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# Developing Sales and Operations Execution Process within the Sales and Operations Planning Framework

## Case: Neste Oyj

Master´s Degree in International Business Management

Spring 2024

KAMK • University of Applied Sciences

## Abstract

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**Title of the Publication:** Developing Sales and Operations Execution Process within the Sales and Operations Planning Framework. Case: Neste Oyj

**Degree Title:** Master of International Business Management

**Keywords:** Business planning, Sales & Operations Execution, Sales & Operations Planning, Process Design, Process Development

This thesis focused on evaluation of the current state and maturity level of Sales and Operations Execution (S&OE) process within the broader Sales and Operations Planning (S&OP) context and on the identification of the key areas of the S&OE process that required development at the commissioning company Neste Oyj. S&OP and S&OE are both business planning processes helping organizations to align and clarify their strategic goals, customer demand, and operational capabilities altogether to make company level decisions based on and justified by data.

The main purpose of S&OE is to balance supply and demand in short-term and to align the plans from S&OP – a process focused to mid-term planning – to executable actions in the daily operations of a company. The objective of this thesis was to re-design Neste's current S&OE process, by enhancing its maturity by creating a standardized, transparent, and efficient approach to daily operational planning. The case company has implemented processes for both S&OP and S&OE, but the current process analysis of the existing S&OE process revealed difficulties in distinguishing between mid-term and short-term planning, as well as challenges in aligning S&OP plans to executable actions in S&OE. Additionally, case company doesn't currently have any implemented key performance indicators (KPI) to actually track and follow the performance of their S&OE process.

In the theoretical part of this thesis, the business planning framework and key characteristics of business planning processes are discussed. Integrated Business Planning (IBP) and Sales and Operations Planning (S&OP) are explored, with differing definitions found in literature. While some sources consider IBP synonymous with S&OP, other sources view it as a distinct process, where the distinguishing factor is the level of maturity. Consequently, both IBP and S&OP are covered in this study's theoretical framework. Due to the scarcity of literature explicitly on S&OE, it was essential to primarily utilize S&OP literature and publicly accessible sources such as blogs and internet articles concerning S&OE to support the creation of a new S&OE process. This thesis focuses specifically on the managerial aspects of the S&OE process within the broader context of the business planning framework, highlighting the importance of understanding the interconnectedness between S&OP, S&OE, and other planning concepts.

This thesis employed a constructive research methodology with a both qualitative and quantitative research approaches to develop concrete solutions to the existing problem at Neste Oyj. It involved quantitatively analyzing responses from company stakeholders associated with the current S&OE process through surveys, as well as qualitative document and content analysis and examination of the company's current key performance indicators. These methods were instrumental in identifying the current state of the S&OE process and to find the areas for improvement. The resulting research findings, derived from these thorough methodologies and subsequent analyses, were considered reliable.

Based on the research results, deliverable of this thesis was a development proposal created by combining relevant theory and literature with an analysis of the current state and identified areas for improvement, in a form of a robust, effective, coherent and transparent new S&OE process description and KPI parameters for the tracking of the performance of the process. For the purpose of continuous improvement of the S&OE process in the future, further development ideas were also shared to the company.

PREFACE

First and foremost, I would like to thank my employer, Neste Oyj, for providing such an exceptionally interesting and important research topic for this thesis. The sales and operations execution process turned out to be significantly under-researched, and exploring this subject has been a highly educational journey. I also want to express my special gratitude to Aleksi, Elina, Jaakko, Juha-Antti, and Juuso. The world is changing at an extraordinary pace, and the past years have brought their fair share of challenges to all of us. However, working alongside you has made navigating these difficulties not only manageable, but also extremely rewarding and enlightening by all means. Your support, collaboration, and friendship have been invaluable, and I am truly grateful for the journey we have shared. Also, I would like to express my gratitude to my supervisor, Petri Koponen, for your extremely useful support and mentorship throughout this project, and to Jaana Lappalainen for your valuable final tips and guidance to finalize this project.

Lastly, I want to thank my dear family and all my friends who have supported me not only throughout this project but also in life in general. Sharing life's joys and sorrows with others is what makes it genuinely meaningful. I truly appreciate all of you.

In Vantaa May 23rd, 2024

*Mikko Liimatainen*

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Abbreviations

| | |
|---|---|
| APICS | American Production and Inventory Control Society |
| BMPN | Business Process Model and Notation |
| ERP | Enterprise Resource Planning |
| IBP | Integrated Business Planning |
| KPI | Key Performance Indicator |
| MPS | Master Production Schedule |
| MRP | Material Requirement Planning |
| OTIF | On Time In Full |
| S&OE | Sales & Operations Execution |
| S&OP | Sales & Operations Planning |
| SCM | Supply Chain Management |
| SKU | Stock Keeping Unit |

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# 1 Introduction

The business landscape of companies in the present time faces several challenges such as tightening global competition, increasing supply chain complexities, growing customer expectations, and the never-ending necessity to continuously boost global revenues while still maintaining cost efficiency. Additionally, for the past few years, these challenges have also been compounded by the current economic conditions where there has been a globally recognized excess of supply over demand in many industries. (Chase, 2016, 1-2) Thus, addressing the balance between supply and demand has emerged as the most important challenge of many companies' management to resolve in order to achieve and maintain seamless operations within their supply chains. Once the unpredictability of markets and their fragmentation are also added to this equation, it has become evident that companies need to start adopting more streamlined, targeted and demand-driven supply chain processes in order to increase their financial performance whilst also keeping up with the increased customer demands. (Chase, 2016, 2)

According to (Wallace, 2004, p. 3-4), sales and operations planning (S&OP) is one such cross-functional business process developed specifically for manufacturing companies to attain maximum profitability and customer service level by the synchronization of their demand and supply. (Gianesi, 1998) further explains that S&OP is a process that establishes a connection between manufacturing and top management, as well as with other functional areas within the company.

However, whereas S&OP oversees monthly and quarterly plans in the so called "tactical horizon", a new planning dimension focused on the shorter-term balancing of supply and demand in "operational horizon" – termed sales and operations execution (S&OE) by Gartner – has emerged in recent years. S&OE aims at contributing additional value to companies by managing all the daily and weekly fluctuations in demand and supply by actively monitoring real-time data and adjusting variables, such as production rates, inventory utilization and transport plans, whilst executing the tactical plans from S&OP. Therefore, the aim of S&OE is to enhance the flexibility of supply chains and supplement S&OP, by guiding its plans through various stages and to also adjust those plans, when it is justified or required. (Hoey, 2018)

Sales and operations planning (S&OP) is an integrated business planning process aimed at harmonizing customer demand with supply capabilities in the medium- to long-term. S&OP serves as a tool for vertically aligning business strategy with operational planning and horizontally aligning demand and supply plans (Tuomikangas & Kaipia, 2014). Sales and operations execution

(S&OE) then aims to bridge the space between S&OP and daily operations, by acknowledging the limitations of S&OP's long-term plans in addressing short-term challenges like shipping delays and unplanned equipment downtime (Riverlogic, 2023). Feigin (2011, 71) states that S&OP supports informed decision-making in production, inventory, and resource allocation, through a shared understanding of customer demand and operational constraints to supply in longer-term horizon. S&OE then facilitates the efficient execution of the S&OP plan in near-term horizon whilst also considering all day-to-day changes to key variables, such as demand deviations or production constraints (Carvalho, 2018, 44). Therefore, S&OE is often considered to serve as a complement to S&OP and as such, is gaining prominence as a focal point for supply chain organizations to implement (Kennedy, 2021). Together these two processes, S&OP and S&OE, excel at aligning company's strategic goals to tactical and operational capabilities and limitations, by providing visibility and clarity to decision-making. Tangible benefits that can be derived from both processes, S&OP and S&OE, include for example increased customer satisfaction, operational efficiency and the financial performance of the company, but their benefits are actualized just on different organizational levels and with different scopes in terms of time. (Skyplanner, n.d.)

The basic structure of this thesis is based on following parts: introduction, theoretical framework, research strategy, empirical study, process development and lastly, discussion. In the first part of this study, brief background for the research objective of the study is explained, followed by research scope, research problem and research strategy. In the theoretical part of this study, the focus is mainly concerning S&OE, where its typical characteristics and implementation requirements are thoroughly discussed. Due to the nature of S&OE being subordinate to S&OP process, S&OP as well as the business planning framework in general are also described and discussed to the extent that is required in order to understand the interconnectedness of them all.

Since integrated business planning (IBP) is often in literature mixed with S&OP, it is also explained in theoretical part of this study to clarify the distinction and to enhance overall understanding of the planning processes. Prior to the empirical study, the case company is briefly introduced. The research strategy is then outlined, detailing the methodologies and approaches utilized, and their justifications. Additionally, a specific S&OE maturity model is introduced, which integrates theoretical background and the author's own expertise and knowledge of the field. This model serves as a framework for evaluating the maturity of the case company's S&OE processes, enabling the further process development later on.

In the empirical part of the study, focus is on analyzing and reviewing survey results from individuals associated with the S&OE process through a survey concerning different elements of it, and

further information about the research subject is sought by conducting theory-driven thematic content analysis of the internal documentation regarding the current S&OE configuration. Thus, the empirical study is conducted by utilizing quantitative, and qualitative research approaches. Following the research, the next chapter focuses on process development and presents development initiatives and introduces a new S&OE process based on the findings from the theoretical framework and empirical study. Finally, the last chapter of this thesis is a discussion section that addresses the research questions and provides suggestions for future development initiatives within the case company. Structure of this thesis is illustrated in Figure 1 below.

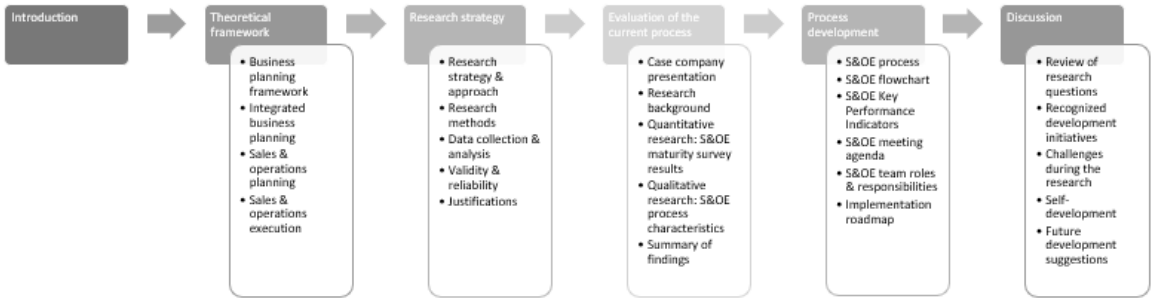



Figure 1. Thesis structure.

## 1.1 Research objective

The main objective of this thesis is to develop a new S&OE process – which is an embedded subprocess of the case company's S&OP process – for the case company, by first studying and defining the state of art of the current process and its maturity level. Additionally, this thesis aims at identifying the key areas included in the current S&OE process that can be developed to increase the overall maturity level of the S&OE process holistically. The challenge of connecting the two business planning levels, S&OP and S&OE, with each other's, is also addressed, and this study aims to find a way of integrating these processes together. Also, this thesis introduces new key performance indicators (KPI) for the case company to implement in order to track the performance of their S&OE process in the future.

On the managerial level of Neste's supply chain management (SCM) it has been recognized that the company currently has documented and standardized process for S&OP, but the S&OE process on the other hand lacks proper documentation and standardization and is not perceived to be as efficient as it could potentially be, thus creating a gap between what is planned in S&OP

and how the plans are executed in S&OE. Therefore, this thesis will be drilling down into the current state of the case company's S&OE process and examine how this process specifically, and the broader business planning framework in general, are designed in comparison to commonly known equivalent business planning models. The justification and deliverable of this thesis is an efficient, coherent and transparent S&OE process that will be introduced and implemented to the respective team working daily with the topic in the supply chain management-function of the case company. Furthermore, this study presents sub-processes and other relevant elements that could be employed to the S&OE process, in order to elevate its effectiveness and to integrate it better with the case company's S&OP process.

## 1.2 Research scope and delineation

This thesis focuses specifically on the managerial aspects of the S&OE process its related elements. Theoretical framework in this thesis begins with general presentation of business planning framework and planning hierarchies, which forms the basis for the planning levels discussed in this study. Strategic planning is only briefly defined as a concept, as its relevance for this study is considered low. S&OP, S&OE, and their characteristics are described more in detail. Additionally, IBP is explained in theory, as it is often in literature mixed with S&OP.

S&OP and its concept and elements are discussed from the perspective of their relatedness to S&OE and only to the extent, that is required in order to understand the relations between these processes. Detailed descriptions of attributes related to S&OP planning such as mathematical models are not discussed, as well as the advanced planning systems and scheduling systems, that are typically utilized for creating the S&OP plan and executing S&OE plan, are not in the scope of this thesis.

Due to S&OE being relatively new business process concept and academic work of the topic of it being scarce, a very limited amount of literature exists on S&OE alone, as it is often considered to be a complementary part or a sub-process of S&OP. Thus, some support to create a new S&OE process for the case company was therefore sought from mainly online publications, such as blogs, internet articles and materials from consultancies, as well as from previously published academic studies, such as from Carvalho's (2018) "The intermediate link in planning: a multicase study of the Sales and Operations Execution process".

## 1.3 Research problem and research questions

The current maturity level of the S&OE process at Neste has not been thoroughly studied before. Since the current S&OE process is partly unclear and it has not been properly documented, the general assumption within the case company is that additional value at the current state is likely not captured, or in some cases, even recognized. This is problematic due to the fact, that ideally S&OE process should be an interface, that creates additional value to the supply chain through constant optimization of different variables of the supply chain. At the current state, lack of adequate documentation concerning the process leads to inconsistent execution of the optimized S&OP plans in S&OE scope, and potentially, also leads to the inability to meet the defined S&OP targets, which is particularly problematic given the volatile business environment in which the case company operates.

An additional challenge arises from the fact that S&OE planning is carried out by individual team members within the S&OE team, with each of the team members being responsible of steering their own product chains. However, since production and logistics assets are shared between the product chains in most cases, these different plans should be consistently aligned and the mutual effects, that are concerning various product chains, should be considered in all decision making, in order to maximize the value of the S&OE steering. Moreover, the lack of standardized S&OE process restricts the team's ability to efficiently respond to unexpected supply and demand changes or other supply chain deviations. This might lead the S&OE team to miss out on opportunities stemming from for example increased demand, or them facing difficulties in effectively managing production disruptions or logistical challenges, which then consequently exposes the case company to potential monetary losses or situations, where potential additional value remains unrealized. Therefore, in order to gain knowledge of the current process and challenges of it for the development of a more mature S&OE process, research questions to address these topics are presented below.

The research questions of this thesis are as follows:

**RQ1**: How can the S&OE process be improved?

In order to answer to the first research question, it must first be studied what the current S&OE process is like, and what is the maturity level of it. Additionally, the challenges as well as the improvement areas of the current S&OE process should be clarified. In order to be able to answer the first research question, sub-questions as follows should be answered:

*How is the current S&OE process described?*

*What is the maturity level of the current S&OE process?*

*What are the recognized challenges of the current S&OE process?*

Additionally, since this study aims at developing the S&OE process holistically, it is required to also study how the S&OE process can be linked with the S&OP process, in order to maximize the additional value that can be captured by executing S&OP plans as planned. Furthermore, along with the redesigned S&OE process, implementing last-minute changes in S&OE and reacting to changes in supply and demand should be more efficient and less complicated. Also, the performance of S&OE should also be constantly reviewed and monitored in the future, to ensure alignment to tactical-level plans from S&OP, and to be able to utilize data for decision-making. Therefore, the second research question and sub-questions are presented followingly:

**RQ2**: How can the S&OE process be linked to S&OP process to close the gap?

*How should the S&OE team be organized and work to reach the set S&OP targets?*

*How can additional value be captured by linking S&OE to S&OP?*

*What kind of key performance indicators should be implemented to track the performance of S&OE?*

## 1.4 Research strategy

The research strategy used in this thesis is constructive research, which is an optimal choice for developing a new solution to a practical problem. Because the research topic is considered to be ultimately complex and broad, extensive information is needed to understand all perspectives of the subject and its related elements. In order to develop a completely new solution for the case company, in terms of a new, more mature S&OE process, the state of art and even the smallest details of the current process must be first studied. Therefore, a mixed methods research approach is chosen to be used. The mixed methods approach of this thesis consists of a quantitative research in the form of a survey targeting individuals associated with the current S&OE process, accompanied with qualitative research through content analysis, that aims to create a more

comprehensive understanding of the research subject and to also complement the findings from the quantitative research.

To effectively address research questions 1 and 2 along with their associated sub-questions, qualitative research utilizing thematic content analysis of internal documentation is considered essential for this study. This qualitative approach is expected to complement the findings of quantitative research survey, and to uncover relevant aspects of the current process that may not be fully captured through quantitative survey alone.

Further, the theoretical framework will integrate all the findings of business planning framework, as well as of S&OP and S&OE processes from literature and online sources to enrich the research in overall, and derived from the theory and research findings, a new S&OE process is presented in chapter 7, preceded by the findings from both researches, and followed by the discussion section of this thesis.

# 2 Business planning framework

Those organizations that regularly use supply chain planning frameworks as part of their standard business operations gain a strong competitive advantage over their competitors. Also, those organizations, that follow the disciplined approach of a business planning framework become more flexible, thus allowing them to respond quicker to the ever-changing business conditions. Key characteristics of these most successful companies include the ability to connect and coordinate business planning across long-term strategic, medium-term tactical, and short-term operational horizons. This hierarchy ensures that strategic plans guide tactical decisions, and tactical plans guide day-to-day operations, all connected to and aligned with the firm's overall strategy. (Liberatore & Miller, 2021, 2) Figure 2 below illustrates a basic framework that showcases an integrated process, where the goals and objectives of a company determines the goals and objectives of its supply chain organization.

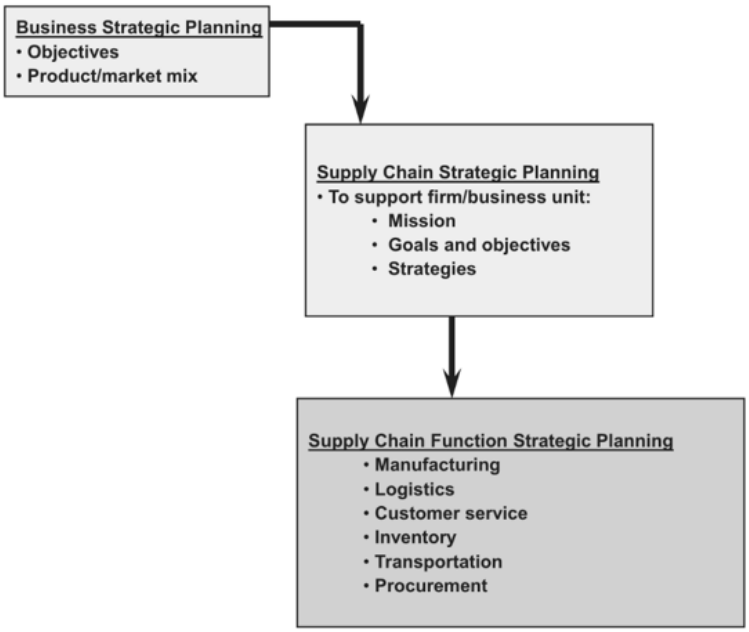



Figure 2. Integrated business and supply chain strategic framework. (Liberatore & Miller, 2021)

As demonstrated in the Figure 2, in the highest-level business strategic planning, companies need to address their overall key corporate objectives, such as market share, profitability goals, and product mix targets. Decisions made in business strategic planning for overall corporate goals, is then further guiding the development of strategic supply chain plans: for example, the objectives related to market share and product mix targets significantly shape a company's supply chain and

production capacity and service strategies. In the supply chain strategic planning process, other high-level supply chain strategies, like setting customer service targets and managing inventory levels, are also developed to support the overall business goals. After a company's supply chain planning team sets its overarching strategies, the various functions within the organization must proceed to create and execute their own specific strategies. (Liberatore & Miller, 2021, 3-4) In this business planning framework, Liberatore & Miller (2021, 5-7) explains the hierarchy followingly: business strategic planning drives and guides supply chain strategic planning, which drives and guides strategic planning by individual supply chain functions. Ultimately, this presented framework of business planning hierarchy is further connected to the different planning horizons (strategic, tactical, operational) as presented in Figure 3.

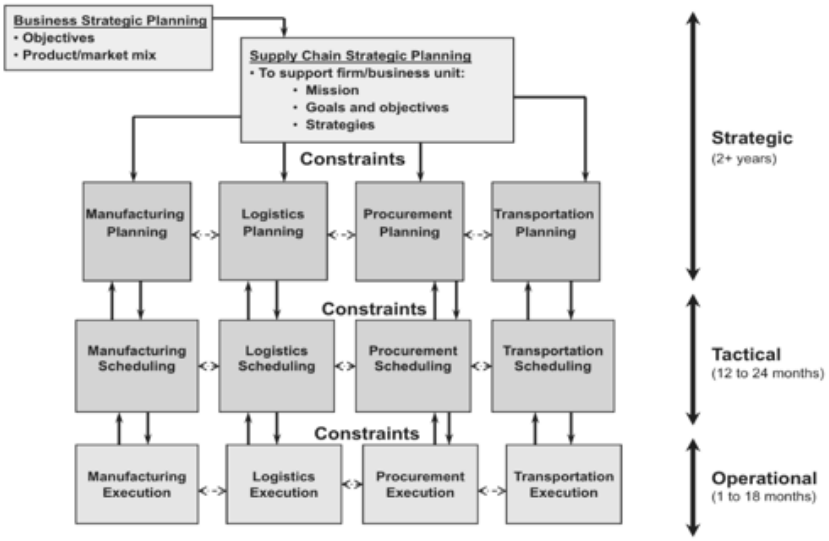



Figure 3. Business planning hierarchy and planning horizons. (Liberatore & Miller, 2021)

## 2.1 Planning level and horizon

However, many companies find it hard to bring their planning processes together into a single, integrated business planning framework, thus not being able to unlock the full potential and value of integrating and managing their planning processes holistically in terms of time horizon and levels (Kepczynski et al., 2018, 1). Therefore, as the business planning involves establishing a company's objectives and goals and figuring out the most suitable strategies to attain them, also the requirements for planning should occur across various time horizons and levels. Kepczynski et al.

(2018, 1-2) explains that the different levels of business planning are local, regional and global, whereas the time horizon of business planning is strategic, tactical or operational. From time horizon perspective, strategic planning shapes the business for a horizon of up to 10 years, and tactical planning horizon can extend up to 3 years whereas the operational planning window usually is at maximum 4 to 12 weeks. According to Lapide (2011), sales and operations planning (S&OP) is a one conceptualized, routinely executed tactical planning process, and the planning horizon for S&OP typically is somewhere between six-month to two-year. Operational planning on the other hand, can drill down to even a single-day horizon. Even though the planning levels differ in terms of horizons and level, all three levels of planning should be integrated to ensure that operations align with the strategy and consequently, are all required for a company to be successful. (Lapide, 2016) Anthony's triangle illustrates the different levels of planning, as shown in Figure 4.


Figure 4. The Anthony triangle for planning hierarchy. (Anthony, 1965)

Strategic planning is on the highest-level in the hierarchy and is done on both global and regional level and is concentrating on aggregate-level planning and company vision. Strategic planning defines the strategy of the company for a long-term horizon and can extend to even up to 10 years. Below strategic planning is tactical planning, which typically spans mid to long-term periods of 1 to 3 year on global-regional-country level and focuses on products, financials, supply, and demand. Tactical planning operates on all three business levels: local, regional, and global, and is often considered and referred to as sales & operations planning (S&OP) or integrated business planning (IBP). Operational planning as the lowest level of planning, occurs on a local level and involves balancing short-term supply and demand, usually in time horizon of 4 to 12 weeks. Operational planning aims to optimize the utilization of company's resources and available assets within a specific timeframe, focusing on the short term. Notably, operational planning has been introduced in many companies when the monthly S&OP process has lacked the necessary

granularity to address imbalances of supply and demand driven by product type or channel, thus operational planning can be driven by product or industry characteristics. Operational planning can be especially relevant for companies associated with for example customer-specific products and commodity business. (Kepczynski et al., 2018, 3-5) Data granularity indicates the level of detail in the data, and the higher the granularity, the more information there is available in each data points (Marocco, 2020). Importantly, the ability to easily aggregate and disaggregate data across various hierarchies and perspectives is essential for successful hierarchical planning (Mallik, 2021).

Therefore, to aid the companies struggling with S&OP and its relevance and lack of the necessary granularity, IT service management company Gartner has introduced S&OE in recent years, as a concept to run operational planning with a shorter horizon than S&OP (Chainanalytics, 2019). As S&OP is an integrated business planning process that aims at vertically aligning business strategy to operational planning (Tuomikangas & Kaipia, 2014), S&OE on the other hand aims at filling the gap between S&OP and daily operations (Riverlogic, 2023). In S&OE, the plans formulated at the tactical level – typically S&OP plans – are disaggregated into programs with lower product aggregation level (such as from product families to sub-families or stock keeping units, SKUs). Additionally for better granularity, or the level of detail in data, S&OE focuses on shorter time horizons than S&OP, from for example 18 months to three month, and divides them into more frequent time buckets, for example from monthly to weekly intervals. (Riverlogic, 2023) As S&OP is considered to concern the time horizon of tactical planning, whereas S&OE's time horizon is typically somewhere between tactical and operational window, they are positioned further on The Anthony Triangle as illustrated in Figure 5.

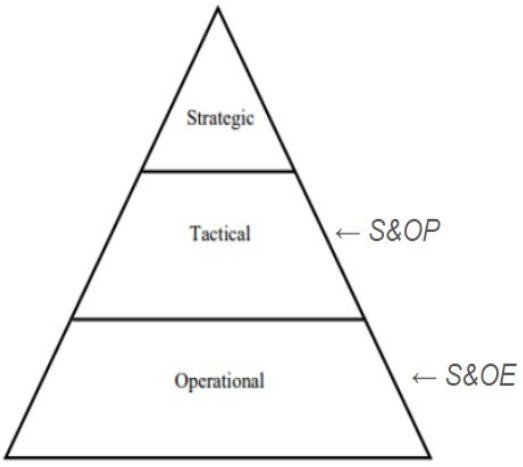



Figure 5. S&OP and S&OE on The Anthony triangle. (Adapted from Anthony, 1965)

The issue that often arises in companies is that these planning horizons and levels are not always integrated with each other's, leading to isolated operations without synchronization, structures, or capabilities for connection between planning levels. Operational, tactical, and strategic planning share the same S&OP process dimensions but differ in focus and importance. Organizationally and capability-wise, these processes are often disconnected, which then consequently leads to functions operating in silos. Many companies struggle to determine the appropriate level of detail for each planning type. Additionally, companies often use fragmented planning solutions in terms of for example IT tools, requiring significant time for data integration and reconciliation. Therefore, being aware of the characteristics of each of the planning levels and their granularity is the key thing to start tying them together in order capitalize the benefits and value add from each of the planning levels. In order to accomplish this goal, it is vital for companies to start by defining what is the right amount of detail for each of the planning levels. (Kepczynski et al., 2018, 7-8) The focal point of value add for each of the planning horizons are illustrated in Figure 6.

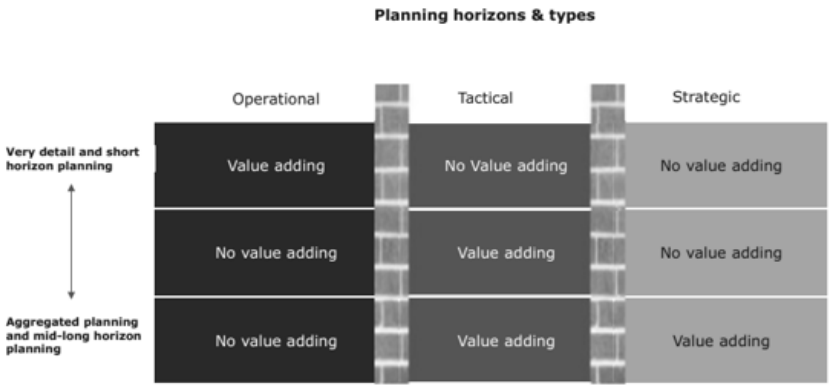



Figure 6. Planning detail on different planning levels. (Kepczynski et al., 2018)

## 2.2 Integrated business planning (IBP)

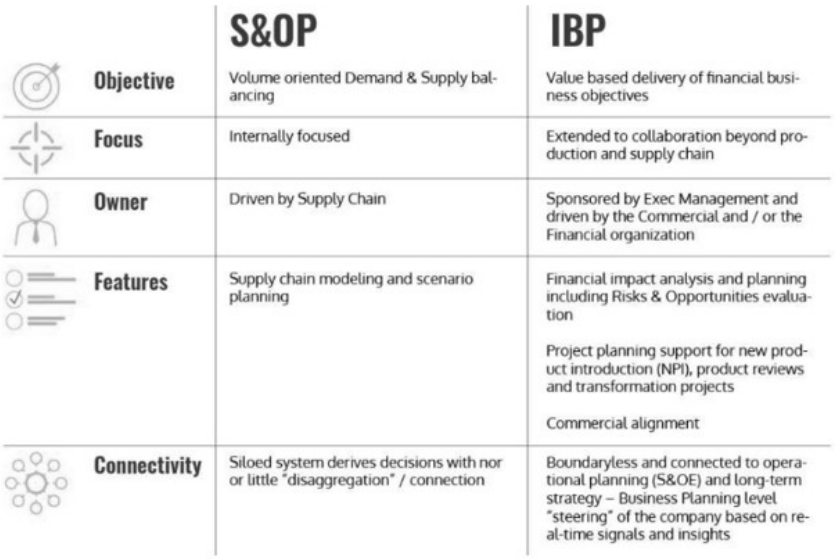
Nowadays, with the increasing complexity of products and options in the modern manufacturing environment that are coupled with heightened competitive demands for quality, timely delivery, low prices, quality service, and technological advancements, the balancing mechanisms of more integrated business planning has become an essential management tool across various organizational levels. The Oliver Wight Companies was the first to create and introduce a process known as integrated business planning (IBP), previously referred to as "advanced" sales and operations planning (S&OP), to aid leadership and management in making decisions regarding aggregate

supply rates. At the management level, IBP serves as the unifying force for all high-level plans, covering product and portfolio, sales, marketing, engineering, manufacturing, quality, logistics, and financials. (Proud & Deutsch, 2021, 41;74) Kepcynzski et al. (2018, 10) also highlights that IBP or S&OP delivers significant value to companies by facilitating enhanced management of business operations through the seamless integration of operational planning, tactical sales and operations planning (S&OP), and strategic planning.

## 2.3 IBP and S&OP characteristics

IBP – also often in terminology referred as S&OP – focuses on the company's vision, strategies, aggregate product planning, demand planning, supply planning, financial planning, and resolving imbalances. In contrast, S&OP primarily addresses sales, production, inventory, backlog, and shipment balancing. The IBP process produces approved plans for new products, demand, and supply, aligned with financial plans to execute strategic objectives. Both IBP and S&OP operate within the framework of product families, supply rates, volumes, and monthly time periods over a mid-to long term planning horizon, even as far in the future as 24 months. What distinguishes IBP from S&OP in some of the literature, is that in IBP the plans for products, demand, and supply are usually expressed in both financial and non-financial terms, like units, tons, hours, and similar measures. On the other hand, financials are not always included in companies' S&OP process, but by some definitions can however be included, creating confusion in-between the terms. IBP or S&OP as a process, however, is a crucial link between top and middle management, fostering collaboration and resolving conflicting expectations about new products, anticipated demand, and supply capabilities. (Proud & Deutsch, 2021, 41-42)

According to Intito (2021), while IBP and S&OP may seem similar initially, they still differ slightly in their approach. IBP takes a holistic view of a company's business and emphasizes future modeling. Understanding this distinction is crucial in addressing contemporary business planning challenges. S&OP, on the other hand, focuses on managing material flows and costs to ensure the seamless alignment of production and demand. It aims to meet demand at the lowest possible cost, whilst working collaboratively on production plans with sales to align with the company's strategy. IBP, as an extension of S&OP, continues this holistic perspective of S&OP by also modeling the future of key business aspects and optimizing the overall picture, considering both internal and external influences. (Intito, 2021) The key differences of S&OP and IBP are presented in Figure 7.



| | S&OP | IBP |
|---|---|---|
| Objective | Volume oriented Demand & Supply balancing | Value based delivery of financial business objectives |
| Focus | Internally focused | Extended to collaboration beyond production and supply chain |
| Owner | Driven by Supply Chain | Sponsored by Exec Management and driven by the Commercial and / or the Financial organization |
| Features | Supply chain modeling and scenario planning | Financial impact analysis and planning including Risks & Opportunities evaluation<br><br>Project planning support for new product introduction (NPI), product reviews and transformation projects<br><br>Commercial alignment |
| Connectivity | Siloed system derives decisions with nor or little "disaggregation" / connection | Boundaryless and connected to operational planning (S&OE) and long-term strategy – Business Planning level "steering" of the company based on real-time signals and insights |

Figure 7. Key differences between S&OP and IBP. (Intito, 2021)

However, it should be disclaimed that the terminology associated with S&OP in literature is varied and may therefore cause confusion. Other terms used interchangeably for S&OP include for example sales operations and inventory planning – SIOP. (Intito, 2021) As stated by Kristensen & Jonsson (2018, 23-24), the existence of multiple terms is in fact related to S&OP as a concept and process being mainly consultancy driven. Therefore, different consultancies introduce new terms for S&OP with slight fine-tuning as a marketing strategy to attract new clients. Despite the different terms, they however generally refer to the same process with some minor distinctions. For instance, SIOP places emphasis on inventory management, while IBP focuses on financial aspects in the process. (Kristensen & Jonsson, 2018, 23-24) The same challenge with terminology is addressed also by Oracle (n.d), as over the years, similar and occasionally slightly varied processes have emerged with diverse naming conventions. Examples as stated by Oracle (n.d.) also include IBP, as well as the so-called "connected planning". While finance may play a more prominent role in both of those processes, financials are always involved when executive management participates to the process, as feasible and profitable plans need to be approved by executive management (Oracle n.d.). Therefore, IBP can also be understood to have mostly the same key essential characteristics as S&OP in general.

For the validity of this study, however, the general introduction of IBP is a necessity to be described in theoretical framework, due to the above explained similar characteristics to S&OP and for the validity of this study also from the perspective of the case company, which is including the financial perspective to their S&OP process already due to date, and also uses future modelling

in their S&OP process. In fact, based on the definition of IBP introduced above, the maturity level of the case company's current S&OP process can be positioned and understood to be somewhere between the above definitions of S&OP and IBP. Therefore, for the reader to understand the interconnectedness of IBP or S&OP to S&OE, it is essential to also describe IBP as its own business planning process to create more understanding of the planning processes holistically.

# 3 Sales & Operations Planning (S&OP)

The roots of S&OP likely trace back to practical experiences and experimentation in various companies. Oliver Wight, a pioneer in material requirements planning (MRP), may be credited for the early development of the S&OP methodology, possibly already as early as the late 1970s or early 1980s. As this new concept, S&OP, gained momentum, organizations like American Production and Inventory Control Society (APICS) played a significant role in sharing experiences and refining the process further. Notably, the Oliver Wight organization's process was documented for the first time in the book "Orchestrating Success (Wiley, 1988)" by Richard Ling and Walt Goddard. Around the same time, both Oliver Wight and David W. Buker organizations offered video tools to facilitate this top management planning process. Since 1980s, the S&OP methodology has continued to evolve significantly still to present date. (Sheldon, 2006, 3-4)

## 3.1 Process purpose and benefits

S&OP serves as a business process designed to maintain the balance between demand and supply within companies. It focuses on aggregate volumes, such as product families and product groups, in order to facilitate the handling of mix issues related to individual products and customer orders. Executed on a monthly cycle, S&OP presents information in both units and currencies, seamlessly integrating operational and financial planning together. As a cross-functional process, S&OP typically involves various stakeholders, such as general management, sales, operations, finance, and product development. The purpose of S&OP is to establish a connection between the company’s strategic plans and business plan to its other detailed processes such as production scheduling and purchasing, that are operational necessities to run the business, in order to provide a holistic view of the business and to offer insights into the future for company managers. (Wallace, 2004, 7)

According to Sheldon (2006, 2), in simple terms, S&OP is a monthly planning cycle that involves reviewing and ensuring the accuracy of plans for customer expectations and internal operations. The process includes assessing process accountability, learning from experiences, and managing future risks. Plans are regularly monitored, updated at scheduled intervals, and consistently reviewed. Ultimately, S&OP’s primary goal is to just avoid significant mismatches between supply and sales plans, preventing scenarios where the company either overproduces products

compared to sales forecasts or commits to higher sales volumes in the future than it is able to produce. (Andrés 2017, 21-22) Moreover, S&OP facilitates businesses in creating consensus among sales, operations, finance, product development and other functions regarding the corporate strategy. S&OP also supports the ongoing process of revising and realigning plans to adapt to changing circumstances. (Ross, 2010, 85)

## 3.2 Process definition

The process of S&OP has been presented similarly by several authors, such as (Palmatier & Crum, 2003; Lapide, 2004; Grimson & Pyke, 2007; Wallace, 2004; Esper et al., 2009; Thomé et al., 2012), who share the same view that S&OP typically consists of five connected stages. In S&OP process, the first stage involves gathering and analyzing sales and production data from the previous month, assessing current stock levels, back orders, and formulating statistical sales forecasts for the upcoming months. In the second stage, focus is on defining the sales plan for the upcoming months, by incorporating statistical data and input from sales, in other words aggregating demand. Third stage involves reviewing supply plans feasibility based on the new sales plan, by considering constraints related to manufacturing capacity or component deliveries. In the third stage, S&OP aims to assess how to meet the anticipated demand by the supply. Fourth stage includes a meeting for the whole S&OP team, where constraints related to supply and demand are presented and impacts are evaluated, and collaborative solutions are proposed. On the fourth stage, different future-looking scenarios are also created for supply and demand. The final stage involves presenting main results from the previous month to the top management, as well as discussing risks and opportunities for the upcoming months; in other words, presenting a plan for supply and demand alignment. This stage also involves evaluating of scenarios from stage four, especially those that are expected to have an impact to the company's financial outcomes. (Bagni & Marcola, 2019, 4-5) These five stages of S&OP process are presented below in Figure 8.

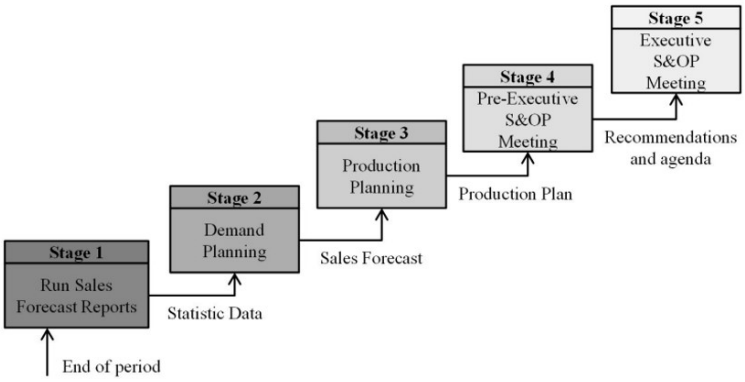



Figure 8. Five stages of S&OP process. (Adapted from Bagni & Marcola, 2019)

The objective of S&OP process as presented in stages in Figure 8. is to act as a tool that is harmonizing company's planning, financial, sales, and operational aspects, thus ensuring alignment of goals across different areas. In order to achieve consensus within the company regarding resource allocation and priority setting, S&OP also requires strong support from the company's top executive management. S&OP facilitates a comprehensive understanding of the market, consisting of factors such as potential demand, productional complexity, market trends, and the company's market share. Furthermore, S&OP also enables internal analysis of processes, capacities, available resources, achievable opportunities, and existing constraints. Since company-wide decisions are made based on S&OP results, it is vital to have the information flow constantly distributed to all stakeholders throughout the whole process. Ultimately with S&OP, all members of the organization, in their respective roles, can also proactively respond to necessary changes within the established timeframe and, as S&OP ensures a unified understanding of the company among its members, it allows different stakeholders to align their efforts towards common objectives. (Andrés, 2017, 21-22)

## 3.3 Integrating S&OP and S&OE

As presented in Figure 5, S&OP's role in Anthony's planning hierarchy can be placed to tactical level and there is a vital connection further to S&OE when moving down on the hierarchy to operational level. Further, the necessity of connecting S&OP to S&OE can be understood from the definition from Lapide (2011); "Sales & Operations Planning provides the key connection between strategic planning and operational execution. It's a critical factor in how well a company achieves its business objectives." In Figure 9, S&OP is presented in the tactical level, where its connection

down in the hierarchy to operational level can also be observed. Notably, S&OP plan is vertically connected to attributes related to upper-level strategic objectives and goals, and to lower-level daily operations of the company. Horizontally, the key elements related to S&OP are demand and supply data.

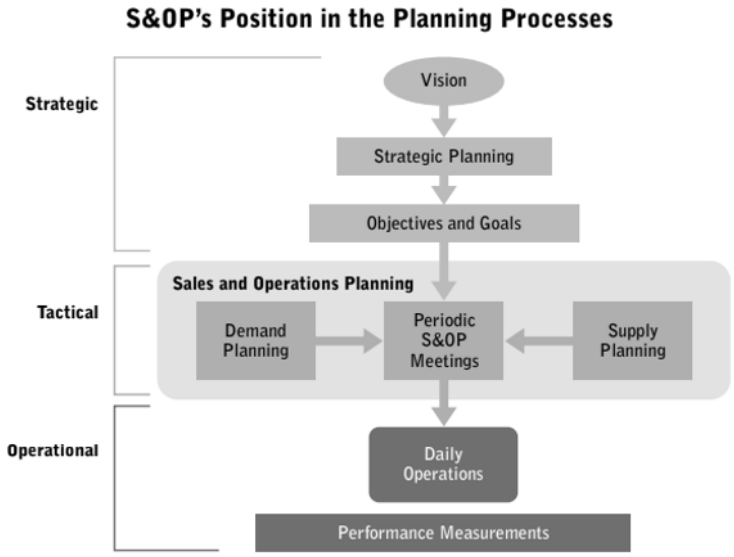



Figure 9. S&OP's position in the planning processes. (Lapide, 2011)

However, as per findings from industry research, most companies that use S&OP, are in fact struggling to develop a consistently achievable S&OP plan. According to a survey conducted by Supply Chain Insights in 2015, only 30 percent of manufacturers can "nearly always" or "most of the time" effectively integrate S&OP planning with execution on the operational level. (Toolsgroup, n.d.) A study by Elementum (2021) further highlights that the actual service level in companies using S&OP process is even 60% lower than initially forecasted in their S&OP plan. Research by Gartner supports these views by indicating that the primary challenge faced by manufacturing companies lies in connecting the sales and operations plan (S&OP) to operational planning and execution, namely sales and operations execution, or abbreviated S&OE (Pukkila, 2016).

This gap exists because there isn't a clear process in place in the companies for short-term planning. As a result, when there is deviation in between what was planned and what actualizes, organizations struggle to react quickly to those deviations. This leads to problems such as having too much or too little inventory and lower service levels. Sales and operations execution (S&OE) steps in to fill this gap, by ensuring planned activities are accomplished as intended. From the

financial performance perspective, the usefulness of S&OE can't be argued - according to a simulation study performed by Adexa, typical S&OP plan achieves accuracy levels ranging from 40% to 65%, but when complemented with S&OE, its accuracy can rise to 98% or higher. (Pukkila, 2016) Pukkila (2016) further discusses that "value-adding, effective S&OP process cannot exist without S&OE, as it provides the planning interface to execution."

### 3.3.1 Key integration characteristics

S&OP and S&OE as planning processes serve for different purposes in companies. S&OP is effective for longer-term planning, providing a general overview to the business and enabling the balancing of supply and demand when constraints within the supply chain are relatively minimal due to longer timeframes. S&OE requires a focused approach and is namely tailored to handle specific timeframes and variations effectively. S&OE is excellent tool in facilitating rapid, short-term decision-making, particularly in situations with limited available options. However, as companies are often lacking the ability to connect these two processes with each other's, they are creating a gap and are not able to enhance their financial performance to the best possible outcome. (Gilchrist, 2023) Therefore, it is crucial to establish harmony between the decision-making approaches utilized in S&OP and S&OE to ensure their effective integration.

Other way around, also the planning results from operational level should be seamlessly incorporated into tactical S&OP on a monthly basis, by having a two-way information flow. This entails documenting all decisions regarding volume and value and ensuring complete transparency between these two processes. (Kepczynski et al., 2018, 41-42) Consequently, linking the two processes, S&OP and S&OE, and ensuring transparency and appropriate information flow between the two processes and both ways is critical for companies looking for the best performance gains. This critical link between S&OP and S&OE is demonstrated in Figure 10.

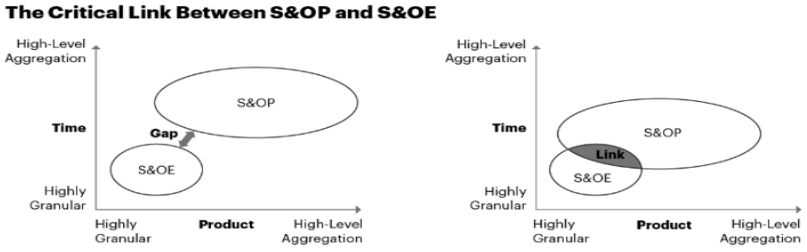



Figure 10. The Critical Link Between S&OP and S&OE. (Gilchrist, 2023)

Thus, S&OE establishes an essential link between monthly planning and daily operations. More companies are realizing the importance of having three distinct planning horizons: annual, monthly, and weekly, as recommended by Gartner. Annual, or strategic planning, focuses on big decisions like capacity changes or new product launches. Monthly S&OP concentrates on product family-level of planning by aggregation of data, and weekly S&OE zooms in further to the stock-keeping unit (SKU) level and details, ensuring alignment between demand and supply on a day-to-day basis. The challenges arises when these planning phases aren't connected to each other and are operating independently. (Riverlogic, 2023)

The key to successful planning configuration is having a unified approach across all these timeframes by integrating different planning processes. S&OE plays crucial role in this integration: it evaluates the production capacity's ability to meet demand through quick adjustments in inventory management and lead time optimization. S&OE's evaluation not only validates the efficiency of the S&OP process, but it also provides visibility to whether the sales and operations planning is actually successful at all, and if so, likely also the longer-term annual or strategic planning is on a correct course. However, the absence of such a seamless connection between planning and operations often leads to companies for example overreacting to short-term fluctuations or issues, and there S&OE also serves as a stabilizing mechanism for companies. (Riverlogic, 2023) The alignment of business planning processes is illustrated to Figure 11.

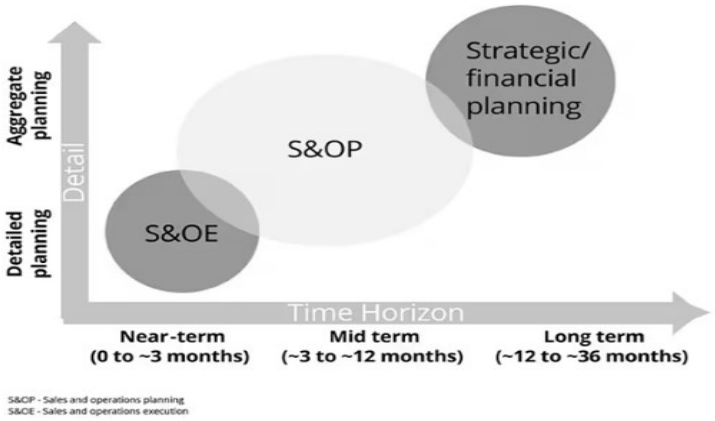



Figure 11. Business planning processes and their alignment. (Rajani & AryaCrossman, 2023)

From the perspective of interconnectedness, S&OE can be understood as a bridge between the day-to-day operations and long-term strategic planning of a business. Acting as a middleman, S&OE is translating the strategic directives outlined in S&OP into actionable instructions for daily operations. After implementation, S&OE refines the resulting data, presenting leaders with a clear

view of how reality aligns with the initial plan. Many businesses integrate S&OE functions within the S&OP process by default, but this isn't ideal due to the differing objectives and requirements of S&OP and S&OE – instead, they should be separated processes, that are integrated. Supply chain planning leaders should therefore first start by identifying what are the S&OE elements within the S&OP framework and then separate them into their own agendas. (Hippold, 2019)

In order to differentiate between S&OE and S&OP, their different timeframes should be also considered: S&OE focuses on the immediate to near-term horizon, typically 0 to 3 months, and it addresses practical challenges coming from actual demand and supply dynamics, which may or may not diverge from the idealized scenarios of S&OP plans. Therefore, to summarize it, S&OE ensures operational efficiency, thereby striving for optimal operational costs management. S&OE's ability to promptly identify and address disruptions also reduces the risk of excessive spending in the company. (Hippold, 2019) While in general, challenges are inevitable in supply chain management, S&OE is excellent tool in effectively managing and minimizing the impact coming from supply chain disruptions and other challenges as they arise. (Ostdick, 2017a; Hippold, 2019)

### 3.3.2 Integration benefits

An effective S&OE process ensures smoother operations and optimized costs by promptly identifying and resolving issues (Ostdick, 2017a). Implementing an integrated S&OP and S&OE process sets companies apart and delivers substantial benefits for the company, and the leading organizations consistently report improved performance after integrating these complementary processes to each other's. S&OE complements S&OP by generating and deploying immediate plans aligned with the higher-level strategy, and together they ensure coherent and feasible workflows, thus optimized operational costs. (Logility, 2021)

When S&OE is implemented to handle the day-to-day supply chain issues, it allows S&OP to maintain focus on longer-term strategies and enables team members of S&OP and S&OE to concentrate on their primary objectives. For quick operational decisions that aim at preventing customer disruptions and avoid inventory shortages, or in other words mismatch between supply and demand, S&OE serves as a facilitator for cross-functional collaboration alongside S&OP. Simplified even further, S&OE makes supply chain of the company more responsive to short-term

fluctuations. (Van Lacker, 2020) Some of the additional benefits of implementing S&OE process and integrating S&OP with S&OE listed by Logility (2021) include the following:

***Improve forecast accuracy:*** *Inaccuracies in a demand plan will cascade through the supply chain and increase costs, which makes it crucial to driving your plan using a valid market-driven forecast.*

***Inventory optimization:*** *Implementing S&OE can reduce inventory and safety stock levels up to 45%*

***Improve on-time delivery:*** *S&OE can drive customer and brand loyalty by improving on-time delivery by 10% to 50%*

***Align planning, budgets, and financial goals:*** *Set departmental goals that will add up to your top-level goals across all departments, divisions, and locations.*

***Increase working capital:*** *More working capital allows for more efficient inventory, payables, receivables, and cash conversion needed to run the organization.*

Furthermore, matching up S&OE with S&OP promotes teamwork between departments, and it also involves the middle managers to decision-making. This cross-functionality enables companies to be able to mutually agree on changes to short-term plans on a quick manner and to build consensus on short-term supply and demand balance, thus bringing instant clarity to all stakeholders on how they affect revenue, production, and inventory of the company. (Logility, 2021) Van Lancker (2020) also highlights that manufacturing companies have increasingly started to adopt sales and operations planning (S&OP) to improve their tactical planning and stabilize their supply chains. However, according to Van Lacker (2023) the fast-paced business environments of nowadays demand the integration of sales and operations execution (S&OE) as well, in order for companies to be able to effectively monitor plan execution and to address short-term disruptions, that are unforeseen in S&OP, as such variations and fluctuations to supply and demand can't always be forecasted for months ahead in the S&OP plans.

(Hippold, 2019; Kennedy, 2021; Hoey, 2018) further describe the benefits of integrating S&OP to S&OE, by sharing the view that S&OE enables better operational costs optimization and risk management by promptly addressing supply chain disruptions. S&OE also reduces the need of reactive acting in companies, or so called "firefighting", as it is actively monitoring the supply and demand data and provides clarity and transparency to stakeholders for more proactive decision making, whilst also decreasing supply chain volatility by allowing the companies to align

production processes more closely with real-time demand data. (Kennedy, 2021) Consequently, S&OE process minimizes discrepancies between what is planned and what is actualizing, and thus promotes better profitability for a company, by better overall optimization of operations. (Hippold, 2019; Kennedy, 2021; Hoey, 2018)

Summarized, the objective of designing S&OE process is to establish a seamlessly integrated workflow that aligns with the S&OP process. Additionally, S&OE process also aids companies in their longer-term planning, as described by author Ostdick (2017a); *"when working synergistically, S&OP and S&OE provide companies with an enhanced level of agility, transparency, and responsiveness in each aspect of the planning process in the short, near, and long-term."*

# 4 Sales & Operations Execution (S&OE)

Many companies find it challenging to derive benefits and value from S&OP initiatives as the process is designed to be a high-level, strategic guidance rather than an execution-oriented one. The operational entities such as manufacturing companies require a finer level of granularity that is breaking down product families into specific regions and SKUs, and for this purpose, S&OE was developed as a process with a shorter planning horizon to complement the longer planning horizon of S&OP. (Cheng, 2019) While often grouped together in companies, S&OP and S&OE are distinct processes that have symbiotic relationship. Whereas S&OP typically plans for 3-18 months, S&OE deals with the immediate 0-3 months as the planning horizon (Ostdick, 2017b). Thus, implementing S&OE principles in demand and production planning processes provides a substantial benefit in reducing supply chain risk and volatility (Hoey, 2018). S&OE serves as a facilitative process that ensures alignment with the overall business strategy of the company and it ensures that the objectives established in strategic planning and transferred to S&OP are respected during the execution as well. This includes ensuring consistent demand fulfillment, maintaining high service levels, and complying with order prioritization rules. Additionally, S&OE process aligns operational key performance indicators (KPIs) with strategic goals and oversees the execution of S&OP plans to ensure they are fulfilled. (Carvalho, 2018, 100)

S&OE takes completely different approach compared to traditional S&OP and annual planning, which rely heavily on forecasting and hypothetical scenarios. S&OE provides a company with real-time tracking of actual demand and production metrics, and thus offers a more accurate understanding of the demand and production capacity. By monitoring actual data in real-time, S&OE serves as an “early warning system” for supply chain planners and leaders, helping them maintain smooth production cycles in the shorter term. (Ostdick, 2017a) This proactive approach of S&OE allows supply chain leaders to prevent costly bottlenecks or production breakdowns also in the future, by addressing current issues on hand before they even escalate further and start to impact longer term planning and operations of the company. (Ostdick, 2017c; Kennedy, 2021)

S&OE process has an essential role in synchronizing the company’s strategic vision with operational capabilities, by connecting tactical planning from S&OP to the operational planning and execution (Cheng, 2021). As a process, S&OE is intended to be agile and data-driven, and to help companies to align the operational activities of supply and demand, as well as financial objectives. It also helps companies to boost their customer satisfaction, reduce inventory costs, and enhance their supply chain flexibility. (Skyplanner, n.d.) In recent years, S&OE has been gathering

increasing interest as a planning process that assists companies responding swiftly to changes in their market and demand and therefore keeping their supply and demand balanced in the short-term (Logility, 2018). It aligns tactical plans with operational planning and execution, by breaking down the high-level, tactical plans from S&OP into more detailed, short-term actions that can be more promptly adjusted. On top of mitigating demand fluctuations and supply and demand imbalance, S&OE also focuses on identifying opportunities and responding to deviations in operations. (Carvalho, 2018, 88-90; Kennedy, 2021)

Whereas the tactical level plans, namely S&OP plans, are focused to aggregated volumes and longer-term horizon, S&OE disaggregates the tactical level plans to lower aggregation, from product families to sub-families or SKUs and narrows the long-term planning horizon to immediate and short-term window. This disaggregation brings finer granularity to business planning in overall and by doing so, S&OE ensures that the objectives outlined during the S&OP process are in harmony with the actual execution of the S&OP plan. Consequently, S&OP process should in fact be complemented with S&OE process to gain the most added value out of it, by keeping the aggregation and granularity on different levels and accuracy between these two processes in order to gain competitive advantage from better optimization of a company's operations. (Carvalho, 2018, 89)

## 4.1 Process purpose and benefits

S&OE process acts as a decision-making process used to harmonize the short-term supply and demand, whilst also acting as an interface to translate the results from the S&OP process into executable details in planning. As the plans from S&OP are implemented, S&OE serves also as a checkpoint for supply chain and business leaders, ensuring that the actual outcomes also mirror the planned objectives. And in case of any remarkable deviations are detected between what is planned and what is the actual outcome, S&OE allows companies to execute prompt corrective actions proactively. (Cheng, 2019; Gilchrist, 2023) S&OE can be characterized as a weekly iterative process that serves as the bridge between operational everyday operations and the strategic or tactical initiatives carried out within the company's S&OP or IBP processes (Riverlogic, 2023).

The main purpose of S&OE is to offer a real-time view of the supply chain's condition by real-time monitoring of metrics, allowing decision makers to initiate weekly adjustments in response to the actual demand and production. This approach differs from the objectives of S&OP, which relies

on forecasts and simulations and focuses on longer-term instead. However, through the real-time tracking of actual production and demand, S&OE also offers a future-looking perspective to supply chain planners and managers by providing them with insights that enable them to make preventive decisions against potential bottlenecks and production issues also on a longer-term basis. These insights from S&OE should further then be included into the S&OP planning cycles. This proactive approach helps a company to maintain seamless production cycles and to avoid costly disruptions in the future, and with S&OE, the full potential from S&OP can also be unlocked. (Ostdick, 2017a)

Visualized in Figure 12 are the five distinct planning categories of S&OE. S&OE process can be divided into demand planning, inventory planning, supply and replenishment planning, manufacturing planning and transportation planning (Logility, 2018). In Figure 12, these distinct planning categories of S&OE are combined to the planning hierarchy by Anthony (1965) to create understanding of the interconnectedness between different planning levels, and what planning elements are typically included in the S&OE process. S&OE is the interface between S&OP and operational execution that closes the gap of tactical planning and operational execution, while it also focuses on different types of planning activities.

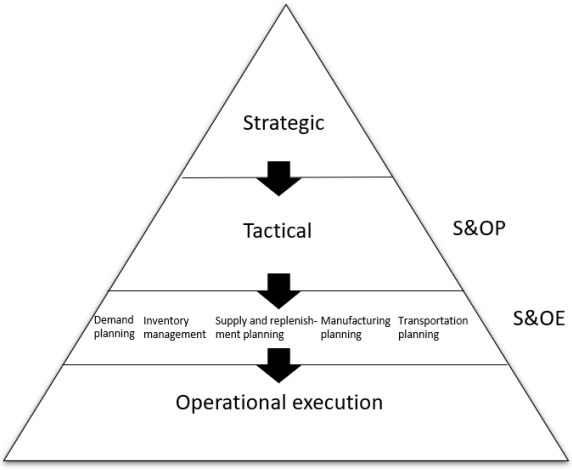



Figure 12. The Anthony Triangle with S&OE process activities. (Adapted from Anthony, 1965; Logility, 2018)

By the separation of S&OE from S&OP, supply chain managers can enable their S&OP team to have more resources to primarily focus on future planning, and on the other hand, the S&OE team can set their focus to short-term issues. This further enables S&OE team to proactively handle supply chain fluctuations and adjust company's production plans to align with the real-time

tracked demand. Additionally, separated S&OE process allows the S&OP team to have more available resources to collaborate closely with business leadership to ensure the supply chain aligns with overall business objectives by translating the S&OP results that are set on the tactical level of the planning hierarchy to S&OE's scope. Further, separating S&OE from S&OP enables both teams to focus on initiatives and objectives related to their respective planning scopes, promoting better overall coordination of the supply chain's higher-level business goals. (Ostdick, 2017b; Ostdick, 2017c)

In addition, S&OE should be in fact viewed as a vital value-adding process, that not only puts the S&OP plans into action and is responding to fluctuations in demand forecasts and sales orders, but that also is reducing the costs associated with continuous rescheduling of production and having for example excessive product inventories, by the constant monitoring and fine-tuning of the plans. By unveiling the aggregated information from the tactical planning of S&OP into less aggregated information to S&OE, S&OE allows the company to connect their tactical objectives to executable details, thus allowing the company to balance their supply and demand much more accurately, but to also maintain their customer service level and bring further stability to the execution of the plans. (Carvalho, 2018, 92-93)

In summary, S&OE enables better supply and demand optimization by offering real-time insights into supply chain performance and providing the ability to make timely adjustments to planning and production. Additionally, implemented S&OE process leads to benefits such as increased scheduling accuracy, waste reduction, and improved production and customer service levels. S&OE also allows for a consistent weekly overview of the supply chain, assisting in the observation, analysis, and improvement of supply chain performance overall. Finally, S&OE complements advanced analytics by providing a real-time view of supply and production cycles, facilitating data-driven adjustments and optimizations by supply chain planners and managers. (Ostdick, 2017c)

Also, by the definition from Cheng (2019), similar benefits to earlier mentioned are recognized to be gained from a functional S&OE process, as it also aids the S&OP process, by increasing adaptability by providing real-time insights that improve supply chain performance and allow for quick adjustments to planning and production. (Cheng, 2019; Ostdick, 2017c) also share the same view that improved overall supply chain performance gained from functional S&OE process increases the visibility to operations, and thus enhances for example scheduling accuracy and minimizes waste. Additionally, by implementation of S&OE process, a company can benefit from better communication and increased planning accuracy in tactical and operational levels, leading to more accurate forecasts and improved inventory management also for the S&OP process. Therefore,

the benefits of S&OE are also vertically gained: tactical plans are brought to operational execution, and decisions from operational execution are taken back as an input to tactical planning. Therefore, this two-way communication flow achieved by seamless integration closes the gap and aids companies to increase their profitability holistically, by better overall planning of operations in both tactical and operational levels. (Cheng, 2019)

S&OE process also decreases the necessity to constantly reschedule production and it improves schedule stability, and in addition, allows for continuous comparison of actual operations with forecasts and enables adjustments to be made in case of disparities arise. In overall, the collaborative process of S&OE ensures alignment between strategical and tactical planning and operational execution and yet again, closes the gap between S&OP and S&OE. Different consultancies outline different tangible advantages that companies can gain from S&OE. However, the collective and shared viewpoint underlines that there is undeniable value that can be derived from S&OE, mainly from improvements in forecast accuracy, inventory productivity and product availability. (Masters, 2016)

According to one consultancy, Veritico, companies that use S&OE, benefit from a notable boost in overall performance due to a 10% decrease in lost sales resulting from timely alerts about low-performing categories or channels, and a further 25% increase in resource utilization has been observed through the effective balancing of inbound and outbound logistics alongside production optimization. Additionally, the adaptability to changes increases by 15% by the implementation of S&OE process together with scheduling systems. (Veritico, n.d.) As a conclusion, one overlooked possibility for supply chain managers is to establish a S&OE process independently of the S&OP process. Though these two processes, S&OP and S&OE, may appear similar, establishment of a distinct S&OE process requires after all minimal resources and can offer substantial benefits in turn, not only in terms of short-term optimization of operations and derived cost reductions, but in terms of increased accuracy in long-term strategic planning of a company. (Masters, 2016)

## 4.2 Process definition

Ultimately, the most important objective of S&OE process is to support companies to achieve their organizational and financial objectives, first and foremost by recognizing variances as they arise. Those variances can appear either on supply or demand side, and handling them during weekly short-term cycles, rather than waiting for monthly planning meetings of S&OP process is

one of the key characteristics of S&OE process. S&OE aims at identifying the gaps on short-term and then deciding the appropriate methods to address them, thus optimizing the supply chain of the company on a short-term. (Hainey, 2022)

S&OE process also has various other tangible benefits for a company, for example in terms of reduced costs from better inventory and cash flow optimization as well as increased customer delivery performance and customer satisfaction. (Skyplanner, n.d.) Thus, implementing a S&OE process not only promotes better financial performance for a company, but according to Hoey (2019), implementation of a S&OE process separated from S&OP is a perfect fit for any highly digitized company operating on a production environment as it also provides more visibility to the future compared to the stand-alone solution of only having S&OP process. Masters (2016) further adds that with S&OE process, supply chain visibility in general also increases as the data and insights from S&OE are brought back to the S&OP process, which in turn, aligns the supply chain of a company better with the broader business objectives of the company. According to Kepczynski et al. (2018, 41), implementation of S&OE process leverages company profitability and total supply chain performance by ensuring that:

- *Execution of tactical S&OP plans are approved by management.*
- *Short-term optimization of supply chain is based on the profitability of the decisions.*
- *Immediate, short-term-focused escalations and prejudices are excluded from tactical S&OP.*
- *Short-term perspective is maintained while significant insights are delivered as inputs back to S&OP, thus S&OP is refined based on S&OE.*
- *Feasibility of tactical S&OP plans is enabled, allowing for continuous improvement of the S&OP process.*
- *Decision-making is data-driven, supported by demand figures and financials.*

Additionally, the outcome from S&OE planning should be then integrated back to tactical S&OP on a monthly basis. This consists of recording all the decisions concerning volume and value, and ensuring full transparency between the two processes, S&OP and S&OE. This alignment should ideally occur no later than on the same week when tactical S&OP formulates an integrated business plan on the tactical level. During this week, reconciliation among demand, supply, and finance should take place as well. (Kepczynski et al. 2018, 42-43)

S&OE process typically consists of a series of data-driven subprocesses. These are demand review where customer orders and forecasts are assessed to predict demand; supply review which focuses on inventory levels, production capacities and supplier management; consensus meeting where the key stakeholders are collaborating to address the mismatches between supply and demand and lastly, the executive review, where S&OE plans are aligned to meet the financial objectives and corporate strategy, or in other words, the planning levels of a company with higher granularity and aggregation than S&OE. (Skyplanner, n.d.)

For the consensus meeting where supply and demand mismatch and other topics are collaborated on, Kepczynski et al. (2019, 381), proposes a straightforward approach to S&OE meeting, which involves preparing the S&OE meeting with topics and actions to be decided on, mutually agreeing the decisions within the meeting and finally, communicating and tracking the execution phase of the decisions. Elementum (2021) shares similar view of the general S&OE process characteristics and advises that the deployment of a S&OE process can be started by implementation of just a few simple practices:

1. Deviations are monitored and any supply chain incidents are systemically captured and shared, which enables organizations to evaluate what is the state of their current supply chain system.

2. A cross-functional team, responsible for tracking and facilitating the resolution of these incidents, is established.

3. Daily, weekly and monthly meetings are implemented to prioritize resolving of incidents. Teams collaboratively analyze trends and identify opportunities and risks within the supply chain system. Root causes and best practices to prevent future problems are outlined.

Conclusively, according to insights also from various other authors, such as (Hoey, 2018; Hainey, 2022; Kennedy, 2021), the core element of S&OE lies in the S&OE meeting and fostering cross-functional collaboration across the organization. The key topic of S&OE meeting on the other hand involves active monitoring of metrics related to both supply and demand, facilitating coherent and transparent decision-making processes that are essential for effective operational management in general (Hippold, 2019; 3SC, 2023).

## 4.3 Carvalho's proposed S&OE model

Above mentioned practices for the deployment of S&OE process can be thought as the laying principles of setting up a structured S&OE process. According to an extensive cross-case analysis by Carvalho (2018, 94-97) S&OE process model can be divided into five non-sequential sub-processes, that are modelled by Carvalho (2018) into a Business Process Model and Notation (BMPN) model in Appendix 1: *disaggregate plans, generate and program orders, evaluate opportunities and deviations, define fulfilment, confirm orders.* Further, Carvalho's S&OE process is summarized and described, and the process inputs and outputs are shown in Figure 13.

| Sub-process | Sub-process description | Data input | Data output |
|---|---|---|---|
| Disaggregate plans | 1. S&OP plans are disaggregated for higher granularity<br>2. Plans are analyzed, validated and documented. | S&OP plan | Documented, disaggregated plans for products and sales channels |
| Generate and program orders | 1. Orders are generated based on the disaggregated data<br>2. Orders are brought to master production schedule (MPS) | Documented, disaggregated plans for products and sales channels | MPS plan and sales quotas |
| Confirm orders | 1. Data entry of orders<br>2. Setting prioritization rules for order fulfillment<br>3. Discussing and deciding order alternatives<br>4. Modifying and prioritizing orders | MPS plan and sales quotas | Confirmed orders and data promises to customers |
| Evaluate opportunities and deviations | 1. Changes and different scenarios are simulated<br>2. Impacts from opportunities and deviations in operations are evaluated, including orders requiring reprogramming<br>3. Best scenario is selected, or scenario is returned to evaluation<br>4. Determine if the team has autonomy to accept orders or if the orders have to be discussed in S&OE meeting | Orders from "Confirm orders" sub-process requiring further reprogramming are evaluated | A) Orders that can be accepted by the team are sent to order confirmation<br>B) Orders that still require reprogramming are sent to "define fulfillment" sub-process |
| Define fulfillment | 1. Prepare S&OE meeting<br>2. Perform S&OE meeting for: opportunities, deviations, fulfillment definition and order prioritization | Orders from "Evaluate opportunities and deviations" sub-process that are requiring reprogramming are decided on the S&OE meeting | Orders that can be fulfilled are forwarded to order confirmation |

Figure 13. Sub-processes of Carvalho's proposed S&OE model. (Adapted from Carvalho, 2018, 94-97)

### 4.3.1 Disaggregation of plan

The essence of hierarchical planning, as shown in Figure 14 below, involves dividing the overall planning task into manageable partial plans or sections, that are further assigned to different planning levels: strategic, tactical or operational planning. Each of the planning levels deals with the entire supply chain in overall, but they vary in terms of detail and time frame, as discussed earlier in chapter 2. On the upper planning level, strategic planning focuses on broader, long-term plans with more aggregation, for example in terms of individual products, which are aggregated into product families or groups. These sections on each planning level are coordinated by a comprehensive plan on the next higher level, creating a hierarchical structure: the amount of detail is therefore either increasing when moving down in the hierarchy, or vice versa, decreasing when moving up in the hierarchy. Level of granularity is therefore changed by breaking down or combining data and outcomes as there is movement either up or down in the hierarchy. Purpose of the aggregation is therefore to group products into groups, resources into capacity groups and time into longer periods. (Stadtler et al., 2016, 75)

The hierarchical plan involves two types of hierarchies: one hierarchy categorizes levels, such as from SKU (individual products) to product family or group, while the other hierarchy is based on the time horizon: short-term, medium-term, long-term (Mallik, 2021). According to Mallik (2021), in S&OE process, the plans from S&OP are disaggregated to more detailed product and location level, and the time horizon is narrowed to short-term. This disaggregation of S&OP plans into specific details helps in the coordination of executing S&OP plans (Lapide, 2016). In Carvalho's (2018, 95) S&OE process model, disaggregated plans from S&OP – concerning variables related to supply and demand – are first analyzed and validated by the S&OE team. Once the validation of disaggregated plans is done, the execution programs, such as production plan to balance supply and demand, are validated and documented. After the first step, generating and programming orders starts. (Carvalho, 2018, 95-96)

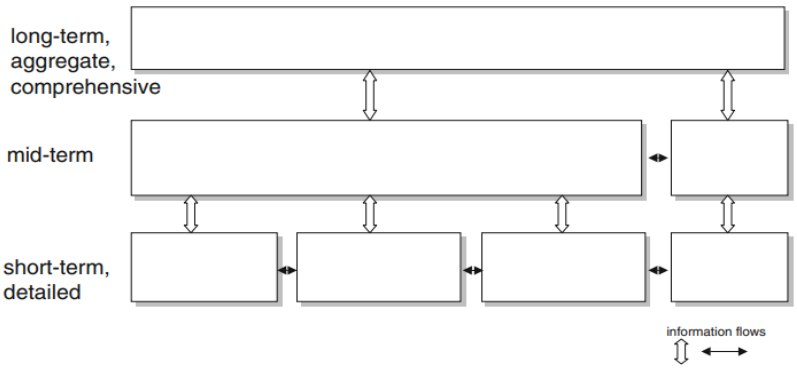


Figure 14. Hierarchy and aggregation of planning tasks. (Stadtler et al., 2015)

### 4.3.2 Order generation & programming

Generating and programming orders refers to the creation of a master production schedule (MPS) plan, that is initially based on the disaggregated plans from the published S&OP results. Once the S&OP results are first disaggregated to a more detailed level, customer orders are exported to MPS, allowing for the scheduling of production and aligning production to the forecasted demand. (Carvalho, 2018, 79; 94-95) MPS is a crucial part of the production planning process in manufacturing companies, and it involves establishment of a central document, that outlines the products and quantities to be made to fulfill the forecasted demand, as well as the timelines for completing the production (Optessa, n.d.).

Since the results from S&OP are based on aggregated demand and the time horizon of S&OP is longer than in S&OE window, disaggregation of the S&OP plans is the first required task in order to create a feasible MPS plan, that is constantly adjusted when changes arise. The simple objective of MPS plan is the total cost optimization of production capacity utilization, and it is balancing the costs of capacity utilization against the seasonal inventory fluctuations and sales demand. (Stadtler et al., 2016, 80) As the main attention of S&OE process is on operational horizon and fluctuations of supply and demand in short-term, the level of detail generated in MPS is with higher granularity due to the disaggregation of S&OP data and it assists in the execution of the S&OP plan (Kennedy, 2021).

However, Carvalho (2018, 101) also discusses that according to the cross-case analysis, it can be observed that a S&OE process in fact transitions S&OP plans into executable actions in a way, that is better aligned with high-level business objectives than just the deployment of a traditional MPS solution alone. Similar view is also discussed by (Mallik, 2021): as MPS is generated based on demand and supply reconciliation from higher level planning and uses disaggregated information from S&OP, the output from MPS planning should further act as a guide in company's production capacity scheduling and ultimately, to complete the connection from S&OP to S&OE in the hierarchical planning. Therefore, MPS should be considered as a tool that supports S&OP execution and to yield the best possible benefits, MPS should be used in alignment with structured S&OE process.

### 4.3.3 Confirmation of orders

Confirming customer orders includes order-entry into systems, definition and determination of order prioritization rules, and evaluation of possible alternatives and changes to orders. Once the prioritization of orders is completed, orders and delivery dates are further promised to the customers. Orders requiring reprogramming are forwarded to the sub-process of evaluation of opportunities and deviations. (Carvalho, 2018, 95) Order promising, and demand fulfilment are critical supply chain processes. Also, the prioritization and confirming of customer orders are some of the vital activities to be performed on short-term planning and are on the responsibility of supply chain teams. On the short-term there is the most visibility to the customer orders and their share of the total forecasted demand for the near future since many of the customer orders are already received. As there is more information to the demand fluctuation available on this short-term planning period due to the approaching delivery times, the demand information must also be integrated back to the longer-term demand forecasts, in so called “forecast netting”, to maintain a high level of forecasting accuracy. (Stadtler et al., 2016, 91-92)

Forecast netting is a calculation method, where the actual orders are aligned with the forecasted demand by consolidating them into a single, integrated total demand (Frepple, n.d.). Consolidating real-time demand signals and actual orders to the demand forecasts increases the efficiency, profitability and service level performance of the company (KPMG, 2023). In the demand planning process, demand forecasts should be updated on a weekly basis for all products and components and adjusted with actual orders through forecast netting. Since some products or customer orders from the initial forecast may already be realized, the remaining forecast is simply balanced against actual orders for an integrated total demand. Further, in master planning this information about netted forecast and actual orders are used as inputs to create a fulfilment plan and to schedule how the production can be aligned with the demand and how the customer orders can be confirmed. (Stadtler et al., 2016, 435-436) On the short-term planning level, in other words in S&OE planning, MPS systems - such scheduling tools – are utilized to support decision-making regarding demand fulfilment and other activities concerning near-term balancing of supply and demand, as well as to also provide support to the company’s mid-term planning, or in other words, S&OP (Stadtler et al., 2016, 100-101).

### 4.3.4 Evaluation of opportunities & deviations

In this step of the S&OE process, S&OE team constantly evaluates what is the impact and required level of changes to operations in short-term, stemming from identified opportunities or deviations that can originate from for example customer service level agreements, issues in production or supply or changes in demand. This step takes into consideration demand fluctuation and ensures the fulfilment of customer orders by matching them with the production in a daily basis. The team creates simulations and different scenarios in an iterative process, with the objective of ultimately being able to select the best scenarios for further analyzing and finally, execution. In this stage, S&OE team should have autonomy for certain level of decisions: accepted orders are forwarded directly to define fulfilment-sub-process, and orders requiring further reprogramming and their fulfilment are evaluated separately within the S&OE meeting. (Carvalho, 2018, 79;89-91;97)

SOE processes' active monitoring of demand, orders, supply and inventories promotes swifter detecting, solving and preventing of problems in the supply chain (Van Lancker, 2020). The total supply and capacity needed for the fulfilment of demand should be calculated and reviewed on a weekly basis in operational planning. Demand forecast should be constantly updated and netted against actual orders, and the netted demand plan should be shared further to master planning in order to create a fulfilment plan. Kepczynski et al. (2018, 435-436) Therefore, the purpose of this step in S&OE process is to add value by providing a decision-making forum that analyzes and agrees on solutions for short-term deviations, and thus, mitigates possible inventory stock-outs and customer impacts (Van Lacker, 2020).

### 4.3.5 Defining of fulfilment

In Carvalho's S&OE process model, demand fulfilment is iterated on a weekly basis in S&OE meetings, that are considering opportunities, deviations, fulfilment definition and order prioritization (Carvalho, 2018, 97). (Hippold, 2019; Hainey, 2022; Gilchrist, 2023) share similar views that S&OE meetings should be initiated at least on a weekly basis to detect and manage deviations effectively and the focus of the meetings should be in the short-term fluctuation of supply and demand, and in finetuning of operations. According to Logility (2021), efficient S&OE process also requires conducting weekly meetings to analyze and address prompt supply chain issues on the short-term, but it is also required to implement the tasks required for the execution of tactical

plan, S&OP. Additionally, including the right stakeholders, utilizing sophisticated supply chain management solutions, such as scheduling tools, and promoting collaboration and visibility through-out the supply chain organization should be included to the S&OE meetings. By keeping S&OE meeting separated from S&OP meeting, both teams are also allowed to concentrate on their own specific planning horizons. Thus, in the context of S&OE, in addition to the short-term finetuning and decision-making, this weekly meeting is the right forum to keep track of the monthly progress towards the business goals defined in S&OP and it also allows for planning of strategies for the upcoming months. (Hippold, 2019)

In addition to scheduled S&OE meetings, it is important to define what type of deviations would require immediate actions and unscheduled meetings, thus the structure of S&OE process and meetings should have flexibility also for prompt, on-demand meetings for swift decision-making. Lastly, S&OE meeting should be facilitated by a leader, that has a connection to the S&OP by their position. Facilitator of the S&OE meetings should also have the mandate for unbiased decision making to ensure the best possible overall outcome is achieved in situations, where trade-offs in the short-term are required to be made. (Gilchrist, 2023)

## 4.4 Implementation of S&OE process

Deployment of the S&OE process can be started by the implementation of a few simple practices: first, organization begins to systemically capture and communicate supply chain incidents to relevant stakeholders along with active monitoring of other deviations, a dedicated team is established for the tracking and resolving of those incidents and deviations and lastly, a standardized meeting practices are implemented to ensure the holistic operational management and optimization of the supply chain system as whole. (Elementum, 2021) Similar steps for a successful S&OE implementation are also described by supply chain analytics consultancy 3SC (2023): the first stage in S&OE process design involves defining the requirements, data hierarchy, inputs and outputs and determining the scope of execution. Once the requirements are established, designing of S&OE process can begin. Once the process is designed, it is required to start the implementation of weekly meeting practices, where S&OE performance is reviewed and decisions to execute the plans are agreed amongst the appropriate stakeholders. From there on, S&OE process is constantly identifying and tracking deviations, and appropriate measurements are taken for resolution of the deviations. (3SC, 2023) The steps for S&OE process implementation are illustrated in Figure 15.

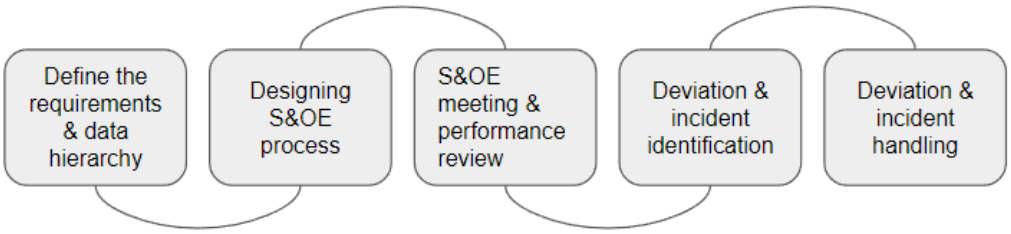



Figure 15. S&OE process deployment. (Adapted from 3SC, 2023)

However, in order for the organization to start deploying their S&OE process, it is first required to define the key characteristics that are foundational for a feasible S&OE process and their connectiveness to each other's in the workflow. The elements that should be defined for the process are aggregation of data, defining the appropriate S&OE stakeholders and their responsibilities in the process and determining the best suitable key performance indicators for the sake of tracking the process performance and effectiveness.

### 4.4.1 Data aggregation

Typical to S&OE is the data aggregation, which simplifies complex issues and helps to mitigate uncertainty, such as in demand forecasts. Aggregation can occur in three dimensions: time, products, and resources. For instance, at a higher level, time might be aggregated into weekly time buckets, focusing only on primary finished products regardless of their variations. Similarly, available production capacities are considered as approximate maximum output rates on a weekly basis. The duration of the planning cycle is crucial for responsiveness to short-term changes in real-world conditions and thus determining appropriate planning cycles ensures that the data remains relevant and up to date throughout the planning process. (Stadtler et al., 2016, 25;46)

The planning horizon refers to the timeframe for which plans are created for, whereas the planning cycle or time bucket refers to the planning horizon, which is divided into several shorter periods to enable more accurate planning (Stadtler et al., 2016, 162-163). By defining the appropriate planning horizon and cycles to S&OE process, it allows for the assessment of the necessary resources for executing the production plan, identifying opportunities and constraints and addressing any potential issues that could impact production in short-term (Riverlogic, 2023), thus

also allowing the S&OP team to set their focus on addressing longer-term opportunities, constraints and risks (Hainey, 2022). Typical planning horizon in S&OE process ranges from 0 to 12 weeks and is performed in planning cycles or time of one week (Carvalho, 2018, 78). Therefore, S&OE process is focused on planning and aligning the demand and supply of the company for 0 to 12 weeks planning horizon, within a time buckets of one week, where also the production plans and demand are reviewed on a less-aggregated SKU-level (Carvalho, 2018, 99-100).

### 4.4.2 Stakeholders and responsibilities

S&OE process requires a supply chain leader, that typically is either a S&OE manager or S&OE coordinator, depending on where S&OE is positioned in the company's planning hierarchy. This individual should be unbiased, and they should have the knowledge to understand the consequences of aligning different plans across the supply chain as well as the autonomy to make decisions regarding trade-offs to find the best consensus for the company. Additionally, in their responsibility, is the overall coordination of all the S&OE activities and acting as the process owner of S&OE and S&OE meetings, with an involving role also in the S&OP process and meetings to support the decision making further in S&OE. The S&OE team consist of team of analysts or planners, that are responsible of generating orders and running the operational systems, such as scheduling tools, and are constantly analyzing supply and demand data to elaborate reports and to support decision-making. Additionally, team is monitoring KPIs, tracking supply chain deviations or incidents on a daily basis and seeking out opportunities throughout the whole supply chain. These analysts or planners are empowered to make minor, routine decisions independently, whereas the decisions that include trade-offs or concern longer time horizon, are ruled by the S&OE leader. (Carvalho, 2018, 99-100)

S&OE team is responsible of ensuring the alignment of S&OP plans to execution, whilst balancing the demand with production and purchasing plans in short-term, and upholding order fulfillment while meeting the agreed service levels towards customers. In the daily operations, team has the autonomy to make routine decisions. However, decisions that have wide-ranging effects beyond the direct focus and scope of S&OE that are impacting multiple functional area – such as the production planning or whole supply chain of the company – or are posing significant risks to operations, need to be discussed and decided in the weekly S&OE meeting, facilitated by the S&OE leader. (Carvalho, 2018, 99-100)

### 4.4.3 Key Performance Indicators

Selecting the most suitable key performance indicators often involves some trial and error. Each metric has its own strengths and weaknesses, and every business on the other hand has their unique objectives, whether it be rapid growth or sustaining current market share and thus, the optimal KPIs for planning purposes differ among companies (Jenkins, 2021). However, once the supply chain processes of a company are mapped out, it's essential to start establishing relevant key performance metrics (KPI) for evaluating changes and assessing the performance of both the entire supply chain and its individual processes. The focus should be on identifying the most relevant metrics rather than merely measuring something, and the selected KPIs must align with the general supply chain strategy and most importantly, reflect the objectives of the specific planning process and its scope. (Stadtler et al., 2016, 40-41)

However, despite that every supply chain is unique and may require tailored approaches in terms of KPI setting, there are certain performance metrics that are generally relevant across various contexts, and many of them are related to customer delivery performance. As customer orientation plays a vital role in supply chain management, the delivery performance stands as a crucial indicator of the overall supply chain effectiveness. (Stadtler et al., 2016, 43;44) In S&OE planning context, KPIs typically focus on service level, order fulfillment and maintaining the supply and demand balance, in terms of production and the order book. Commonly utilized KPIs associated to S&OE in Carvalho's (2018) model are related to customer delivery performance and schedule attainment, such as OTIF (On Time in Full), adherence to the programs (production, distribution, purchasing), inventory management indicators (stock-outs, excess inventory), backlog, service level and change in sales orders. (Carvalho, 2018, 100). The KPIs associated to Carvalho's S&OE model are represented in Figure 16 and further explained below.

| KPI | Description and relevance to S&OE | Formula |
|---|---|---|
| On-Time | Result applied to OTIF KPI | Delivery time – Confirmed delivery time |
| In-Full | Result applied to OTIF KPI | Cases matching the criteria / Total number of cases |
| On Time In Full (OTIF) % | Performance benchmark for evaluating the efficiency of operations (Adapt Ideations 2022). | Total deliveries completed on time and in full / Total deliveries made x 100 |
| Schedule attainment % | Measures completed production to planned production, providing an overview of productions' ability to meet targets within a specified timeframe (Lauzier 2022). | Completed planned work / Planned work x 100 |
| Adherence to production plan % | Monitors the effectiveness of adhering to production plans (Carvalho 2018). | (Scheduled production – Actual production) / Scheduled production x 100 |
| Order backlog % | Monitors the backlog of orders by measuring the number of received orders that are yet to be fulfilled (Stadtler et all. 2015 & Bonderud, D 2020). | Backlog of orders / Total sales x 100 |
| Forecast error (FE) | Monitors the accuracy of sales forecasts compared to actual sales, therefore evaluating the performance of the sales team. FE provides insights into the quality of forecasts in terms of monetary value, by comparing forecasted revenue to actual revenue (Jenkins, A 2021). | Actual sales – Forecasted sales |
| Forecast accuracy (FA) % | Reflects the accuracy of sales and demand predictions. High FA indicates better synchronization of operational costs with demand, resulting in higher profitability. Disregards positive or negative sign, due to being "absolute value (Jenkins, A 2021). | 1 – [Absolute value of (Actual sales for time period – Forecast sales for the same time period) / Actual sales for time period] |
| Service level % | Measures the proportion of customers who avoid experiencing stock-outs, helps in managing the balance between excess inventory costs and the costs resulting from inadequate inventory to fulfill demand (Luther, D 2022). | (# orders delivered / # orders received) x 100 |

Figure 16**.** Descriptions of the KPIs associated with Carvalho's (2018) S&OE model. (Adapted from Adapt Ideations, 2022; Lauzier, 2022; Carvalho, 2018; Stadtler et al., 2015; Bonderud, 2020; Jenkins, 2021; Luther, 2022)

On time in full (OTIF) is a benchmark that evaluates the efficiency of a company's delivery operations and can be used as a performance indicator for suppliers, manufacturers and logistics companies. OTIF KPI calculates the percentage of deliveries completed in full quantity and meeting the agreed delivery time, versus the total number of deliveries. OTIF is composed of two distinct metrics, On-Time and In-Full, and then calculated simply by counting the total number of

deliveries delivered on time and in full and dividing that number by the total number of deliveries. (Adapt Ideations, 2022)

*On-Time*

*On-time = Delivery time – Confirmed delivery time*

*In-Full*

*Cases matching the criteria / Total number of cases*

*OTIF KPI*

*On-Time In-Full Rate % = Total deliveries made on time and in full / Total deliveries made x 100*

As customer delivery performance evaluates the promptness of meeting customer demand and relies mostly on the forecast accuracy and supply chain's ability to execute plans (Stadtler et all., 2016, 180), one of the relevant key performance indicators associated with it is adherence to programs – often referred as schedule attainment, or for example adherence to production plan – in other words, how effectively the plans are executed in terms of planned production versus actualized production (Carvalho, 2018, 100). Specifically for this purpose, schedule attainment KPI measures how much of the planned production was completed compared to the total planned production. It gives an overall view of how well manufacturing operations meet their production targets within a specified timeframe, such as in one week. Understanding schedule attainment is crucial, as it offers valuable insights into a company's ability to adhere to its planned schedule and assists in revealing factors influencing its production performance. Often, low schedule attainment is indicating some inefficiencies in company's production. (Lauzier, 2022) Another usable metric, adherence to production plan KPI, tracks the efficiency of adhering to production schedules, and it can be also measured with multiple different variables, such as production, distribution and purchasing plans (Carvalho, 2018, 83).

*Schedule Attainment KPI*

*Schedule Attainment % = Completed Planned Work / Planned Work x 100*

*Adherence to production plan KPI*

*Adherence to production plan % = (Scheduled Production– Actual Production) / Scheduled Production x 100*

Other KPIs related to delivery performance from the perspective of a company's service level are backlog and change in sales orders, which refers to forecasting accuracy**.** Backlog KPI tracks the existing order backlog by assessing the volume of orders that are received but have not yet been produced (Stadtler et all., 2016, 85). Although a backlog might indicate strong demand, it's essential to monitor its size carefully and to implement measures to prevent customers from experiencing prolonged wait times for their orders. Sales backlog is often represented as a ratio and it is comparing daily, weekly, or monthly order volumes against the capacity for order processing. Backlog ratio can be calculated by dividing the number of backlogged orders by the number of sales in a given time. The higher the ratio is, the better the demand generally is. If this metric increases over time, but the capacity remains unchanged, more orders are backlogged. Conversely, a decreasing trend suggests declining order numbers and improved fulfillment meeting demand. (Bonderud, 2020)

*Backlog KPI*

*Sales backlog % = Backlog of orders/Total Sales x 100*

Change in sales orders can be measured by measuring forecasting and two especially relevant metrics are forecast error and forecast accuracy. Forecast error is a KPI that is measuring forecasted sales with actual sales helps to evaluate how the sales department or specific teams are performing. It can be reported on weekly, monthly or quarterly frequency, depending on the product and the urgency of decision-making. Forecast error provides insights into the forecast quality for planning from the monetary perspective: how much revenue was forecasted versus how much revenue actualized. (Jenkins, 2021) By active monitoring of forecast error in S&OE, it is possible to gain insights into customer behavior and market trends also on a weekly basis (Cheng, 2019).

Jenkins (2021) further discusses that another useful KPI from the perspective of demand planning that indicates the accuracy of sales and demand forecasts is forecast accuracy. Higher forecast accuracy implies better alignment of operational costs with demand, which leads to increased profitability. For new products lacking sales history, an 80% ratio can be considered excellent, but products with an established sales history should aim at 90% ratio or better. Similarly, to forecasting error, the frequency for calculating forecast accuracy can be agreed according to the business needs. The formula of forecasting accuracy disregards the positive or negative sign, being "absolute value". (Jenkins, 2021)

*Forecast Error KPI*

*Actual sales – Forecasted sales x 100*

*Forecast Accuracy KPI*

*Forecast accuracy % = 1 – [Absolute value of (Actual sales for time period – Forecast sales for the same time period) / Actual sales for time period]*

Inventory management relies on KPIs that track and guide decision-making regarding stock levels and provides insights into attributes such as demand and process efficiency. In terms of inventory management, service level is a one KPI that addresses the percentage of customers who avoid stock-outs. This KPI aids in balancing the costs associated with excess inventory and the costs incurred from insufficient inventory to meet demand. Moreover, service level KPI also assists companies in addressing supply chain complexities, customer demands, and inventory rotation challenges. (Luther, 2022)

*Service Level KPI*

*Service Level % = (# orders delivered / # orders received) x 100*

### 4.4.4 Implementation challenges

According to Hoey (2020), implementing a new supply chain strategy like S&OE presents challenges similar to many other high-potential supply chain approaches. Thus, in the implementation phase of S&OE, there are some typical pitfalls that should be first considered and reviewed in order to successfully implement the process to use in organizations (Hoey, 2020). These pitfalls of S&OE process implementation are typically related to the relevance of available data, availability of technological solutions for real-time data and organizations' inability to define and separate S&OE process and its meetings from S&OP (Hoey, 2020; Porter, 2023). Typical S&OE challenges and their resolutions are illustrated in Figure 17 below.

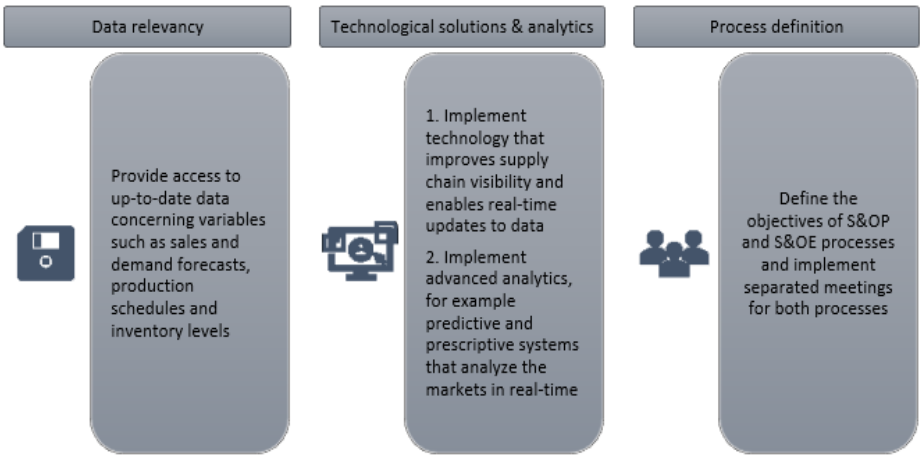



Figure 17. S&OE challenges and resolutions to challenges. (Adapted from Hoey, 2020; Porter, 2023)

Due to the nature of S&OE, the purview of the process is more limited compared to S&OP and therefore to be able to make decisions regarding the daily balancing of supply and demand, the faced challenge is often related to selecting the wrong data sources and irrelevant or inaccurate information. Therefore, it's crucial that a S&OE dashboard that displays relevant and accurate information from the correct sources, according to the specific needs of the company, is implemented. This for example includes current S&OP plans. (Hoey, 2020) Since data plays an essential role in S&OE as it guides the process and provides leaders with comprehensive visibility into the supply chain operations, access to up-to-date data is especially beneficial for S&OE. Some of the data sources that should be taken into consideration for effective S&OE process are sales and demand forecasts, production schedules and inventory levels. (Porter, 2023)

Once the planning environment is established with the right data streams, it is essential to implement real-time planning technologies. As S&OE workflows are tailored for short-term operational decision-making, quick access to real-time information for example concerning production output in order to make changes to operational plans is required. (Hoey, 2020) Further, according to (Hoey, 2020; Porter, 2023), integrating S&OE process with advanced supply chain solutions that provide real-time tracking and visibility to deviations is a required, in order for the team to proactively identify and address potential disruptions in the supply chain. Hoey (2020) further explains that without implementing technology that improves visibility and enables real-time updates, S&OE may struggle to realize its full potential, as it will consistently lag behind the actual events happening in the supply chain. Additionally, even though data visibility itself enhances agility and aids in the decision-making, also advanced analytics would boost the effectiveness of

S&OE. As discussed by Hoey (2020), for example with predictive and prescriptive analytics systems, S&OE planners can analyze market trends in real-time and quickly adjust their plans to new conditions. For instance, when dealing with last-minute orders or shipping delays due to weather conditions, advanced analytics can assist in determining optimal solutions utilizing available inventory and supplier alternatives.

S&OE often also requires teamwork across different departments, but this can be held back by organizational barriers. To address this challenge, organizations should establish procedures and standards for cross-functional communication and aim to break down communication barriers. (Porter, 2023) A common pitfall is blending S&OP and S&OE into one unclear process, which reduces the effectiveness of both processes. S&OP should concentrate on long-term planning based on forecasted demand and capacity, while S&OE should ensure weekly supply chain stability and provide feedback for future planning back to S&OP. Therefore, both S&OP and S&OE should have its own clear objectives and meetings and be considered as their own processes, that have interconnectedness. (Hoey, 2020)

In order to understand the potential obstacles to implementing a new S&OE process, a S&OE implementation readiness survey, as presented in Appendix 2, was conducted. This survey relates to the possible S&OE pitfalls and challenges as part of the empirical study and was directed at stakeholders actively involved in S&OE. The objective was to identify any significant barriers hindering the successful introduction of the new S&OE framework. Referencing insights from the literature by (Hoey, 2020; Porter, 2023), which highlighted potential challenges such as data relevance, technological solutions and analytics, and defining the process, the survey aimed to determine if these obstacles actually exist within the case company's current operations. Purpose of the survey was to collect insights from the stakeholders and aimed to connect theoretical insights with practical realities, and further provide actionable recommendations for the implementation of the new S&OE process.

### 4.4.5 Supply chain maturity

Academically, maturity models are structured frameworks that typically are representing a series of development stages and are highlighting the expected, logical path from a certain stage to a full maturity. Maturity models are designed to assess an organization's existing capabilities and provide a development roadmap. The primary use of maturity models is to evaluate the current

situation, prioritize improvement actions and monitor progress. Objective of maturity models is to define clear stages and pathways of development and to highlight areas that require enhancement to address and improve capabilities. (Poeppelbuss & Roeglinger, 2011).

Usually, maturity models focus on key areas like processes, organization, skills, data, system functionality and scalability. All of these areas don't have to be addressed at once in every transformation program and the success and output of the development project depends on the required maturity level for the subject of the review. For example, maturity model can concern a certain organizational process or system functionality only. The importance of sustainability in change should also not be underestimated in the maturity development journey, and it is essential to ensure that there is ability in organization to effectively implement and integrate the changes to use after the maturity assessment. (Kepczynski et al. 2018, 237-238)

Before implementing a new S&OE process, the maturity level of the current supply chain configuration and S&OE process should be comprehensively investigated and described. Earlier sections presented the typical elements and characteristics of a functional S&OE process, along with the common challenges that are often faced within the implementation. In order to be able to develop a new S&OE process for the case company, it is essential to first evaluate, what is the state-of-art and maturity of the current process.

In the context of supply chain maturity, it is essential to continuously evaluate and improve the maturity level due to the highly competitive business environment of the present. Supply chain maturity refers to the resilience and efficiency of a supply chain and by increasing the supply chain maturity, an organization is better equipped to handle risks and deviations that arise within their supply chain. For example, a delay in a supplier's shipment won't stop the entire production, as the organization is able to anticipate the delay and arrange alternative solutions to ensure a continuous workflow in their production. (Lester, 2023)

As explained further by Lester (2023), supply chain maturity models enable a detailed examination of the business efficiency and identifies bottlenecks for improvement and development. Researchers from PricewaterhouseCoopers (PwC) and Massachusetts Institute of Technology (MIT) have outlined general assessment criteria for organizations for the evaluation of their supply chain maturity based on the four stages that are presented below (Lester, 2023):

1. **Reactive supply chain management:** This initial stage is characterized by limited integration and coordination among operations, suppliers, and partners, which is resulting in

inventory imbalances and customer dissatisfaction due to a lack of synchronization and visibility into potential supply chain risks.

2. **Internal supply chain integration with planned buffers:** At this stage, organizations align their performance objectives and internal information, enabling them to adapt to shifting demand and integrate risk management processes.

3. **Collaboration across an extended supply chain network:** In this phase, organizations engage in extensive data and information sharing across all supply chain partners. They have the visibility into what is going on externally, which allows them to anticipate changes and enhance supply chain resilience.

4. **Dynamic supply chain adaptation and flexibility:** Representing the highest level of maturity, organizations at this stage align key performance indicators across the entire ecosystem, and there is supportive systems and flexibility to identify and address emerging value chain patterns. They utilize real-time monitoring and data analytics to facilitate quick responses and establish risk strategies tailored to supplier profiles and market-product combinations. Lester (2023)

Another maturity model specifically for the assessment of a specific process of supply chain, according to Lester (2023), evaluates the gap between current performance and company objectives and consists of five levels. Whereas the above model is considering supply chain maturity in general, this model is considering supply chain process maturity from the perspective of evaluating a specific process within the supply chain. These five levels of the model by Lester (2023) are represented below:

1. **Initial** – At this stage your processes lack organization and collaboration.

2. **Managed** – Essential project management processes are put into place.

3. **Defined** – Your processes are now organized, defined, and fully documented.

4. **Quantitatively Managed** – Your processes are measured with statistical and quantitative techniques.

5. **Optimizing** – Continuous process improvement helps you reach your business goals. (Lester, 2023)

Whereas the aforementioned maturity models aim at mapping the maturity of the whole supply chain, or a specific process within a supply chain, Supply Chain Media has developed a ten-point maturity model specifically tailored for the purpose of evaluating S&OE process. This model is presented in Figure 18. On the lowest level of maturity when 7-10 questions are checked with no, the company predominantly utilizes S&OP or IBP process for both medium and short-term decision-making. To address this, the company should begin by distinguishing between short-term and long-term planning and set the focus on enhancing the S&OE process accordingly. (Supply Chain Movement, 2023)

The next highest level of maturity is achieved, when 4-6 questions are answered with no. On this level, the company has a foundational S&OE process. However, while they are already handling tactical and operational planning separately, refining their S&OE process further could still enhance short-term decision-making effectiveness. The highest level of maturity according to this evaluation is achieved, if 0-3 questions are answered with no. In this case, the company employs a solid S&OE process that supports efficient operational decision-making. However, there are still potential areas for enhancement to advance to the next maturity level. (Supply Chain Movement, 2023)

| Question | Yes | No |
|---|---|---|
| 1. Tactical and operational decision-making is done separately through two structured processes (S&OP and S&OE) that each focus on a specific horizon. | | |
| 2. The S&OE process runs at a higher frequency than the S&OP process and manages demand and supply plans on a more detailed level. | | |
| 3. The objectives of the S&OE process are based on written guidelines set in the S&OP processes following a formal handover | | |
| 4. If there are supply constraints, available product is divided over competing recipients according to a written allocation plan based on business rules. | | |
| 5. When faced with supply chain disruptions or other deviations from the S&OP plans, changes are made following written guidelines and a structured process. | | |
| 6. All business functions involved in short-term planning understand their clearly defined roles and responsibilities in the S&OE process. | | |
| 7. Demand and supply performance are monitored weekly based on predefined KPIs and reliable data to identify gaps with the plan. | | |
| 8. A standard, formalized set of preparation activities are performed before every S&OE meeting to ensure decision-making is based on the latest demand and supply outlook. | | |
| 9. The S&OE meeting follows a clear, formalized agenda and output actions are captured and followed up based on an action list. | | |
| 10. Supply and demand plans are maintained in an ERP and/or APS system to continuously provide an outlook in real time. | | |

Figure 18. Checklist for S&OE general maturity assessment. (Supply Chain Media, 2023)

# 5 Research strategy

The theoretical framework of this thesis is conducted based on various business planning processes, with a specific focus on S&OE process, that is a one business planning process tailored specifically for the short-term optimization of a supply chain. The aim of the empirical study is to determine the current state of the case company's S&OE process and to investigate concrete development areas associated to it. This chapter outlines the research design for the thesis; how the empirical part of this study is conducted, what is investigated, and why. The chosen research strategy, approach, and methodology, as well as the data collection and development methods that are employed in this thesis, are theoretically explained and justified.

## 5.1 Research strategy and approach

A research strategy serves as a comprehensive plan utilized by the researcher, in order to execute a research project. It encompasses the specific methods of research that involve particular rules and considerations tailored to the specific research project. (JYU, 2010) In order to select the correct research methods to solve a research problem, specifying the research objectives is at first required. Researcher is responsible of identifying and determining what type of information or data is required to solve the research problem, how this information or data is gathered and from what types of sources, what are the suitable collection methods for the data and how the collected data is analyzed. (Kananen, 2014, 35-36; 47) Selecting suitable research approach also sets the stage for selecting the research strategy, which can be i.e. case-study or constructive research (Ojasalo et al., 2015, 65).

Researchers often find constructive research to be a suitable approach for addressing practical challenges and creating new solutions to a practical problem (Ojasalo et al., 2015, 38). New solution to a practical problem emerging from constructive research can for example be a model, metric or a plan. The process of constructive research focuses on developing a solution, that is based on existing theoretical knowledge combined with practical observations. (Ojasalo et al., 2015, 65) The objective of a constructive research approach is to introduce new insights into the business while also implementing a new solution to a practical problem. Constructive research involves developing something concrete and testing its feasibility. (Ojasalo et al., 2015, 65).

## 5.2 Research methods

Choosing the suitable research methods is guided by the research subject, and typically the selection is either quantitative or qualitative. However, quantitative and qualitative research methods are not mutually exclusive; instead, both can be employed in research if needed. In quantitative research, subject matter knowledge is required from the researcher to be able to understand what is actually being measured. If there is lack of information about the research subject, qualitative research methods can be used to complement quantitative approach, in order to gain additional insight or knowledge of the research subject. (Kananen, 2014, 12-15)

In cross-disciplinary research it is possible to employ triangulation. Triangulation or mixed methods approach involves combining various research methods, such as qualitative and quantitative methods, which is known as methodological triangulation. Data triangulation on the other hand refers to the utilization of different sets of research data, which means that the research data is collected from different data sources, i.e., from surveys and written documentation. (Vilkka, 2021, 125-128) Also, in mixed methods research where both quantitative and qualitative research is applied, content or document analysis can be performed with qualitative research approach. Qualitative content analysis can be used to complement or to verify the findings from other research methods, such as quantitative survey. Information and insights derived from the qualitative content analysis therefore increase the knowledge of the research subject. (Bowen, 2019)

## 5.3 Data collection and analysis

Quantitative research is a methodology that is used to provide a broad overview of the relationships and differences between measurable variables. Quantitative research is objective, and objectivity refers to the neutrality of the researcher, which means that the researcher does not have any impact to the research results. (Vilkka, 2007, 13) Quantitative research involves analyzing theories as variables which are then quantified as numerical data for statistical examination. During the literature review phase of the quantitative research, potential topics and questions are often revealed (Creswell, 2003, 22;57). In quantitative research, one can describe and interpret the subject statistically using numerical data (JYU, 2010). Also, quantitative research proves effective when the audience is more inclined towards receiving information in the form of factual data, graphical representations, charts, and statistical analyses (Williams, 2021). Reliability in

quantitative research is achieved when results remain consistent across different instances, ensuring the research's validity and reliability (Clark-Carter, 2004, 28-29).

In quantitative research, questions are often direct and effective in prompting responses to "how" and "what" queries. Researchers can then quantitatively measure percentages, frequencies, trends, and behaviors, as well as evaluate attitudes based on the data. However, quantitative research typically does not extensively explore the underlying causes of observed behaviors or attitudes. Therefore, in order to gain a deeper understanding, researchers may also turn to qualitative research approaches to complement their findings. (Goertzen, 2017, 12)

For qualitative research, there are many different approaches and analysis methods that can be used, thus no single definition for it exists (Juhila, 2021). Qualitative research involves summarizing and refining data into conceptual or scientific form, and its purpose is to understand the data – what is the content of it, and what does it implicate. Data should be therefore analytically reviewed with the objective of enriching the informal value of it by also utilizing theoretical framework and personal insights for the examination and interpretation. In qualitative research, analysis method or the approach used to examine and analyze the data is also determined. Analysis method refers to the concrete methodology, which is used for processing and analyzing the data. (Günther et al., 2021)

Content analysis is methodology to analyze written texts by focusing on what topics, subjects and themes that the material covers. Content analysis is based on coding that is performed by the researcher, where significant elements found from the material that are relevant or interesting for the research subject, are identified and labeled. In theory-driven coding, the researcher, based on their theoretical understanding, can select what interests them in the material. For the content analysis, either specific tools or tables or matrixes can be utilized, and as this method does not rely on any specific theoretical-methodological framework, there is no universal rules or specific guiding principles on how the analysis must be performed. However, content analysis is not just a description of the material, rather it serves as the basis for conclusions based on the material. (Vuori, 2021) In qualitative research, one analyzation methodology that can be utilized for content analysis is theming (Günther et al., 2021). The aim of thematic analysis is to identify and reveal relevant themes within the data, that are relevant to the research problem (Juhila, 2021).

Lastly, in order to evaluate case company’s S&OE process and its maturity level more holistically, and due to the lack of existing models available in academic literature specifically for this purpose, a unified S&OE maturity model presented below in Figure 19 is created by the author. This

maturity model is applied to the empirical research, by utilizing its framework for the evaluation of the maturity level of the current S&OE process, by applying the results from one section of the quantitative research into it. The detailed survey questions related to this maturity model are shown in Appendix 4. This maturity assessment is derived from distinct models presented in the theoretical framework by Lester (2023) & Supply Chain Movement (2023), and further refined by applying author's relevant knowledge of the matter subject into the development of this maturity model. This unified model is designed by identifying characteristics, common themes and levels of different maturity models presented in the theoretical framework, that would be suitable in the context of evaluating the maturity of the case company's S&OE process from different perspectives.

Unique elements and features of each of these aforementioned different maturity models presented in the theoretical framework are incorporated into this unified maturity model, whilst ensuring that the model would remain coherent and consistent, with a logical flow from one maturity level to the next one. Lastly, this unified model is then further refined and validated with author's own contribution, whilst also ensuring that it accurately represents the common characteristics of all the three different models, with respect to their unique characteristics, whilst also ensuring it would be relevant from the perspective of the case company. Also, it is considered that the model represents maturity progression from one level to another and would be applicable to the specific context and needs of the case company, and it can be used to map the current maturity level of S&OE process at the case company and most importantly, to pinpoint areas, that can be developed within this study, but also in any future researches concerning the same topic.

| Level of maturity | Characteristics | Key features |
|---|---|---|
| 1. Initial | • Processes lack organization and collaboration.<br>• Limited integration and coordination among operations, suppliers, and partners. | • Reactive supply chain management with limited synchronization and visibility. |
| 2. Managed | • S&OE has integrated sub-processes.<br>• Tactical and operational decision-making is done separately through two structured processes (S&OP and S&OE) focusing on specific horizons.<br>• Roles & responsibilities for short-term planning are defined. | • The S&OE process manages demand and supply plans on a detailed level at a higher frequency than the S&OP process.<br>• Objectives of the S&OE process are based on written guidelines set in the S&OP processes following a formal handover. |
| 3. Defined | • S&OE related processes are organized, defined, and fully documented.<br>• Alignment of performance objectives and internal information to adapt to demand fluctuation or other deviations.<br>• Decision-making is done holistically, and S&OE plans are aligned with company objectives. | • Internal supply chain integration with planned buffers in terms of for example inventories.<br>• A formalized set of preparation activities before every S&OE meeting.<br>• Supply and demand plans maintained in an ERP and/or APS system for real-time outlook. |
| 4. Quantitatively managed | • Processes are measured with statistical and quantitative techniques, such as advanced analytics.<br>• Extensive data and information sharing across all supply chain stakeholders. | • Demand and supply performance monitored weekly based on predefined KPIs and reliable data.<br>• Collaboration across an extended supply chain network with enhanced visibility to anticipate changes and increase supply chain resilience. |
| 5. Optimizing | • Alignment of key performance indicators across the entire supply chain ecosystem.<br>• Utilization of advanced analytics and other real-time data monitoring systems. | • Dynamic supply chain adaptation and flexibility with supportive systems.<br>• Flexibility to identify and address emerging value chain patterns, risks and other kind of deviations. |

Figure 19. Unified S&OE maturity model. Author's own contribution. (Adapted from Lester, 2023; Supply Chain Media, 2023)

## 5.4 Validity and reliability

Researches are always constructions by the researcher within certain frameworks, meaning that different researchers might produce slightly different results from the same data. Both quantitative and qualitative research are therefore just one version of the research subject, thus they do not always provide objective, absolute information, and hence, could be always considered

entirely valid and reliable. Conclusions drawn from research are therefore always contextual and tied to factors like time, place, and the researcher. (Saaranen-Kauppinen & Puusniekka, 2009)

Validity of a research refers to the ability of the research metrics and research methodology to accurately measure what they were intended to measure. The validity of a study should be assessed already during the design phase of the research. In order to consider the research results to be valid, there should be no systematic errors. Systematic error means for example that the participants of a survey have understood the survey questions differently than what the researcher intended. Study can be considered valid, if the researcher has successfully translated the concepts and theoretical framework used in the study into the survey questionnaire. (Vilkka 2021, 352-353)

Reliability of a study concerns the consistency of results, which assesses whether they would remain consistent if the research would be repeated. Validity concerns the accuracy and correctness of the research process, which includes selection of suitable and correct methods and metrics for reliable and accurate research results to address the research problem. (Hirsjärvi et al., 2007, 231; Kananen, 2014, 258). Further, evaluation of a study's validity and reliability involves assessing the correctness of the research design, research problem, research methods and data analysis and their ability in addressing the research question. In reliability assessment, researcher considers if the study achieved its objectives and if the analysis of the results is reliable. (Kananen, 2014, 257-259) However, the validity and reliability of qualitative research cannot be evaluated in exactly the same way as quantitative research (Eskola & Suoranta, 2000). Rather, in qualitative research, the evaluation is a comprehensive critical examination (Saaranen-Kauppinen & Puusniekka, 2009).

## 5.5 Justifications for the empirical study

The methodological approach of the thesis was characterized as constructive research, with the objective of generating solutions to specific problems, and thereby to invent a concrete solution to the existing problem at the case company Neste Oyj. In order to ensure comprehensive understanding of the existing problem – i.e. the specific characteristics and maturity of the current S&OE process and all related aspects of it – the empirical study was conducted as mixed methods study. Justification for this choice was the assumption, that the quantitative research alone may not provide sufficient insights into the research subject, and thus, qualitative research is

performed, with the expectation that it might reveal relevant information for the development part of this thesis. Therefore, by utilizing both quantitative and qualitative research approaches, it was expected that more relevant information and insights would be obtained to answer the research questions of this study holistically, as they would also complement each other's findings. Additionally, to assess the maturity of the S&OE process more comprehensively, against specific framework, and due to the lack of available or existing S&OE maturity models in literature, various general maturity models concerning supply chain maturity and the researcher's own knowledge on the subject were utilized. This approach enables comparison and mapping against a specific framework, and for this purpose, the presented unified S&OE maturity model was developed.

# 6 Evaluation of Neste's S&OE process

This chapter briefly introduces the case company and reviews the background of the research and its justification and reviews the data collection and analysis methods utilized for both researches. Additionally, this chapter presents the results of the quantitative survey and qualitative content analysis, and based on the research, conclusions which will enable the development phase later in this thesis, are drawn.

## 6.1 Neste Oyj

This thesis was commissioned by a Finnish energy sector company Neste Oyj, a globally recognized organization operating in the fields of energy, sustainability and environment. The case company's strategy revolves around offering their customers sustainable solutions for transportation and industrial purposes and discovering new ways to reduce their customers carbon emissions. In 2022, Neste generated a revenue of EUR 25.7 billion, with a comparable EBITDA of 3,537 million euros, whilst holding an average workforce of over 5,000 employees in the same year. Their refineries in Finland, the Netherlands, and Singapore are dedicated to producing renewable products exclusively from sustainable raw materials, boasting a current annual nameplate capacity of approximately 3.3 million tons. (Neste, n.d.)

Neste has publicly announced their dedication to helping their customers cut down their greenhouse gas emissions by at least 20 million tons of CO2e each year by 2030 and they are aiming to be the global leader in renewable and circular economy solutions. Today, the company already holds the title of the leading producer for sustainable aviation fuel and renewable diesel for transportation, as well as renewable feedstock solutions tailored for various applications across the polymers and chemicals industry. In addition to the existing solutions, the company is actively engaged in the development of new chemical recycling technologies to address the issue of plastic waste and are incorporating new renewable and recycled raw materials, like waste plastic, as a feedstock for their existing refining processes. Neste's goal is to transform their Porvoo refinery in Finland into the most sustainable refinery in Europe by 2030 and to achieve carbon-neutral production by 2035. (Neste, n.d.)

## 6.2 Research background

The research was initiated based on the recognition that the current S&OE process in the case company likely does not generate as much added value for the case company as it could potentially produce, as it is not comprehensively documented, and it likely does not hold all the typical characteristics of an ideal, functioning S&OE process. The key assumption in this study is that the introduction of a new, more mature S&OE process will result to a positive business impact and increase the overall profitability of the case company, achieved by better overall optimization of their supply chain operations. Firstly, enhanced efficiency of the S&OE process is expected to improve the coordination and execution of S&OP plans within the S&OE scope. Secondly, streamlined process is expected to assist the S&OE team in deviation management and in overall optimization of the supply chain and thus, generate added value for the case company.

Additional value is expected to be gained when the new S&OE process creates clarity and transparency to the daily work and introduces new ways of working, i.e., by promoting the importance of data monitoring, particularly in terms of monitoring demand and supply variables. Additionally, defined and structured process is expected to eliminate reactive planning and promote proactivity in the daily operations. Additionally, the introduction of new KPI metrics will enable continuous assessment of S&OE process performance, thereby enhancing team's motivation towards reaching common objectives and targets.

Conclusively, primary expected benefits of a mature S&OE process include enhanced accuracy and efficiency in execution of the S&OP plans, thereby maximizing the operational and supply chain potential of the company. Furthermore, by clarifying the requirements of successful S&OE process and defining the process in overall, i.e. in terms of streamlining and defining the responsibilities of the S&OE supply chain planners, the increased process transparency is anticipated to elevate the team's effectiveness by making expectations and set objectives clearer moving forward. Moreover, new process is expected to encourage S&OE team towards increased proactivity in optimization, in terms of managing supply and demand deviations beyond the scope of S&OP, when unexpected events, such as demand deviations or supply disruptions, occurs.

Altogether, the new process is anticipated to yield measurable financial benefits to the case company. These benefits result from improved overall supply chain optimization, for example in terms of avoiding excessive product inventories and excessive capital tie-up, and from the better ability to capitalize short-term opportunities through proactive planning.

## 6.3 S&OE process maturity: quantitative research

The quantitative research for this study was conducted through a survey targeting one population (n=12), that is divided into two groups: team members directly involved in S&OE operations (n=8) and managerial individuals associated with S&OE, but that are not directly engaged in daily operations (n=4). The survey, conducted using "Webropol" software, consists of three sections with identical questions for both groups to identify potential discrepancies in their perceptions of the current S&OE process maturity level, its related elements, and possibly challenges within the current process, that could hinder the implementation of the new process. This approach provides a comprehensive understanding from both groups' perspectives and further highlights possible knowledge gaps and differences in perceptions. The survey aims to assess the current state of Neste's S&OE process and identify areas for development to enhance process maturity overall. Respondents were informed in advance that the survey would quantitatively measure three different areas, with all questions consolidated into a single survey.

Before initiating the actual implementation phase of the new S&OE process emerging from this thesis, it is crucial to first assess Neste's "S&OE implementation readiness" level. This evaluation aims to ensure the seamless integration of essential elements for an effective S&OE process, such as real-time data utilization and agile decision-making. Based on the theoretical frameworks of Hoey (2020) and Porter (2023) outlined in the theoretical framework, the first section of the quantitative survey focuses on key implementation aspects within the current process, including topics such as data relevance, technological infrastructure, and the distinction between S&OE and S&OP processes. The objective of this section of the survey is to identify any clearly recognized challenges in implementing a new S&OE process and to conduct a preliminary assessment of the maturity level of the current process. Respondents rated these dimensions on a scale from one to five, with 1 indicating the lowest level of readiness and 5 indicating the highest. Insights from this section of the survey will pinpoint common challenges and areas needing improvement, thereby guiding the future development and implementation of the new S&OE process. Detailed questions for this first part are available in Appendix 2.

The second part of the survey assessed the general maturity level of the current S&OE processes, based on the framework by Supply Chain Media (2023) in theory, and it aimed to understand foundational and general aspects of the current S&OE process, before transitioning to a more specified and comprehensive assessment against the unified S&OE maturity model. This section included "YES" or "NO" questions aiming to evaluate various dimensions such as process clarity,

objective alignment, effectiveness of handover mechanisms between S&OP and S&OE processes, and use of technological solutions for real-time data updates. Insights from this section provide a general level of understanding of the current S&OE process maturity and to highlight development areas within the current process, which then also sets the stage for the more specific evaluation of the process maturity against the unified S&OE maturity model in the last section of the survey. Detailed questions for this second part are available in Appendix 3.

Lastly, the "Unified S&OE maturity model", adapted from Lester (2023) and Supply Chain Media (2023), has been enriched by the author's own contributions and expertise in the field, to ensure it fits the specific needs of the case company. This developed maturity model forms the framework for the final section of the survey, which aims to comprehensively assess the maturity of the current S&OE process. This survey section evaluates Neste's S&OE process and associated key aspects and elements, providing a thorough understanding of its current maturity level by comparing the findings against the unified model. Further, this section aims at identifying areas for the holistic process development outlined later in this thesis. This survey consists of 12 questions, which are covering various aspects of the S&OE process, including organizational collaboration and information sharing, integration with key stakeholders, and other S&OE related sub-processes. Further, it examines planning and decision-making processes, performance tracking methods, and availability of technological solutions. Detailed questions for this third part of the survey are available in Appendix 4.

By analyzing the results, this survey aims to uncover and identify potential challenges in the current S&OE process that could affect the implementation of the new process, assess its general maturity level, and ultimately, to evaluate the maturity of the process and its key elements and characteristics against the comprehensive model, that is developed specifically for this purpose.

### 6.3.1 S&OE implementation

In order to analyze the results of the first survey section, descriptive analysis was used, which summarizes information about the characteristics of variables. Descriptive analysis allows for summarizing and providing simplified descriptions of the survey responses. In interpretation of the responses of this first section of the survey, it was decided to provide individual frequency distributions for all of the responses and use absolute frequency. Frequency means the number of occurrences and absolute frequency reports the absolute numbers in different classes or

categories; thus, this means that absolute frequency indicates how many times each of the values occurs in the dataset.

This approach is selected due to the small sample size of respondents (n=12). Therefore, the analysis primarily focuses on the quantity of responses and their descriptive analysis. The total population consists of eight S&OE supply chain planners (n=8) and four managers (n=4) associated with the S&OE process. Therefore, the responses are categorized into two groups accordingly. Since the analysis of responses also aims to also make observations about the differences in perceptions between S&OE supply chain planners and managers, the responses are presented later in this chapter side by side in bar charts for both groups. As the answer definitions to the scale 1-5 are not consistent across all of the questions in this part and since the number of respondents is small, this analysis does not present averages but instead analyzes the responses to questions using descriptive analysis for frequency distribution only. The responses to the first section of the survey evaluating case company's readiness to implement a new S&OE process, are collected in Table 1 below, and detailed questions are available in Appendix 2.

Table 1. Frequency distribution of answers to S&OE implementation.

| Survey question | S&OE team absolute frequency | | | | | | S&OE managers absolute frequency | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Total | 1 | 2 | 3 | 4 | 5 | Total |
| On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of sales and demand forecasts data from PowerBI? | 1 | 4 | 1 | 2 | 0 | 8 | 0 | 1 | 2 | 1 | 0 | 4 |
| On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production schedules data from Spiral Schedule? | 1 | 0 | 6 | 1 | 0 | 8 | 0 | 1 | 3 | 0 | 0 | 4 |
| On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production forecasts data from Spiral Plan? | 0 | 3 | 4 | 0 | 1 | 8 | 0 | 0 | 2 | 2 | 0 | 4 |
| On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of product inventory data from ROMMS? | 0 | 0 | 1 | 4 | 3 | 8 | 0 | 0 | 1 | 3 | 0 | 4 |
| On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update demand forecast? | 3 | 3 | 2 | 0 | 0 | 8 | 0 | 2 | 2 | 0 | 0 | 4 |
| On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update production forecast? | 0 | 3 | 4 | 1 | 0 | 8 | 0 | 2 | 1 | 1 | 0 | 4 |
| On a scale from 1 to 5, how readily available and accessible are advanced analytics systems (such as predictive and prescriptive analytics for real-time market analysis) to support decision-making in S&OE? | 4 | 3 | 1 | 0 | 0 | 8 | 3 | 1 | 0 | 0 | 0 | 4 |
| On a scale of 1 to 5, how well-defined and comprehensive are the objectives and targets of the current S&OE process? | 0 | 4 | 2 | 2 | 0 | 8 | 0 | 2 | 1 | 1 | 0 | 4 |
| On a scale of 1 to 5, how effectively does the unified S&OE meeting - if present - facilitate comprehensive decision-making and target setting across various product chains? (Note: this question refers to a recurring, unified S&OE meeting for the whole S&OE team) | 0 | 4 | 2 | 2 | 0 | 8 | 0 | 1 | 2 | 0 | 0 | 3 |
| On a scale of 1 to 5, how well are communication procedures implemented to ensure clear communication, distinct target setting, and collaboration between S&OE and S&OP processes? (Note: this question refers to information flow between the S&OP and S&OE processes) | 0 | 4 | 3 | 1 | 0 | 8 | 1 | 1 | 2 | 0 | 0 | 4 |

In the first question of this section in Figure 20, respondents were asked to evaluate, "*On a scale of 1 to 5, how would you rate the overall accessibility and timeliness of sales and demand forecasts data from PowerBI?*" Among the S&OE team's responses, it is apparent that four respondents, or half of the entire group, perceive the data from PowerBI to be somewhat outdated but accessible by answering "2", while the other responses are otherwise more scattered, and are thus assessing

the accessibility and timeliness of the data to be either at a worse or better level. Similarly, at the manager level, it's generally perceived that this particular data is indeed accessible but also more up to date – compared to the answers of S&OE team members – since half of the S&OE managers answered “3”, which is that the data is moderately up to date and accessible.

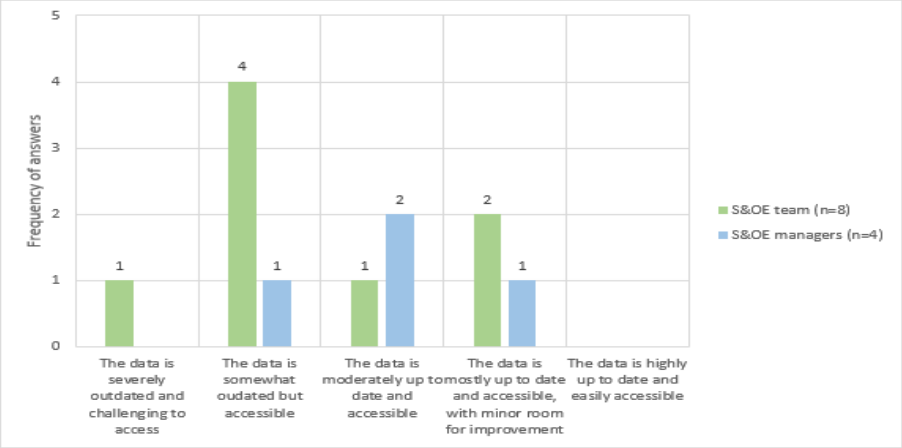



Figure 20. Sales and demand forecast data’s accessibility and timeliness (n=12)

In the following question, as shown in Figure 21, respondents were asked to assess the availability and timeliness of production schedule data. In response to the question "*On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production schedules data from Spiral Schedule?*" according to the frequency distribution, six out of eight members of the S&OE team and three out of four S&OE managers chose the response option "3", which was the most selected option. One member of the S&OE team perceived the data to be more up to date by selecting "4", while one respondent found the data both challenging to access and severely outdated, choosing "1". Additionally, one S&OE manager selected answer "2", indicating that they perceive the data to be "somewhat outdated but accessible". Overall, production schedule data is perceived to be more up to date than sales and demand forecast data amongst both answer groups.

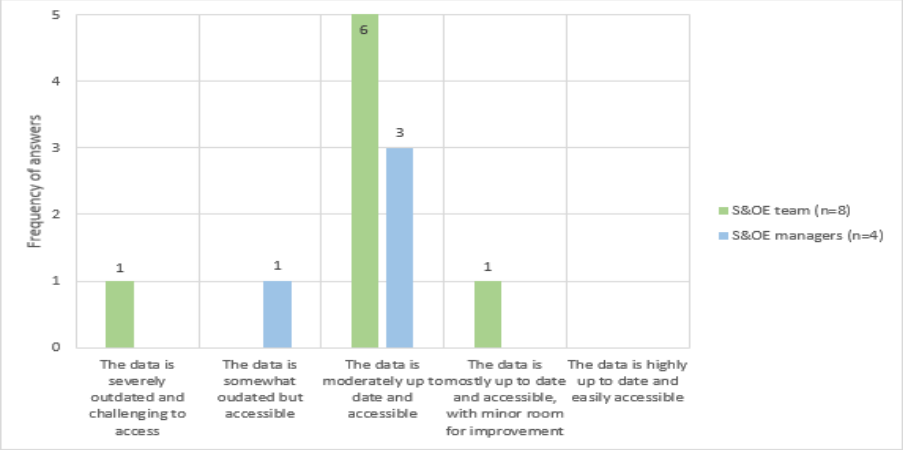



Figure 21. Production schedule data's accessibility and timeliness (n=12)

In Figure 22, the question presented was "*On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production forecasts data from Spiral Plan?*" In this question, half of the respondents from each group chose the answer "3", indicating that the data is moderately up to date and accessible. However, there is variability in the responses of both groups. Nevertheless, three out of eight members of the S&OE team perceive this data to be even less up to date than the option 3 suggests. Similarly, according to the absolute frequency distribution, half of the S&OE managers still perceive the data to be even better updated, choosing option 4: "the data is mostly up to date and accessible, with minor room for improvement".

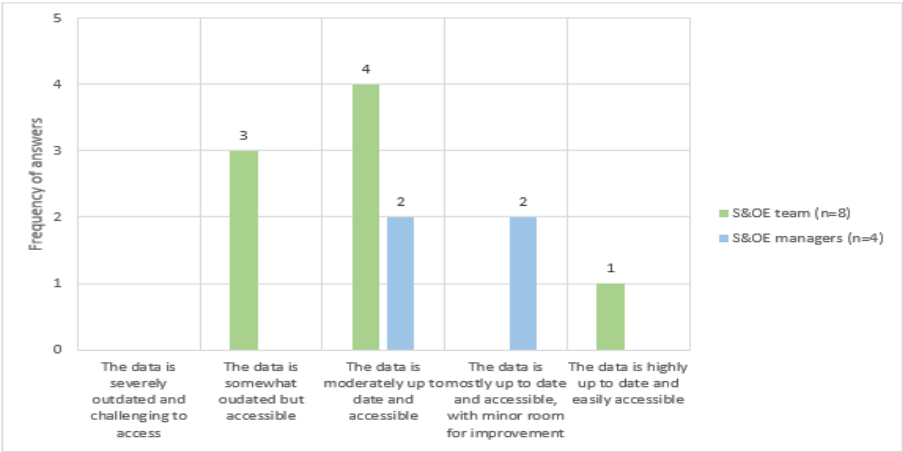



Figure 22. Production forecasts data's accessibility and timeliness (n=12)

From the questions regarding data sources and their accessibility and timeliness within this S&OE implementation readiness survey, the last question was, "*On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of product inventory data from ROMMS?*" In this question, whose responses are presented in Figure 23, the frequency distribution of responses was

clearly shifted towards the upper end of the scale compared to the previous questions. One respondent from each group chose the option number 3 in the middle, but three S&OE managers and half of the S&OE team members, chose option 4: "The data is mostly up to date and accessible, with minor room for improvement." Three team members chose the highest option, 5, indicating that the data is perceived to be highly up to date and easily accessible.

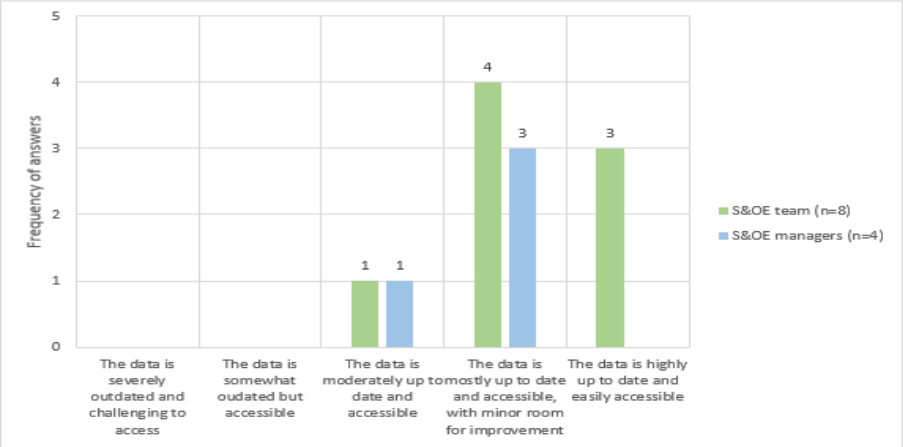



Figure 23. Product inventory data's accessibility and timeliness (n=12)

The following two questions in this survey assessing the S&OE implementation readiness aimed to determine how members of the S&OE team and S&OE managers perceive the level of manual involvement in different forecast updating processes. The first question regarding the process of updating forecasts is presented in Figure 24, where it asked, "*On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update demand forecast?*". The best responses, two respondents from each group, chose option 3, indicating that the process is balanced between manual and automated methods. However, three S&OE team members and half, meaning two out of four S&OE managers, feel that the automation of the updating process is somewhat manual, with limited automation, by answering 2. Last three respondents from S&OE team chose option 1 for their answers, meaning that they believe that "The process heavily relies on manual methods with little automation".

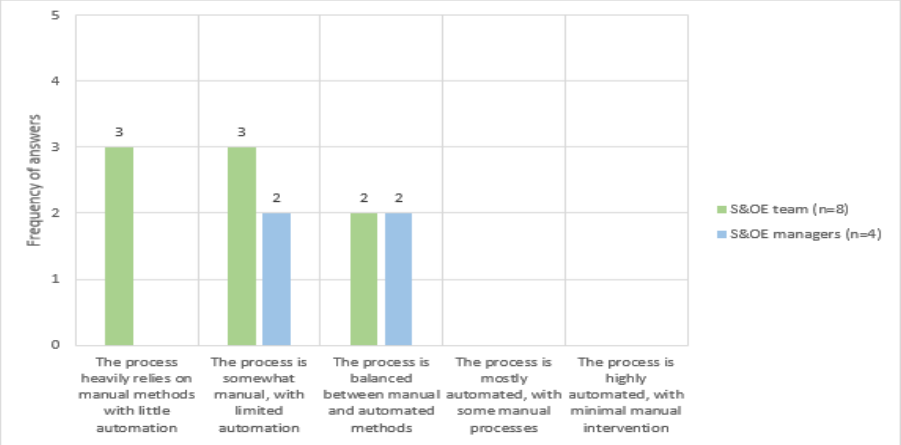



Figure 24. Use of manual vs. automated methods in updating demand forecast (n=12)

In the sixth survey question, respondents were asked about the level of automation in the production forecast updating process, as represented in Figure 25. The question reads as follows: "*On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update production forecast*?" The absolute frequency distribution of responses shows that four out of eight S&OE team members chose the middle option, 3, which indicates that "the process is balanced between manual and automated methods". However, three respondents of this team member group considered the updating process to be more manual than that, whereas one respondent perceives the process to have even more automatization, by answering 4, which stated that the process is mostly automated, with some manual processes. All responses from S&OE managers are also on the same scale, on 2 to 4, with two of them considering the process to be "somewhat manual, with limited automation", one respondent perceiving the process to be balanced between manual and automated methods, and the last one views the process to be mostly automated, with some manual processes.

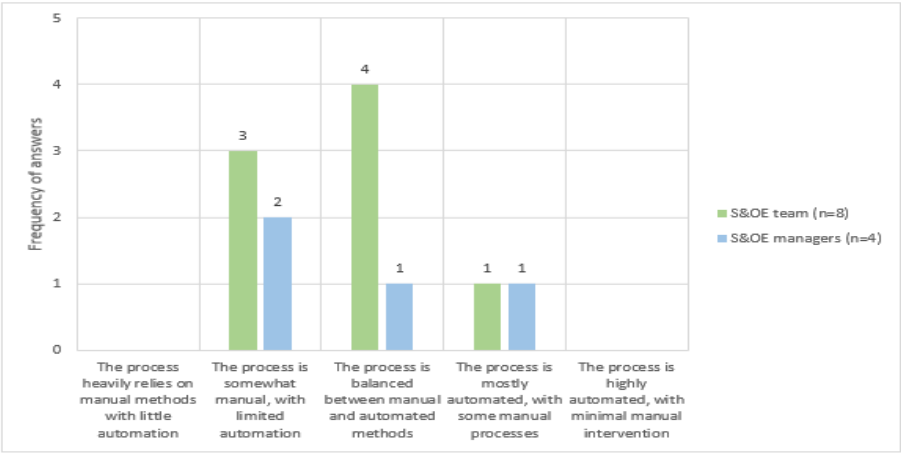



Figure 25. Use of manual vs. automated methods in updating production forecast (n=12)

The seventh question in the survey in Figure 26 was: "*On a scale from 1 to 5, how readily available and accessible are advanced analytics systems (such as predictive and prescriptive analytics for real-time market analysis) to support decision-making in S&OE?*" From the responses, it's clear that the frequency distribution of answers is clearly below the mid-level or answer 3. The absolute frequency distribution of responses from the S&OE team indicates that four members believe that the "advanced analytics systems are not readily available and accessible", a view also shared by three S&OE managers, by answering option 1. Three S&OE team members and the fourth manager responded that these systems are "somewhat available and accessible, but improvements are needed", while the last team member chose answer 3, "reasonably available and accessible, with some room for improvement".

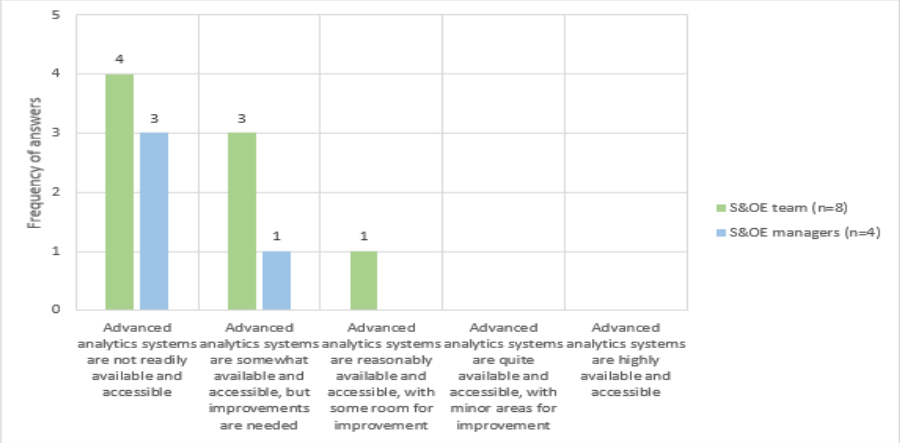



Figure 26. Availability and accessibility of advanced analytics systems to support S&OE decision-making (n=12)

On Figure 27, the question was, "*On a scale of 1 to 5, how well-defined and comprehensive are the objectives and targets of the current S&OE process?*" The frequency distribution of answers indicates that response options one or five were not chosen in either group at all. Four responses from the S&OE team indicated that the objectives and targets are somewhat defined but lack comprehensiveness, while the next two response options, 3 and 4, each received two selections from team members. Half of the S&OE managers also chose response option 2, with the remaining two responses from this group falling evenly into the third and fourth options.

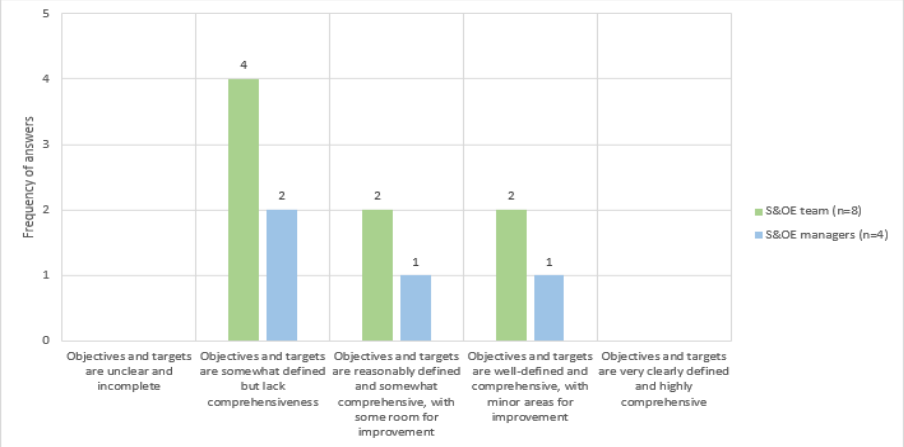



Figure 27. Clarity and comprehensiveness of current S&OE process objectives and targets (n=12)

The ninth question in Figure 28 asked the following "*On a scale of 1 to 5, how effectively does the unified S&OE meeting - if present - facilitate comprehensive decision-making and target setting across various product chains?*" and in response, four team members and one S&OE manager chose option 2, indicating limited meeting support; decision mostly ad hoc. Two team members selected option 3, as also did two S&OE managers. The last two team members responded that there is "substantial meeting support, ad hoc decisions prevalent", whereas one S&OE manager did not respond to this question at all.

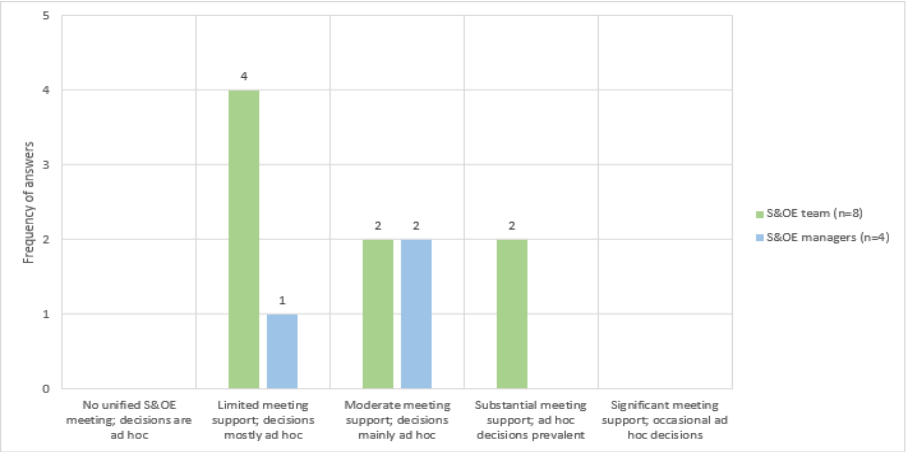



Figure 28. Relevancy and comprehensiveness of current S&OE meeting (n=12)

In terms of the last question at this point, in Figure 29, respondents were asked to evaluate "*On a scale of 1 to 5, how well are communication procedures implemented to ensure clear communication, distinct target setting, and collaboration between S&OE and S&OP processes?*". Most of the responses were received to answer numbers 2 and 3**,** where responses were evenly distributed between these options, with four S&OE team members choosing option 2 and three of them

choosing option 3. Meanwhile, among the S&OE managers, one chose option 2, and two chose option 3. The remaining responses, one from each group, were split between option 1 and option 4.

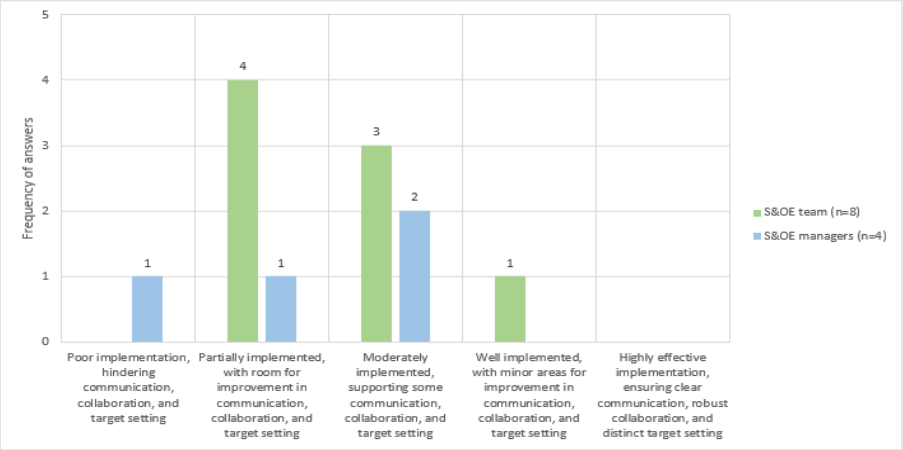



Figure 29. Communication procedures between S&OE and S&OP processes (n=12)

### 6.3.2 S&OE general maturity

In this second section of the conducted survey, the aim was to assess the general level of maturity of Neste's S&OE process, in comparison to presented maturity model (Supply Chain Media, 2023). Again, the same questions were presented to both survey groups in the total population (n=8), which consisted of two groups; S&OE team members (n=4) and S&OE managers (n=4). Descriptive analysis was employed for this part as well, which enables the summarization of information regarding variable characteristics. Similar to the first section of the survey, the focus of this section also lies in the frequency distribution of responses and their descriptive analysis. Notably, some S&OE managers chose not to respond to questions 8-10 at all in the survey, which is also visible in the results reviewed below. Table 2 below presents the frequency distribution of answers to the second part of the survey, concerning the general or generic level of S&OE processes maturity at the case company.

Table 2. Frequency distribution of answers to “S&OE general maturity assessment”.

| Survey question | S&OE team absolute frequency | | | S&OE managers absolute frequency | | |
|---|---|---|---|---|---|---|
| | YES | NO | Total | YES | NO | Total |
| Is there a distinct process for both tactical (S&OP) and operational (S&OE) decision-making within the company? | 4 | 4 | 8 | 2 | 2 | 4 |
| Is the S&OE process managing demand and supply plans at a more detailed level compared to the S&OP process? | 6 | 2 | 8 | 3 | 1 | 4 |
| Do the objectives of the S&OE process match the written guidelines set in the S&OP process and follow a formal handover from S&OP to S&OE? | 4 | 4 | 8 | 3 | 1 | 4 |
| Is there a written guidelines that outlines how products are allocated to customers based on pre-defined business rules when there are supply constraints? | 1 | 7 | 8 | 0 | 4 | 4 |
| Are there clear written guidelines or procedures for handling deviations, such as unexpected demand or production disrupts, in S&OE? | 0 | 8 | 8 | 0 | 4 | 4 |
| Do all business functions (S&OE team and other key stakeholders) involved in short-term planning have clearly defined roles and responsibilities within the S&OE process? | 4 | 4 | 8 | 2 | 2 | 4 |
| Are demand and supply performance monitored on a weekly basis using predefined KPIs along with reliable data to identify any gaps with the S&OP plan? | 1 | 7 | 8 | 1 | 3 | 4 |
| Are there standard and formalized preparation activities conducted before each S&OE meeting to ensure decision-making is based on the most recent demand and supply outlook? | 3 | 5 | 8 | 0 | 2 | 2 |
| Does the structure of the current S&OE meeting adhere to a clear and formalized agenda and are the output actions from the S&OE meeting also actively documented and followed up? | 0 | 8 | 8 | 0 | 3 | 3 |
| Apart from the current product chain specific "S&OE handshake"-meetings, is there a unified S&OE meeting for the whole S&OE team and key stakeholders available? | 5 | 3 | 8 | 0 | 2 | 2 |
| Are the supply and demand plans stored and managed within an enterprise resource planning (ERP) and/or Advanced Planning and Scheduling (APS) system, allowing for real-time updates to S&OE plans? | 6 | 2 | 8 | 3 | 1 | 4 |

Below in this chapter in Figure 30, is presented a combined stacked column for all responses from both population groups, S&OE team members and S&OE managers, to eleven questions that concerned the general maturity level of the current S&OE process.

For the first question, "*Is there a distinct process for both tactical (S&OP) and operational (S&OE) decision-making within the company?*", the responses were evenly split between YES and NO in both groups. Regarding the question "*Is the S&OE process managing demand and supply plans at a more detailed level compared to the S&OP process?*", six out of eight team members answered YES, two answered NO, while among the comparison group of managers, three answered YES and one answered NO. For the third question, "*Do the objectives of the S&OE process match the written guidelines set in the S&OP process and follow a formal handover from S&OP to S&OE?*", the team's responses were again evenly split between YES and NO, and for this question, three managers responded YES, while one responded NO. Further, there was notable consensus for the fourth question, "*Is there a written guidelines that outlines how products are allocated to customers based on pre-defined business rules when there are supply constraints?*", as only one S&OE team member answered YES, while all seven others and all four managers answered NO.

Again, complete consensus was found for the fifth question, as all respondents from both groups answered NO to the question "*Are there clear written guidelines or procedures for handling deviations, such as unexpected demand or production disrupts, in S&OE?*". The sixth question showed variation again since responses were evenly split between YES and NO from both groups when

asked "*Do all business functions (S&OE team and other key stakeholders) involved in short-term planning have clearly defined roles and responsibilities within the S&OE process?"*.

In the seventh question, which sought answer for "*Are demand and supply performance monitored on a weekly basis using predefined KPIs along with reliable data to identify any gaps with the S&OP plan?*", the responses leaned more towards NO in both of the groups - seven out of eight S&OE team members answered NO, and three out of four S&OE managers also answered NO. Similarly, also for the eighth question, which was "*Are there standard and formalized preparation activities conducted before each S&OE meeting to ensure decision-making is based on the most recent demand and supply outlook?*", the responses also leaned more towards NO; five out of eight team members answered this way, and among the S&OE managers, two also answered NO, whilst two managers did not respond to the question at all.

In the ninth question, "*Does the structure of the current S&OE meeting adhere to a clear and formalized agenda and are the output actions from the S&OE meeting also actively documented and followed up?*", there was again full consensus found - all eight team members answered NO, and three out of four managers similarly responded NO, while one manager did not respond at all. The next question, which concerned S&OE meeting practices, was "*Apart from the current product chain specific "S&OE handshake"-meetings, is there a unified S&OE meeting for the whole S&OE team and key stakeholders available?*" and this question received five YES responses from team members, with three NO responses. From managers group, two also answered NO, while two did not respond at all. Finally, the last question asked, "*Are the supply and demand plans stored and managed within an enterprise resource planning (ERP) and/or Advanced Planning and Scheduling (APS) system, allowing for real-time updates to S&OE plans?*" resulted to a similar trend in both groups - six out of eight S&OE team members answered YES, and three out of four S&OE managers also answered YES.

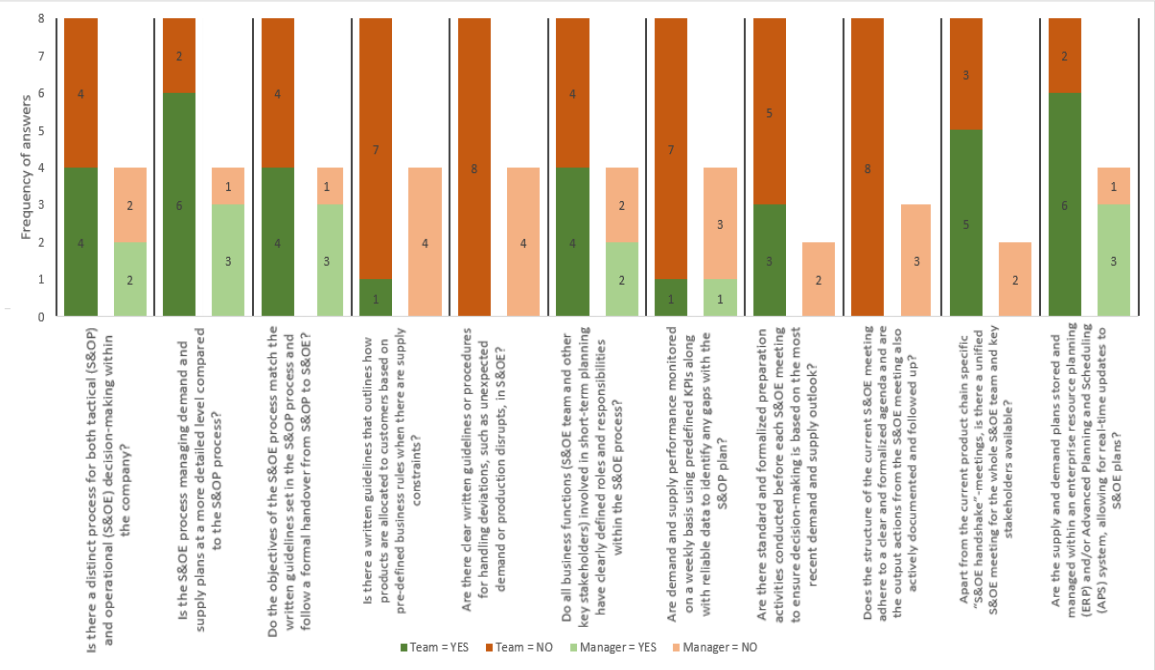



Figure 30. S&OE general maturity assessment for S&OE team members and S&OE managers (n=12)

### 6.3.3 Unified S&OE maturity model

In this chapter, the results of the third and last part of the survey conducted for two groups, S&OE team members (n=8) and S&OE managers (n=4) are presented, with the aim to determine the current maturity level of the S&OE process and its related elements, in comparison to the "*Unified S&OE maturity model*". The responses from this section of the survey are presented in Table 3, which is displaying the frequency distribution of answers amongst the whole population (n=12). These questions related to this maturity model have also been later categorized into the Table 3 according to the maturity level they represent or correspond to. The categorization that is presented below follows the model's five levels of maturity. Additionally, Appendix 5 also presents the absolute frequency, absolute cumulative frequency, relative frequency, and cumulative relative frequency of the responses for this part of the survey.

Table 3. Frequency distribution of answers to “Unified S&OE maturity model survey”.

| Corresponding unified S&OE maturity model level | Survey question | S&OE team absolute frequency | | | | | | S&OE managers absolute frequency | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Total | 1 | 2 | 3 | 4 | 5 | Total |
| Initial | On a scale of 1 to 5, how would you assess the team structure and collaboration within the S&OE process? | 0 | 1 | 4 | 3 | 0 | 8 | 0 | 0 | 2 | 2 | 0 | 4 |
| Initial | On a scale from 1 to 5, how would you rate the integration and coordination among other stakeholders, such as operations, suppliers, and partners? | 0 | 3 | 5 | 0 | 0 | 8 | 0 | 1 | 2 | 1 | 0 | 4 |
| Managed | On a scale of 1 to 5, how effectively are other S&OE-related sub-processes, such as the execution of S&OP plan and scenario-modelling, integrated into the S&OE process? | 0 | 5 | 3 | 0 | 0 | 8 | 0 | 1 | 3 | 0 | 0 | 4 |
| Managed | On a scale from 1 to 5, how well are tactical (S&OP) and operational (S&OE) decision-making separated and structured at Neste, through distinct (yet interconnected) S&OP and S&OE processes? | 0 | 3 | 4 | 1 | 0 | 8 | 0 | 1 | 1 | 2 | 0 | 4 |
| Managed | On a scale of 1 to 5, how well-defined are the roles and responsibilities among S&OE team members? | 0 | 1 | 2 | 5 | 0 | 8 | 0 | 0 | 4 | 0 | 0 | 4 |
| Defined | On a scale of 1 to 5, how well-organized, defined, and documented are all the S&OE-related processes? | 0 | 3 | 5 | 0 | 0 | 8 | 0 | 2 | 2 | 0 | 0 | 4 |
| Defined | On a scale from 1 to 5, how effectively are performance objectives from the S&OP plan aligned with internally available information to adapt to demand fluctuations or other short-term deviations in S&OE? | 0 | 4 | 2 | 2 | 0 | 8 | 0 | 0 | 4 | 0 | 0 | 4 |
| Defined | On a scale of 1 to 5, how effective is the holistic decision-making and alignment of product chain-specific plans in the S&OE meeting, to ensure further alignment with general company objectives and S&OP plan? | 1 | 2 | 4 | 1 | 0 | 8 | 0 | 0 | 4 | 0 | 0 | 4 |
| Quantitatively managed | On a scale of 1 to 5, how effectively are S&OE process performances measured using statistical and quantitative techniques, such as predefined key performance indicators (KPI)? | 3 | 3 | 2 | 0 | 0 | 8 | 2 | 2 | 0 | 0 | 0 | 4 |
| Quantitatively managed | On a scale of 1 to 5, how effective is the extent of data and information sharing across all supply chain stakeholders and business units? | 1 | 1 | 4 | 2 | 0 | 8 | 0 | 1 | 3 | 0 | 0 | 4 |
| Optimizing | On a scale from 1 to 5, how well do the S&OE processes' KPIs align with the overall supply chain KPIs and consequently, guide the S&OE team towards the set S&OP targets and other general company level targets? | 1 | 3 | 3 | 1 | 0 | 8 | 0 | 3 | 0 | 1 | 0 | 4 |
| Optimizing | On a scale from 1 to 5, how well does the S&OE team leverage advanced analytics and other supportive systems to adapt to and manage emerging trends/patterns and deviations in the value chain? | 3 | 4 | 1 | 0 | 0 | 8 | 3 | 0 | 1 | 0 | 0 | 4 |

Results in this analysis utilize an interval scale, which is suitable for numerical measurement and is also referred to as an interval scale. On an interval scale, the values of variables are evenly distant of each other's. Sometimes, the scale can be also changed or converted to be able access more statistically efficient methods for analyzation, which can be done, for example, with attitude variables by converting ordinal scales to interval scales. (Tilastokeskus, N.D.) Interval scale offers researchers the opportunity to measure and differentiate between different options which is allowing the options to contribute to significant objectives and outcomes. Interval scale is frequently more effective for businesses and scientific research compared to the nominal or ordinal scales, as it enables the consideration of quantitative results. (Bhat, N.D.)

The assumption in the analysis of these responses in this section of the survey is that each of the responses in interval is equally distant. In the case of the following twelve questions, it was assumed that the variables are on an interval scale, and therefore, the averages for each question's responses were possible to be calculated for both the S&OE team and S&OE managers. Based on the averages, conclusions are drawn about whether the perceived maturity level of the current S&OE process holds certain characteristics or not, and to what extent the characteristics are perceived to be met within the current process. Descriptive analysis was employed for this part as well, which enables the summarization of information regarding variable characteristics.

Conclusion about the current level of the S&OE process are drawn based on the averages of the responses, by comparing them to unified S&OE maturity model at the end of this chapter. The Unified S&OE maturity model presented five different levels of maturity: "*initial, managed, defined, quantitatively managed, and optimizing*". Each of these levels has its own characteristics

and key features, and the model is designed to be used and interpreted to illustrate, at which level both the S&OE team members and S&OE managers perceive the current S&OE process to be in terms of various aspects of the process at each level, and these averages aim to reflect that in interval scale.

The results below are presented according to the maturity level they correspond to in the unified S&OE maturity model. For example, as shown in the previously presented Table 3, first and second questions are related to the first maturity level, which is "*initial*", while questions three, four and five are reflecting the second level of maturity, which is "*managed*". Using the same categorization and logic, the results are presented below in charts, and within the charts, they are representing the averages for each question separately, as well as the combined average for all of the questions that are corresponding to a specific maturity level in the unified maturity model.

The first and second questions with results presented in Figure 31 aimed to assess how the characteristics of the first level, "initial", within the "Unified S&OE maturity model" are reflected in the current S&OE process. The first question was "*On a scale of 1 to 5, how would you assess the team structure and collaboration within the S&OE process?*", with an average response of 3,3 from team members and 3,5 from managers. In the second question, respondents were asked "*On a scale from 1 to 5, how would you rate the integration and coordination among other stakeholders, such as operations, suppliers, and partners?*" The average response from the team was 2,6 and from managers was 3,0. The combined average for these two questions related to the first level in this model, "initial maturity", from team members was 2,9 and from managers was 3,3.

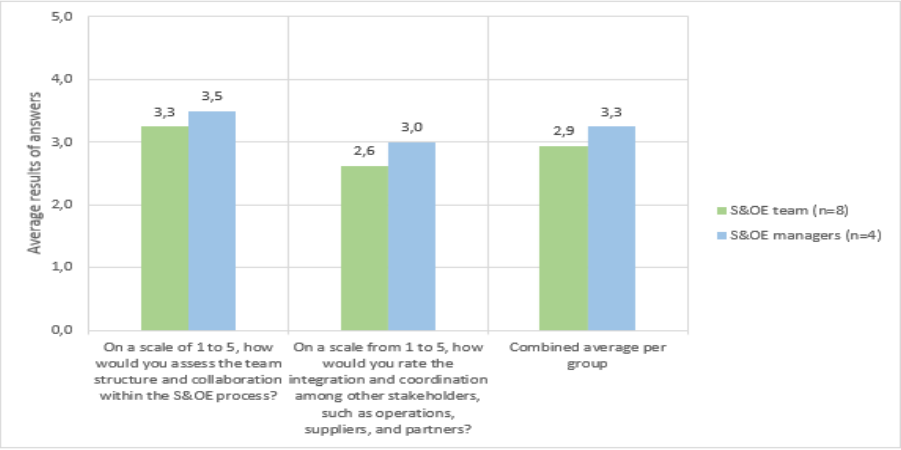



Figure 31. Combined survey results for initial level of maturity in the Unified S&OE maturity model (n=12)

In Figure 32, the third, fourth, and fifth questions corresponding to the "managed" level of maturity within the model are presented. The third question asked, "*On a scale of 1 to 5, how effectively are other S&OE-related sub-processes, such as the execution of S&OP plan and scenario-modelling, integrated into the S&OE process?*" The average score from the team members was 2,4 and managers average score was 2,8. The fourth question was, "*On a scale from 1 to 5, how well are tactical (S&OP) and operational (S&OE) decision-making separated and structured at Neste, through distinct (yet interconnected) S&OP and S&OE processes?*" For this question, the average score from the team members was 2,8 and from the managers score was 3,3. The fifth question in the survey, which corresponds to the third question at the managed level in the model, was: "*On a scale of 1 to 5, how well-defined are the roles and responsibilities among S&OE team members?*" In terms of this question, the average score from the team members deviates from the trend of the previous two questions and was higher than of the managers, at 3,5; while the average score from the managers was 3,0. The combined average for these three questions related to the second level in this model, “managed maturity“, from team members was 2,9 and from managers 3,0.

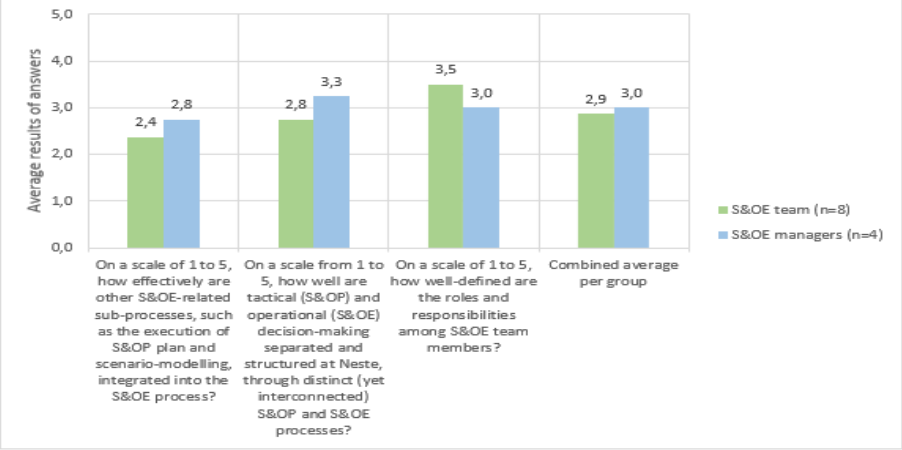



Figure 32. Combined survey results for managed level of maturity in the Unified S&OE maturity model (n=12)

At the third-highest level of maturity in the maturity model, "defined", three questions were again asked from both groups, as shown in Figure 33. The sixth question of the survey was, "*On a scale of 1 to 5, how well-organized, defined, and documented are all the S&OE-related processes?*", with average score from the team 2,6 and from the managers 2,5. The following and seventh question was, "*On a scale from 1 to 5, how effectively are performance objectives from the S&OP plan aligned with internally available information to adapt to demand fluctuations or other short-term deviations in S&OE?*" S&OE team’s average score for this question was 2,8 while the

managers' score was 3,0. The third question related to this maturity level, as well as the eighth question in this survey section was: "*On a scale of 1 to 5, how effective is the holistic decision-making and alignment of product chain-specific plans in the S&OE meeting, to ensure further alignment with general company objectives and S&OP plan?*" For this question, the responses in the graph showed an average of 2,6 from the team and 3,0 from the managers. The combined average for these three questions related to the third level in this model, “defined maturity“, was 2,7 from the team members and 2,8 from the managers.

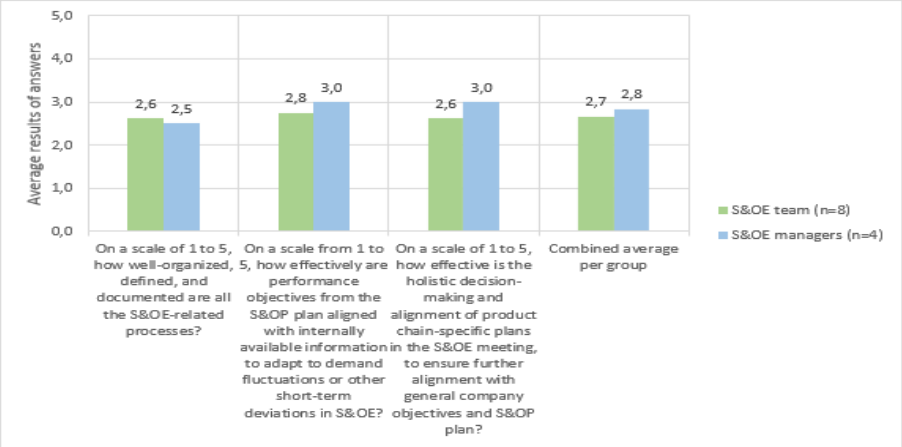



Figure 33. Combined survey results for defined level of maturity in the Unified S&OE maturity model (n=12)

The fourth level of the maturity model, "quantitatively managed" and its average scores are visible in Figure 34. There were two questions concerning this level: the first question concerning this maturity model and ninth for this part of the survey was "*On a scale of 1 to 5, how effectively are S&OE process performances measured using statistical and quantitative techniques, such as predefined key performance indicators (KPI)?*" and it received an average score of 1,9 from the team and 1,5 from the managers. The second question, "*On a scale of 1 to 5, how effective is the extent of data and information sharing across all supply chain stakeholders and business units?*" received an average score of 2,9 from the team and 2,8 from the managers. Conclusively, the combined average for these two questions related to the fourth level in this Unified S&OE maturity model, the level being “quantitatively managed maturity“, was 2,4 from the team members and 2,1 from the managers.

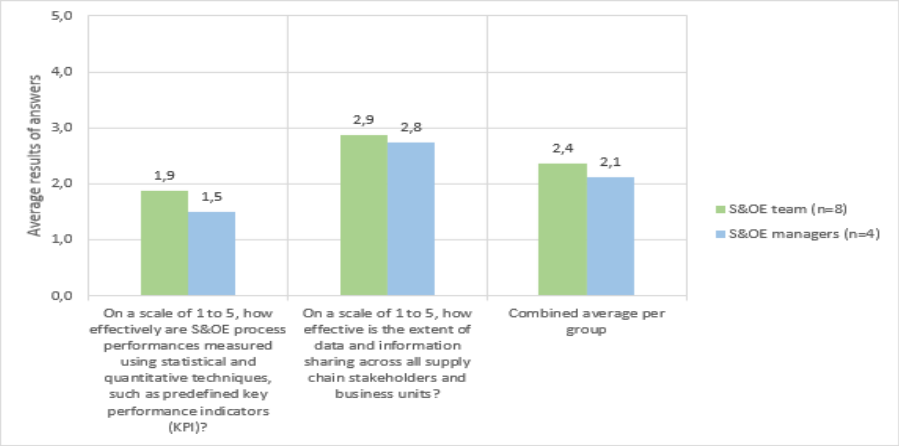



Figure 34. Combined survey results for quantitatively managed level of maturity in the Unified S&OE maturity model (n=12)

At the highest level of the Unified S&OE maturity model, which is "optimizing", both groups were asked to respond to two questions. The first question related to this level and eleventh in the whole survey section, as in Figure 35, was as follows: "*On a scale from 1 to 5, how well do the S&OE processes' KPIs align with the overall supply chain KPIs and consequently, guide the S&OE team towards the set S&OP targets and other general company level targets?*" The average score for both groups' responses to this question was 2,5. The second and final question in this set was "*On a scale from 1 to 5, how well does the S&OE team leverage advanced analytics and other supportive systems to adapt to and manage emerging trends/patterns and deviations in the value chain?*" The average score for the S&OE team's responses was 1,8 and for the managers' responses, average of responses was 1,5. In conclusion, the combined average per group for this "optimizing" level was 2,1 from the S&OE team members and 2,0 from the managers.

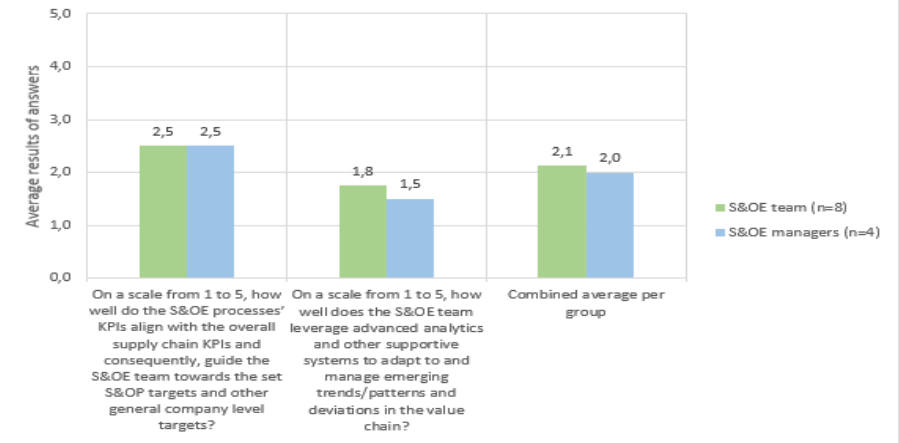



Figure 35. Combined survey results for optimizing level of maturity in the Unified S&OE maturity model (n=12)

### 6.3.4 Summary of findings

**S&OE implementation**

The results from the first section of the survey indicated that there likely is room for improvement in the current process and on different factors and elements related to S&OE process. Based on the findings, it is possible to clearly identify potential challenges to be addressed later in development part of this thesis, that may hinder the implementation of the new S&OE process. However, it is noteworthy that there is also a considerable amount of variability in the responses both within, and between the respondent groups. In fact, there was no complete consensus in any of the questions to be observed, but from a general perspective, survey answers clearly indicated that each of the addressed topics can be developed on some parts.

**S&OE general maturity**

For the second section, there was more variation in responses among S&OE team members than among S&OE managers group. However, an important observation overall is that despite some variance in responses between the groups, there seems to be a general alignment in the “direction” between the two groups’ answers, and based on the absolute frequency distribution, the responses were mostly consistent across the groups as well for most of the questions. There was a complete consensus within the team on questions 5 and 9, and similarly, among S&OE managers’ group there was consensus on questions 4 and 5. Additionally, those managers who responded (with one or two not answering these particular questions), were in complete agreement on questions 8, 9, and 10 as well. In terms of contradiction, in the S&OE team, responses were evenly split for questions 1, 3, and 6, while in the comparison group, responses were evenly split for questions 1 and 6. Another observation is that for questions 4 and 7, one person in the S&OE team answered "YES", while the other seven team members responded "NO", which makes it challenging to draw any conclusions from the results of this survey other than general ones and trends. The trend in managers' responses was mostly consistent as well, but in questions 2, 3, 7, and 11, one manager answered differently from the other three respondents to these questions.

At a general level, it can also be observed that out of the S&OE team's responses, 34 out of 88 were YES, while the remaining 54 were NO. Similarly, based on the responses of S&OE managers, 14 were YES, while 25 were NO, with a total response count of 39. This indicates that there were more NO responses in both groups than YES responses, which on the other hand, indicates that according to the topics of the survey, there are several development areas that can be identified

from the current process, but the maturity can't be explicitly determined. Due to the considerable variance in responses, the final conclusion is that the responses cannot be directly scored against the maturity model presented in Figure 18 by *Supply Chain Media (2023)* per se, thus evaluation of the case company's S&OE processes' maturity level has to be determined in this quantitative research based on the survey results from the last section of the survey, corresponding to the "unified S&OE maturity model".

**Unified S&OE maturity model**

The logic of this model presented in Figure 36 is that each level of maturity has certain specific characteristics, which were assessed in the last section of the quantitative survey. Each characteristic carries the exact same weight within the level, and for the case company to be considered as meeting all the requirements of a particular level, the average score of the responses should be exactly 5. Unified S&OE maturity model is presented below in Figure 36 with the averages of responses from the entire population (n=12) as divided into the two groups: S&OE team members (n=8) and S&OE managers (n=4).

However, the purpose of the model is not to explicitly describe or determine whether all the characteristics at a particular maturity level are fully met or not, or to conclusively determine a specific level of maturity for the case company. Instead, the aim of this model is to illustrate through averaging how close or how far the S&OE team and S&OE managers perceive the current S&OE process to be from the ideal level, which would have a value of 5 on the interval scale. The same logic applies to all of the maturity levels, and thus, the answers concerning each levels are averaged, in order to pinpoint the current perceptions regarding various characteristics and levels within the model. Each of the maturity levels in this maturity model consists of five stages – the exact same stages as presented earlier – which facilitate the interpretation of answers, in terms of where the case company stands on the scale of 1-5, when compared to this model.

| Level of maturity (1-5) | Characteristics | Key features | Averaged survey results for this maturity level (1-5) |
|---|---|---|---|
| 1. Initial<br><br>1 = Poor<br>2 = Limited<br>3 = Moderate<br>4 = Good<br>5 = Excellent | • Processes lack organization and collaboration.<br>• Limited integration and coordination among operations, suppliers, and partners. | • Reactive supply chain management with limited synchronization and visibility. | S&OE team **2,9**<br>S&OE managers **3,3** |
| 2. Managed<br><br>1 = Poor<br>2 = Limited<br>3 = Moderate<br>4 = Good<br>5 = Excellent | • S&OE has integrated sub-processes.<br>• Tactical and operational decision-making is done separately through two structured processes (S&OP and S&OE) focusing on specific horizons.<br>• Roles & responsibilities for short-term planning are defined. | • The S&OE process manages demand and supply plans on a detailed level at a higher frequency than the S&OP process.<br>• Objectives of the S&OE process are based on written guidelines set in the S&OP processes following a formal handover. | S&OE team **2,9**<br>S&OE managers **3,0** |
| 3. Defined<br><br>1 = Poor<br>2 = Limited<br>3 = Moderate<br>4 = Good<br>5 = Excellent | • S&OE related processes are organized, defined, and fully documented.<br>• Alignment of performance objectives and internal information to adapt to demand fluctuation or other deviations.<br>• Decision-making is done holistically, and S&OE plans are aligned with company objectives. | • Internal supply chain integration with planned buffers in terms of for example inventories.<br>• A formalized set of preparation activities before every S&OE meeting.<br>• Supply and demand plans maintained in an ERP and/or APS system for real-time outlook. | S&OE team **2,7**<br>S&OE managers **2,8** |
| 4. Quantitatively managed<br><br>1 = Poor<br>2 = Limited<br>3 = Moderate<br>4 = Good<br>5 = Excellent | • Processes are measured with statistical and quantitative techniques, such as advanced analytics.<br>• Extensive data and information sharing across all supply chain stakeholders. | • Demand and supply performance monitored weekly based on predefined KPIs and reliable data.<br>• Collaboration across an extended supply chain network with enhanced visibility to anticipate changes and increase supply chain resilience. | S&OE team **2,4**<br>S&OE managers **2,1** |
| 5. Optimizing<br><br>1 = Poor<br>2 = Limited<br>3 = Moderate<br>4 = Good<br>5 = Excellent | • Alignment of key performance indicators across the entire supply chain ecosystem.<br>• Utilization of advanced analytics and other real-time data monitoring systems. | • Dynamic supply chain adaptation and flexibility with supportive systems.<br>• Flexibility to identify and address emerging value chain patterns, risks and other kind of deviations. | S&OE team **2,1**<br>S&OE managers **2,0** |

Figure 36. Unified S&OE maturity model with averaged survey results.

## 6.4 S&OE process maturity: qualitative research

This section focuses on the more closely examination of the current S&OE process of Neste by applying qualitative content analysis to their internally available documentation. Qualitative research part of this thesis is performed by a theory-driven thematic content analysis for the

internal documentation. Internal documentation related to S&OE process is reviewed in this section, to form comprehensive understanding of how the current S&OE process and steering of S&OE is implemented in the case company, and how the current operating model compares to the presented theoretical framework. Currently, the S&OE process has not been described very comprehensively in the documentation, and there is in fact no clear description of the S&OE process available in terms of a comprehensive process flowchart. However, some documentation can be found in the company's internal management system regarding what is considered to be included in S&OE work and what the key tasks in S&OE steering are, and these elements are reviewed in comparison to theory. Additionally, the internal documentation presents the most commonly utilized tools and programs in S&OE, describes the roles and responsibilities of S&OE team members and also outlines the key stakeholders and communicational matters, which are also reviewed and analyzed. The purpose of this approach is to determine the extent of alignment between theory and documentation.

The research begins by examining key elements from the theoretical framework and internal documentation related to S&OE process. First, all S&OE related elements are systematically analyzed and coded into tables, allowing for initial comparison and identification of discrepancies between theory and practice. In the second stage, elements of S&OE are further analyzed, and based on their relevance against the research objectives, larger themes are summarized into thematic categories. Correspondences to the theoretical framework are thoroughly investigated from the documentation, and findings are collected, and after each iteration round, the table is further summarized in a way, that similar elements corresponding to a specific S&OE sub-process are categorized. Going forward, the content analysis assesses whether theory requirements for certain, larger themes are fulfilled within the internal documentation. Thus, thematic tables are utilized throughout the analysis, by concluding several thematic tables and iterating the findings, and for each table, findings are marked accordingly into tables, with complete, partial, or no connection found. The final conclusions based on the findings from the qualitative content analysis are summarized in Appendix 9.

Figure 37 illustrates the content analysis process. The analysis process began with data collection, followed by coding of relevant keywords, expressions, and longer sentences from the internal documentation related to the research subject. Next, larger themes associated to S&OE process were identified, reviewed, and assessed for alignment with the ideal S&OE process as outlined in theoretical framework. These themes were then further defined and named to reflect their connection with the theoretical framework. Subsequently, the themes were analyzed against the

theoretical framework to determine the extent of correspondence. After each iteration round, and throughout the process, larger themes were applied, and findings were summarized into categories. The initial thematic tables for the business planning framework and S&OE process are available in Appendices 6 and 7. Further, in Appendix 8, elements found from the content analysis were further summarized into larger categories by identifying, which characteristics of an ideal S&OE process were also found from the documentation. Lastly, the final conclusions in terms of how the internal documentation corresponded to theoretical framework are summarized Appendix 9 and the results were utilized for the process development in chapter 7, and further discussed in the last chapter of this thesis.


Figure 37. Content analysis steps.

The following sections focuses on the similarities and differences between the theory and Neste's business planning framework, as well as Neste's S&OE general business process description, the tools and software used by the S&OE supply chain planners, meeting practices, KPI metrics, as well as roles and responsibilities, which are all related to S&OE, by using qualitative content analysis. Objective of this chapter is to provide holistic understanding of how and by which parts Neste's business planning framework and current S&OE process aligns with the theoretical framework. All findings from these sections were collected for the thematic content analysis and analyzed for further development of the process, and the purpose of the below sections is to describe the findings more in detail.

### 6.4.1 Business planning framework

In a general sense, within Neste's internal database, there exists a description of how S&OE is aligned into the business planning framework and how the planning hierarchy is currently structured within the company. Neste's general-level process description of business planning framework, as presented in Figure 38, along with other internally available and relevant documentation for the topic, are examined in this section. The objective is to analyze how the current

representation of the business planning framework aligns with the theoretical framework outlined in this thesis.


Figure 38. Neste's Business Planning Framework.

According to the above description found in the database, at the highest level of the hierarchy is the strategic planning of the company and it is followed by the next level of planning, which is business planning. Both of these planning processes are in the documentation described as strategic planning processes where decisions at the business unit level are made on an annual basis. This structure aligns with the theoretical framework. Additionally, S&OP is perceived as a tactical business planning process, and according to Neste's model, decisions are made at the product and product group levels in S&OP, with a focus on 1-27 months and with a closer examination of periods on a monthly or quarterly basis. There is a slight deviation from the typical horizon and scope of the S&OP process, as outlined in theory, since typically the planning horizon for S&OP ranges between six months to two years.

The current hierarchy on the documentation seems to adhere to Anthony's triangle otherwise in most parts, but there are some slight differences compared to the theoretical framework. Prior to S&OE, documentation illustrates a horizontal "intermediate level" which includes a "sales plan" and "operations plan". In reference to theoretical framework, where the primary objective of S&OP is the alignment of supply and demand plans and achieving consensus among various business units, "sales plan" and "operations plan" could also be mapped or described as an integral part of S&OP planning in this documentation, without an intermediary stage, which might be misleading. Therefore, since the S&OE process serves as the link between tactical planning (S&OP) and operational planning and execution, and S&OP focuses on balancing supply and demand over the long term, the "operations plan" should rather be placed under the S&OE process. This is due to the fact that S&OE typically guides the execution of the higher-level S&OP plans down to lower-level execution phase in operational planning. Otherwise, S&OE process typically includes

demand, inventory, supply and replenishment, manufacturing and transportation planning, but those are not specifically described in Neste's business planning framework but are possibly categorized to be included in the "operations plan" visible in the documentation.

Documentation describes S&OP to include volume and financial data in the process, which differs from typical S&OP process, but on the other hand aligns with the theory for IBP, since IBP often differs from S&OP planning in specifically by IBP including financials to the planning process. The connection to theory is also found in the fact that in the company's documents; S&OP planning implements the outcome of strategic planning hierarchy, and as described in theory, a hierarchy built this way ensures that tactical planning is guided by the strategic planning in organizations, and that all the planning levels are connected and aligned with the overall strategy of the organization.

On a vertical level, documents reveal that "demand planning" and "sales planning" extend across the entire planning hierarchy from the S&OP level down to the lowest level, which is production scheduling and material planning. However, there is a connection to theoretical framework in this, as illustrated in Figure 10, since the critical link between S&OP and S&OE is that the two processes are integrated, and one of the key tasks of S&OE in this integration is to assess the effectiveness and feasibility of the S&OP plan and how the production and demand plans are brought into alignment. Therefore, it is justified to state in the internal documentation that "demand planning" and "supply planning" address all of these planning levels.

Regarding the S&OE description in the internal business planning framework, the planning horizon is set at 1 week to 2 months, which is in line with the typical S&OE planning horizon. Additionally, the documentation outlines the S&OE cycle as daily-recurring, which is also corresponding to the theoretical perspective, which explains that the purpose of S&OE is the daily monitoring of demand and production and the adjustment of plans accordingly. Further theoretical framework describes that S&OE can be characterized as weekly iterative process and usually, in regard to theory, S&OE process typically holds a weekly meeting, which aligns with the cadence or cycle also visible in the internal documentation.

### 6.4.2 S&OE process description

According to the content analysis, S&OE serves as the "handshake" between S&OP and operational planning within the product chain management at Neste. In Neste's context, operational

planning is referring to a specific “operative team”, which is in charge of the operational activities at the production facilities of the company. Additionally according to the process description, in S&OE, the optimized monthly-level plan of S&OP is translated into more detailed production unit quantity and quality targets for further operational execution by disaggregation. For these above parts, there is clear alignment with the key characteristic of S&OE as explained in theory. Additionally, at Neste, S&OE is providing guidance to operational planning on the components to be used in the manufacturing process for each product. This is more of a company- and industry-specific feature when it comes to liquid and fuels production, and there is no direct reference to this in the theory. S&OE also forms the basis for why specified components are used for producing end-products or certain types of fuel qualities, what is the commercial justification for selling a specific product quality and what the inventory targets are based on, or what is purchased. This practice is aligned with the theory, as the short-term optimization of the supply chain relies on the profitability of the choices made in S&OE steering.

According to the presented theory, one of the key elements of S&OE is the translation of plans from higher planning levels to lower levels, and for these parts, there is relation in-between theory and documentation, specifically in terms of the data disaggregation from S&OP plans for production plans, for further generation and programming of orders for scheduling. Thus, clear connection is found between the theory and Neste’s current practices, in terms of the generation and programming of orders, or in other words enabling the scheduling of production and alignment of supply and demand based on the disaggregated plans. In terms of mitigating risks, documentation reveals that the typical deviations arisen from production disruptions and demand fluctuation are addressed in S&OE as well, and for this part, the documentation aligns with the theoretical framework.

In Neste’s description, at the core of the communication are the S&OE team members and operational planners, and on their responsibility is to ensure that all relevant stakeholders are actively involved in the execution and deployment of the S&OP plans for their dedicated product chains. As per the documentation, this communication addresses a range of factors, including production unit input levels, inventory targets, component specifications and quantities, as well as timing considerations in terms of scheduling the production. In theoretical framework, it is first described that S&OE helps to reduce reactivity and firefighting by actively monitoring supply and demand data in the process. In the same theory part, it is explained that the purpose of S&OE is also to increase transparency and clarity in decision-making processes, and in that regard, it can be observed that Neste's current S&OE process description correctly emphasizes the importance

of cross-functional collaboration and communication for S&OE. Neste's internal documentation also clearly outlines the different key stakeholders that are affected by S&OE, and in this respect, it can be observed that the theory aligns with the current process.

Generally, the description of the current S&OE process at Neste aligns well with the theoretical framework on most parts. In the theoretical framework, there is also theoretical justification for one of the key features of S&OE, which is to ensure that the objectives set in S&OP are executed in S&OE. This alignment is also reflected in Neste's internal documentation describing the general objectives of S&OE; producing a feasible plan for S&OE steering that aligns with S&OP plan and can be executed on the operational level. However, there is some distinguishment in theory versus the internal documentation in terms of the responsibilities: internal documentation reveals that S&OE supply chain planners are responsible together with production planners of the S&OP plan.

However, according to theory, S&OP and S&OE processes have different objectives and requirements, and they should be separate processes that are integrated with each other, to close the gap in planning and information sharing. In ideal process, S&OE and S&OP plans are developed and created by separate teams, that nevertheless support each other, and it becomes clear from the internal documentation that creating the S&OP plan is not in fact the main responsibility of the S&OE supply chain planner. Therefore, the reference to S&OP planning in the responsibilities of the S&OE supply chain planner is in a way understandable and justified; S&OE team should rather act as supportive key stakeholders in the S&OP process, and the processes should be separated, yet integrated with each other to allow for better deviation-handling and optimization of operations, as is highlighted in the theory.

Additionally, theory outlines the role of S&OE to validate the efficiency and feasibility of the S&OP plan and to provide short-term planning information as input for future S&OP planning cycles. However, the S&OE process, and thus the S&OE supply chain planner as well, should not directly participate in the actual creation of the S&OP plan, because as presented in theory in several instances, the horizons and focus of S&OP and S&OE planning differ significantly from each other's. Thus, the focus in S&OE processes scope in the internal documentation should be in the upcoming near months, not in the 15-month scope of S&OP.

Also, S&OE is intended to provide visibility and insight into the future through its real-time tracking of different variables, in regard to what proactive measures should probably be taken in order to mitigate risks and to avoid bottleneck situations also over the longer term, or other words, in

S&OP planning, according to theory. According to the theoretical framework, it is crucial to incorporate these observations and perspectives of S&OE also into the future S&OP planning cycles, and the internal documentation regarding S&OE process does in fact address this from some perspective as well. Per the internal documentation, the S&OE supply chain planner is responsible for ensuring that the S&OP plan is feasible and realistic, but their responsibilities also include forwarding necessary changes and considerations to the next cycle's S&OP plan. In the documentation, there is some guidance and instructions on how supply chain deviations, such as production disruptions or demand fluctuations, are observed and how they should be responded or handled, and they align with most parts with theoretical findings. Additionally, in other parts of the internal documentation, the tools or programs that are available for S&OE supply chain planners does provide some insights in terms of how the different data and metrics are used and monitored in the daily work for decision-making, and these will be examined in following chapters.

### 6.4.3 Tools and software

According to the content analysis of internal documentation, various tools are used in the daily S&OE work at Neste. The Spiral Plan tool is used to generate the S&OP plan, which is further transferred to a Google Sheets-tools for review once the S&OP plan is finalized. The S&OE supply chain planner is responsible for ensuring that this plan is feasible before its deployment to the operational level through the “handshake”-meeting. The Spiral Schedule tool is used to schedule the disaggregated S&OP plan into a daily-level plan, and the purpose of these two tools, Spiral Plan and Spiral Schedule, are aligned with the theoretical operating model of disaggregating plans and transferring them to scheduling by generating and programming orders.

The documentation also presents the production utilization plan, or “käyttösuunnitelma”, which is applied in S&OE, but its specific purpose is not further explained at all. Otherwise, the documentation states that the purchasing plans from S&OP should be aligned in the S&OE process, by scheduling them at a weekly and daily levels, which seems to be a straightforward and understandable practice, that aligns again with theory. Finally, PowerBI-reports are presented as tools that are used in the S&OE process to monitor inventory levels, sales and demand forecasts and purchasing quantities, and blending reports. However, the documentation does not reveal the frequency of updating different data sources: how often and how production forecasts are updated, and similarly, how often and by what means sales forecasts are updated.

While the internal documentation provides a general overview of the purposes of the tools used in S&OE process, there is no explicit description for example of how sales and demand forecasts are monitored in S&OE on a daily or weekly basis, or how the production data is monitored. For S&OE, as highlighted in theory, this continuous data monitoring in S&OE process is especially crucial, as it is enabling S&OE to add value by anticipating the future and making data-driven decisions, while also addressing and handling the short-term deviations and mitigating risks to the supply chain in general. However, it is apparent, based on the internal documentation, that the data monitoring might not currently be continuous and based on real-time, and the documentation doesn't specify the frequency of data updates by any means at all. Therefore, as it is particularly important for S&OE process to have constantly available access to up-to-date data on sales and demand forecasts, production schedules, and inventory levels, there is a gap in-between theory and current operating model, as revealed by the documentation.

### 6.4.4 Key Performance Indicators

Upon performing the content analysis, another notable gap becomes apparent when the documentation is compared to the outlined theory. According to the documentation, there is an absence of defined Key Performance Indicators (KPI) within the current S&OE process. While Customer Delivery Performance (CDP) KPI is implemented and used for operative planners as one KPI, there are no KPIs defined for the S&OE team specifically at all. Per theoretical framework, one significant characteristic of the S&OE process is the alignment of monitored KPIs that are also aligned with the company's strategic objectives, ensuring that the objectives outlined in the S&OP plan are followed, and ultimately, also achieved in S&OE process. Theory further emphasizes the importance of utilizing appropriate KPIs to track the performance across the entire supply chain and therefore, the applied KPIs should be reflecting the objectives and scope of the specific planning process.

### 6.4.5 Roles and responsibilities

In Neste's context, S&OE team members are referred to as supply chain planners and below in Figure 39**,** the documented responsibilities of S&OE supply chain planners are presented. In this table, the responsibilities and tasks of the operational planner – as found from the same internal

documentation – are also presented, in order to compare whether the responsibilities align with the presented theory and whether there are any overlaps or significant differences found.

However, it is important to note in the below analysis that the comparison is made from a general perspective regarding which tasks of S&OE supply chain planners at Neste are justified by the theory. Many of the tasks presented in Figure 39 are specific to the company and to the industry it operates in, thus the review and content analysis only concerns the aspect of what are the typical responsibilities of the S&OE team.

| Responsibility area | Role | Task |
|---|---|---|
| S&OE end-results for own product chain | Supply chain planner (S&OE) | • Qualitative responsibility for the outcome of SOE<br>• Responsibility for tracking inventories and assets<br>• Responsible for ensuring that the S&OP plan is feasible<br>• Responsibility of determining costs for over-quality production |
| Sales data | Supply chain planner (S&OE) | • Sales is responsible for sales forecast<br>• Responsibility of seasonal quality changes (summer/winter) |
| New product launches | Supply chain planner (S&OE) and operational planner | • Responsibility of ensuring Oili data is up-to-date<br>• Responsible of guiding production, blending and distribution on how to proceed with a new product |
| Operational plan | Operational planner | • Responsible of ensuring that the operational plan (production units, tanks and logistics) are taken into account in S&OE and in scheduling |
| Product, raw material and feedstock purchases | Supply chain planner (S&OE) | • Responsible of ensuring the end-use for the purchases<br>• Responsible of ensuring that all appropriate analyses are performed for the purchases |
| Scheduling | Operational planner | • Responsible of verifying S&OE plans by scheduling<br>• Responsible of highlighting potential risks and infeasibility of S&OE plan |
| Development of Spiral-tools | Supply chain planner (S&OE) | • Responsible of communicating and highlighting any development requirements of Spiral tools to appropriate stakeholders |

Figure 39. Roles and responsibilities in current S&OE process.

From general perspective, it can be again observed that the responsibility areas presented in the first section of above figure are on most parts consistent with most of the responsibilities defined in typical S&OE process in theory. In the above table, it is defined that S&OE supply chain planner is responsible for implementing the S&OP plan and executing the S&OE plan in the short term, which again aligns with theoretical framework. Additionally, the responsibility areas defined in the table include monitoring inventories and production metrics, but according to the theory, in S&OE, it is also necessary to monitor sales forecasts and any deviations or changes within any of

these parameters, to enable balancing of demand and supply and mitigating risks to the supply chain. However, the current role description of the S&OE supply chain planner doesn't necessarily specify that the planners would also be responsible of tracking sales and demand, as it is only mentioned that sales is responsible for sales forecasts within this documentation. Additionally, another documentation reveals that in case of the S&OP plan being infeasible in terms of observed deviations in demand, this might lead to a new cyclical update of the S&OP plan. This documentation doesn't however specifically address that the S&OE team should be constantly monitoring the demand data and, thus, data-based decision-making in S&OE would suffer if all of the variables aren't constantly monitored within the process.

Otherwise, the rest of the tasks of the first two responsibility areas are more company- and industry-specific, which is why a direct connection to theory is not readily apparent. It is also worth noticing that in this table, the S&OE supply chain planner is responsible for the qualitative outcome of S&OE but not the quantitative responsibility, and the terminology used in this sense might come out as confusing. This is due to the presented theory, since it should be noted that the purpose of S&OE, as outlined in theory, is specifically to ensure that demand and supply figures are aligned in the most optimal and economically viable manner, and the S&OE process. Thus, from theoretical perspective, collaboration between the S&OE supply chain planner and the sales team could ensure that sales and demand forecasts would be regularly updated, and it would consequently allow for better-informed decisions based on current, up-to-date market insights in the S&OE process. Based on the theory, by adopting a more agile approach to demand forecasting with shorter update cycles to the S&OE process by introducing a demand review to the process, S&OE team can respond more effectively to fluctuations or deviations in market conditions and customer demand, which could consequently improve overall performance and efficiency of the process and add value for the work of the S&OE team. However, direct alignment between the theory and documentation for these parts is not completely evident.

In regard to the above listed sections of theoretical framework, S&OE process typically consists of a series of sub-processes, that are data driven. Thus, it is advisable for Neste to consider implementing a demand review and a supply review within its current S&OE process. The demand review would assess received and planned orders and align them with the forecasts, as well evaluate deviations, while the supply review would focus on inventory levels, production, and purchasing, and assess them against the set S&OP objectives. Thus, per theoretical framework, if then any significant deviations would be detected between planned and actual outcomes, corrective actions could be proactively taken in the S&OE process. Therefore, since Figure 39

indicates that the S&OE supply chain planner is responsible for steering production and managing purchasing process, it would be advisable to further clarify the roles of planners as well as to investigate whether the current available tools are capable of conducting such a supply and demand reviews at this stage, or if tool development is required to enable it.

Additionally, the responsibilities listed in the table for the operational planner are understandable both in terms of the alignment between theoretical framework and Neste's context. While S&OE process doesn't typically involve production scheduling per se, tasks such as order confirmation, data-entry into systems, and managing order prioritization rules as well as order revisions are presented in theory and they are fundamentally connected to production scheduling, and thus, alignment with theory is evident in this case. Additionally, theory outlines that S&OE involves addressing deviations, opportunities, risks, and threats to the supply chain in weekly S&OE-meetings. However, per the documentation, S&OE supply chain planners responsibility areas are not specifically encompassing these specific tasks related to deviation handling and risk management, as they are currently assigned under the operational planner.

However, theoretical framework highlights that the S&OE process isn't necessarily about daily operational planning either, but it rather serves as an intermediate link between operational and tactical planning, raising awareness of potential risks, changes, and challenges to the supply chain and operations in general and actively seeking solutions to address any of deviations or potential risks in the future. Therefore, as the operative planner is the main responsible party for production scheduling per the documentation, this part of the roles and responsibilities-table can also be perceived as a company-specific, and the responsibilities can as well be shared, if better suited in Neste’s context. Further, the additional responsibilities of S&OE supply chain planner found from other sources in the internal documentation that were outlined in theory, were not documented in the same table as the abovementioned responsibilities, creating inconsistency in the documentation. Upon examining the documentation, it became evident that the roles and responsibilities of S&OE supply chain planners are somewhat scattered across different documents stored in different locations, which can cause confusion and unreliability.

### 6.4.6 Meeting practices

According to the content analysis, possibly one of the most significant differences between the ideal S&OE process as presented in theory and Neste's current practices, relates to the company's

S&OE meeting practices. The current S&OE process description reveals that the earlier mentioned "handshake" between S&OE supply chain planner and operational planner is held as soon as possible after the S&OP plan is finalized, which from the timeline perspective aligns with theoretical framework – the first S&OE meeting should be typically held within a week from the completion of the S&OP plan. In addition, there is also a weekly-level handshake meeting between supply chain planner and operational planner, with the purpose of ensuring that the weekly production scheduling is up-to-date and completed before the weekly-occurring meeting called "E2E-viikkopalaveri" that is held for S&OE team, operational team and other key stakeholders and where each of the product chain is reviewed for a bigger audience. Alignment to theoretical framework is thus partly found in terms of meeting practices, even though there is not a specific S&OE meeting applied in the current configuration.

The purpose of the "handshake"-meeting is to achieve a mutual consensus between the S&OE supply chain planner and the operational planner regarding the results of S&OP, and the aim is to agree in more detail on the deployment of the S&OP plan. However, in theory it is suggested and highlighted that one of the biggest challenges or pitfalls of a functioning S&OE process relates to S&OE meeting practices and their agendas. One of the key requirements from theory for a functioning S&OE process is that a weekly S&OE-meetings are held, and in those meetings the S&OE performance is reviewed, and decisions are made regarding the execution of plans and in alignment of supply and demand. The internal documentation reveals that currently S&OE meetings as "handshake"-meetings are held weekly, and they can be considered relevant for balancing the short-term supply and demand at some level, as well as communicating the S&OP plans down to the operational level. However, theory also emphasizes that there should be a more "unified" S&OE meeting as a decision-making forum, with a clear agenda, and these discussions are led by a specific S&OE-leader, who can make independent decisions in situations where there are conflicts between different S&OE areas. However, no clear connection is found from internal documentation for such, specifically tailored and iterated S&OE meeting.

### 6.4.7 Summary of findings

This section summarizes the findings from the qualitative content analysis and explains how the findings corresponded to the requirements for certain larger S&OE related themes as outlined in the theoretical framework of this study, as further illustrated in this chapters Figure 40. This summarization, together with the findings from the quantitative research presented earlier, further

allows for the final analyses of all the results to be utilized in the process development section followed by this chapter.

The Business Planning Framework and its related areas, such as the hierarchy of planning levels and their interconnections, are thoroughly presented, and it can be considered that the requirements of the themes found from theory are fulfilled for this part. However, the S&OE process is not described entirely in line with the requirements derived from theory and the distinguishment between S&OP and S&OE is partly incomplete. S&OE documentation lacks a flowchart for the process. On the other hand, the description differs only slightly from theory, for instance in terms of what the process fundamentally aims to achieve; to bridge S&OP and S&OE. However, the main purposes, such as the execution of the S&OP plan and short-term optimization of the supply chain, are found in the documentation. The methods and key principles used in S&OE steering align with theory; for example, S&OE disaggregates and executes S&OP plans and guides operational planning, while monitoring supply and demand data. Conclusively, the description of the S&OE process is outlined in the documentation for most, but not by all, parts in alignment with theory, as the process is addressing the short-term optimization of the supply chain.

However, while the main tools used in the process are identifiable and in use, based on content analysis, it is not clear whether these tools allow for actual real-time monitoring and tracking of the supply chain. Similarly, not all the means to set objectives for S&OE, as well as the means used to track the S&OE performance were found in the content analysis. Per the analysis, the case company lacks KPI metrics for the S&OE process altogether. Also, differences were found between theory and documentation regarding the responsibilities of the team responsible for S&OE planning and steering, and the documentation in this regard is partly incomplete. Further, the documentation regarding the responsibilities for the S&OE team is somewhat unclear, i.e. in Figure 39 some responsibilities were defined, but the documentation lacks other responsibilities, that are defined in other documents, which may cause confusion. This Figure 39, as well as the Appendix 9, illustrates the final conclusions and findings from the qualitative content analysis, as different elements found from the documentation are thematized and categorized according to their correspondence with the theoretical framework.

Also, typically S&OE process consists of a series of data-driven sub-processes, but in some cases, the documentation does not specify what these sub-processes are and how they are managed, or whether they are existent at all. S&OE meeting practices are not entirely aligned with theory either, as the process seems to be lacking S&OE meeting, where for example demand and supply

reviews are performed, and comprehensive decisions regarding the supply chain are made and assesses from the perspective of their profitability and rationale.

| Theory requirements for this theme are fulfilled | Included | Not included | Partially included |
|---|---|---|---|
| Business Planning Framework and hierarchies are described | x | | |
| S&OE process is comprehensively described | | | x |
| S&OE process focuses on short-term optimization of the supply chain | x | | |
| S&OE process utilizes necessary tools for real-time tracking of the supply chain | | | x |
| S&OE objectives and responsibilities are defined and monitored | | | x |
| S&OE deploys relevant sub-processes and meeting practices | | | x |
| **Summary** | **2** | **0** | **4** |

Figure 40. Correspondence of theoretical themes found from content analysis.

# 7 Process development

In this chapter, the proposed new S&OE process and its related elements are presented. The S&OE process development utilized the results of both quantitative and qualitative research. Considering the broad and complex nature of the research topics, the findings from this quantitative research were complemented by qualitative content analysis of internal documentation, in order to establish a comprehensive and specific understanding of the research topic. By utilizing two different research approaches – quantitative and qualitative – in this thesis, concrete and detailed development suggestions can be presented in this chapter, and the redesigned S&OE process can be presented. Throughout the process development, special attention is focused on initiatives and elements within the current S&OE process that are considered challenging, insufficient or ineffective in the current configuration.

Further, some findings from a multi-case study *"The intermediate link in planning: a multi-case study of the Sales and Operations Execution process"* by Ana Lima de Carvalho (2018) were utilized to assist in the redesigning process, along with other S&OE concerning material presented in the theoretical framework. In Carvalho's study, five sub-processes were proposed for the S&OE process, and of them, four are adapted, and tailored to the new S&OE process, to fit the needs of the case company: *disaggregation of plans, generation and programming of orders, evaluation of opportunities and deviations, and defining the fulfillment*. The development proposals take into account the current configuration of the case company, aligning with the existing and available tools and systems. These proposals are designed to require minimum financial investment, and rather are focusing on suggesting new ways of working and making better use of existing capabilities.

## 7.1 S&OE process

In this proposal, S&OE scope is the first calendar month after S&OP is completed, and the scope is further divided into weekly time-buckets, with recurring activities to be performed by the S&OE team on a weekly basis. The proposed framework for the new S&OE process with key sub-processes or activities is illustrated in Figure 41.

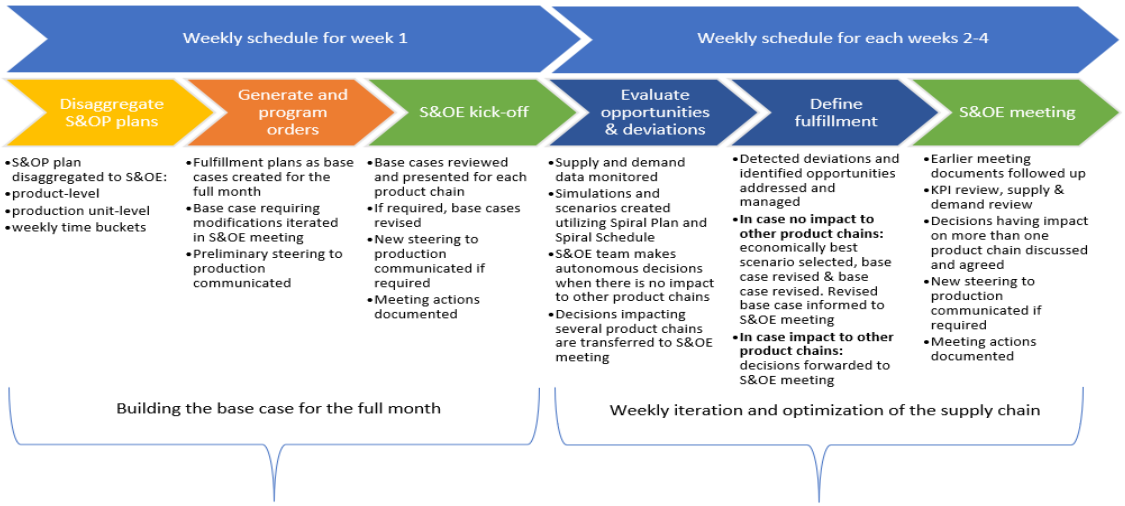



Figure 41. Proposed S&OE framework with sub-processes.

**Disaggregate S&OP plans** is done once the S&OP plan is completed, within the first week of S&OE's one month scope. The purpose is to identify from the S&OP plan, of which different products the total aggregated sales volume consists of, and of which components or raw materials the products are made of and to which sales markets – such as domestic or export markets – they are planned to be sold to. Similarly, the S&OP production is reviewed, to make sense of how the production units should be operated in the S&OE scope – namely, to achieve the S&OP target, how much production of different components would be required. Disaggregation is done by exporting, reviewing and analyzing the S&OP plans from Spiral Plan into Excel or Google Sheets.

The output of this activity is a documented and disaggregated S&OE plan in a weekly time buckets, that is detailing what should be produced and in what quantity and when to match the demand, which is then further considered in the next stage.

**Generating and programming orders** is the next activity, where supply chain planner creates a high-level plan, that is further reviewed and validated together with the production planner in a handshake-meeting. Once the plan is validated, it is transferred from Excel or Google Sheets to the Spiral Schedule. In the Spiral Schedule, the aim is to create a plan on how to fulfill the demand by production. This plan is a "base case", that addresses how different production units are to be operated within the scope of S&OE, i.e., over the next month in weekly time buckets, and what products are sold to which markets and when, to ensure that the S&OP objectives would be achieved at the end of the month. The existing inventory levels and S&OP plan's targets for month-end inventories are considered and aligned as well within this activity, and preliminary transportation program is scheduled. Thus, the planning extends to concern all five typical S&OE

categories: demand planning, inventory planning, supply planning, manufacturing or production planning and transport planning.

The output of this activity is a high-level and feasible “base case”, as the sales and production plan for the next month in Spiral Schedule, where production runs and deliveries to customers are planned. If the base case is considered feasible, executing it can be started and steering can be communicated to production, and the base case is only presented in the S&OE meeting to the whole team. If the base case is not feasible and it requires support and co-operation from other team members, it is transferred to the S&OE meeting first and once it can be considered feasible, steering can be communicated to production.

**S&OE kick-off** is held on at the end of the first week. Within this meeting, the scheduled S&OE plans are shortly presented by each of the supply chain planner concerning their own product chains. KPIs for the month are reviewed. Discussions is led by the S&OE leader and any conflicts in-between the different plans are reviewed, and possible revisions are done to the plans if necessary. In case the base case is infeasible, it will be iterated in the S&OE meeting and impacts to other product chains are analyzed and decisions are made holistically. A new steering is given to production once the base case is considered to be feasible. Additionally, all activities to be performed within the upcoming weeks of the S&OE scope by the S&OE team that arise during the meeting, are documented and followed up in the next meeting.

The output of the first S&OE meeting is to have an aligned, comprehensive and clear base cases for all product chains for the remaining three weeks of the month before the new S&OP is completed, and a comprehensive steering to be communicated to production.

**Evaluate opportunities & deviations** is an optimizing activity, that is performed on a constant basis during the weeks 2-4. S&OE team actively monitors supply and demand data. Opportunities stemming from demand fluctuation or prompt sales opportunities, or deviations such as production issues are considered, and simulations and various scenarios are created by utilizing Spiral tools. The supply chain planner can make decisions regarding opportunities or deviations that only affect their own product chain, but not other product chains.

The output of this activity is different simulations and scenarios that are addressing opportunities and deviations. These simulations and scenarios are further considered when defining the fulfillment plan.

**Define fulfillment** is another optimizing activity, that is partly simultaneous with evaluate opportunities & deviations, and is also constantly occurring during the weeks 2-4. In case the opportunities or deviations detected don't have impact to other product chains, of the simulations and scenarios created, the economically most feasible solution is selected, and base case is revised accordingly and steering to production is revised. In such cases, the decisions are further only informed to the S&OE meeting at the end of the week. If the new base case would have impact over other product chains, the decisions are forwarded to be done in the S&OE meeting, where their impacts are holistically reviewed and all plans from each product chains are aligned.

The output of this activity is either a new base case and new steering to production, or topics to be discussed in the S&OE meeting and decisions regarding fulfilment to be made in the meeting.

**S&OE meeting** is performed during weeks 2-4 on every Friday. S&OE team can also hold ad-hoc meetings outside of the weekly meeting in case deviations detected in the supply chain require so. Actions taken by the S&OE team during the past week as agreed on previous week's meetings, are reviewed. Supply and demand reviews are reviewed to analyze, how the S&OP plan is aligning with S&OE, i.e. whether the actual demand aligns with the forecasted demand, or whether the production aligns with the anticipated monthly production. Also other chosen KPIs are reviewed. Each product chain is shortly presented in the meeting. If there have been any changes in product chains plans since the last meeting, those changes are also presented by the supply chain planners. In case the scenarios created to fulfill the demand indicated that a change to one product chain would have impact other product chains as well, those discussions and decisions are also addressed in this meeting. Lastly, new steering is again handed out to production for the next week.

After the first week and the S&OE kick-off, the S&OE process is continued by following the same pattern for weeks 2-4, with the same activities recurring each week. Below, Figure 42 presents the proposed monthly S&OE process divided into weekly time buckets.

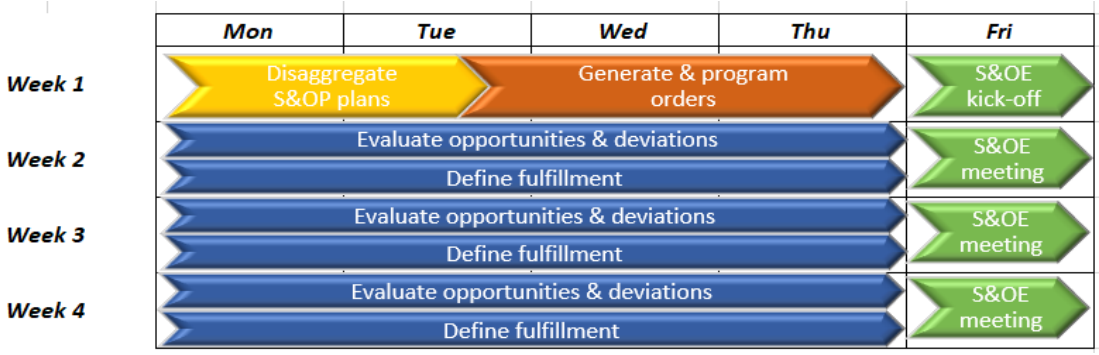


Figure 42**.** Proposed S&OE process monthly calendar.

## 7.2 S&OE flowchart

The managerial-level S&OE flowchart in Figure 43 and Appendix 10 outlines weekly activities in the process for the full period of one month. In the first weekly bucket, S&OE base cases are built and the foundation for optimization for the upcoming weeks is created, and the objectives for the month are reviewed. Then, weeks 2-4 follow the same process: the S&OE team builds various scenarios and simulations as opportunities and deviations are identified, continuously optimizes the supply chain based on data based on supply and demand outlook and provides new S&OE steering for production to implement production plans, whenever changes to base case are done. At the end of each week, summaries of all product chain plans are reviewed in the S&OE meeting, and plans are further iterated as needed. The meeting also includes a supply review, with schedule attainment as the KPI, and a demand review, with demand forecast accuracy as the KPI. Other KPIs aiming to assess the delivery performance are OTIF and service level. Finally, any information that is considered to be relevant for the upcoming S&OP cycles, are further documented in the S&OE meeting, and communicated via appropriate channels and methods for the S&OP team to ensure coherent alignment with S&OE steering.

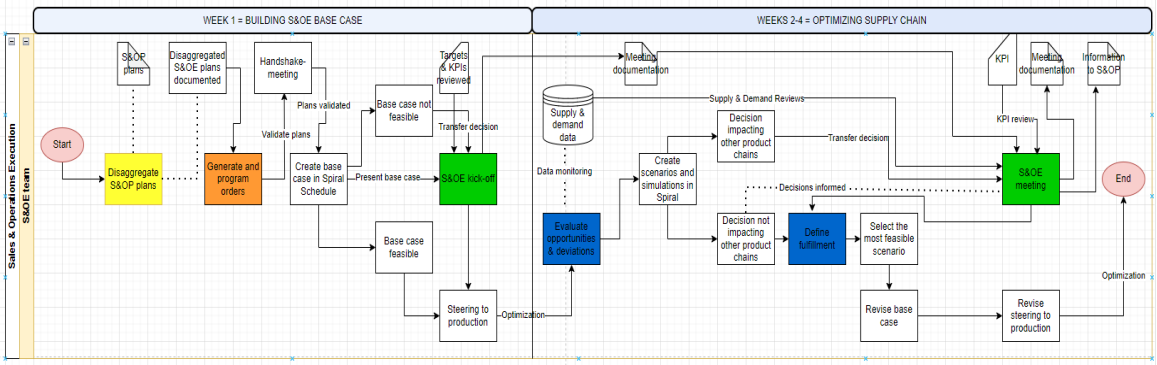



Figure 43. Proposed S&OE process managerial flowchart.

## 7.3 S&OE Key Performance Indicators

New key performance indicators for S&OE process were selected in collaboration with the case company. The selection was based on metrics' relevancy in addressing short-term fluctuation of

different variables within their supply chain. The purpose of the chosen KPIs is to assist the S&OE team in optimizing short-term supply chain operations and enable data-driven decision-making and fine-tuning of their base case plans. The selected KPI metrics are: OTIF, schedule attainment, service level, and forecast accuracy. The specified timeframe for measuring all of the KPIs is one week, except for the first review of the first KPI, which occurs during the second week in the first actual S&OE meeting. During the first S&OE meeting's review, KPIs are assessed from the beginning of the preceding week, i.e. from the beginning of the S&OE process for the month. In the first S&OE meeting, S&OE kick-off, KPIs and objectives for the full S&OE scope are reviewed. Justification for the chosen KPIs and their data sources is illustrated below in Figure 44.

| KPI | Formula | Data source | What is measured? | Why is measured? |
|---|---|---|---|---|
| OTIF % | Total deliveries completed on time and in full / total deliveries completed x 100 | BO PRRB01 - Production analysis; VES015 - In-Transit vessels and transports; TR001 - Trucks Self Service Report | Accuracy of deliveries in terms of quantity and quality | To detect any production issues and mitigate risks impacting customers |
| Schedule attainment % | (Completed planned production in tons / planned production in tons) x 100 | PAP - Production Actuals & Planning; PRRB01 - Production Analaysis; Spiral Schedule | How actual production follows the plan from S&OP or base case | To illustrate whether the S&OP objectives or revised S&OE objectives are reachable |
| Forecast accuracy % | 1 - [(Actual sales for period in tons) - (Forecasted sales for period in tons)] / actual sales for period in tons | SAL013 - Sales self service; PAP - Production Analysis & Planning; Spiral Schedule | How accurate is the initial demand FC received from sales, how demand actualizes | To identify whether there is misalignment between supply and demand, and appropriate actions can be planned |
| Service level % | (Quantity of orders delivered / quantity of orders received) x 100 | SAL013 - Sales self service; PAP - Production Analysis & Planning | Amount of customer orders in volume to be delivered in the period | To be able to optimize inventory levels |

Figure 44. Proposed KPIs for S&OE process.

## 7.4 S&OE meeting agenda

In the first S&OE meeting of the month, the S&OE kick-off, the supply chain planners present their plans for the entire S&OE period, the upcoming month. During the meeting, the S&OE base cases that impact more than one product chain are also iterated and validated. The purpose of the meeting is to provide consistent and comprehensive steering for production, based on which the supply chain will be further iterated and optimized in the following weeks. Agreed actions and activities are documented and followed up in the next week's S&OE meeting. Additionally, the KPIs and the objectives to be followed during the upcoming weeks, are reviewed.

The agenda for the S&OE meetings in weeks 2-4 is always similar. In these meetings, the documentation from the previous week is reviewed, if there have been any activities to follow up on or tasks to be completed during the week. Supply and demand are reviewed along with other KPIs to ensure that the focus of the team is set to short-term optimization, and decisions are data-based. KPIs and their progress are also visually presented in meetings, to ensure the tracking of goals and performance is more practical and easier. Changes to the base case plans are presented

by the supply chain planners, and changes requiring holistic decision-making that would be impacting more than one product chain, are discussed and decisions are made in the meeting. New agreed actions and activities are again documented, and thus, reviewed in the following week's meeting. The outcome of the meeting is again a consistent and comprehensive steering for production, ensuring fulfillment and alignment of supply and demand. Any relevant information that should be considered in upcoming S&OP planning, is documented in the S&OE meeting and further shared to the S&OP team. Meeting agendas and the workflow of the meeting is illustrated to below Figure 45.

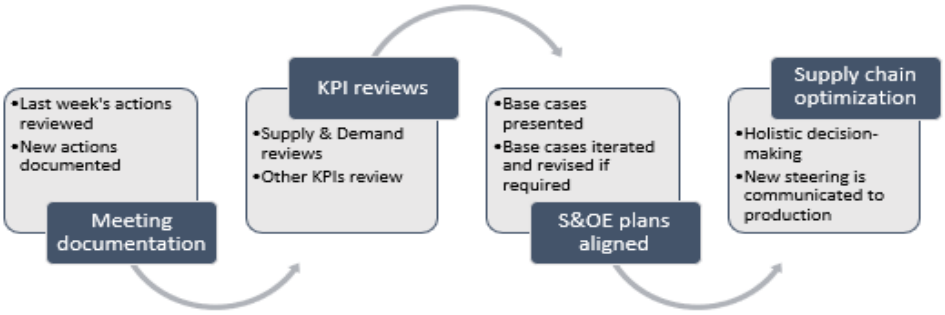



Figure 45. Proposed S&OE meeting agenda.

## 7.5 S&OE team roles and responsibilities

S&OE team's responsibilities were summarized to a managerial-level description available in Appendix 11. Any of the existing responsibilities were not considered necessary to be removed, but new responsibility areas and tasks have been added to make the documentation more comprehensive and to guide S&OE team members towards a more holistic optimization of the supply chain. The areas added to the responsibility description include monitoring KPI metrics and communication with key stakeholders related to deviations. Additionally, the responsibilities are in overall clarified, and sub-processes related to S&OE meeting are added. Also, the key tasks related to S&OP planning are in the documentation.

## 7.6 Implementation roadmap

The implementation of the new S&OE process utilizes methods adopted from the theoretical framework. Implementation increases the overall comprehensiveness of S&OE and enables the case company to shift from reactive optimization to proactive optimization, and thus eliminates the unnecessary fire-fighting. Benefits expected from implementing this new process includes improvement of the demand forecast process in general, as demand forecast accuracy is monitored more closely. It is also expected that operational costs will decrease by more precise supply and demand alignment, which also enables more accurate inventory optimization. Consequently, volatility of the case company's supply chain will decrease as decisions are made based on data and in a coordinated, holistic manner. The integration of S&OP and S&OE will also improve, by promoted communication and monitored progression towards the set objectives. In summary, the greatest benefit of the implementation is the entire S&OE process becomes more comprehensive and precise than before and consequently, additional value will be gained.

Considering the implementation requirements that were outlined in theoretical framework, the relevant data sources are identified, and their utilization is applied in the new process. New S&OE process is described and a flowchart, that considers the various sub-processes, is illustrated. Data-driven decision-making is promoted, within both the S&OE process and in the S&OE meetings, and performance and progress are actively monitored against objectives. Similarly, responsibility areas are defined for the S&OE process overall, including identification and management of deviations, and how they are addressed. Overall, the fulfillment of S&OP objectives is monitored comprehensively and changes in S&OE scope are taken into account in the objective monitoring. The implementation roadmap with a preliminary, proposed schedule is further illustrated in Figure 46.

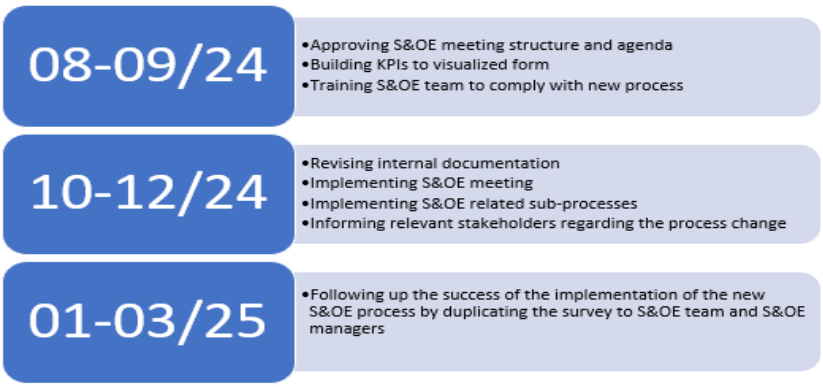



Figure 46. Proposed S&OE implementation roadmap.

# 8 Discussion

The main objective of this thesis was to find out, how the S&OE process of the case company could be holistically developed by evaluating its maturity from the perspective of overall comprehensiveness of the process, as well as evaluating current processes' other S&OE related elements and challenges. Additionally, this thesis aimed at finding solutions to integrating S&OP and S&OE processes in order to maximize the added value from S&OE process. Due to the comprehensive nature of the thesis and complexity of the topic, both quantitative and qualitative methods were utilized in the research. Eventually, the results of the quantitative survey complemented the findings of the qualitative content analysis performed for the internal documentation.

Theoretical part of this thesis focused on researching and presenting different planning levels within the business planning framework, their interconnections, and the specific characteristics of different planning processes. Theory is based on a comprehensive range of literature, but the construction of the theoretical framework concerning S&OE relied on most parts on online sources, such as blogs and guides, as the availability of academic research on S&OE is relatively scarce. Based on the theoretical frameworks and researched best practices, it was possible to initiate the empirical part of the research. By utilizing findings from theoretical framework, it was also possible to develop a specific maturity model for the assessment of the current S&OE processes state.

Based on the theory, a quantitative survey was conducted for the S&OE team and S&OE managers in the empirical study, which provided valuable insights into case company's S&OE processes current state, challenges, and potential areas for improvement. In terms of the maturity level, quantitative survey was not able to explicitly determine per se, but the maturity evaluation provided valuable insights and pinpointed specific improvement areas for the holistic development of the process in overall. Additionally, qualitative research, applying content analysis for the internal documentation available in the case company's database, further deepened the understanding of these topics. Qualitative research also complemented and validated the survey results and provided further additional knowledge usable for the development process.

Eventually, all research questions and their sub-questions were addressed and answered in the empirical part of the study. The research questions were considered relevant from the perspective of the objectives of the study, and answers enabled the development part of this thesis to be performed. Ultimately, a comprehensive and holistic view of the elements or characteristics

existing and missing in the current process, as well as the potential challenges potentially hindering the implementation of a new process was formed. The major challenges in the current process related to how the S&OE process should be executed and what the process aims to fundamentally achieve, and what other sub-processes or elements should be included to the process, and the proposed solutions are considered to be suitable in terms of elevating the maturity level of the case company's S&OE process and the framework in general.

## 8.1 Review of the research questions

In this section, derived from the results of both the quantitative research and the qualitative research, the research questions 1 and 2 are answered. The analyses of these researches focused on the extent to which the current S&OE process aligns with the theoretical framework, and how the findings corresponded to the research questions and sub-questions outlined. The structure in this section is such that the sub-questions for both research questions 1 and 2 are presented and answered first, which then enables the main research questions to be addressed – the presentation logic for this section is thus bottom-up. Research questions 1 and its sub-questions were as follows:

RQ1: How can the S&OE process be improved?

*How is the current S&OE process described?*

*What is the maturity level of the current S&OE process?*

*What are the recognized challenges of the current S&OE process?*

***"How is the current S&OE process described?"***

The main characteristics of the typical S&OE process were found from the current configuration, though some elements were missing. Defining and clarifying S&OE related documentation to enhance its overall comprehensiveness was essential to increase its comprehensiveness and usability. The clearest development suggestion concerned the process flowchart. Most notable elements that were missing from the current S&OE process description were the process-relevant sub-processes, thus the new process flowchart therefore also includes the most relevant sub-processes outlined in the theory, for demand review, supply review, and S&OE meeting. This findings was also supported by the survey results: there seemed to be gap on the integration of sub-

processes into the S&OE process, and the S&OE and S&OP processes and their objectives were not perfectly structured and separated. Therefore, the new S&OE process also includes the perspective of integrating S&OP and S&OE, by applying some key practices into it.

***"What is the maturity level of the current S&OE process?"***

The conclusion regarding the assessment of the general level of maturity of the S&OE process is that it cannot be definitively described. The reason for this is that the second part of the survey, which aimed to find answers to the simplified model with YES/NO questions, yielded a lot of variation in responses. Since the model was directly adopted from the author, Supply Chain Media (2023), the questions related to the model could not be modified for the sake of validity and reliability of it. Thus, it was assumed that due to this reason, there have possibly been differences in the interpretation of the questions amongst the respondents. Additionally, it was assumed that there were also differences in the level of knowledge among respondents, which may have had impact to the respondents' answers.

However, for the unified S&OE maturity assessment, the results were more significant. In this model which consisted of five maturity levels, the average responses ranged between 2 and 3 among both groups, on the scale of 1 to 5. This indicated that it could not again be definitively determined what the maturity of the current process is per se, but it could be observed, that there were aspects on all levels that required further development, which assisted in the development work within this thesis. Additionally, the found research areas will likely be beneficial for any future development initiatives associated with the subject of this topic.

The conclusion is that in in order to develop maturity of the S&OE process, it was important to consider what conclusions could be made in overall, when comparing the results from the survey to the content analysis results. It seemed evident that the process could be holistically developed by identifying areas for improvement, by cross-referencing the responses to individual survey questions and the findings of the content analysis. Thus, the findings from both researches were helpful in order to map the current maturity level in approximate scale, and they were considered to be invaluable in the development process in general, as they provided insights into the most crucial areas that were in need of improvement in the current process.

***"What are the recognized challenges of the current S&OE process?"***

The most essential challenges in the current S&OE process are reviewed in this part, and the ones considered the most crucial were also selected for further development in this thesis. Identifying

the challenges of the current process was possible by combining research data obtained from the quantitative survey and qualitative content analysis.

*Data management*

Different data sources are available, but the available data is not always up to date, as some of it requires manual updates, thus the data may be outdated by the time it is used to support decision-making in optimization, which could affect or risk the justification or profitability of the decisions made. Additionally, manual data updates expose it to potential errors and human mistakes. Advanced analytics systems, such as predictive analytics, which could provide future forecasts based on past data and offer data based recommendations, are not utilized at all. In terms of data management challenges, the development of this thesis focuses on appropriate data utilization in the S&OE process, but not on the development of the data, or the data systems.

*KPI meters and objectives of S&OE process*

Similarly, all the target setting, and objectives monitoring that are typically associated with S&OE in theory were not found in the content analysis, and same conclusion was made based on the survey results. The case company lacks KPI metrics altogether for their S&OE process. Similar view is supported by the results of the survey; performance is not constantly monitored, and it is not entirely clear what is the objective of S&OE. On the other hand, there also seems to be a lack of clear distinction between the S&OP and S&OE processes, but also on the alignment of their objectives. The lack of metrics and performance monitoring jeopardizes the focus to be set towards correct issues, and thus, selecting suitable KPIs was included into the development.

*Roles and responsibilities*

Discrepancies were also found between theory and documentation regarding the responsibilities of the team responsible for S&OE planning and the documentation related to it is partly incomplete. There are also challenges in perceiving and understanding one's own roles within the S&OE team, due to the insufficient documentation regarding the roles and responsibilities. Cross-functional collaboration and team structure also seemed to be lacking some elements: although communication channels are clear and cross-functional collaboration does exist and were described, results indicated that there are challenges in information sharing between different functions. To address this challenge, a proposed S&OE supply chain planner role description was developed.

*Meetings and decision-making*

Some meeting practices related to the S&OE process were already in use, and they certainly have their place in the process, such as the handshake meeting, where the S&OP plan is implemented to the operational level. However, it came clear that the S&OE process should also have its own recurring meeting, that is preferably held on a weekly basis, and where comprehensive decisions are made based on their profitability impact and data. These decisions in the meeting should be holistically made, and the meeting should be led by a facilitator, S&OE leader. Thus, the method of having unified S&OE meeting included in the S&OE process ensures that decision-making is consistent and considers all product chains and their relations, rather than making decisions independently for different product chains without considering decisions' overall impact.

**RQ1: How can the S&OE process be improved?**

By answering to the presented sub-questions, it is now possible to address the first research question of this thesis. According to the findings of this research, there was quite a much room for improvement in the current S&OE process. Some areas for development were beyond the scope of this thesis, such as improving data management and the implementation of entirely new advanced analytics systems, that would enhance the accuracy and efficiency of the process. However, some low-hanging fruits were clearly identifiable and could be developed in this thesis. These included i.e., visualizing the S&OE process with a flowchart and specifying and documenting sub-processes relevant to S&OE, including recurring S&OE meetings. Thus, the responsibilities and areas of responsibility of the S&OE team were also clarified by describing the process in more detail. Additionally, by selecting and implementing suitable KPI metrics to ensure data-based decision-making, the efficiency, accuracy, and overall comprehensiveness of the process relative to its and S&OP's objectives can be monitored in the future.

Research questions 2 and its sub-questions were as follows:

RQ2: How can the S&OE process be linked to S&OP process to close the gap?

*How should the S&OE team be organized and work to reach the set S&OP targets?*

*How can additional value be captured by linking S&OE to S&OP?*

*What kind of key performance indicators should be implemented to track the performance of S&OE?*

***"How should the S&OE team be organized and work to reach the set S&OP targets?"***

The first sub-question was already partially addressed in the first section of the first research question. By distinguishing S&OP and S&OE processes more precisely, and by defining the description and scope of the S&OE process, as well as implementing KPI metrics, achieving S&OP objectives becomes easier. The key takeaway was that the target setting should be clarified, and the results and performance must be constantly monitored in the S&OE process, in order to allow the S&OE team to constantly work towards achieving them.

***"How can additional value be captured by linking S&OE to S&OP?"***

An answer to this sub-question was also found. By separating the S&OP and S&OE processes, clarifying the objectives of the S&OE process along with defining the roles and responsibilities in S&OE and by monitoring processes performance and making decisions based on data, that is always up to date and reliable, as well as consistently addressing them in the S&OE meetings, it is possible to enhance objective attainment in general. Thus, based on these development initials, supply chain optimization will be more comprehensive, and therefore, unlock the full potential of S&OE as a value-adding process.

***"What kind of key performance indicators should be implemented to track the performance of S&OE?"***

The implemented KPI metrics should align with the desired outcomes and reflect the agreed objectives: it is not relevant to measure something just for the sake of measuring; instead, the chosen metrics should also serve the ultimate purpose. Thus, in collaboration with the case company, it was decided to implement the following metrics to the S&OE process to track delivery performance, actualization of production plans, accuracy of demand forecast, and service level. Therefore, the selected KPI metrics were: OTIF (On-Time In-Full), schedule attainment, service level, and forecast accuracy.

**RQ2: How can the S&OE process be linked to S&OP process to close the gap?**

Again, derived from the answers to the sub-questions, it becomes possible to address the second research question of this thesis. Linking S&OE process to S&OP process is expected to be straightforward after all: by defining the purpose of each process and objectives and distinguishing them from each other, as well as clarifying responsibilities and roles related to the S&OE process, it is expected that the new process will close the gap between them. The future S&OE planning should focus on attainment of S&OP plans, but the S&OE plans can also differ from S&OP plans, as a result of constant supply chain optimization. Thus, it is vital to ensure that the S&OE process

deploys and executes plans from S&OP, but the deployment comes through the typical disaggregation, and other elements such as addressing demand fluctuation and supply chain deviations, are considered within the S&OE scope. Execution of S&OP should therefore follow the set S&OE objectives, but S&OE focus should be on the active monitoring and optimization of the supply chain in overall. Thus, the new S&OE process description is considered to be relevant and justified for this purpose as well; it will close the gap between S&OP and S&OE, and S&OE team will have their focus set towards relevant issues and constant supply chain optimization in the short-term.

## 8.2 Summary of development initiatives

The results of both quantitative and qualitative research clearly indicated areas requiring development in the current process. Based on the understanding and on the findings from the researches, it was possible to leverage theoretical insights to develop a new S&OE process for the case company. Key elements in the new S&OE process included implementation of sub-processes such as demand review, supply review, KPI metrics, and S&OE meetings. From a holistic perspective, the S&OE process was defined more precisely, and a flowchart outlining the workflow was created. Additionally, certain tasks and activities were proposed to be included in the responsibility description of the S&OE team. In terms of the objectives of the study, the identified areas for improvement were relevant and clearly needed. Ultimately, a proposal to the case company in terms of implementing the S&OE process is provided in terms of a timeline addressing different elements of the new process, and implementation is expected to begin in August 2024.

## 8.3 Challenges during the research

Several challenges were encountered at different stages during this thesis. Defining and selecting the research questions turned out to be time-consuming, as it had to be ensured that they would be comprehensively addressing the research objectives and thus, would enable researcher to develop the process in alignment with the research objectives. Other challenge related to the narrowing of the research topic and theoretical framework, so that the thesis would not become too broad and too confusing, while still addressing all the issues relevant to the research objectives. Due to this, the ultimate decision was however to cover the business planning framework on general level, as well as S&OP and IBP in theory, while some other related elements to them were decided to be left out, such as the sub-processes of S&OP. Including other planning processes in

addition to S&OE were thus considered a necessity, in order for the reader to understand the big picture and the interdependencies between different planning levels. Upon investigating and conducting the material related to the theoretical framework, it came apparent that there is in fact a lot of theory available in S&OP, so deciding and selecting the most relevant sources was also very time-consuming. However, since S&OE is a relatively new and unknown planning process and concept, there was hardly any academic research available regarding it, and thus, this thesis had to mostly rely on online sources and previous studies concerning it.

Also choosing an appropriate research approaches and methods turned out to be somewhat challenging, due to the complexity and broadness of the research topic. Thus, it was believed right at the beginning that relying entirely on quantitative or qualitative research alone might lead to a situation, where some relevant or essential aspects of the current processes maturity and its development needs would have been overlooked, or not identified at all. Therefore, when the decision to use two different approaches was made, it became apparent that there would be a lot of material and results to be analyzed, which turned out to be very demanding and time-consuming. In retrospect, it could probably have been also possible to include open-ended questions in the quantitative survey instead of performing qualitative content analysis, as the open-ended questions might have had addressed the same issues that were identified in content analysis. This could have potentially saved time and resources in this this thesis, and lead to similar kind of results. Despite of all the challenges, the research and its findings are however considered to be valuable and based on them, relevant development suggestions were made for the case company. The outcome of this thesis is considered to provide tangible financial benefits for the company, once the new process is fully implemented.

The reliability of the results of this study must be evaluated from two different perspectives. The validity and reliability of the quantitative survey in overall is considered to be on a good level. However, as the survey consisted of three different sections, it is beneficial to critically reflect the various sections. The results of the first research section that assessed the challenges within the current process and in regard to the implementation of a new process, were considered to be reliable and valid. Results provided useful insights regarding the challenges and the same challenges were also identified, and thus validated, by performing the qualitative content analysis.

The second part of the survey and its results are to be considered semi-reliable and semi-valid, due to the complexity of the questions, which might have led to partial systematic error. The questions had to be presented in a certain way, since the responses from this section of the survey were derived from a specific maturity model that was presented in the theory. Thus, it is possible

that due to the formulation of the questions, the respondents may have interpreted some of the questions differently compared to how they were intended to be understood. Also, it should be considered possible that the numerical responses were influenced by respondents' subjective experiences, possible motivational factors or even their general knowledge level of the current process. In overall, despite the possibility of an error, the responses however assisted in forming the big picture for the sake of the development process in this thesis, so they were however considered to be useful, and insightful.

The results of the third section can be considered reliable and valid and they proved to be the most beneficial also for this thesis out of all the sections of the survey. The purpose of the questions within this section was to determine the maturity level of the case company's current S&OE process, and to identify and pinpoint clear improvement areas in the current process, which could be further utilized in the process development phase. The results allowed to make clear conclusions about the maturity level by placing them within the Unified S&OE maturity model, which, in combination with the results from the qualitative content analysis, greatly contributed to the development work in this thesis.

The results from the qualitative content analysis of internal documentation were considered to be reliable and valid. The documentation was relevant to the research objectives, and the chosen qualitative method was considered suitable. Ultimately, elements identified and found from the internal documentation, and insights derived from them, also supported the results of the quantitative research, but in addition, they provided invaluable information that proved to be beneficial for the development altogether. In conclusion, the research methods were overall appropriate and suitable for this thesis, and based on the research, comprehensive and feasible solution proposals for the case company were developed. It should be however noted that the results of the study may not necessarily be generalizable to other companies operating in the same industry, but the findings, and used research methodology can be valuable for similar researches concerning S&OE and process maturity.

## 8.4 Self assessment

Conducting this thesis was challenging, yet highly educational. Prior to starting the project, I outlined some relevant aspects that should be studied based on my previous experience, and also set personal goals for my own self-development, and imagined how this self-development could

be utilized in my future career endeavors. This goal-oriented approach pretty much guided the entire thesis process and I actually had even defined, how I wanted to execute the research and what are my goals for this thesis. A bit too ambitious, in retrospect. Not very surprisingly, the vision I had ended up causing a lot of pressure in the end, as due to my personality, I often tend to be striving for perfection with my own work. Further, as I sometimes struggle to summarize information effectively, it results in lengthy explanations that can be confusing to follow. During this project, this personality trait led to a situation that more than once, I had to return back to my goals and vision and remind myself that it's sometimes better to keep things rather too simple than too complex and re-do some of the things I had already done.

However, what helped a lot with this thesis after all, is that I had the possibility to utilize at least some of the expertise and subject matter knowledge I have accumulated over the years regarding supply chains and their planning processes. Additionally, I was able to utilize my development-oriented personality, as I have always enjoyed critically examining different things and findings ways to improve them. It could be argued, that instead of choosing to take this business-oriented path in my studies, I could have also pursued a career as an engineer. Who knows.

Nevertheless, as the research progressed and my knowledge and understanding deepened, I found my interest towards different business planning processes to start growing exponentially. Simultaneously, I was also faced with some hard realities, when I realized that I had assumed I already knew pretty much everything about this subject, but instead, I had to critically review my own level of knowledge and admit that in fact, I barely know anything at all. However, in a way, this was a turning point that increased my interest towards the topic even more, which likely also positively contributed to the outcome after all and accelerated my learning curve even more.

In terms of successes, I feel that I succeeded very well with information gathering and managed to utilize a wide range of different sources and perspectives in this thesis. Especially considering S&OE process is so relatively new and under-studied. On the other hand, this also presented challenges at times—finding relevant and reliable information was not always easy, and on several occasions, I had to return to my previous research in light of new information, and critically evaluate my sources, and completely re-do what I had already done. However, I feel like I managed to conclude a very comprehensive theoretical framework after all.

In the end, I feel that this thesis greatly improved my knowledge of the subject, but also my skills of developing things. I was enjoying writing this thesis and exploring the topic, and most importantly, I feel like I’ve actually done something meaningful – thus, I truly hope, that maybe

someday, someone else finds my thesis beneficial for their own purposes. For now, I could say that I am truly an expert on this field, and happy to have taken this long and demanding journey.

## 8.5 Future development suggestions

In reference to the chapter discussing IBP in theoretical framework, which describe the key differences between IBP and S&OP, and during analyzing the documents, it was identified that it might be beneficial for the case company to also research their S&OP processes' maturity level. This is due to the current S&OP process holding some characteristics, that are typically described to be achieved in the IBP, which as a planning process, is more mature than typical S&OP. This is because the case company's current S&OP process aims at delivering financial business objectives based on value, rather than only focusing on balancing demand and supply volumes

It is recommended to also investigate, whether there would be benefits for the case company in terms of developing their data management in overall. The research of this thesis revealed that data updates are not currently automated, which may to some extent pose challenges to comprehensive optimization of the whole supply chain, and also, consumes resources due to manual work. Additionally, case company lacks advanced analytics systems, which could be used to create demand and supply forecasts based on for example historical data or external market factors.

Lastly, it is recommended to assess the current competence level of the S&OE team and to develop their skill levels further. The survey results revealed that there are potentially some gaps in knowledge in general, in terms of the S&OE process. Some of these gaps can be addressed by the implementation of the new S&OE process, along with some internal training regarding the process, but the implementation does not explicitly concern fundamental issues within the skill levels of individuals. Additionally, it is recommended to repeat the presented quantitative survey in full in spring 2025 to evaluate, whether there has been any improvement in perceptions, knowledge and skill levels by the implementation of the new process. Also, utilizing survey's third section in the future assessments would likely provide valuable insights in terms of whether the maturity of the new S&OE process has been then increased, or is perceived to have increased, enabled by the implementation of the new process.

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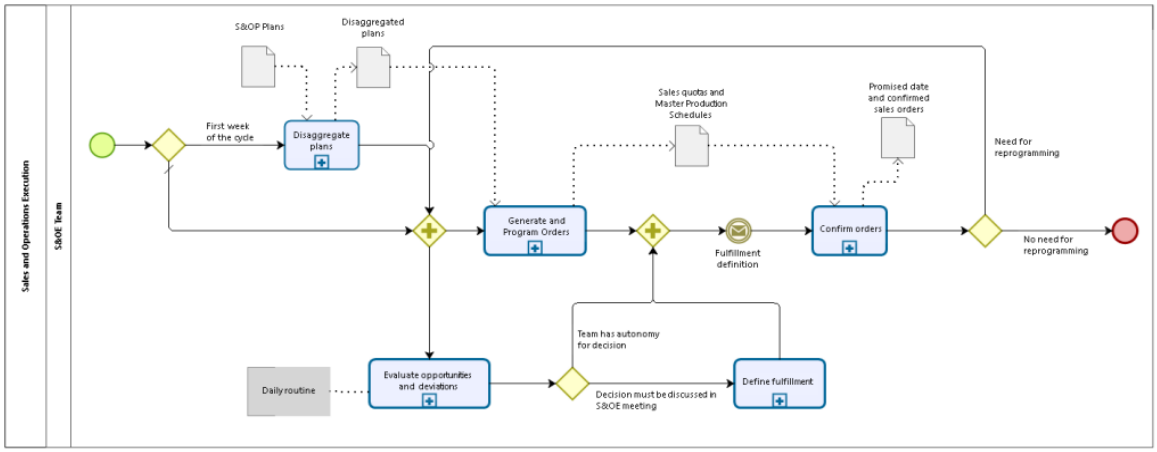
Appendices

**Appendix 1.** Business Process Model and Notation model of S&OE (Carvalho 2018)




**Appendix 2.** S&OE implementation readiness survey.

| |
|---|
| **Q1. On a scale of 1 to 5, how would you rate the overall accessibility and timeliness of sales and demand forecasts data from PowerBI?** |
| 1: The data is severely outdated and challenging to access. |
| 2: The data is somewhat outdated but accessible. |
| 3: The data is moderately up to date and accessible. |
| 4: The data is mostly up to date and accessible, with minor room for improvement. |
| 5: The data is highly up to date and easily accessible. |
| |
| **Q2. On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production schedules data from Spiral Schedule?** |
| 1: The data is severely outdated and challenging to access. |
| 2: The data is somewhat outdated but accessible. |
| 3: The data is moderately up to date and accessible. |
| 4: The data is mostly up to date and accessible, with minor room for improvement. |
| 5: The data is highly up to date and easily accessible. |
| |
| **Q3. On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of production forecasts data from Spiral Plan?** |
| 1: The data is severely outdated and challenging to access. |
| 2: The data is somewhat outdated but accessible. |
| 3: The data is moderately up to date and accessible. |
| 4: The data is mostly up to date and accessible, with minor room for improvement. |
| 5: The data is highly up to date and easily accessible. |
| |
| **Q4. On a scale from 1 to 5, how would you rate the overall accessibility and timeliness of product inventory data from ROMMS?** |
| 1: The data is severely outdated and challenging to access. |
| 2: The data is somewhat outdated but accessible. |

| |
|---|
| 3: The data is moderately up to date and accessible. |
| 4: The data is mostly up to date and accessible, with minor room for improvement. |
| 5: The data is highly up to date and easily accessible. |
| |
| **Q5. On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update demand forecast?** |
| 1: The process heavily relies on manual methods with little automation. |
| 2: The process is somewhat manual, with limited automation. |
| 3: The process is balanced between manual and automated methods. |
| 4: The process is mostly automated, with some manual processes. |
| 5: The process is highly automated, with minimal manual intervention. |
| |
| **Q6. On a scale from 1 to 5, how much does the current process use manual methods versus automated technology to update production forecast?** |
| 1: The process heavily relies on manual methods with little automation. |
| 2: The process is somewhat manual, with limited automation. |
| 3: The process is balanced between manual and automated methods. |
| 4: The process is mostly automated, with some manual processes. |
| 5: The process is highly automated, with minimal manual intervention. |
| |
| **Q7. On a scale from 1 to 5, how readily available and accessible are advanced analytics systems (such as predictive and prescriptive analytics for real-time market analysis) to support decision-making in S&OE?** |
| 1: Advanced analytics systems are not readily available and accessible. |
| 2: Advanced analytics systems are somewhat available and accessible, but improvements are needed. |
| 3: Advanced analytics systems are reasonably available and accessible, with some room for improvement. |
| 4: Advanced analytics systems are quite available and accessible, with minor areas for improvement. |
| 5: Advanced analytics systems are highly available and accessible. |
| |
| **Q8. On a scale of 1 to 5, how well-defined and comprehensive are the objectives and targets of the current S&OE process?** |
| 1: Objectives and targets are unclear and incomplete. |
| 2: Objectives and targets are somewhat defined but lack comprehensiveness. |
| 3: Objectives and targets are reasonably defined and somewhat comprehensive, with some room for improvement. |
| 4: Objectives and targets are well-defined and comprehensive, with minor areas for improvement. |
| 5: Objectives and targets are very clearly defined and highly comprehensive. |
| |
| **Q9. On a scale of 1 to 5, how effectively does the unified S&OE meeting - if present - facilitate comprehensive decision-making and target setting across various product chains? (Note: this question refers to a recurring, unified S&OE meeting for the whole S&OE team)** |
| 1: No unified S&OE meeting; decisions are ad hoc. |
| 2: Limited meeting support; decisions mostly ad hoc. |
| 3: Moderate meeting support; decisions mainly ad hoc. |
| 4: Substantial meeting support; ad hoc decisions prevalent. |
| 5: Significant meeting support; occasional ad hoc decisions. |
| |
| **Q10. On a scale of 1 to 5, how well are communication procedures implemented to ensure clear communication, distinct target setting, and collaboration between S&OE and S&OP processes? (Note: this question refers to information flow between the S&OP and S&OE processes)** |

| |
|---|
| 1: Poor implementation, hindering communication, collaboration, and target setting. |
| 2: Partially implemented, with room for improvement in communication, collaboration, and target setting. |
| 3: Moderately implemented, supporting some communication, collaboration, and target setting. |
| 4: Well implemented, with minor areas for improvement in communication, collaboration, and target setting. |
| 5: Highly effective implementation, ensuring clear communication, robust collaboration, and distinct target setting. |

**Appendix 3.** S&OE general maturity assessment survey.

| Answers: YES or NO | |
|---|---|
| 1. | Is there a distinct process for both tactical (S&OP) and operational (S&OE) decision-making within the company? |
| 2. | Is the S&OE process managing demand and supply plans at a more detailed level compared to the S&OP process? |
| 3. | Do the objectives of the S&OE process match the written guidelines set in the S&OP process and follow a formal handover from S&OP to S&OE? |
| 4. | Is there a written guidelines that outlines how products are allocated to customers based on pre-defined business rules when there are supply constraints? |
| 5. | Are there clear written guidelines or procedures for handling deviations, such as unexpected demand or production disrupts, in S&OE? |
| 6. | Do all business functions (S&OE team and other key stakeholders) involved in short-term planning have clearly defined roles and responsibilities within the S&OE process? |
| 7. | Are demand and supply performance monitored on a weekly basis using predefined KPIs along with reliable data to identify any gaps with the S&OP plan? |
| 8. | Are there standard and formalized preparation activities conducted before each S&OE meeting to ensure decision-making is based on the most recent demand and supply outlook? |
| 9. | Does the structure of the current S&OE meeting adhere to a clear and formalized agenda and are the output actions from the S&OE meeting also actively documented and followed up? |
| 10. | Apart from the current product chain specific “S&OE handshake”-meetings, is there a unified S&OE meeting for the whole S&OE team and key stakeholders available? |
| 11. | Are the supply and demand plans stored and managed within an enterprise resource planning (ERP) and/or Advanced Planning and Scheduling (APS) system, allowing for real-time updates to S&OE plans? (Note: this refers to Spiral tools in Neste context) |

**Appendix 4.** Unified S&OE maturity model survey.

| |
|---|
| **Q1. On a scale of 1 to 5, how would you assess the team structure and collaboration within the S&OE process?** |
| *1: Poor structure and collaboration within the S&OE process.* |
| *2: Limited structure and collaboration within the S&OE process.* |
| *3: Moderate structure and collaboration within the S&OE process.* |
| *4: Good structure and collaboration within the S&OE process.* |
| *5: Excellent structure and collaboration within the S&OE process.* |
| |
| **Q2. On a scale from 1 to 5, how would you rate the integration and coordination among other stakeholders, such as operations, suppliers, and partners?** |
| *1: Poor integration and coordination among operations, suppliers, and partners.* |
| *2: Limited integration and coordination among operations, suppliers, and partners.* |
| *3: Moderate integration and coordination among operations, suppliers, and partners.* |
| *4: Good integration and coordination among operations, suppliers, and partners.* |
| *5: Excellent integration and coordination among operations, suppliers, and partners.* |
| |
| **Q3. On a scale of 1 to 5, how effectively are other S&OE-related sub-processes, such as the execution of S&OP plan and scenario-modelling, integrated into the S&OE process?** |
| *1: Poor integration of other S&OE-related sub-processes.* |
| *2: Limited integration of other S&OE-related sub-processes.* |
| *3: Moderate integration of other S&OE-related sub-processes.* |
| *4: Good integration of other S&OE-related sub-processes.* |
| *5: Excellent integration of other S&OE-related sub-processes.* |
| |
| **Q4. On a scale from 1 to 5, how well are tactical (S&OP) and operational (S&OE) decision-making separated and structured at Neste, through distinct (yet interconnected) S&OP and S&OE processes?** |
| *1: Poor separation and structure between S&OP and S&OE decision-making.* |
| *2: Limited separation and structure between S&OP and S&OE decision-making.* |
| *3: Moderate separation and structure between S&OP and S&OE decision-making.* |
| *4: Good separation and structure between S&OP and S&OE decision-making.* |
| *5: Excellent separation and structure between S&OP and S&OE decision-making.* |
| |
| **Q5. On a scale of 1 to 5, how well-defined are the roles and responsibilities among S&OE team members?** |
| *1: Poor clarity in understanding roles and responsibilities among S&OE team members.* |
| *2: Limited clarity in understanding roles and responsibilities among S&OE team members.* |
| *3: Moderate clarity in understanding roles and responsibilities among S&OE team members.* |
| *4: Good clarity in understanding roles and responsibilities among S&OE team members.* |
| *5: Excellent clarity in understanding roles and responsibilities among S&OE team members.* |
| |
| **On a scale of 1 to 5, how well-organized, defined, and documented are all the S&OE-related processes?** |
| *1: Poor organization, definition, and documentation of S&OE-related processes.* |
| *2: Limited organization, definition, and documentation of S&OE-related processes.* |
| *3: Moderate organization, definition, and documentation of S&OE-related processes.* |
| *4: Good organization, definition, and documentation of S&OE-related processes.* |
| *5: Excellent organization, definition, and documentation of S&OE-related processes.* |
| |
| **Q7. On a scale from 1 to 5, how effectively are performance objectives from the S&OP plan aligned with internally available information to adapt to demand fluctuations or other short-term deviations in S&OE?** |
| *1: Poor alignment of performance objectives and internal information to adapt to short-term deviations.* |
| *2: Limited alignment of performance objectives and internal information to adapt to short-term deviations.* |
| *3: Moderate alignment of performance objectives and internal information to adapt to short-term deviations.* |
| *4: Good alignment of performance objectives and internal information to adapt to short-term deviations.* |
| *5: Excellent alignment of performance objectives and internal information to adapt to short-term deviations.* |
| |

| |
|---|
| **Q8. On a scale of 1 to 5, how effective is the holistic decision-making and alignment of product chain-specific plans in the S&OE meeting, to ensure further alignment with general company objectives and S&OP plan?** |
| *1: Poor holistic decision-making and alignment with company objectives in S&OE meetings.* |
| *2: Limited holistic decision-making and alignment with company objectives in S&OE meetings.* |
| *3: Moderate holistic decision-making and alignment with company objectives in S&OE meetings.* |
| *4: Good holistic decision-making and alignment with company objectives in S&OE meetings.* |
| *5: Excellent holistic decision-making and alignment with company objectives in S&OE meetings.* |
| |
| **Q9. On a scale of 1 to 5, how effectively are S&OE process performances measured using statistical and quantitative techniques, such as predefined key performance indicators (KPI)?** |
| *1: Poor utilization of statistical and quantitative techniques.* |
| *2: Limited application of statistical and quantitative techniques.* |
| *3: Moderate use of statistical and quantitative techniques.* |
| *4: Good utilization of statistical and quantitative techniques.* |
| *5: Excellent utilization of statistical and quantitative techniques.* |
| |
| **Q10. On a scale of 1 to 5, how effective is the extent of data and information sharing across all supply chain stake-holders and business units?** |
| *1: Poor sharing of data and information across stakeholders and business units.* |
| *2: Limited sharing of data and information across stakeholders and business units.* |
| *3: Moderate sharing of data and information across stakeholders and business units.* |
| *4: Good sharing of data and information across stakeholders and business units.* |
| *5: Excellent sharing of data and information across stakeholders and business units.* |
| |
| **Q11. On a scale from 1 to 5, how well do the S&OE processes' KPIs align with the overall supply chain KPIs and consequently, guide the S&OE team towards the set S&OP targets and other general company level targets?** |
| *1: Poor alignment between S&OE and overall supply chain KPIs.* |
| *2: Limited alignment between S&OE and overall supply chain KPIs.* |
| *3: Moderate alignment between S&OE and overall supply chain KPIs.* |
| *4: Good alignment between S&OE and overall supply chain KPIs.* |
| *5: Excellent alignment between S&OE and overall supply chain KPIs.* |
| |
| **Q12. On a scale from 1 to 5, how well does the S&OE team leverage advanced analytics and other supportive systems to adapt to and manage emerging trends/patterns and deviations in the value chain?** |
| *1: Poor use of advanced analytics and supportive systems.* |
| *2: Limited use of advanced analytics and supportive systems.* |
| *3: Moderate use of advanced analytics and supportive systems.* |
| *4: Good use of advanced analytics and supportive systems.* |
| *5: Excellent use of advanced analytics and supportive systems.* |

**Appendix 5.** Unified S&OE maturity model survey frequency distribution table.

| S&OE team | | | | | S&OE managers | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Score | Absolute frequency | Absolute cumulative | Relative frequency | Cumulative relative | Score | Absolute frequency | Absolute cumulative | Relative frequency | Relative frequency |
| 1 | 9 | 9 | 9 % | 9 % | 1 | 5 | 5 | 10 % | 10 % |
| 2 | 33 | 42 | 34 % | 44 % | 2 | 11 | 16 | 23 % | 33 % |
| 3 | 39 | 81 | 41 % | 84 % | 3 | 26 | 42 | 54 % | 88 % |
| 4 | 15 | 96 | 16 % | 100 % | 4 | 6 | 48 | 13 % | 100 % |
| 5 | 0 | 96 | 0 % | 100 % | 5 | 0 | 48 | 0 % | 100 % |
| **Total** | **96** | | 100 % | 100 % | **Total** | **48** | | 100 % | 100 % |

**Appendix 6.** Thematic data table for qualitative content analysis of Business Planning Framework.

**Business planning framework**

| Theme | Included | Not included | Partially included | Summary and disparencies of document analysis |
|---|---|---|---|---|
| Planning processes' hierarchy is defined | x | | | Found in documentation |
| Objectives of planning levels follow top-down logic | x | | | Found in documentation |
| Planning process interval | x | | | Found in documentation |
| Planning horizons are specified | | | x | Partially found in documentation; S&OP planning horizon (1-27 months) differs from theory |
| Data granularity in data points | x | | | Found in documentation |
| Scope of each planning level | | | x | Partially found in documentation; operations plan is placed between S&OP and S&OE, which deviates from theory |
| Supply & demand planning is performed at several planning levels | x | | | Found in documentation |

**Appendix 7.** Thematic data table for qualitative content analysis of S&OE process.

**S&OE process & process characteristics**

| Theme | Included | Not included | Partially included | Summary and disparencies of document analysis |
|---|---|---|---|---|
| S&OE planning horizon is between 0-3 months | x | | | Found in documentation |
| S&OE facilitates alignment of business strategy | x | | | Found in documentation |
| S&OE has set Key Performance Indicators | | x | | Not found in documention |
| S&OE flowchart is described | | | x | Not found in documention, but process is verbally described |
| S&OE is a weekly iterative process | x | | | Found in documentation |
| S&OE executes S&OP plans | x | | | Found in documentation |
| S&OE disaggregates S&OP plans | x | | | Found in documentation |
| S&OE tracks supply and demand data | x | | | Found in documentation |
| S&OE tracks in metrics, such as supply and demand, in real-time | | | x | Tools for data tracking are available, but documentation doesn't specify data update cycles |
| S&OE is data driven | | | x | Partially found in documentation; but not specified |
| S&OE consists of data-driven sub-processes (demand review, supply review, production capacities & supplier | | x | | Not found in documentation; documentation does not address topics specifically |
| S&OE has a dedicated meeting practices | | x | | Not found in documentation; "handshake"-meeting is performed between S&OE and operational planning, but no dedicated S&OE meeting available |
| S&OE process has a leader that facilitates decision-making | | x | | Not found in documentation |
| S&OE utilizes advanced analytics | | x | | Not found in documention |
| S&OE re-schedules production in accordance with supply and demand outlook | | | x | Partially found in documentation; production scheduling is described to be under the responsibility of operational planner |
| S&OE monitors deviations and optimizes supply chain if necessary | | | x | Partly found in documentation; process for deviation-handling to some extent described, demand monitoring partly defined |
| S&OE guides operational planning | x | | | Found in documentation |
| S&OE is integrated with S&OP | x | | | Found in documentation |
| S&OE and S&OP should have separate teams and objectives | | | x | Partially found in documentation; some disparency, such as S&OE team being responsible of S&OP plans feasibility. Objectives are to some extent defined. |
| S&OE adds value to S&OP by providing short-term insights | x | | | Found in documentation |
| S&OE communicates cross-functionally | x | | | Found in documentation |
| S&OE is profitability driven | x | | | Found in documentation |
| S&OE team has defined roles and responsibilites | x | | | Found in documentation |
| S&OE plans are holistically reviewed to ensure alignment with company objectives and S&OP plans | | | x | Partly found in documentation; S&OE follows the objectives of other planning levels, but no clear decision-making mechanism defined |

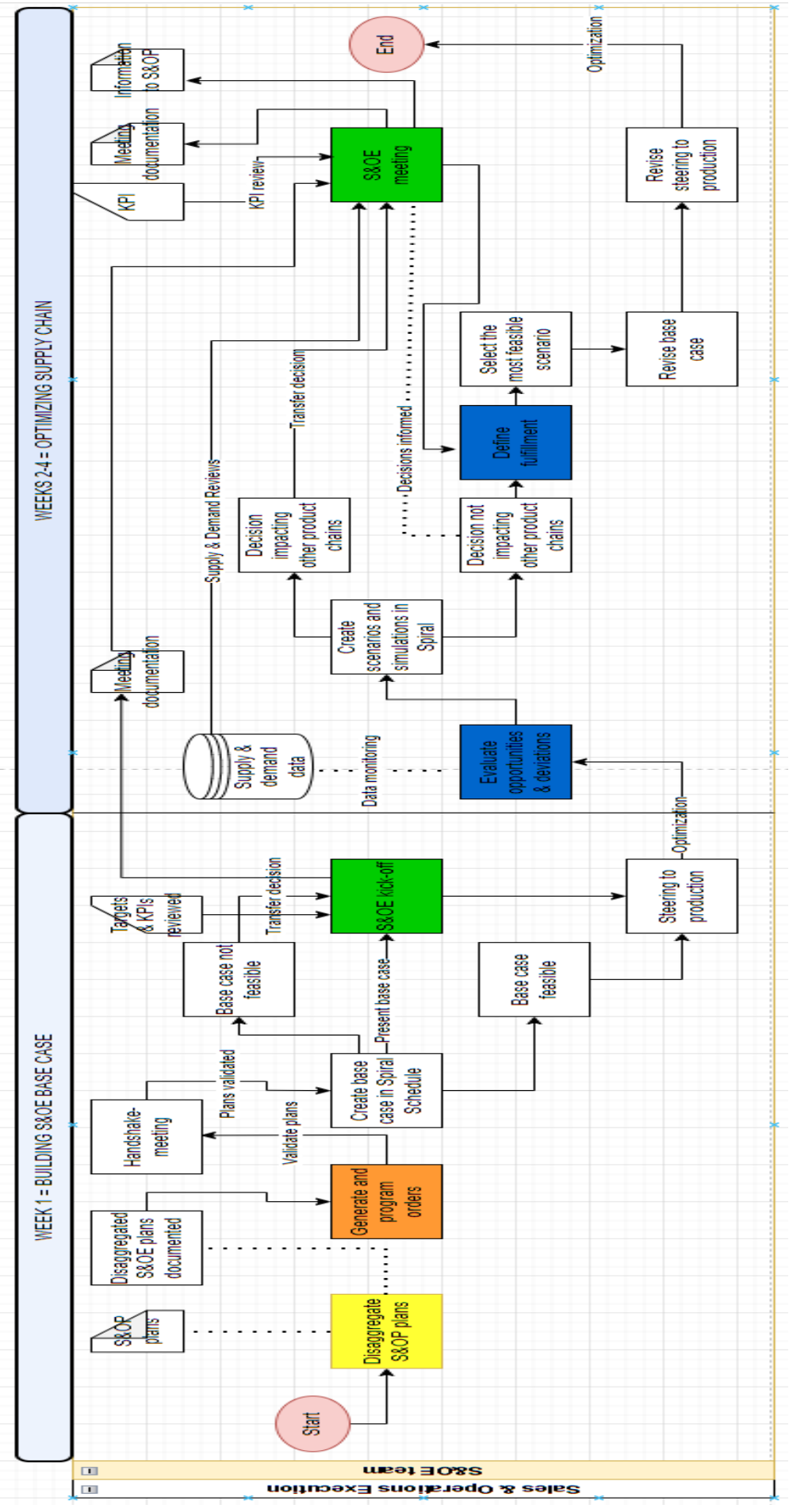
**Appendix 8.** Thematic summarized data table for qualitative content analysis.

| Thematic summary table | | | |
|---|---|---|---|
| **Themes summarized by their characteristics** | **Included** | **Not included** | **Partially included** |
| Business Planning Framework definition | | | x |
| S&OE process general description | x | | |
| S&OE sub-process descriptions | | | x |
| S&OE flowchart described | | x | |
| S&OE connected with S&OP | x | | |
| S&OE connected with operational planning | x | | |
| S&OE tracking tools are available | x | | x |
| S&OE tracking tools provide real-time data | | x | |
| S&OE advanced analytics available | | x | |
| S&OE process is led by a S&OE leader | | x | |
| S&OE constantly optimizes supply chain | | | x |
| S&OE objectives clear | | | x |
| S&OE teams' responsibilities & roles defined | x | | |
| S&OE meeting available | | x | |
| S&OE key performance indicators available | | x | |
| **Summary** | **5** | **6** | **5** |

**Appendix 9.** Final conclusions from the qualitative content analysis.

| Theory requirements for this theme are fulfilled | Included | Not included | Partially included |
|---|---|---|---|
| Business Planning Framework and hierarchies are described | x | | |
| S&OE process is comprehensively described | | | x |
| S&OE process focuses on short-term optimization of the supply chain | x | | |
| S&OE process utilizes necessary tools for real-time tracking of the supply chain | | | x |
| S&OE objectives and responsibilities are defined and monitored | | | x |
| S&OE deploys relevant sub-processes and meeting practices | | | x |
| **Summary** | **2** | **0** | **4** |

**Appendix 10.** S&OE flowchart.


Sales & Operations Execution
S&OE team
WEEK 1 = BUILDING S&OE BASE CASE
WEEKS 2-4 = OPTIMIZING SUPPLY CHAIN
Start
End
S&OP plans
Disaggregate S&OP plans
Disaggregated S&OE plans documented
Generate and program orders
Handshake-meeting
Plans validated
Validate plans
Create base case in Spiral Schedule
Present base case
Base case not feasible
Base case feasible
Targets & KPIs reviewed
Transfer decision
S&OE kick-off
Steering to production
Optimization
Meeting documentation
Supply & demand data
Data monitoring
Evaluate opportunities & deviations
Create scenarios and simulations in Spiral
Decision impacting other product chains
Decision not impacting other product chains
Supply & Demand Reviews
Transfer decision
Decisions informed
Define fulfillment
Select the most feasible scenario
Revise base case
Revise steering to production
Optimization
KPI
Meeting documentation
Information to S&OP
KPI review
S&OE meeting

**Appendix 11.** Managerial-level responsibility description for S&OE team.

| Responsibility area | Role | Task | New task |
|---|---|---|---|
| S&OE end-results for own product chain | Supply chain planner (S&OE) | • Qualitative responsibility for the outcome of S&OE<br>• Responsibility for tracking inventories and assets<br>• Responsibility of determining costs for over-quality production | • Monitoring KPIs in overall<br>• Building S&OE base case after S&OP finalized<br>• Revising base case on a weekly/daily basis based on supply and demand outlook<br>• Creating scenarios and simulations to ensure comprehensive optimization and maximal profitability for the product chain<br>• Proactive monitoring of the whole product chain |
| Sales data | Supply chain planner (S&OE) | • Sales is responsible for sales forecast<br>• Responsibility of seasonal quality changes (summer/winter) | • Identifying root-causes for demand fluctuation<br>• Reviewing sales forecasts with sales to identify patterns and to increase the accuracy of forecasts in the future<br>• Requesting updates to sales forecasts |
| New product launches | Supply chain planner (S&OE) & operational planner | • Responsibility of ensuring Oil data is up-to-date<br>• Responsibility of guiding production, blending and distribution on how to proceed with a new product | • No changes |
| Operational plan | Operational planner & **Supply chain planner (S&OE)** | • Responsibility of ensuring that the operational plan (production units, tanks and logistics) are taken into account in S&OE and in scheduling | • Supply chain planner to create the base case for the month, supported by operational planner<br>• Supply chain planner to follow the health of the supply chain on a daily basis<br>• Opportunities & deviations are communicated in a timely manner to operational planner to ensure scheduling is always up-to-date |
| Product raw material and feedstock purchases | Supply chain planner (S&OE) | • Responsible of ensuring the end-use for the purchases<br>• Responsible of ensuring that all appropriate analyses are performed for the purchases | • Responsible of monitoring and communicating delivery schedules to stakeholders<br>• Responsible of ensuring feasibility (logistics, storage space) for purchases |
| Scheduling | Operational planner & **Supply chain planner (S&OE)** | • Responsible of verifying S&OE plans by scheduling<br>• Responsible of highlighting potential risks and infeasibility of S&OE plan | • Supply chain planner monitors schedule attainment KPI and production in overall; objective is to ensure alignment of base case and scheduling<br>• Deviations are handled in co-operation with operational planner |
| Development of Spiral tools | Supply chain planner (S&OE) | • Responsible of communicating and highlighting any development requirements of Spiral tools to appropriate stakeholders | • No changes |
| S&OE meeting | Supply chain planner (S&OE) | • Participating in S&OE meeting and presenting elements related to own product chain | |
| S&OP | Supply chain planner (S&OE) | • Translating S&OP objectives and targets to S&OE<br>• Participating in S&OP process<br>• Handling tasks and activities assigned to S&OE team in accordance with other internal guidelines<br>• Providing relevant data to S&OP concerning the supply and demand outlook<br>• Ensuring S&OP objectives are reachable and in case of deviations to S&OP plan, communicating changes and root-causes to S&OP team | |