/signing the project. Providing a percentage of this change presented by regions monthly ensures the overall situation visibility.

Even though this thesis's aim is to improve demand planning, it is beneficial in KPIs to have visibility to the overall S&OP process, which includes also supply planning. This means that KPIs should be measured also regarding the supply chain and its performance. The supply chain in the case company business unit S&OP process could be measured through its transparency and responsiveness. Transparency can be measured for example by estimating how well we have information on supplier availability or capacity constraints. This KPI could be followed by setting up a target to when we receive the optimal information, for example 100 % is when information is received from each supplier once a month during the S&OP process supply planning phase. This can be measured by many indicators such as maximum capacity, lead-time and exceptional issues or constraints they may have. KPI can be followed by comparing the actual times of information sharing to the target. Supply chain agility and responsiveness can be followed by creating KPIs around the supplier responses to changes happening in the project schedules and if the change creates any delays in manufacturing. By for example measuring confirmation of forecast, which is already to some extents followed by case company. Following this we can determine which suppliers are the most responsive and therefore determine which is the bottleneck equipment.

After the project is signed and agreed to deliver at a certain time, project schedules can change, or issues may arise in project manufacturing or shipping, which cause the project to be late. This lateness can be followed by measuring on-time shipping percentage as a KPI. This can be followed by the number of projects that had delays being the basis of percentage. If 30 of a 100 completed project were late the On-time shipping percentage would be 30 %. Because the time by which the project was late is significant in the

overall project execution for the case company industry, a beneficial KPI to follow is also Average days late of delivery. This KPI can be measured also by different times such as month or week, which could give a more comprehensive view of project schedule lateness. This KPI is calculated with the average time that each project has been late. Average day/week/month late could also be calculated based on the planned dates regarding delivery such as closing date of the project or planned delivery date. This could demonstrate again the accuracy of the demand planning process. The changes between the dates would be compared to what they were at the time of first offer or S&OP process introduction and then at time of closing/signing the project.

Fill rate KPI could be used to show how well the customer demand can be filled. Fill rate is the percentage of customer demand met without backorders (Investopedia.com, 06.04.2025). This can be followed by measuring the unconstrained demand and seeing the effect of possible constraints such as resource deficiency at supplier or case company. With the case company projects this can be explained in other words the number of orders that cannot be ordered because of the lack of available supply. If 10 projects of a hundred would have issues, then the fill rate of project would be 90 %.

For longer range planning, firstly the alignment of production can be followed, in other words how many projects have been planned, measured at time of S&OP introduction, compared with what was ordered on a yearly and monthly basis. This KPI progress can then be followed to see where the case company business progresses. This measure can be followed by equipment capacity measure or number of projects. Secondly the following of capacity utilization provides longer range view through the supplier's effectiveness. The maximum capacity of suppliers is compared with the capacity that was used. This, however, requires frequent and accurate information sharing with the supplier which can complicate the following of this KPI. Capacity utilization can also be at use when considering new supplier integration, is it a needed process or is there a possibility to allocate projects differently.

5.3 Theoretical and managerial implications

The study contributes to the existing literature in combining the learnings regarding a generalized S&OP process among the references in literature review (Section 2, table 1). The study also provides a combination of an effective S&OP process benefits (Section 2, table 2). In this the generalized steps of an S&OP process are presented. It also creates a framework for businesses to enable in an effective S&OP process and demand planning in their business. The study contributes to the existing studies with providing a case study of a system integrator company, the supply chain of which is relatively different to the ordinary manufacturing company.

The thesis study also provides clear suggestions for the case company on how to improve their S&OP process and demand planning, by enhancing collaboration, using of simpler and more flexible planning tools, enabling performance follow-up (KPIs) and data accuracy. The study also provides a list of Key Performance indicators to follow in their S&OP process. This contributes to the studies done in the topic of S&OP by providing instructions for management to follow when aiming to improve their process. The thesis suggestions are created specifically for the case company business unit, however they can be used as reference for other companies as well.

5.4 Answering research Questions

1. What are the factors that affect demand planning to support S&OP process in a company?

Several key factors influence demand planning in support of a company's S&OP process. Firstly, the quality of data from sources like sales, marketing, operations, and external partners are fundamental for accurate forecasting. The choice of suitable forecasting techniques, quantitative, qualitative, or hybrid is also crucial. Collaboration and open

communication within the organization and with suppliers or logistics partners are essential to combine all available knowledge as one coherent plan. Management commitment, clear alignment of goals with business strategy, and regular involvement in the approval process of demand planning increases accuracy and internal alignment and therefore enhances S&OP process effectiveness. Continuous measurement and improvement practices, supported by well-chosen Key Performance Indicators, help maintain and improve the demand planning process over time. Together, these factors enable organizations to efficiently align demand with supply, respond proactively to market changes, and achieve the strategic objectives of their S&OP process.

2. How to forecast the most probable projects in demand planning phase to support S&OP process in the case company?

To forecast the most probable projects in the demand planning phase and effectively support the S&OP process in the case company, case company should aim for a multi-faced approach, which combines human judgement-based decisions with clear criteria of data to produce a list of projects in forecasts. This can be supported by creating standardization base for probability assessment, which is shared across regions. With the help of historical data study, the understanding of forecasting decisions should be broadened across the sales, project management and planning teams. This would support reducing inconsistency across teams and regions. Regular validation and cleading of data as well as adaption of more flexible tools and KPIs, will increase forecast quality. Key performance indicators should be incorporated to the S&OP process within the case company to support on-going development.

3. How to control and improve the uncertainty in demand planning to support S&OP process in the case company?

The industry of case company business unit is seen as unpredictable. Broader collaboration and information sharing regarding supplier capabilities and product updates will

help create a more accurate forecast as it will give sales an accurate description of the market situation and provide insights to which type of projects to pursue. Clear communication and collaboration both internally and externally will provide agility to case company in rapidly changing environments. Problems can be solved faster. As an S&OP process aims generally to balance demand and supply and help with mitigating change, focusing on forecast accuracy with data quality and conducting an effective S&OP process, will help minimize the effects of the unpredictable environment. Regularly monitoring KPIs, such as forecast accuracy will help identify improvement needs in the process and measure its performance.

Table 8. Research questions and summary of results.

Research Question	**Summary of results**
1. What are the factors that affect demand planning to support S&OP process in a company?	Ensuring data quality, selecting correct forecasting method to create most accurate forecast, collaboration within whole organization, market/customer insights, visibility to possible constraints, use of KPIs to follow process performance.
2. How to forecast the most probable projects in demand planning phase to support S&OP process in the case company?	Broaden understanding of future planning with study of historical data, increase standardization of probability scoring, add monitoring of KPIs, determining and sharing best practices of sales, add collaboration with more communication cross functionally.
3. How to control and improve the uncertainty in demand planning to support S&OP process in the case company?	Enhance collaboration and information sharing within sales and planning, maintain clear communication to help mitigate change, ensure quality of data to create more accurate forecasts, monitor KPIs to ensure on-going development.

Table 11 presents the answers to research questions in a summarized format.

5.5 Limitations and suggestions for future research

The thesis itself was limited to studying the demand planning part of the S&OP process as this was views to provide noticeable improvement to the overall process. As case company focuses on external supplier manufacturing, control of supply planning is separate from demand planning in this sense and therefore would require a larger scope of study, which was seen as ineffective for this thesis. The aim was limited to seek improvement points in case company business units demand planning. Therefore, there is a gap for future research in the supply planning part of the process.

Suggestions are excluding numerical statistical forecasting based on historical data as a part of Demand planning, which was highlighted in literature part of thesis. Based on interviews and instructions from the case company, the industry is seen as too unpredictable at this point to create numerical forecasts as basis of planning. This, however, can change in the future, when there is a need for more studies on how to incorporate statistical forecasting.

The literature review supported the following of Key behavioral indicators (KBIs), however this is left out of the suggestion part for case company due to the difficulty of measuring it. KPI related suggestions were considered only from this limited scope which was seen to be possible for case company. This also limits most of the KPIs related to collaboration across teams. The level of collaboration between sales, production, and distribution teams is difficult to quantify. While the frequency and quality of meetings can provide some insights, these are soft KPIs without concrete numerical measurements. This makes it challenging to integrate these aspects into a single, consistent Sales and Operations Planning (S&OP) process.

5.6 Conclusions

The two-way study that was conducted with qualitative and quantitative methods, provides results that have both similarities and differences. Combining these two views provides a comprehensive and more accurate description of the current state of the case company business unit's demand planning. The qualitative part of the study, conducted with salespersons interviews, emphasizes that good data management, open communication, and personal judgment (like salespeople's "gut feeling" when assessing the probability of winning projects) are all important. The interviewees also mentioned they need better tools, clearer guidelines, and more opportunities for sharing information across different teams. These points match what the literature review highlighted: cross-department cooperation and good information sharing are essential for successful sales and operations planning.

Data in quantitative results showed that there are irregularities in the number of projects signed and no clear trends over time or across regions. This lines up with results of interviews – the case company business units demand can be unpredictable, and the industry can be erratic. Literature review results also support these findings: it can be especially challenging to forecast demand in project-driven industries where orders and needs change frequently (Singh et al., 2024; Wallace & Stahl, 2008). Improving accuracy and consistency of data was highlighted in both qualitative and quantitative results. They were concluded to be a key factor of better forecasting and planning, which was supported by literature. Also, literature review confirmed that using the right KPIs and updating data regularly are necessary practices in demand planning (Singh et al., 2024).

Overall, interviews provided a more human side of demand planning viewing also the interviewees experience of the current process. This was then supported by the data analysis, which offered an objective perspective. Both results are supported by the literature review and suggest that the best improvements come from combining strong data management, clear processes, fluent cooperation and balanced approach to demand

planning. Literature review results confirm that ensuring an effective demand planning process withing an organization clearly contributes to an effective S&OP process.

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Appendices