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Integration of Planning Functions to Improve Operational Supply Chain Planning

A case study of the facilitators and obstacles at IKEA

Master's thesis in Supply Chain Management

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Abstract

The power dynamic in the transport market has shifted in the seller's favour, creating a need for buyers of transport to change their approach to the market in order to secure sufficient access to required resources. Additionally, the retail industry is encountering both large supply chain disruptions and increasing customer demands regarding product availability and sustainable operations. The need to adapt to these changing conditions in the retail planning environment in order to sustainably secure a high service level constitutes the background for this case study at IKEA. The aim of the study is to explore how integration of the planning functions at IKEA can improve their short-term planning. In order to generate a case description and enable an analysis of the current state of the planning functions, data was collected through interviews and internal documents. By adapting and applying an S&OP maturity model first presented by Grimson & Pyke (2007), the potential for integrated supply chain planning at IKEA has been analysed.

The study identifies interaction, collaboration, and alignment as three key components of integrated supply chain planning. Findings show that by strengthening these components in the context of the short-term planning at IKEA, potential benefits are increased executability of plans, reduced silo mentality, higher market responsiveness, and improved conditions for the development of an S&OE process. Related to the integration of planning functions at IKEA, main facilitators are the existing connections between IT systems in use and the structured organisation with formal responsibilities. The main obstacles for integrated supply chain planning at IKEA are low compliance and a heterogeneous set of performance measurements. The identified benefits, facilitators, and obstacles can to some extent also be applied in the broader context of the retail industry. To better integrate the planning functions at IKEA and thereby achieve the identified benefits, the recommendations for IKEA include to increase their use of feedback loops, leverage the main facilitator connected to their IT systems, and revise their set of performance measurements.

Keywords: IKEA, Integrated Supply Chain Planning, Integration, Maturity, Planning, Retail, S&OE

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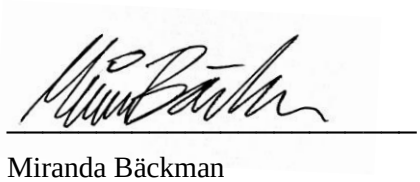
Secondly, we would like to express our gratitude towards our supervisor Patrik Jonsson at Chalmers University of Technology for both giving us valuable guidance in the literature review and providing us with feedback throughout the process.



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List of Abbreviations

APS	Advanced Planning and Scheduling
BA	Business Area
CCP	Centralised Constraint Planning
CDC	Customer Distribution Centre
CSR	Corporate Social Responsibility
DC	Distribution Centre
ERP	Enterprise Resource Planning
ESP	Enterprise Supply Planning
HFB	Home Furnishing Business
IBP	Integrated Business Planning
KPI	Key Performance Indicator
OSCP	One Supplier Capacity Process
OTD	On Time Delivery
PBSS	Plan and Balance Sales and Supply
SC	Supply Chain
SCM	Supply Chain Management
SKU	Stock Keeping Unit
S&OE	Sales & Operations Execution
S&OP	Sales & Operations Planning
TFP	Transport Forecast Plan

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1. Introduction

The topic of supply chain management (SCM) receives increasing managerial attention across various industries in today's global business environment. There are several reasons for this, such as the increased customer demands, the need to reduce costs, and the related need to identify which parts of a company's supply chain (SC) that are not competitive (Mohan, 2014). In order to reach optimal SC performance, standardisation and coordination between the actors in the SC are facilitating factors, which can be derived from common planning processes (Jonsson et al., 2012). The authors further explain that aspects such as planning accuracy, product availability, transparency, and quality of data can be improved through the use of common planning processes.

Customers have grown accustomed to not having to wait for the goods they demand and are thus placing increasing requirements on companies to ensure product availability in the SC (Madhani, 2021; McCrea, 2019). Furthermore, Hübner et al. (2013) emphasise that the requirement for a high service level is especially prominent in the retail industry. Customers are also placing higher demands on companies to fully take their corporate social responsibility (CSR) as a result of an increased awareness in the society of social, ethical, and environmental issues (Arvidsson, 2010). As companies are operating in an increasingly global context, they are also exposed to disruptions to a larger degree (Lapide, 2022). A potential risk with disruptions caused by, for example, recessions, pandemics, or congestion, is diminishing performance regarding product availability. Insufficient product availability can make companies lose revenue and consequently resort to reactive approaches to manage the situation, such as express transports and other ad hoc solutions (Hübner et al., 2013). This is however neither economically nor environmentally sustainable, implying that a more suitable method would be to implement a proactive approach, which in turn increases the importance for companies to improve their SC planning capabilities.

Sales and operations planning (S&OP) is a planning process aimed at creating balance between supply and demand from a long-term perspective while also guiding planning at lower hierarchical levels (Jonsson & Mattson, 2009). This, the authors explain, leads to better alignment and synchronisation both across functions within the organisation and between actors in the SC. While alignment on a tactical level is necessary for a well-functioning planning process, it is not sufficient to ensure applicable plans. This creates a need for vertically integrated planning processes to strengthen the link between planning on a tactical and operational level. An emerging concept within this area is sales and operations execution (S&OE). However, no general design for such a process has yet been defined as there is limited previous research on this topic.

1.1 Background

This master's thesis has been performed in collaboration with IKEA of Sweden AB as part of the prestudy "Sales and Operations Execution" within the department of Supply Chain Operations. This collaboration has made it possible to study a full-scale SC planning and its related effects. IKEA of Sweden AB is a part of the IKEA brand which currently includes 466 retail stores and about 225.000 employees globally (IKEA, 2022a). The IKEA brand is present in 63 markets, with the largest presence being in Europe followed by Asia and North America. Key figures for the financial year 2021 display that they opened more than 40 new sales locations, reached 41.9 billion in retail sales, and grew their online sales with 73%, accounting for 26% of their total sales (IKEA, 2022b).

In order for IKEA to fulfil their vision "*To create a better everyday life for the many people*", they use their tool democratic design focusing on five dimensions: function, form, quality, sustainability, and low price (IKEA, 2022d). IKEA has approximately 1.600 suppliers positioned globally (IKEA, 2022c), and strives towards having low total costs throughout their entire SC. As they are offering functional products, their SC is characterised by physical efficiency rather than a high focus on market responsiveness. Jonsson et al. (2012) describe that physical efficiency is associated with a high degree of control of the SC, which supports a focus on low costs through centralised planning.

IKEA has during the past years realised the need for a new approach for managing the transport market. The COVID-19 pandemic with its ensuing SC disruptions and shortage of resources has further increased the urgency of this challenge. Up until now, large buyers of transport have been able to commit to transported volumes with short notice and by that place high demands on carriers in terms of flexibility and risk management. IKEA is no exception and has been sharing forecasted volumes with carriers beforehand but not confirming the volumes until one or a few days prior to execution. As the transport market has shifted from a buyer's to a seller's market, this approach is no longer adequate and in the case of IKEA, the late bookings have resulted in insufficient access to transport capacity.

The S&OE prestudy was initiated to address the challenges of capacity shortages related to transport but also includes additional capacity perspectives. Furthermore, the aim of the prestudy was also to both examine the potentials for integrating the planning functions at IKEA at an operational level with a primary focus on short-term and capacity planning with a horizon of maximum three months, and to acquire more knowledge about the S&OE concept. Integration can be defined as "*a process of interdepartmental interaction and interdepartmental collaboration that brings departments together into a cohesive organisation.*" (Kahn & Mentzer, 1996, p. 9). IKEA is a suitable unit of analysis for exploring the potentials of integrated SC planning as it is a large organisation with planning processes that are extensive and accountable for managing the entire flow of goods, from sender to receiver.

However, to enable an analysis of the potential for integrating planning functions with a focus on short-term planning, the key components of integrated SC planning must be identified.

Furthermore, IKEA is an especially interesting case to study with respect to the increased customer demands for availability and sustainability because of their vision and democratic design. Since they aim to reach the many people, the concept of availability is important for them from both an internal and external perspective. Additionally, IKEA is a company with a recognised focus on low price and sustainability which presumably makes it particularly relevant for them to ensure the availability of their products in a cost-efficient and sustainable manner. Studying how the planning functions that IKEA refers to as demand planning, need planning, and capacity planning can be integrated with each other can aid in identifying potential benefits of integrated SC planning at IKEA. The study of planning functions also enables an identification of current facilitators and obstacles at IKEA that can enhance, respectively hinder, the integration of planning processes. The integration of planning functions focusing on short-term SC planning could serve as the first step in developing an S&OE process at IKEA. Hence, this exploratory study can contribute to the research on the topic of S&OE.

1.2 Aim

The aim of this study is to explore how integration of the planning functions at IKEA can improve their short-term capacity planning. This includes identification of key components of integrated SC planning and the benefits integrated SC planning may bring in the context of IKEA. Furthermore, it includes both the performance of an as-is analysis of the current planning processes and the identification of related facilitators and obstacles.

1.3 Problem Formulations and Research Questions

The aim to explore the potential of integration of planning functions at IKEA to improve short-term capacity planning comprises several problems to be understood. They regard the constituents of integrated SC planning, its resulting benefits in the context of IKEA, and the identification of IKEA's main facilitators and obstacles related to the integration of their planning processes. Through the formulation of these problems, three research questions have been developed. The examination and answering of these questions together aid in fulfilling the aim of the study. This section presents the background to the problems and the ensuing research questions.

1.3.1 Research Question 1

Integrated SC planning is a general concept with the aim of achieving integration across different functions and processes. The scope is wide, and the concept can refer to both vertical and horizontal

integration (Cavalieri et al., 2004). Kahn and Mentzer (1996) also conclude that integration is a broad concept with multiple definitions and characteristics. Its broad meaning implies that there is a need to explore the different areas of application of integrated SC planning. With knowledge about in which contexts integrated SC planning can be used, it becomes possible to define its constituting elements and various levels of integration. This aids in making the concept more tangible and thus lower the level of abstraction. A lower level of abstraction is necessary for further analysis of the concept and to be able to communicate with the team at IKEA to ensure that they understand how it can be applied in their planning environment. It is important to be knowledgeable of what integration entails in a specific context since it has implications for the management of different cross-functional relationships (Kahn & Mentzer, 1996). The need for defining the general concept provides the foundation for the first research question:

1. What are the key components of integrated SC planning?

1.3.2 Research Question 2

The identification of key components of integrated SC planning forms a basis for the continued study of the concept. The key components can give an indication of which areas could benefit from integrated SC planning. This further facilitates the search for relevant literature within existing research related to the potentials for integrated SC planning. Using the literature as a guidance makes it possible to achieve a comprehensive overview of potential benefits, thus reducing the risk of not identifying benefits that might be achievable for IKEA in their context. A couple of aspects illustrating the value of integration are increased information exchange (De Waal et al., 2019) and improved operational performance (Chen et al., 2007). By concretising the benefits that can be achieved in the context of the short-term planning at IKEA through a higher level of integration in the SC planning, IKEA may become more receptive towards making changes to their operational configuration. The need for achieving a comprehensive depiction of the potential advantages integrated SC planning can bring to short-term planning in combination with the importance of demonstrating the value of integrated SC planning motivates the second research question:

2. What are the potential benefits of integrated SC planning for the short-term planning at IKEA?

1.3.3 Research Question 3

Using a combination of the knowledge about what integrated planning entails, what benefits it may bring within short-term planning at IKEA, and an in-depth case study, it is possible to perform an as-is analysis and identify facilitators and obstacles for IKEA related to the integration of planning functions

and processes. As the S&OE prestudy at IKEA was initiated with the purpose of examining the potentials for integrating the short-term planning processes to provide a foundation for future development of an S&OE process, this thesis applies an internal perspective on integration. An internal perspective may focus on the use of data within different hierarchical levels within a company (Cavalieri et al., 2004) and the improvement of cross-functional collaboration (Chen et al., 2007). Thereby, it becomes interesting to study the integration of the planning functions and processes in the current state and to explore its unrealised potentials to guide future development. The above reasoning leads to the formulation of the third and last research question of this study:

3. Which are IKEA's main facilitators and obstacles related to the integration of their short-term planning functions and processes?

1.4 Delimitations

This study is delimited to the SC planning within the forward SC, reaching from first-tier suppliers to IKEA fulfilment units. The units of analysis are delimited to the planning functions demand planning, need planning, and capacity planning, which are part of the planning process for home furnishing. Furthermore, the thesis will not provide an implementation plan for how to integrate the SC planning.

1.5 Disposition of the Thesis

The thesis is structured into six chapters: Introduction, Literature Review and Theoretical Framework, Methodology, Empirical Findings, Discussion, and Conclusions. Additionally, a case description of IKEA is found in Appendix A. The first chapter presents the background of the thesis with the objective of providing an understanding for the relevance of the issue under investigation. It offers an explanation to the problem to be studied and the research questions to be answered in order to fulfil the aim of the study. The next chapter presents literature relevant to the research field and concerns topics such as S&OP, S&OE, SC planning, and the retail planning environment. The literature review resulted in a theoretical framework that both conceptually answers the first research question and subsequently is used in the study to answer the second and third research question. Next, the methodology used to conduct the study is described, including the model of analysis that will be used to answer the research questions. The fourth chapter presents the main empirical findings of the case study structured according to an applied maturity model from the theoretical framework. The following chapter elaborates on the key findings from the study in relation to theory in order to arrive at answers to the second and third research question. The last chapter summarises the main findings of the study along with recommendations for IKEA and discusses both the limitations of the study and areas for future studies.

2. Literature Review and Theoretical Framework

In the following chapter, a theoretical framework is formed based on the existing literature within areas relevant to the aim of the study. Initially, the concepts of S&OP and S&OE and their respective characteristics are presented. Subsequently, integrated SC planning including related benefits and challenges are covered followed by a description of the retail planning environment. The chapter ends with the theoretical framework which presents both the key components of integrated SC planning and an adapted maturity model.

2.1 Supply Chain Planning Levels

Hübner et al. (2013) present an overview of SC planning and describe how planning tasks can be sorted according to their planning horizons. The authors divide planning horizons into three categories: long-term, mid-term, and short-term. A long-term planning horizon is often associated with tasks on a strategic level of planning while more coordinating tasks, which can be referred to as master planning, are performed on a mid-term horizon. Planning tasks that are operational and have close connection to execution are performed on a short-term horizon and include, for example, order planning, production scheduling, and transport planning (Hübner et al., 2013). In relation to the variety of planning activities, the authors emphasise the importance of linking planning tasks both across and along planning horizons.

2.1.1 Sales and Operations Planning (S&OP)

S&OP is a long-term periodic planning process on a tactical level with an aggregated approach for the balancing of supply, in terms of for example capacity and stock, and demand in terms of forecasted sales (Jonsson & Mattsson, 2009). The authors explain that the characteristics of the S&OP process may differ but need to be established in order to achieve efficiency and cohesiveness in the planning.

2.1.1.1 Characteristics of S&OP

Key characteristics which can be used to differentiate between various hierarchical levels of planning are planning object, planning horizon, and planning frequency. The planning object depicts the level of detail in the plans and Thomé et al. (2012) present that in S&OP, sales and production volumes are frequently determined on a product group level rather than in terms of individual stock keeping units (SKUs). The planning horizon refers to how far into the future the planning is extended and typically ranges between 6 and 18 months (Thomé et al., 2012). However, according to Jonsson and Mattson (2009), the planning horizon of S&OP can extend up to 24 months. The authors explain that the purpose of having a long planning horizon is to enable the capacity to be adapted in time to both capture opportunities on the market and avoid having underutilised capacity. S&OP has a monthly planning frequency, which refers to how often the planning is performed (Jonsson & Mattson, 2009).

Additionally, the authors present the concept of period length which generally coincides with the planning frequency, with the exception being on the lowest hierarchical level of planning where the period length may be broken down further than the period frequency.

The resulting output of S&OP is derived from the overall goals and strategies set for the company and primarily include production plans, containing volumes to be manufactured, and sales plans, containing roughly planned volumes to be delivered to customers (Jonsson & Mattsson, 2009). Examples of goals and strategies influencing the S&OP may regard profitability, prioritisation of markets and changes in the product range. The plans are limited by time fences which restrict how much of the plans are allowed to be changed within a certain time window (Jonsson & Mattsson, 2009). The authors explain that the positioning of time fences depends on the lead times as well as the flexibility of operations. Thomé et al. (2012) further elaborates on restrictions for the final plans by presenting the financial budget and the available production capacity as main constraints.

2.1.1.2 The Planning Cycle of S&OP

S&OP is generally described as being composed of five sequential steps covering demand forecasting, generation of initial sales plans followed by production plans, adaptation of the plans, and a decisive executive meeting (Jonsson & Mattson, 2009; Thomé et al., 2012). Each of these steps involves stakeholders from various departments in order for the S&OP process to contribute to consensus and limited silo mentality. Jonsson and Mattsson (2009) explain that in the first step, the marketing department creates a forecast for the expected demand of the coming planning period without taking available capacity into account. This forecast forms a foundation for the preliminary sales plan which is formulated in the second step together with the establishment of goals related to stock levels. Subsequently, the production departments, together with purchasing, prepare a preliminary plan of volumes to be produced within each period of the planning horizon. This plan takes both sales plan, accessible raw material, and available capacity into account, thus making it a constrained plan (Jonsson & Mattson, 2009).

The fourth and fifth step of the S&OP process aim at adjusting the preliminary plans so that a balance between supply and demand is obtained while still complying with the financial requirements (Jonsson & Mattsson, 2009). The sales and production plans are established in the fourth step and proposed in an executive meeting, representing the fifth step, where the final decisions are made and the responsibilities of the different departments are confirmed.

Related to the planning cycle of S&OP, Noroozi and Wikner (2016) emphasise the value of evaluating the process in order to be able to find potentials for improvement. The authors explain that because S&OP is a cross-functional process, the measurements used to follow up the process should also be

cross-functional. This is of high importance in order to integrate functions which may have different goals. An individual company's unique set of measurements should be specifically developed based on the company's planning environment (Noroozi & Wikner, 2016). Some examples of metrics that may be used are capacity utilisation, inventory level, and forecast accuracy, and the authors point out that financial metrics such as revenue and profitability work cross-functional to integrate different functions and goals. Noroozi and Wikner (2016) further explain that the S&OP process should be modified based on the problems identified in the evaluation process. The authors motivate this by stating that it is of high importance to have an updated S&OP to be able to improve business performance and thereby reach financial targets.

2.1.1.3 S&OP in Various Contexts

When the S&OP concept emerged in the late 1980s, it was primarily designed for the purpose of planning sales and production in a single manufacturing unit (Ling & Coldrick, 2009). However, as different companies operate in different contexts, Kreuter et al. (2021) emphasise the need for companies to contextualise their S&OP processes to fit within their specific planning environments. Furthermore, the authors explain that a company has contingencies related to both the outside and inside of its organisation. By designing the S&OP with regard to the company specific contingencies, a context specific process with increased effectiveness can be achieved (Kreuter et al., 2021). Kristensen and Jonsson (2018) agree that the planning environment of a company influences the design of its specific S&OP process and explain that the design of the S&OP process is affected by aspects such as industry, SC complexities, and internal organisational characteristics.

Kristensen and Jonsson (2018) present that two aspects varying between industries are the details regarding S&OP characteristics and what SC complexities are faced. Additionally, structured S&OP processes are adopted to varying extents depending on the industry, where the authors highlight retail and service industries as being associated with a low level of maturity. The authors divide SC complexity into dynamic and detail complexity. Dynamic complexity refers to demand and supply uncertainties and in order to adapt the design of the S&OP in contexts with high dynamic complexity, scenario planning is presented as a suitable tool. Detail complexity concerns the number of variables, such as multiple market and sales units, where a high detail complexity can be managed by parsing the S&OP process, i.e. by dividing it into multiple processes. Kristensen and Jonsson (2018) also identify IT support systems as critical components of the S&OP in contexts with high detail complexity. The authors further present that the internal organisational characteristics that affect the S&OP design comprise three dimensions: human, technical, and organisational, and include, for instance, orientation as well as involvement. The authors suggest that some orientations are associated with higher S&OP commitment and consequently performance. For example, process-oriented companies tend to perform

better than function-oriented companies. Additionally, efficient integration within the organisation facilitates efficient external integration.

2.1.1.4 S&OP Maturity Models

Several S&OP maturity models exist which all aim to describe how advanced the S&OP process is across a number of dimensions (Jonsson & Lindau, 2019). The models may differ in terms of specifics, but the dimensions generally focus on people, organisation, process, performance measurements, and IT. Most maturity models emphasise internal improvements at the lower levels and extends towards external involvement and holistic SC alignment at the higher levels (Danese et al., 2017). Grimson and Pyke (2007) explain that companies can use a maturity model to understand the current level of maturity of their S&OP processes and identify opportunities for developing them to become more advanced. Danese et al. (2017) agree and add to this by describing that maturity models also can be used for comparative purposes across both companies and industries.

Based on an analysis of three companies transitioning between different levels of maturity, Danese et al. (2017) conclude that increasing the level of maturity requires balanced actions across all dimensions. Furthermore, the authors explain that to which degree the transition can be serial, i.e. addressing one dimension at a time, depends on the level of maturity. A higher maturity places greater demands on taking developing measures in parallel due to considerable interdependencies between the dimensions. The authors present the parallel development as a reason for why it is more difficult to transition between higher levels of maturity compared to lower levels.

The general view of maturity is that a higher level is more beneficial for the company (Danese et al., 2017). However, Jonsson and Lindau (2019) note that even though higher levels of maturity imply a larger effect, not all companies should strive for the highest stage of maturity since that requires valuable resources and a lower maturity may be sufficient. For instance, Danese et al. (2017) present that dimensions related to people and organisation tend to become increasingly important for transitioning. However, they also require the most capital and time to change, especially when the complexity of the S&OP grows and more stakeholders are involved.

2.1.1.4.1 Grimson and Pyke's Maturity Model

Grimson and Pyke (2007) present a maturity model which classifies maturity into five levels: no S&OP process, reactive, standard, advanced, and proactive, where low levels of maturity are characterised by not having an S&OP process or having a reactive approach, while an advanced or proactive S&OP process is considered to be of high maturity. A company's level of maturity can be determined based on how they perform on the model's five dimensions: meetings and collaboration, organisation, measurements, IT, and S&OP plan integration, see Table 1.

Table 1. The five stages and dimensions of Grimson and Pyke's (2007) S&OP maturity model.

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

Note. From "Sales and operations planning: An exploratory study and framework" by J. A. Grimson and D. F. Pyke, 2007, *The International Journal of Logistics Management, 18*(3), p. 330 (https://doi.org/10.1108/09574090710835093). Copyright 2007 by Emerald Group Publishing Limited.

Grimson and Pyke (2007) explain that the first dimension, meetings and collaboration, focuses on the human component of S&OP and they exemplify the lowest level of maturity in this dimension with sales and production departments working in parallel without any collaboration or communication between each other. This results in a low level of trust between the departments regarding the information that is shared, which can be exemplified with the production department not fulfilling the volumes in the demand forecast as the numbers may be inflated by the sales department. Grimson and Pyke (2007) describe how a reactive level of maturity entails S&OP meetings that involve senior management while the other parts of the organisation are still characterised by silo mentality. It is not until the third level of maturity that the S&OP is a formalised process with dedicated executive meetings and regular associated pre-meetings involving several parts of the organisation. The maturity further increases as more customers and suppliers are incorporated into the meetings and as the data used as input to the process is gathered from a broader set of stakeholders (Grimson & Pyke, 2007). Ultimately, the highest level of maturity is reached when the S&OP process also includes complementary event-driven meetings and when the information sharing between internal and external stakeholders takes place in real time.

Grimson and Pyke (2007) present that regarding the dimension of organisation, the lowest level of maturity corresponds to not having an S&OP function present in the organisation while at the reactive level, some S&OP-related tasks are performed. The authors continue by explaining that as the formality of S&OP increases, the responsibility of it is assigned to another position at a standard level of maturity

and to an S&OP team at an advanced level of maturity. Grimson and Pyke (2007) state that a high level of maturity corresponds to the executive level participating in the S&OP process and emphasise that the proactive level is only reached when the entire organisation understands and respects the S&OP process and the value it brings.

According to Grimson and Pyke (2007), no measurements are used at the lowest maturity level while with an established S&OP process, the main measurement regards the sales and production departments being responsible for meeting the sales plans. To further increase the level of maturity in terms of measurements, a company should measure the accuracy of the sales forecasts. This, the authors explain, incentivises the sales department to consider feedback from the receivers of the forecasts and adjust accordingly. Furthermore, the advanced level of maturity is associated with adding effectiveness of the S&OP process and new product introduction to the set of measurements. Finally, a proactive company holds sales, operations, and the S&OP team altogether accountable for the company's profitability.

Increasing the maturity from the lowest level to the reactive level in terms of IT involves developing the spreadsheets owned and managed by individuals from being entirely separate to manually consolidating some of the information (Grimson & Pyke, 2007). Furthermore, companies who consolidate information automatically by using various planning software are considered mature to a standard degree. At an advanced level of maturity, the planning software also optimises revenues and operations, although sequentially as opposed to jointly. Grimson and Pyke (2007) further state that S&OP data should be automatically shared and visualised throughout the organisation with the use of an S&OP workbench. At the highest level of maturity, the S&OP software is integrated across the organisation, utilising real-time data to optimise sales and operations jointly, which avoids sub-optimisation and allows for quick reactions to changes (Grimson & Pyke, 2007).

The last dimension, S&OP plan integration, evaluates the interface between the production plan and the sales plan as well as how effectively the plans are produced. Grimson and Pyke (2007) explain that plan integration is derived from the other four dimensions of the maturity model. With, for instance, more developed collaboration and IT, increased information sharing is enabled, thus enhancing the integration as a consequence. According to Grimson and Pyke (2007), the least developed form of plan integration, which is present at the reactive level of maturity, occurs when the sales plan drives the production plan but adjustments of the sales plan are absent and capacity utilisation is ignored. A standard level of maturity is reached when forecasts are developed with a bottom-up approach rather than a top-down approach and some information exchange is present resulting in adjustments of plans. The authors explain that at an advanced level of maturity, the S&OP process is collaborative rather than sequential as in the lower levels. Furthermore, the capacity constraints are consistently considered and the resulting plans are thus highly integrated. Ultimately, the highest level of maturity is achieved when

the planning process is seamless and optimised for profitability instead of sub-optimised for sales revenue or operational efficiency. At this proactive stage, multiple constraints are actively considered, such as inventory, competitive actions, and SC constraints (Grimson & Pyke, 2007).

2.1.2 Sales and Operations Execution (S&OE)

S&OE can be described as a periodic planning process aimed at addressing immediate operational concerns (Van Hove & Regeer, 2021). Hippold (2019) proposes that an S&OE process can constitute the connection between the tactical and operational level of planning. Related to this, the author emphasises that it is of high importance to separate the S&OP and S&OE processes from each other since they have different goals and requirements. This contributes to the development of individual processes which are optimised for planning and execution, respectively. Lapide (2022) also stresses the importance of distinguishing between planning levels and their associated processes to ensure that they remain focused on their respective frameworks and horizons. Hippold (2019) explains that as two separate entities, it is possible to solely focus on the tactical planning in S&OP while S&OE manages the operational issues, using the tactical output of S&OP as input to generate detailed and executable plans. Van Hove and Regeer (2021) support this by explaining that there are challenges related to the implementation of concepts underlying the tactical planning. The authors state that operational issues are often addressed in meetings intended for long-term planning, even if there are scheduled weekly S&OE meetings.

Van Hove and Regeer (2021) explain that S&OE may have a planning horizon of three months and a planning frequency of one week. Mendes (2011) describes that weekly S&OE meetings can be used to manage variability in supply and demand, and examine the actual performance compared to the operational plans. Operational decisions within the twelve-week horizon are, according to Van Hove and Regeer (2021), frequent and of a repetitive nature. The authors explain that the decisions are generally made on an SKU-level and regard the balance of supply and demand, inventory change, and order allocation, among other things.

2.2 Supply Chain Planning Concepts

The concept of SCM explains the logistics activities and the planning and control of materials and information flows related to an organisation's internal and external processes (Mohan, 2014). Furthermore, the concept can be used to describe strategic and inter-organisational issues including, for example, alternative organisational forms to vertical ownership and the purchasing and supply perspective. This means that SCM is a cross-functional concept involving many fields, such as marketing, purchasing management, and logistics, and comprises both technical and human aspects (Mohan, 2014). The main driver for SCM, the author continues, is to remove inefficiencies, excess

inventory, and excess costs, to develop an optimal SC where the effectiveness of the entire SC has a higher priority than the effectiveness of each individual part. Van Landeghem and Vanmaele (2002) describe that in order to obtain a more comprehensive view of the SC, integration across the SC is suggested. The authors further indicate that with an integrated SC, the SC planning can process information from all actors involved and convert it into executable plans.

Oliva and Watson (2010) describe SC planning as primarily being conducted cross-functionally within organisations. With cross-functional collaboration, it is possible for an organisation to evaluate both the organisation's specific needs and the current state of the SC, the authors explain. This cross-functional evaluation provides a foundation for the development of an approach for creating value which includes planning and execution at the strategic, tactical, and operational levels. This type of collaboration can, according to the authors, be referred to as integration. Even though it is beneficial to work cross-functionally with SC planning, it is common that different organisational functions specialise in parts of the planning activities (Oliva & Watson, 2010). The different perspectives of the functions may cause conflicts regarding expectations, preferences, and priorities for how to create a balance between supply and demand, the authors point out. The authors further describe that increased competition and globalisation will create new opportunities for SCs while also posing new challenges for organisations in terms of for instance additional differentiation within the organisation.

2.2.1 Integrated Supply Chain Planning

Kahn and Mentzer (1996) define integration as: "*a process of interdepartmental interaction and interdepartmental collaboration that brings departments together into a cohesive organisation.*" (p. 9). Chen et al. (2007) complement this by describing that integration encompasses cooperative work resulting in collectively satisfactory outcomes. The authors further present internal and external integration as two distinct types of integration, where internal integration occurs within a single organisation and external integration takes place across multiple organisations.

According to Den Hertog (2019), integrated planning can be defined as: "*the complete set of an organization's planning activities which seamlessly convert business strategy into results execution—vertically aligning through tactical (S&OP), operational and executional planning tiers; and horizontally coordinating all functional areas to achieve quality, delivery, service and/or efficiency*" (p. 26). Integrated planning thus extends the S&OP concept by also including operational and executional planning activities. These activities involve, for example, sales order management, regular purchasing and production activities, and rapid response. Den Hertog (2019) further explains that these activities strengthen the foundation for the tactical cycle of S&OP review meetings and make it possible to address a broader set of planning challenges. The aim of integrated planning is to improve the

performance regarding on-time launches, forecast accuracy, order fulfilment, inventory turnover, and supply reliability, and to lower SC costs, while reaching sustainability, revenue, and profitability targets (Den Hertog, 2019). The author states that there is a need for a generic integrated planning process model with an associated framework for the transformation and guidelines for the use of information systems.

Planning processes can be integrated both vertically and horizontally (Cavalieri et al., 2004). The authors explain that vertical integration refers to the integration of systems across different administrative levels within an organisation. The need for vertical integration arises when processes and systems at a certain level within an organisation require input from processes at a higher level. In contrast, the authors describe horizontal integration as a process using data from multiple sources at the same level.

Oliva and Watson (2010) state that integrated SC planning in a largely differentiated organisation will require broad cross-functional collaboration. The authors present that the cross-functional approaches that have been developed previously have mainly focused on specific combinations of functions, but the authors also emphasise the importance of achieving a broad integration that develops plans involving multiple functions. The demand for integrated SC planning is derived from the combination of increased complexity of SCs in the global marketplace and the differentiation within organisations (Oliva & Watson, 2010). The need for comprehensive integration also stems from different functions within organisations often having different incentives and different perspectives on time and relationships, the authors explain. This makes it difficult to achieve alignment within the planning and execution processes, and subsequently reach long-term organisational goals (Oliva & Watson, 2010). In addition to achieving alignment, the authors also point out that integration both within and across organisations have shown to improve organisational performance in a broader sense.

2.2.1.1 Framework for Integrated Planning

Oliva and Watson (2010) present a process perspective on integration where process is defined as "*a sequence and interdependency of activities designed to achieve a goal*" (p. 436). The advantage of applying a process perspective on integration instead of using approaches based on responsibilities and structure is, according to the authors, that it enables more systematic and standardised organisational learning related to decisions and actions. The collaborative planning processes Oliva and Watson (2010) examine are S&OP processes, which have the main goal of creating a balance between supply and demand by coordinating supply to meet the demand forecasts. Although a basic S&OP process primarily aims to facilitate the information flow between the demand and supply planning processes, it is argued within several fields of study that this type of process can be applied in other contexts than only the synchronisation between supply and demand (Oliva & Watson, 2010). The authors found that

processes focused on the consistency and quality of information sharing, decision making, and the creation of actionable plans can enhance integration. The authors propose that this also applies for differentiated organisations with function-specific incentives as a process promoting information sharing can improve alignment, implying that changes in terms of incentives is not the only solution to misalignment.

Den Hertog (2019) proposes a process model for integrated planning which consists of three integrated planning cycles: a monthly tactical S&OP cycle, an operational cycle with a weekly or daily planning frequency, and a real-time executional cycle. These planning cycles are also strongly related to fundamental strategic and executional activities. The author further explains that top-down alignment across the processes is essential to turn the corporate strategy into a successful execution. It is of high importance that the actions and decisions taken on the strategic level are carefully considered as the corporate strategy forms the basis for the subsequent planning processes and executional activities (Den Hertog, 2019). The tactical S&OP cycle is another part of high importance for the coordination of planning processes with its regular monthly meetings, the author continues. It provides a structured forum for executive managers to critically assess opportunities and risks, and develop plans to meet business targets. The S&OP process further breaks down annual business targets and key performance indicators (KPIs) for the entire organisation to regional offices and factories and clarifies decision rules. By doing this and also communicating decentralised information during the monthly review meetings, S&OP facilitates the vertical integration of planning (Den Hertog, 2019).

A successful process for integrated planning will require a number of change elements that aim to improve the effectiveness of the organisation, for instance staff resources, business processes, and IT systems (Den Hertog, 2019). Staff resources as a change element emphasises the importance of developing the organisational design that is required to be able to work integrated. This may involve new roles and responsibilities, centralisation of standardised and repetitive tasks, and adjustments of recruitment policies to support the new culture. Business processes constitute a change element focused on defining the processes on multiple levels, from a high level to more detailed levels. In addition, the processes should be linked to each other and their interdependencies should also be mapped. IT systems as a change element then refers to the designing, building, testing, and deployment of IT systems and associated tools which are needed to support the business processes.

Kahn and Mentzer (1996) present two different perspectives on integration across departments within an organisation: interaction and collaboration. From an interaction perspective, the exchange of information is in focus and effective integration is achieved by developing the information flows and communication between departments. The value of meetings and documentation is emphasised, and the authors describe how integration is achieved through the expansion of the number of contact points

intended for both verbal and written information flows. However, with this perspective, functions are viewed as independent units and each interaction is approached as a transaction and with the aim of sharing the information that generates the optimal outcome for the individual department (Kahn & Mentzer, 1996). From a collaboration perspective on the other hand, integration is focused on the alignment of values and goals across the organisation and the development of collaborative behaviours. The authors explain that the collaboration perspective emphasises the interdependency between functions and the use of common goals to incentivise continuous relationships focused on achieving mutual benefits. Furthermore, collaboration is more intangible than activities connected to interaction and is therefore more difficult to regulate and typically more unstructured in nature (Kahn & Mentzer, 1996).

A third perspective which is highlighted by Kahn and Mentzer (1996) is to view integration as a multidimensional concept comprising both collaboration and interaction. This means that integration is achieved through a combination of involvement and information exchange which, according to the authors, is a preferred perspective since neither interaction nor collaboration is enough by itself to ensure successful integration. Kahn and Mentzer (1996) conclude that integration should be viewed from a multidimensional perspective but also note that the dimensions may be of varying importance depending on the context and that the levels of interaction and collaboration thus may differ.

2.2.1.2 IT Systems Roadmap

Den Hertog (2019) explains that IT systems are classified as being the most complex and time-consuming change element, generally requiring large investments. It is therefore of high importance to plan for the implementation of IT systems and have a clear roadmap for how to use them in the restructuring of the organisation. Without a roadmap, there is a risk for a fragmented development that disregards the benefit of optimising system dependencies (Den Hertog, 2019). Furthermore, a fragmented approach also risks resulting in costly rework, delays, and decreased motivation among the employees. The author continues by stating that a high-level IT systems roadmap should be defined to be able to design, build, and test the planning systems necessary for integrated planning. Den Hertog (2019) also emphasises the importance of adapting a generic roadmap to the specific company and context.

The IT systems roadmap proposed by Den Hertog (2019) consists of five stages, where each stage represents a higher level of maturity. The maturity stages are referred to as reacting, anticipating, integrating, collaborating, and orchestrating. The first stage comprises an enterprise resource planning (ERP) platform that provides the data foundation for all integrated planning processes. This makes it possible to collect all real-time data in one location, which both creates opportunities to react and supports the transition towards higher maturity levels. In the second stage, demand and supply planning

modules are created and implemented in parallel and more advanced spreadsheet tools are used. The integrating stage focuses on combining SC planning data and ERP transactional data into visual reports which can be used in S&OP review meetings. The fourth stage includes an upgrade from spreadsheet tools for planning and scheduling of demand and supply to advanced planning and scheduling (APS) systems, which typically requires a larger investment. The fifth and last stage, orchestrating, extends the tools for planning and scheduling by adding advanced optimisation modules, such as inventory optimisation, order management, and rapid response. At this maturity stage, the set of planning systems should be functioning seamlessly, and the tactical, operational, and executional planning processes should be synchronised and connected by automated interfaces (Den Hertog, 2019).

2.2.1.3 Integrated Business Planning

Integrated business planning (IBP) is a process which Van Hove and Regeer (2021) describe aims to create a collective understanding of demand, supply, and related activities among various stakeholders. Danese et al. (2017) describe IBP as a term used during the evolution of S&OP and Van Hove and Regeer (2021) describe it as expanding the scope of S&OP, thus indicating the concept's close connection to S&OP and financial goals. Van Hove and Regeer (2021) explain that IBP relies on three concepts: cross-functional decision making, periodic planning cycles, and sequential process steps. With IBP comprising several planning cycles with different planning frequencies it becomes possible for a company to focus on long-term tactical decision making while maintaining responsiveness in the short-term planning. Moreover, the cycles have sequential meetings where the output of one planning process serves as input for the subsequent process (Van Hove & Regeer, 2021).

Van Hove and Regeer (2021) divide the development of integrated SC planning software into waves, where the third one now has been entered. The first one was ERP focusing on automating transactional business processes and the second one was APS which integrates plans with other functions and optimises SC metrics. The second wave also directed more attention towards the S&OP concept and laid the foundation for IBP. The third wave refers to systems providing intelligent automation which will handle planning, decision making, and execution. Furthermore, Van Hove and Regeer (2021) claim that processes and decisions related to operational and executional issues can be automated to a considerable extent using modern planning technology. However, this places high demands on the development of IBP processes, the authors continue.

2.2.1.4 The Potentials of Integrated Supply Chain Planning to Reduce Silo Mentality

De Waal et al. (2019) explain that it is common for organisations to structure their functions into separate silos, often with the intent of achieving a higher efficiency and being able to divide responsibilities more easily. However, the authors explain that a disadvantage with organising into silos is that the individual functions develop unstandardised working methods that become obstacles for

cross-functional cooperation and integration. Furthermore, the associated silo mentality limits the exchange of knowledge, which for instance increases the risk of not recognising threats at an early stage (De Waal et al., 2019). The limited knowledge exchange, the authors continue, also reduces the opportunities for organisational learning which refers to the ability to share insights across an organisation in order to reduce the risk of repeatedly making similar mistakes. According to the authors, the importance of organisational learning is especially high in complex and dynamic planning environments. Together, these disadvantages can negatively affect the overall performance and effectiveness of the organisation.

De Waal et al. (2019) compile several groups of techniques that are positively correlated with organisational learning, improved internal collaboration, and reduced silo mentality. One group of techniques focuses on integration within an organisation. For instance, the authors include the integration of processes and systems across organisational units, the development of interdependent planning and review processes across organisational units, and the enabling of information sharing by introducing a common IT platform. It is supported by Chen et al. (2007) that cross-functional integration has a positive effect on a firm's operational performance. The positive impact is further enhanced by the extent to which the integration is firm-wide and spans across multiple functions or processes (Chen et al., 2007).

2.2.1.5 Challenges Related to Integrated Supply Chain Planning

Several types of SC challenges which can affect integrated SC planning have been identified in existing literature and Mohan (2014) makes a distinction between challenges in SC integration, SC network design, and information sharing. The author divides the challenges within SC integration into three categories: business micro environment, business macro environment, and technical challenges. The business micro environment describes the relationship between the SCM system and the company's business strategies while the business macro environment focuses on the relationships between the subsystems. Regarding SC network design, Mohan (2014) claims that more research is needed. More specifically, it is important to analyse the implications of SC network design on strategic decisions to reach the full potential of integrated SC planning. It is also of high priority to develop models for SC network design that are based on return-rate since decisions in this area generally concern large investments which are evaluated based on the return on investment (Mohan, 2014). A majority of today's models are cost-oriented, the author explains, and can thereby pose a challenge for the decision-making process.

Within information sharing, one of the main challenges concerns the alignment of incentives between different SC actors (Mohan, 2014). The author stresses the importance of having aligned incentives as actors otherwise will not recognise the value of sharing information and be unsure of how their

information will be used by others. If actors are promised positive gains but are not able to quantify them, they may still be reluctant to share information, which Mohan (2014) explains places higher demands on trust and cooperation. An additional challenge connected to information sharing is the handling of confidential information. Mohan (2014) specifies that this is particularly problematic if competitors share suppliers. Technology can, according to the author, pose a third constraint on information sharing if cross-organisational information systems are necessary. This is because implementations of such systems generally are expensive, time-consuming, and associated with a high level of risk. Mohan (2014) presents one last concern related to the sharing of information which regards the timeliness and accuracy of data. If the shared data is not consistent and adapted to the needs of the receiver, significant efforts will be required to be able to use the data. Following this, Mohan (2014) concludes that information sharing can be considered an enabler for improved SC coordination and planning, but that companies must develop capabilities to use the information effectively.

2.2.2 Centralised Supply Chain Planning

Centralised SC planning can, according to Jonsson et al. (2012), be described from three perspectives: the planning process, the planning organisation, and the planning system. The authors point out that in order for a centralised SC planning to become successful, there are some prerequisites that need to be fulfilled. One of these prerequisites is that the company has full control over the SC it is part of, and another is the possibility of creating one central domain for all planning processes. A centralised SC planning process is applicable for companies offering functional products where low price and timely deliveries are important aspects (Jonsson et al, 2012). The authors also present four dimensions of effects that can be achieved through centralised SC planning. The first dimension relates to the improvements of SC coordination and integration, where increased integration also improves the balance of supply and demand. The second dimension refers to the standardisation of working methods, workflows, and processes, which further enhance the possibilities for integration, the authors explain. The third and fourth dimensions are specialisation and learning effects (Jonsson et al., 2012).

Jonsson et al. (2012) classify the possibility to create a single planning domain with information about inventory, production, and distribution, as an important prerequisite for centralised SC planning. The authors further state that the use of a standardised software is necessary to support the decision-making process in global SCs. The use of a standardised software presupposes that the users adhere to a standardised working method, which may also include a change in mindset among the users (Jonsson et al., 2012). While a standardised software can enhance integration, it can also pose a challenge if there is insufficient user training and knowledge, the authors continue. Additionally, low data quality may be an obstacle for the use of a standardised software. The obstacles for the use of a common software can

thus be related to either human and organisational aspects, or to the quality of the software and data (Jonsson et al., 2012).

2.2.3 Robust Planning

Robust planning is an approach aiming to identify and explore uncertainties in the SC and include those in the planning process (Van Landeghem & Vanmaele, 2002). This results in a more predictable and stable outcome compared to a deterministic approach, where stability refers to low variabilities in the performance measurements being achieved. Van Landeghem and Vanmaele (2002) explain that deterministic approaches generate optimal plans given deterministic values of parameters while a robust approach generates a satisfactory solution that remains valid over a larger range of variable values. The latter thus reduces the scope and frequency of required changes to the plan. Van Landeghem and Vanmaele (2002) argue that robust planning is especially applicable at a tactical level since a longer planning horizon allows for more time to react to uncertainties compared to the shorter horizon at an operational level. As presented by Landeghem and Vanmaele (2002), sources of uncertainty in a SC may regard, for instance, supplier performance, manufacturing processes, and customer demand. On a short-term horizon, the authors indicate that exchange rates, subcontractor availability, and information delays are the most prominent sources.

Van Landeghem and Vanmaele (2002) state that the robust approach specifically addresses SCs which are physically efficient. Physically efficient SCs are generally characterised by a less flexible infrastructure and capacity buffers associated with high costs. They are applicable in a planning environment including low market uncertainty, functional products with long life cycles, and narrow profit margins. Moreover, planners in physically efficient SCs typically rely on material buffers as their main tool to manage unresolved uncertainties (Van Landeghem & Vanmaele, 2002). In contexts where there is a large cost focus and flexibility is limited, a key measure to reduce costs is to limit the number of changes in plans. If material buffers can be sized and located appropriately, for example through the use of risk planning techniques, the plans can remain valid for a wider range of possible scenarios. The authors explain that in this setting, the robustness of the planning can enhance the integration and collaboration in an organisation as it contributes to fewer and smaller changes in plans which therefore are perceived as more reliable. Van Landeghem and Vanmaele (2002) emphasise that the value of including variability in the planning parameters to achieve robust plans is especially high in environments where rapid, unplanned actions are costly or the flexibility of the SC is limited.

2.2.4 Quick Response Planning

Companies' approaches to the management of uncertainties can emphasise either robustness or flexibility (Schütz & Tomasgard, 2011). The authors explain that while robust plans are unaffected by

certain levels of uncertainties, flexibility allows plans to be revised according to new settings. Schütz and Tomasgard (2011) present four types of flexibility in SCs: volume flexibility, operational decision flexibility, delivery flexibility, and storage flexibility. Volume flexibility refers to having excess capacity that enables changes to the production rate in accordance with the experienced demand, while operational decision flexibility regards making changes to decisions regarding SC operations, such as altering the production plan. Delivery flexibility refers to the ability to change delivery dates and volumes rather than treating them as fixed, and storage flexibility regards the ability to move inventory within a relatively short time horizon (Schütz & Tomasgard, 2011).

SCs are increasingly being exposed to significant disruptions due to the fact that they are becoming longer and of a more global nature (Lapide, 2022). The author presents that one approach for managing uncertainties in the context of SC planning has been to adopt buffering strategies, such as increasing safety stock levels. However, this approach is becoming less sustainable as the volatility of both demand and supply has increased due to significant SC disruptions, such as the COVID-19 pandemic, natural disasters as well as macroeconomic fluctuations (Lapide, 2022). The author explains that it is difficult to estimate both the probabilities of these disruptions to occur and the magnitude of their impact. Lapide (2022) argues that although S&OP is a routine planning process on a tactical level, it is still an important process for companies when they are experiencing disruptions as it constitutes the link between the strategic and operational plans. The role of S&OP is to ensure that the actions taken at an operational level in response to disruptions are aligned with the overall corporate strategy. It is, however, not sufficient in order to set the direction for what actions to take at the operational level in contexts of SC disruptions with severe consequences. Following this, integration of planning should focus on creating a strong connection between the strategic and executional level and ensuring that all planning processes strive towards the same strategic goals (Lapide, 2022).

The S&OP process performs well in environments characterised by events associated with known probability distributions (Lapide, 2022). This requires sufficient historical data to enable a statistical analysis, for instance, sales data depicting seasonal demand patterns. The process is, however, not designed to manage environments with several possible outcomes where the probabilities are unknown (Lapide, 2022). As SCs are increasingly being exposed to the latter, the author indicates that there is a need for a quick response planning that develops operational plans based on prevailing circumstances. The quick response planning team should be able to make high-risk decisions in real time to enable rapid adaptation to the market (Lapide, 2022). The result of this planning process would be a demand plan and a supply plan with short planning horizons, ranging from a couple of days up to three months. Furthermore, the planning process should have a high planning frequency with almost daily changes to the plans. Lapide (2022) explains that the quick response team should be short-term oriented and exist

until enough data has been gathered to perform a statistical analysis and thereby making it possible to return to the S&OP process.

2.2.5 Control Towers

A main challenge SC managers face is uncertainties related to both supply and demand (Trzuskawska-Grzesińska, 2017). The author presents visibility and responsiveness as necessary elements in order for a company to dynamically manage their SC and thereby cope with the uncertainties. SC visibility can be defined as the awareness of, and control over, various information concerning aspects such as demand forecasts, inventory levels, and goods flows. The need for visibility and responsiveness consequently requires all involved stakeholders to have access to real-time information which is both synchronised and improved through feedback loops.

Trzuskawska-Grzesińska (2017) presents control towers as a suitable tool to achieve both short- and long-term visibility since its implementation includes both monitoring plans and reporting potential deviations based on real-time data. Additionally, control towers aid in reducing the reaction time to problems and enable companies to have an anticipating rather than reactive approach. Trzuskawska-Grzesińska (2017) explains that a control tower system consists of three parts: human organisation, processes, and IT solutions. The author further explains that the IT component of a control tower is essential for consolidating data from existing systems and for making it widely accessible. The IT component also includes analytics tools that can be used for detecting, analysing, and resolving problems. A control tower and its inherent IT solutions can thus facilitate integration of tools and processes across an organisation.

Patsavellas et al. (2021) present cost savings and improved organisational models as two of the main benefits associated with control towers. By using a statistical method rather than having a more reactive trial and error approach, a control tower can draw more accurate conclusions from unstructured data and thereby contribute to cost savings. The authors further explain that as a control tower provides a common platform for data, it aids in connecting different silos within the organisation and hence improves the organisational model. Patsavellas et al. (2021) also present multiple challenges that an organisation can encounter in relation to the operation of a control tower. Depending on the extent to which the control tower allows manual inputs to the system, the accuracy of the data and consequently the associated analysis may be undermined. The authors also highlight that the collaboration between the involved stakeholders can pose a challenge since a lack of collaboration may result in an unwillingness to be transparent and share data.

2.3 Retail Planning Environment

Retail is pointed out as an industry of high complexity because of the need to often manage multiple brands and marketing channels targeting different customer segments (Agrawal & Smith, 2015). Hübner et al. (2013) further emphasise the retail industry as a planning environment of high complexity by explaining that planning decisions within retail need to be separated into multiple parts due to aspects such as variations in horizons, decision frequencies, and aggregation levels. The authors also state that due to the complexity, doing all planning tasks neither simultaneously nor entirely sequentially will be suitable to optimally plan a retail SC. Agrawal and Smith (2015) argue that home furnishing is considered one of the retail sectors with the highest complexity, partially due to the large number of SKUs and the interrelationships between them, the authors explain. The authors further present that the retail industry has traditionally provided the context for extensive research within operations and inventory management but has more recently also received increased attention from SCM research. Agrawal and Smith (2015) describe that the increased focus on retail within SCM is derived from several factors: hyper-competition in the retail industry, emergence of multiple retail formats and distribution channels, a trend towards globally dispersed retail networks, and a better understanding of the importance of collaboration in the extended SC. These factors combined with the traditional characteristics of the retail industry make assortment selection and SCM decisions especially challenging tasks calling for new solutions (Agrawal & Smith, 2015).

2.3.1 Home Furnishing Retail

A retail assortment can be divided into categories based on several factors, such as physical characteristics, prices, perishability, and seasonality (Agrawal & Smith, 2015). These categories could, for example, be furniture, accessories, and food. The authors expect strong demand interactions across SKUs within these categories, for example because many SKUs may function as complements or substitutes for each other, whereas demand interactions across categories are expected to be lower. Agrawal and Smith (2015) explain that the assortment within home furnishing retailing specifically, must address two marketing objectives: to provide customers with an assortment as complete as possible and to enable attractive presentations of products. Retailers typically display several brands, and it is therefore important to offer a comprehensive set of articles from the brands, respectively (Agrawal & Smith, 2015). The authors also explain that as the presentation of products is likely to drive customer demand, it becomes important to present the products as they are actually arranged in a real context to achieve the best promotional effect. These two marketing objectives demonstrate the importance of product availability to the retail industry, in terms of both achieving a successful advertising impact and enabling sales of interdependent products.

Agrawal and Smith (2015) clarify that the products promoted in one of a home furnishing retailer's channels constitute only a small share of the total product offering. The authors specify that presentations in stores and catalogues can be updated with a frequency of 30 days depending on the season of the year, while the total product assortment does not change to the same extent. However, the products with demand patterns that are largely dependent on season or trend can change with the same frequency as the presentations (Agrawal & Smith, 2015). The authors continue by explaining that some products may be removed from some sales channels but continue to be offered through other sales channels, which causes additional constraints on assortment planning and SCM. Home furnishing retailers generally do not include optimisation of SC costs as a part of their product development and assortment selection process, and sourcing costs and financial outcomes are therefore also classified as constraints (Agrawal & Smith, 2015). Instead, SC decisions are typically made by a sourcing team that is separated from the functions managing the product design and assortment with the responsibility of achieving effective SCM regardless of which assortment is chosen. The authors point out that the division of responsibilities for optimisation of SC costs, product development, and assortment selection is known to be sub-optimal, but that it remains because of the complexity of the decisions. The authors also note that the importance of how products are presented applies for other retail areas as well, and that the concept thus can be generalised.

2.3.2 Retail Planning Processes

Agrawal and Smith (2015) present an outline for a typical planning process for a retailer. The first step in the process is assortment selection where the teams responsible for the product range and SC planning both determine the assortment and perform financial analyses to ensure that sales targets are met by performing a top-down analysis of the sales forecast. Subsequent supply plans are made for each selling unit and new sales forecasts are generated for each selling unit using a bottom-up approach. The authors emphasise that reconciliation between the top-down and bottom-up forecasts is particularly important in this step. This is because it enables either the sales targets or the assortment to be revised if the forecasts are not aligned. The sales targets are then reviewed at recurring meetings, together with targets regarding, for example, markups and markdowns, and revised if necessary (Agrawal & Smith, 2015). Decisions regarding unsold or slow-moving products are important for retailers in order to keep the assortment up to date, and the authors present markdowns at stores or through internet channels as one commonly used approach to clear the assortment of these products.

A retailer managing different brands may choose to organise its planning processes and sourcing according to the brands (Agrawal & Smith, 2015). This means that there may be separate teams managing the planning and sourcing of specific brands and that there are limited responsibilities across brands. Having separate sourcing teams is however recognised as being a disadvantage, according to

the authors. This is explained by the limited potential for achieving economies of scale when purchase orders are not consolidated into larger volumes. Agrawal and Smith (2015) continue by describing that the retail industry is characterised by a variety of nodes in the distribution network, such as suppliers, distribution centres (DCs), and stores, with multiple associated shipping routes. The large number of routes is derived from the many possible combinations of sender-receiver relations, including both direct delivery to selling units and indirect delivery via DCs.

Aside from the substantial number of routes, Agrawal and Smith (2015) present the attempt to achieve high fill-rates within transport units as one aspect adding to the complexity of the retail planning environment. The authors illustrate this by stating that it is desirable to have a transport unit dedicated to a specific store to be able to optimise the load and the transported distance, but that there is a limit to the volume a store can receive. Furthermore, the aim of achieving high fill-rates might also lead to changes to the selection of lot sizes for both transport and manufacturing (Agrawal & Smith, 2015). The combination of the many routes and the ambition of achieving high fill-rates drives a need to secure transport capacity to ensure timely deliveries (Agrawal & Smith, 2015). As one transport unit may be transporting goods for several stores, the authors explain that there is a need for both rearrangement of the goods at DCs and further distribution to the receivers. Hence, the allocation of capacity becomes more complicated and thereby adds to the complexity of the logistics planning.

2.4 Theoretical Framework

Integration is a broad concept with several different definitions depending on the perspective of integration that is referred to. SC planning is one area of application for integration which forms the general concept of integrated SC planning with the purpose of achieving integration across various functions and processes. Since integrated SC planning has a broad scope, this section aims to present the key components of integrated SC planning identified in previous research.

Kahn and Mentzer (1996) present interaction as one perspective on integration which focuses on the exchange of information. With well-developed information flows and communication between different functions within an organisation, effective integration can be achieved, the authors argue. Information exchange implies that the communication is bidirectional which thereby can be seen as an inherent part of the interaction perspective. Kahn and Mentzer (1996) also describe collaboration as a perspective on integration, which aims to achieve alignment of values and goals across the organisation and to develop collaborative behaviours. Within this perspective, the interdependency between different functions is highlighted as well as the use of common goals across the organisation to incentivise continuous relationships that aim to achieve mutual benefits (Kahn & Mentzer, 1996). Based on the above reasoning, both interaction and collaboration can be classified as two key components of integration.

Alignment has been pointed out as a characteristic of integration by several authors. For instance, Den Hertog (2019) describes integration in terms of vertical alignment of S&OP and operational and executional planning processes, and Kahn and Mentzer (1996) highlight alignment of values and goals across organisations as an essential part of the collaboration perspective on integration. Oliva and Watson (2015) address the importance of alignment to better integrate the planning and execution processes as a means to reach the organisational goals. Additionally, Mohan (2014) emphasises the importance of having aligned incentives among stakeholders for them to be willing to share information. This in turn is important since information sharing affects both trust and cooperation between stakeholders, the author continues. Furthermore, information sharing is a necessary condition for information exchange which is a part of the interaction perspective on integration (Kahn & Mentzer, 1996). This shows that alignment is both stated explicitly in definitions of integration and, from different perspectives, seen as a part that contributes to achieving integration. The attention to alignment in several perspectives on integration and planning motivates that it can be considered a third key component of integrated SC planning. Integrated SC planning consisting of several key components is supported by the conclusion that it is a multidimensional concept, drawn by Kahn and Mentzer (1996). The authors motivate this by stating that both information exchange and involvement, which means a combination of interaction and collaboration, are needed in order to achieve successful integration. This is important since an isolated focus on interaction risks resulting in a reinforced silo-mentality because the departments may view the interactions as individual transactions and therefore try to maximise their own value from them.

Building upon that integrated SC planning is a multidimensional concept, the dimensions included in the maturity model for S&OP processes developed by Grimson and Pyke (2007) can also be used to describe integrated SC planning. The original maturity model includes five dimensions: meetings and collaboration, organisation, measurements, IT, and S&OP plan integration (Grimson & Pyke, 2007). The fifth dimension focuses on the interface between the production plan and sales plan and is according to the authors dependent on the other four dimensions in the model. This dimension shows that the maturity model has a strong connection to integration and indicates that the model could be applied to integration in a broader meaning, involving interfaces between other types of plans as well. Besides the model's direct connection to integration, Den Hertog (2019) emphasises that S&OP is central in coordinating planning processes and thereby of high importance in achieving integrated planning. According to the author, S&OP functions as a facilitator in aligning planning processes. This further supports the application of the maturity model on integrated SC planning.

The dimensions in the maturity model include detailed aspects regarding what is associated with different levels of maturity and by making adjustments to the content of the model that shift the focus

from S&OP to integrated SC planning, the model can be applied from the perspective of integration. The adjustments that have been made to the model in this study involve both the exclusion of the term S&OP, including the fifth dimension being referred to only as "plan integration", and minor reformulations intended to make the content more general, see Table 2.

Table 2. An adapted version of the maturity model presented by Grimson and Pyke (2007) from the perspective of integrated SC planning.

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Meetings & Collaboration	• Silo culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff pre-meetings • Some supplier/customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organisation	• No planning organisation	• No formal planning function • Components of planning are in other positions	• Planning function is part of other position: Product manager, SC manager	• Formal planning team • Executive participation	• Throughout the organisation, planning is understood as a tool for optimising company profit
Measurements	• No measurements	• Measure how well operations meets the sales plan	Stage 2 plus: • Sales measured on forecast accuracy	Stage 3 plus: • New product introduction • Planning effectiveness	Stage 4 plus: • Company profitability
IT	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralised information • Revenue or operations planning software	• Batch process • Revenue & operations optimisation software – link to ERP but not jointly optimised • Workbench	• Integrated optimisation software • Full interface with ERP, accounting, forecasting • Real-time solver
Plan integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives operations • Top-down process • Capacity utilisation dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans – tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimisation for whole company

The five dimensions correspond well to the three identified components of integrated SC planning: interaction, collaboration, and alignment. For instance, both collaboration and the dimension of measurements emphasise the value of common goals and objectives. Furthermore, the dimensions of both IT and plan integration include alignment across the organisation as a key aspect. Another example of the correspondence between the components and the dimensions is that the key component interaction shares a focus with the dimension of meetings and collaboration regarding information exchange, communication, and contact points. The adapted maturity model can thereby provide a comprehensive description of integrated SC planning, implying that the different levels of maturity can measure the potential for integration. A more detailed description of integrated SC planning in terms of these five dimensions allows for a concretisation of what integration of planning processes entails within individual organisations and facilitates the identification of how to increase the integration of planning processes. Furthermore, a high level of maturity within the different dimensions indicates that there is a high potential for achieving integrated SC planning.

3. Methodology

The methodology of this study has been developed for the purpose of exploring how integration of the planning functions at IKEA can improve their short-term capacity planning. It was initiated with a problem formulation, followed by research design, a literature review and development of a theoretical framework, data collection, and lastly data analysis. This chapter will present the research design and the subsequent steps of the methodology.

3.1 Research Design

This master's thesis was performed as a case study at IKEA with the purpose of acquiring deep knowledge about their planning functions to enable identification of improvement areas. Bell et al. (2019) explain that a case study aims at understanding a selected case in depth and that it typically includes one to two units of analysis. Denscombe (2018) adds to this by stating that a case study is suitable when studying some aspects in detail as it allows for relationships and processes to be explored. This supports the choice of having a case study as a research strategy to explore the potentials for integration of the planning functions at IKEA. As a case study concerns the specific nature and complexity of the selected case company, the collection of data and the individuals included in the case study should be based on the appropriateness for the issue under investigation (Bell et al., 2019).

This study was initiated with a deductive approach as a literature review was conducted aimed at developing a theoretical framework for SC planning. Dubois and Gadde (2002) describe a deductive approach as using current theory to develop propositions to be tested in a real-world context. The study was also pragmatic in nature, focused on how literature could be applied in the context of integrated planning. Russell (2013) describes a pragmatic approach as focusing on application and context as well as usefulness. Additionally, the models and frameworks used in pragmatic research focus primarily on key issues, relationships, and contexts (Russell, 2013). The literature review identified a maturity model for S&OP developed by Grimson and Pyke (2007) with S&OP plan integration being one of its inherent dimensions. Following the pragmatic approach, this maturity model was adapted to the concept of integrated planning as it had a clear connection to integration. The adapted maturity model was used as a framework to structure and analyse the empirical data according to its five dimensions.

The literature review was followed by data collection which aimed to provide information about the current state of the planning functions and processes at IKEA. Fulfilling the aim of exploring how integration of the planning functions at IKEA can improve their short-term capacity planning requires detailed information about the planning functions demand planning, need planning, and capacity planning. The identification of potential benefits of integrated SC planning at IKEA as well as related

facilitators and obstacles also requires information about the planners' perceptions of the strengths and challenges related to the planning functions. With this as a background, a qualitative approach was chosen. Since the required information regards subject matter expertise and aspects of human experience, semi structured interviews were considered an appropriate method for the collection of data. The interviews were conducted with stakeholders connected to the different planning functions as the purpose of the interviews was to acquire an understanding for the planning processes within the planning functions. The individuals included in the case study were either directly or indirectly connected to the planning functions of focus. Data was also collected through internal documents, and the information obtained from both sources resulted in a case description of IKEA. This part of the methodology had more of an inductive nature in that it focused on gathering information that could serve as the basis for further analysis and development of the planning processes at IKEA. This is in line with an inductive approach which Dubois and Gadde (2002) explain relies on theory systematically generated from data. The last step of the methodology was data analysis which was performed using a model of analysis, including both respondent validation and a workshop. The literature review, data collection, and data analysis are further described below.

3.2 Literature Review

A literature review is a critical examination of previous research relevant to a specific subject (Bell et al., 2019). To establish a foundation for the thesis and the analysis of the potentials for integrated SC planning at IKEA, a literature review has been conducted to compile existing research relevant to the current study. The literature review was initiated with a broad scope to provide background knowledge and increase the understanding of the subject. The literature review was narrowed down based on both the initial findings in the literature and consultation from the supervisor who provided guidance for further literature search with regard to relevant subjects as well as specific academic journals and articles. The literature review covered descriptions of different planning levels including the established S&OP concept and the emerging S&OE concept, various concepts for SC planning such as integrated SC planning and robust planning, and the retail planning environment. Furthermore, a maturity model was identified in the literature review which was then used in the analysis of the collected data. The literature review resulted in a theoretical framework that both provides an answer to the first research question and presents an adaptation of the maturity model from the perspective of integrated SC planning. A variety of literary sources was used including, for example, articles from academic journals, consultancy reports, and books. The academic articles were collected through online databases containing peer-reviewed literature, such as ResearchGate, Scopus, and ProQuest. The search for literature was based on specific keywords relevant to the subject of integrated planning. Main keywords used to retrieve literature were, for example, "S&OP", "S&OE", "Supply chain planning", "Integrated planning", and "Retail planning environment".

3.3 Data Collection

According to Brinkmann and Kvale (2015), the subject matter should be the determining factor in the choice of research method. The authors further explain that interviews are a suitable method when the subject matter is of an exploratory nature rather than, for instance, focused on hypothesis testing. As presented in "3.5 Research Design", interviews were considered an appropriate data collection technique and were conducted with the purpose of developing an understanding of how the planning processes function in practice and gathering input regarding encountered problems. In order to collect this information, the interviewees had to meet several selection criteria. One criterion concerned that the interviewees should have a direct connection to the planning functions of focus in this study. Another criterion regarded selecting interviewees with different professional roles within the organisation, including both process developers and individuals working directly with the operational processes. This was important to achieve both a holistic perspective and a more detailed perspective of the processes. An additional criterion was to interview individuals with technical knowledge about the systems used by the planning functions, in order to obtain information about the feasibility of potential improvement areas. To be able to ask questions about potential challenges that are encountered in connection to the planning processes, the interviewees needed to have experience covering an entire planning cycle and its subsequent effects.

Interviews were held with process developers within IKEA and information regarding their roles as well as the date and the duration of the interviews are presented in Table 3. All interviews were conducted in the form of video conference calls using Microsoft Teams due to the geographical dispersion of researchers and interviewees. Both researchers participated in all interviews.

Table 3. The roles of the interviewees, and the topic, date, and duration of the interviews.

Interviewee role	Topic	Date	Duration
Process Developer for the Manage Order Process	The potentials of flexible and manual order management to improve short-term planning.	2022-02-23	100 min
Process Developer within DORS	Data management within DORS and across the processes it is connected to via input and/or output.	2022-02-28	110 min
Process Developer for the Plan and Manage Delivery Process	The connection between planning and execution of plans, and booking of transports for delivery.	2022-03-08	95 min
Process Developer within Capacity Planning	The key processes within capacity planning and its connection to other functions via input and/or output.	2022-03-09	90 min
Process Developer within the Need & Balancing Process	The centralised constraint planning process and the connection between need planning and capacity planning.	2022-03-14	110 min

Brinkmann and Kvale (2015) explain that a high degree of structure in an interview guide will result in material that is easy to structure and analyse, while a low degree of structure to a larger extent generates unprompted answers. Therefore, the interviews were semi structured in order to capture valuable insights while still allowing for a structured analysis. More specifically, this means that the interviews were based on a predefined list of main questions with associated sub-questions to guide the interview. This allowed for a flexible approach where the questions could be tailored to the individual interviewees' areas of expertise to enhance the information gathering.

The interview guide was divided into seven main sets of questions. The first set of questions focused on the interviewee's role and how it connects to short-term planning. The second set of questions aimed at creating an understanding for how the different plans are used, what business decisions are made based on them, and potential challenges related to the usage of the plans. The next set of questions concerned the planning characteristics, such as time horizon, level of detail and planning objects, as well as measurements used to evaluate the outcome of the plans. The fourth set of questions addressed how the planning is performed and included questions about the input and tools being used. A subsequent set of questions followed, investigating which working methods are being used in the planning processes. The sixth set of questions aimed at exploring improvement areas within the short-term planning processes. The last set of questions then focused on concluding the interview and obtaining the interviewee's perspective on having a common short-term planning process. A more detailed description of the interview guide can be found in Appendix B.

To both achieve a comprehensive view of the current planning functions and processes, including details not captured in interviews, and verify the information obtained in interviews, data also needed to be collected from the IKEA intranet. Documents that have been accessed through the intranet contain primary data related to aspects such as IKEA's organisational structure, their processes, and the performance measurements they use. One type of internal documents which has been used is standardised documentations of processes, their purpose, and involved stakeholders. This type of document is referred to by IKEA as working methods, working instructions, and task descriptions. Other information accessed through the intranet is of more descriptive nature, which has been produced primarily for educational purposes and for enhancing the understanding of the various functions among employees. Common to all internal documents accessed through the intranet is that they are frequently updated and thereby, the information within them constituted a relevant basis for the case description in this study. The use of both interviews and internal documents as sources of information generated a combination of primary and secondary data in which the data complemented each other and provided a holistic view of the planning processes.

A frequently applied research criterion primarily related to quantitative studies is, according to Bell et al. (2019), validity which refers to the integrity of the conclusions drawn from the research. Credibility and confirmability are corresponding concepts applicable to qualitative studies (Bell et al., 2019). Credibility refers to how trustworthy the findings of a study are, and confirmability refers to the level of objectivity applied when collecting the data. In order to achieve confirmability, notes were taken during the interviews to enable the interviewers to identify the need for specifying or interpreting questions. Specifying questions aim to receive more precise descriptions while interpreting questions are asked to ensure that the interviewer has interpreted the answer correctly (Brinkmann & Kvale, 2015). To further increase the confirmability of the information, audio recordings were used and the interviews were transcribed afterwards. Since the prestudy was internal and aimed at improving the processes at IKEA and the work of the people involved, the incentives for the respondents to withhold or distort information was reduced. These aspects, which improve the confirmability, in combination with the information obtained from internal documents imply that the credibility of the information obtained in the study is high.

3.4 Data Analysis

The model of analysis includes the data used as input and the outcome associated with each of the three research questions, and it is illustrated in Figure 1. The first research question was answered in the theoretical framework based on literature, including definitions of integration and integrated planning and descriptions of how integrated SC planning can be applied. The data analysis initially encompassed a comparison of multiple definitions and was followed by development of a broad view of integrated SC planning as a concept. To achieve a comprehensive view, the definitions were combined with components of integrated SC planning found in frameworks describing how to apply and enhance integrated SC planning. The second research question aimed to identify potential benefits of integrating the SC planning at IKEA. The related data used to accomplish this comprised general benefits associated with a higher degree of integration combined with challenges in IKEA's current state. The data was analysed by first listing the current problems acknowledged in interviews to enable an identification of the main challenges based on their frequency of occurrence. The identified main challenges were then compared with both the key components of integrated SC planning identified through the first research question and the general benefits of integrated SC planning. Since the identification of potential benefits of integrated SC planning at IKEA took the company's main challenges and needs for improvement as a starting point, the answer to this research question was mostly empirically driven.

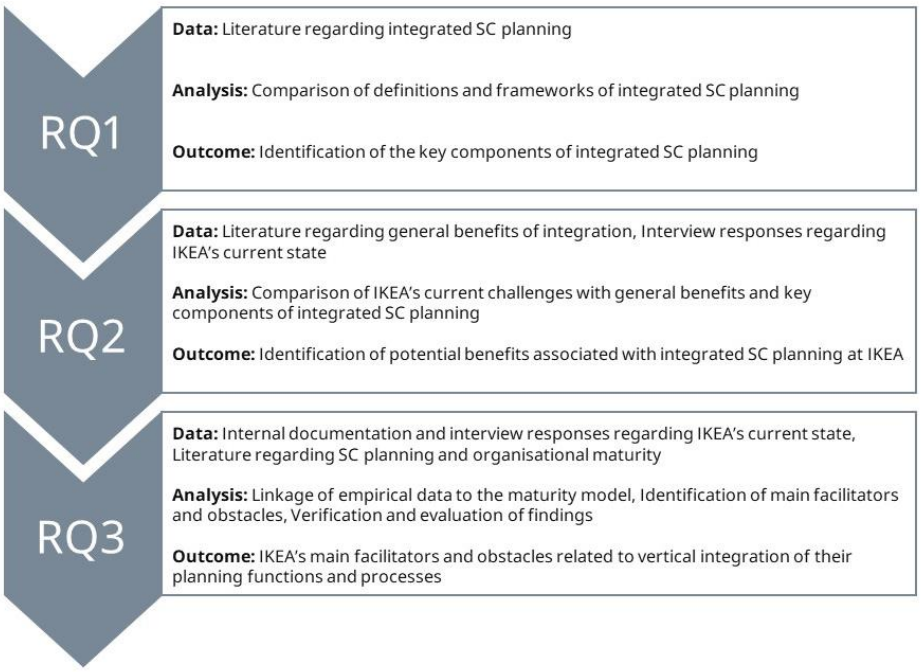

Figure 1. The model of analysis for the case study.

The data analysis associated with the third research question was also empirically driven to a large extent. It was initiated by linking the empirical data regarding IKEA and their planning processes with the five dimensions of the maturity model adapted for integrated planning. Building upon this, the analysis was continued by reviewing which aspects within the planning functions at IKEA that contribute to a heightened maturity in each dimension and which elements are missing to achieve a higher stage of maturity. This enabled an identification of potential facilitators and obstacles related to the integration of planning functions and processes at IKEA. In order to verify the findings of the analysis, respondent validation was used and a workshop was conducted. Respondent validation refers to a process where respondents confirm that the researchers' interpretations of their answers are accurate (Bell et al., 2019). The workshop was conducted with members of the S&OE team to obtain their perspectives on both the case description and the identified potentials for integrated SC planning. The workshop was initiated with a brief presentation of the initial findings, followed by a session where the participants were encouraged to discuss and assess the findings by contributing with their insights and previous experiences related to the subjects of the findings. The potentials for further analysis that were endorsed in the workshop formed the basis for the selection of what to investigate further in the study. In addition to this, meetings have also been held continuously with a contact person at IKEA to further validate the findings and receive input for continued analysis. Finally, the data analysis included an evaluation of the magnitude of the selected facilitators and obstacles in the context of IKEA based both on their relevance with regard to the potential benefits and on the outcome of the workshop and meetings with IKEA.

3.5 Methodological Limitations

The findings of this study have been limited with regard to three aspects: previous research, data collection techniques, and sampling issues. Academic literature on the topic of integration and integrated SC planning exists, however there is no established framework for integrated SC planning. The absence of an applicable framework resulted in a broader investigation of the concept and how it can be applied in the planning environment of IKEA. Furthermore, as previous research on the S&OE concept is limited, it became difficult to link the implications of integrated SC planning to the development of an S&OE process at IKEA. These limitations illustrate a gap in the existing research and thus call for further research within this area.

The data collection technique used constitutes a limitation in that the semi structured interviews generated partially incomparable answers, for instance regarding IT systems, which impeded a structured analysis. Furthermore, the variations in interview responses limited the possibility of performing a comprehensive analysis of the planning functions at a high level of detail. The limitations in terms of sampling issues are related to the interviewees. The interviewees included in this study do not collectively comply with the selection criteria due to a limited opportunity to autonomously decide who to interview. In particular, multiple interviewees had an indirect rather than direct connection to the three planning functions of focus in this study. Additionally, interviews conducted with process developers became limiting as the discussions tended to focus more on how the processes are intended to function rather than the actual usage of them. This led to more specific issues related to the practical application of the processes within the planning functions being neglected. To manage the limitations associated with the sample of interviewees, the workshop was an essential tool. Through involving additional members of the organisation to both validate the empirical data gathered from the interviews and confirm the resulting findings, the conclusions of this study remain valid despite the discrepancies between the selection criteria and interviewee sample.

4. Empirical Findings

IKEA is present on a global market with a strong focus on variety and low cost in their product offering. To enable a global market presence with products that fulfil the needs of a diverse customer base, IKEA has developed a broad product range. Their assortment comprises a large variety of products, including both consumables and more complex furniture. The range is divided into different business areas (BAs) which are then further broken down into smaller product groups to facilitate the management of the assortment. In order to fulfil the customer needs, the IKEA distribution network comprises fulfilment units for customer orders, mid-receivers, DCs, and a large, global, supplier base. The company owns and operates the DCs which can both function as intermediary storage points and facilitate transit flows. The main purpose of mid-receivers is to achieve higher fill-rates during the transport of goods to the customer fulfilment units.

IKEA has a core process referred to as plan and balance sales and supply (PBSS) which aims to secure a balance between sales and supply and enable product availability to the customers as efficiently as possible. The process consists of five sub-processes of which three are within the scope of this study: demand planning, need planning, and capacity planning, which are illustrated in Figure 2. All planning functions are connected to each other as they consecutively use the output from the previous process as input.

Figure 2. An overview of the planning functions of focus in this study and how they are connected.

Beginning with demand planning, its goal is to create demand forecasts that quantify the planned sales on article level. The demand planning process uses several sources of input, such as business plans, retail markets, and the process focused on developing the product offering, and creates a demand plan as its main output. As the articles specified in the demand plan cannot be purchased and stored simultaneously because of, for instance, lead times and various types of uncertainties, planning of the different needs throughout the SC is required. The main purpose of need planning is therefore to make decisions regarding what quantities need to be purchased, stored, and replenished to both fulfil the demand forecasts and reach the availability targets. The need planning process uses the demand plan as input to retrieve information about the quantity of goods that is required throughout the SC and results in a need plan for purchasing, storage, and replenishment which ensures that the demand plan can be met. The need plan then serves as input to capacity planning which is the last planning function in focus. Based on the volumes of articles that need to be produced, stored, and transported, capacity planning

determines the associated resource needs. These resources include manufacturing equipment at supplier sites, trucks, and DCs, and are managed in different applied processes within capacity planning. The plans resulting from the applied processes together constitute the output from capacity planning and are used as input to other processes. Another output from capacity planning is the establishment of framework agreements with carriers. These agreements secure capacity at a tactical level and serve as a basis for the IKEA plan and manage delivery process which on an executional level books transports according to confirmed orders.

The following sections present the empirical findings of the study based on the case description of IKEA and by applying the adapted maturity model presented in "2.4 Theoretical Framework". For a more detailed case description, see Appendix A. The model will be used to assess the maturity of IKEA in terms of potential for integrated SC planning rather than evaluating their current level of integration. The dimensions in the model: meetings and collaboration, organisation, measurements, IT, and plan integration, provide the structure for this chapter, which ends with an overview of the maturity of IKEA with regard to potential for integration.

4.1 Meetings and Collaboration

The workflow within demand planning is based on exceptions between previous forecasts and actual outcomes which are monitored on a weekly level. Need planning on the other hand has a higher frequency in their planning process. A main output from the need planning function, besides the need plan, is order proposals which serve as input to the order management process. To ensure that the subsequent executional processes base their decisions on accurate data, need planning updates the order proposals with a daily frequency. The following planning function, capacity planning, generates output in terms of capacity plans for all resource types along the IKEA SC, for instance DC short-term plans and transport short-term plans. The DC short-term plans are created every four weeks while the transport short-term plans are created every two weeks. All three planning functions thus operate with different planning frequencies which indicates that their respective processes are performed relatively independently from one another. According to the maturity model, having departments operating independently is associated with a low level of maturity in terms of collaboration.

The dimension of meetings and collaboration focuses on the human component of planning and includes the level and nature of communication. Need planning generates order proposals through a system called DSP Fulfilment and communicates them to order management. This system is also used to inform need planning when order proposals have been cancelled in the order management process due to various capacity constraints. This is an example of data being shared internally in real time, which would imply a high level of maturity in this dimension. However, the feedback is only

communicated digitally to need planning without significant human interaction. The maturity is thus reduced as there are no structured meetings in place aimed at preventing the cancellation of order proposals.

Another parameter affecting the maturity is the extent to which input is gathered from multiple sources. Within demand planning, both historical sales data and planned commercial activities are considered when forecasting future demand. Furthermore, both external factors related to macroeconomy and internal factors related to, for example, the product range are taken into account. The need planning process collects input from, for instance, demand planning, sourcing specialists, supply planners, and order management. Capacity planning is largely dependent on the supply plan received from need planning which serves as input to all applied sub-processes within capacity planning. In addition, capacity planning includes historical data as well as multiple types of data regarding the current state, such as storage capacity, container queues, and logistics flows. Accordingly, all three planning functions gather input from a broad set of stakeholders, resulting in the planning processes including multiple perspectives. It is however also of interest to what extent the obtained inputs are being used. Despite the need planning process receiving input from supply planners regarding supplier capacities and feedback regarding order cancellations from order management, a large share of the orders derived from order proposals are still being cancelled by suppliers. One reason for the cancellations is that ordered quantities exceed the capacities that suppliers have stated that they are able to provide. This implies that the need planning function does not use the inputs from supply planners and order management to an extent that achieves the desired outcome.

Within the scope of collaboration, the maturity model emphasises silo mentality as a sign of low maturity and a source of low trust in the output of others. Low trust is recognised in the connection between need planning and capacity planning. In the first step of the capacity planning process, the supply plan generated by need planning is converted from a product perspective to a resource perspective. Additionally, historical data regarding what changes tend to be made before execution is taken into consideration to adjust the supply plan. The modification to the output from need planning, made by capacity planning to increase the planning accuracy, indicates that there is insufficient trust in the accuracy of the plans, which could be derived from a silo mentality within the organisation. Another sign of silo mentality is that the planning functions share their output with external stakeholders with only limited efforts made to ensure that the output can be used for its intended purpose. An example of this is that the need planning function shares the need plan with suppliers in order to allow them time to prepare but continue to make daily changes to the need plan until execution.

A prominent case of cross-functional collaboration taking place within the PBSS process is between demand planning and need planning. When supply limitations arise that are expected to extend over

several months and the associated business impact is evaluated to be significant, need planners inform demand planners about the limitations to enable them to revise their forecasts accordingly. If the changes to the demand forecast are considered substantial, they should be communicated back to need planning. As the demand planners are required to accurately be able to assess what changes need to be communicated, well-developed collaboration between demand planning and need planning is necessary. This implies an increased level of maturity as the collaboration occurs as an integrated part of the planning process rather than isolated instances.

To summarise, the planning processes at IKEA are performed relatively independently of each other which implies a lower level of maturity according to the model. Despite this, information is being shared between the planning functions in real time and they use multiple sources to collect input to their respective planning processes. A form of collaboration related to information sharing is the communication around supply limitations between the demand and need planning function. The information sharing and cross-functional collaboration indicate a higher level of maturity with regard to meetings and collaboration. The real-time information is however communicated without significant human interaction and the use of inputs does not always result in the desired outcome. Signs of silo mentality have also been identified across the planning functions. These aspects lower the maturity with regard to potential for integration and result in IKEA being positioned at the third level of maturity in this dimension.

4.2 Organisation

All planning functions follow some structure, either in terms of the planning processes or with regard to how they are organised. The demand planning function has a structured forecast cycle consisting of four steps: check exception, improve forecast model by cleaning historical data, update future market information, and finalise forecast. The demand planners monitor exceptions regularly and have specific working methods to handle special cases, such as forecasting the demand for new products. They also have differentiated frequencies related to exception management for different products based on, for instance, inventory value and demand pattern. Within the need planning function, the planners are organised according to categories of products where the articles share the same material, production technique, or supplier base. The need planners are responsible for a variety of tasks including management of inventory levels and safety stock and collaboration with stakeholders. The division of planners into categories enables them to focus on a limited part of the range and thus minimises the number of stakeholders to be in contact with. Need planners are also assigned to lead groups that perform centralised constraint planning (CCP) which can be seen as a separate formal process with its own purpose and responsibilities.

Capacity planning with its one generic process and related applied sub-processes result in several plans. These applied sub-processes concern physical resources of varying flexibility and result in various levels of aggregation of the capacity allocation within the plans. The capacity planning function collects data from several sources which serves as input to the different applied sub-processes. The sharing of data is to a large extent automated using different IT systems but also includes more manual elements. For instance, the operational warehousing capacity process uses input from the process define optimal replenishment solutions (DORS) which has been manually transferred into a common tool called transport forecast plan (TFP). From an organisational perspective, it can be stated that all three planning functions have formal processes with dedicated teams carrying out the planning processes. Especially the need planners have defined formal responsibilities for specific parts of the range as a means of increasing efficiency. The maturity model associates formal teams responsible for the planning process with a standard to high level of maturity, although a high maturity also requires participation from the executive level. The planning processes at IKEA do not involve executive management but receive the support that is needed in terms of both resources and mandate for decision making.

The level of maturity with regard to the organisational dimension is also dependent on the degree of organisational understanding. The collaboration between the demand and need planning functions in terms of the bidirectional communication regarding product availability and capacity limitations is one aspect which can increase the organisational understanding. Need planners acquire an understanding of the demand planning processes based on the information they communicate to demand planners. In contrast, demand planners communicate with need planners based on the knowledge they already have of the need planning processes. This implies that the quality of information sharing from demand planning to need planning depends on the demand planners' autonomous understanding of the need planning function. Another aspect that may influence the organisational understanding at IKEA is that the identified constraints in the operational warehousing process are communicated by capacity planners to relevant internal stakeholders. This can increase other functions' awareness of what the capacity planning processes entail and what their main bottlenecks are. According to the maturity model, if the planning processes are understood and respected by all parts of an organisation, the organisation is considered to have reached a high level of maturity. The highest level of maturity means that the planning processes are understood as a tool for optimising company profit.

To conclude, IKEA can be classified as having a standard level of maturity in terms of formal processes and responsibilities, as a higher level of maturity would require participation from the executive level. The collaboration between demand planning and need planning displays a higher level of maturity with regard to organisational understanding. The understanding of the importance of sharing information regarding limitations to improve the plans indicates an awareness of how planning affects the company's results. Combining these two perspectives within this dimension, IKEA can be considered

to be at maturity stage four in terms of organisational potential for achieving integration of the planning functions.

4.3 Measurements

The maturity in terms of measurements is derived from both the specific measurements used and the intention behind them. The demand planning function is evaluated based on its forecast accuracy, which refers to the difference between the forecasts and the actual sales. The two main KPIs used to evaluate the need planning function are product availability and on time delivery (OTD). How product availability is defined and measured varies depending on the location in the SC. For example, the measurement in store availability compares the number of days an article was available in store with the number of days it should have been available, while service level measures how well the availability in customer fulfilment units matches the associated forecasted demand. Related to this, the IKEA product range is divided into five categories with different availability requirements depending on the strategic importance of the products. The capacity planning function is followed up on its planning accuracy by comparing the plans stating required capacities with the actual outcome in terms of execution. Another important KPI for this planning process is capacity utilisation which includes, for example, fill-rate during transport and warehouse utilisation. As described above, IKEA uses multiple measurements including both basic and advanced elements which increases their level of maturity. However, at the second stage in the maturity model, all departments are measured on how well the sales plan is met. From this perspective, IKEA's measurements are not as cohesive as the model proposes since the measurements used for the different planning functions are relatively heterogeneous. The heterogeneity is further emphasised by that demand planning and need planning are measured on article-level while the measurements associated with capacity planning are expressed in terms of resources.

At the third stage in the maturity model, planning accuracy is included as a performance measurement with the intention of holding planners accountable for their output and incentivising the incorporation of feedback. Demand planning is held accountable for their forecasts as the use of forecast accuracy as a measurement is complemented by a further examination of potential deviations. It is determined through analysis whether a low forecast accuracy stems from an unexpected change in demand pattern or a low forecast quality, thus uncovering potential improvement areas within the process. Need planning on the other hand is not held accountable for its planning accuracy. One of its main objectives is to generate order proposals but it is the order management process rather than the need planning process that is measured on order accuracy. This performance is currently considered to be low which is partially explained by the use of flex orders in the order management process. Flex orders serve the purpose of increasing the fill-rate in transports by manually sending future orders earlier than planned. However, the low order accuracy is also partially derived from the output of need planning being

insufficient as a share of the generated order proposals are not executable. This is due to exceeded capacities associated with suppliers, transport, or warehousing, and are therefore supplemented by manual orders.

At the highest stage in the S&OP maturity model, the entire organisation should be held accountable for the company's profitability. When the model is applied in a broader context, the measurement of common focus does not necessarily have to be profitability but any core objective of the company. Within IKEA, a core objective is to provide customers with products in a sustainable manner and through their tool democratic design they further emphasise the importance of sustainability for their vision. Therefore, in the context of IKEA, maturity could also be tied to the collective responsibility for sustainability. The demand planning function is indirectly accountable for sustainable operations as a high demand forecast accuracy can aid in avoiding overcapacity and overproduction. Capacity planning is measured on capacity utilisation which directly affects, for instance, the number of vehicles used and the amount of emissions. The capacity planning function is thus held partially accountable for the sustainability of IKEA and is consequently incentivised to prioritise it. On the contrary, the measurements used in relation to need planning counteract sustainability as the main KPIs put emphasis on timely deliveries rather than efficient transports. The current state thus entails a partial responsibility for sustainability among the planning functions at IKEA. However, the responsibility is not collectively shared by all functions which reduces the maturity with regard to this aspect.

To conclude, IKEA has established measurements for all three planning functions covering a broad spectrum of aspects, however, this also entails a certain heterogeneity regarding what is being prioritised within the organisation. For instance, there is no collective responsibility for sustainability across the planning functions. Furthermore, the planning functions are held accountable for their plans to a varying degree, from not having planning accuracy as a KPI to structurally following up the accuracy of plans. This positions IKEA at the second level of maturity in the dimension of measurements.

4.4 IT

The more technical dimension in the maturity model, IT, concerns both which tools are used and the application of them. A standard level of maturity in this dimension is associated with centralised information and the maturity increases with the degree of seamlessly shared information. Demand planning uses a system called DSP Demand, which is a part of a demand and supply planning platform used within IKEA, to create forecasts for individual demand forecasting units which specify what, where, and when to sell the products in the future. The collective use of this system by the demand planners means that information is being stored and shared centrally within the demand planning

function. Need planning uses DSP Fulfilment to primarily create and communicate order proposals to order management. The system is also used to perform safety stock calculations and constraint planning based on parameter values that are continuously updated to maintain the reliability of the plans. While the use of the system may offer opportunities as it is part of a platform which is common within IKEA, it has limitations in terms of only being able to include one level of constraints, which currently is supplier capacity.

IKEA also has an enterprise supply planning (ESP) system that is used, for instance, by supply planners to compile data regarding the quantities suppliers are able to provide and related sender lead times. ESP is connected to DSP Fulfilment and provides input to need planning in terms of both the information collected by supply planners and information about risks related to supplier capacities. As the connection allows data to be accessed in real time, it facilitates the automated need planning process and enables real-time decision making and optimisation. Supplier data also functions as input to the one supplier capacity process (OSCP) which is one of the applied sub-processes within capacity planning. Supplier-specific data is retrieved by supply planners and consolidated through the OSCP into a global plan for production capacity. This consolidation of information from various data sources can be seen as comparable to the consolidation of information from different spreadsheets in the maturity model, which corresponds to a low degree of maturity. The capacity planning process also uses data stored in TFP related to transport needs in volumes as input to the operational warehousing capacity process to create DC short-term plans in TFP. As TFP is a common tool with information regarding transport, it provides a link between the operational warehousing capacity process and the transport planning process.

One aspect the maturity model addresses within the IT dimension concerns the use of optimisation software and the optimisation of plans. The DORS process both designs and implements solutions aimed at optimising the flow in the SC in order to increase availability and reduce costs, which would correspond to a high level of maturity according to the model. The required inputs to perform this process include, for instance, information about inventory and safety stock levels as well as supply plans defining needed volumes and article overstock limits. Both the need and capacity planning functions exchange information with DORS. However, the level of maturity with regard to IT and data handling is reduced as the output from DORS is only included in the planning processes manually.

To summarise the maturity within the IT dimension, the planning functions use several systems that to a certain extent are connected to each other to share information but that does not necessarily mean that the information is stored and shared centrally. This can be compared to consolidating information from multiple spreadsheets which corresponds to the second level of maturity in the model. However, as the systems are used by several planners and processes, the need for manual consolidation is reduced,

indicating a slightly higher maturity in this respect. Related to the optimisation aspect within the IT dimension, the DORS process is focused on optimisation which would imply a higher level of maturity. Since the optimisation process does not reach its full potential due to a low maturity in terms of IT and data handling, it does not have a significant impact on the maturity level within this dimension. Based on the above reasoning, IKEA is positioned at the second level of maturity with regard to IT.

4.5 Plan Integration

The fifth dimension in the maturity model, plan integration, focuses on the interface between the production plan and the sales plan and on how they are aligned. Stage two in the model means that an organisation has an interface between the sales plan and operations plan but that the interaction between them follows a unidirectional process where the sales plan drives the operations plan. This illustrates a sequential approach which, if combined with some adjustments made to the plans based on operational information, increases the maturity to a standard degree. The planning processes at IKEA can be considered linear since each process receives input from the previous process and generates output that is used in the subsequent process. This implies both a unidirectional and sequential planning process, indicating that IKEA has a low to standard degree of maturity with regard to this aspect. As the demand planning function generates forecasts for the planned sales that subsequently steer the need and capacity planning processes, the planning at IKEA appears to be performed top-down with the development of demand forecasts being at the top. This approach corresponds to the second level of maturity in the model at which available capacity is not taken into account.

Despite the approach being mainly sequential and top-down, there are examples of existing feedback loops connected to the planning processes. For example, demand planning follows a mainly sequential approach but when long-term deviations are concerned, demand plans are revised and communicated back to need planning. Feedback loops are also present between need planning and order management regarding order cancellations, which provide the foundation for the updates of order proposals. Furthermore, capacity planning uses historical data from the executional processes, regarding general discrepancies between the output of need planning and the actual execution, as input to adjust the supply plan. The use of feedback loops enables both information to be included earlier in the planning processes in order to improve the quality of plans and learning from processes later in the sequence. This implies that the planning processes also include a bottom-up perspective to a certain degree which is one of the criteria for the third level of maturity within plan integration.

At an advanced level of maturity in the model, the plans are developed collaboratively. This process includes taking consideration to capacity constraints and results in highly integrated plans. The planning processes at IKEA currently develop plans from different perspectives with both demand and need

planning having a product perspective and with capacity planning having a resource perspective. This indicates a low alignment between the planning processes, resulting in less integrated plans, thus lowering the level of maturity with regard to this aspect.

In summary, the planning at IKEA follows a unidirectional and top-down approach where demand forecasts resulting from demand planning steer the subsequent planning processes. This indicates a maturity corresponding to at least level two in the model. The addition of feedback loops to manage long-term disruptions and to communicate constraints increases the maturity one level. IKEA is therefore considered to have reached the third level of maturity with regard to plan integration even though the planning processes have different perspectives as the alignment of perspectives is primarily associated with an advanced level of maturity.

4.6 Summary of the Maturity of IKEA with Regard to Integrated Supply Chain Planning

This section summarises the maturity of IKEA with regard to the potential for an integrated SC planning based on the reasoning in the previous sections of this chapter regarding the level of maturity within the five dimensions of the model. For an illustration of the maturity of the planning processes at IKEA, see Table 4. Within the dimension of meetings and collaboration, the maturity of IKEA corresponds to the third level in the model. The identified silo mentality in combination with the planning processes having different planning frequencies and being relatively independent of each other lower the level of maturity while the sharing of real-time data and the use of multiple sources of input increase the maturity. Additionally, the cross-functional collaboration related to information about supply limitations corresponds to a higher degree of maturity.

With regard to the organisational dimension, IKEA is considered to be at a maturity corresponding to level four in the model. The formal planning processes and responsibilities correspond to a standard degree of maturity but the collaboration between demand and need planning regarding product availability and capacity limitations improves the organisational understanding and thus increases the level of maturity. Furthermore, the understanding of the importance of information sharing to improve the plans also indicates a higher level of maturity. In terms of measurements, IKEA is positioned at the second level of maturity. This is mainly motivated by the large diversity in what the measurements evaluate which complicates a collective responsibility for the performance across planning functions. Additionally, the planning functions are held accountable for their plans to a varying degree.

IKEA is also considered to be at a maturity corresponding to the second stage in the model in terms of IT. This is explained by the use of different systems by the planning functions, resulting in information

not being stored and shared centrally. However, as the IT systems are used by several planning processes, the need for manual consolidation is reduced to a certain degree. Lastly, IKEA is classified as being at the third stage of maturity within the dimension of plan integration. This is motivated by the planning processes primarily following a top-down approach but also having feedback loops to allow for some adjustments to the plans.

Table 4. A summary of the empirical findings with indications of different levels of maturity, with the resulting stage of maturity of IKEA in terms of potential for integrated SC planning within each dimension marked in blue.

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Meetings & Collaboration	• No structured meetings with need planning and order management aimed to prevent cancellations of order proposals. • Signs of silo-mentality: capacity planning not trusting the accuracy of the supply plan and need planning sharing their output but continuing to make changes to it.	• The planning functions have different planning frequencies indicating that the processes are performed relatively independently.	• Need planning collects data from multiple sources but does not use it all as input, for example, supplier information is not fully incorporated in the creation of order proposals.	• The demand, need, and capacity planning functions incorporate data from multiple sources. • Continuous collaboration between demand planning and need planning regarding supply limitations.	• Real-time data is shared internally between need planning and order management.
Organisation			• Limited stakeholder involvement from executive level.	• Demand planning has a structured forecast cycle and determined monitoring frequencies. • Need planners are divided based on categories of products. • The capacity planning function is organised into several applied sub-processes.	• Collaboration between demand planning and need planning that favours organisational understanding. • Capacity constraints being communicated internally enhances organisational understanding.
Measurements		• The need planning function is measured on product availability and OTD but is not held accountable for the planning accuracy. • The planning functions do not have a cohesive set of measurements. • Varying responsibility for sustainability: capacity planning has a partial responsibility, demand planning has an indirect responsibility, and need planning's measurements counteract sustainability.	• The demand planning function is measured on and held accountable for their forecast accuracy. • The capacity planning function is measured on planning accuracy.		
IT		• DSP Fulfilment is limited with regard to the number of the levels of constraints it can handle. • Supplier data is retrieved separately by supply planners and then consolidated through OSCP. • Capacity planning uses data stored in TFP.	• The demand planning function stores information centrally in DSP Demand. • DSP Fulfilment is used for multiple purposes within need planning.	• Connections between some IT systems, such as ESP and DSP Fulfilment, enable access to some real-time data and certain optimisation.	
Plan integration		• The demand forecasts steer the need and capacity planning processes, indicating a top-down approach. • Capacity utilisation is not fully considered within need and demand planning.	• PBSS is mainly a sequential process in one direction. • A bottom-up perspective is applied to some degree as a result of feedback being communicated. • Limited plan integration due to demand and need planning having a product perspective and capacity planning having a resource perspective.	• A feedback loop exists between demand and need planning regarding long-term supply limitations. • Order management provides need planning with feedback regarding order cancellations. • Capacity planning uses historical data from executional processes to adjust the supply plan.	

5. Discussion

This chapter aims to elaborate on the key empirical findings in relation to the theoretical framework and is divided into three main sections. The first section discusses the potential benefits of integrated SC planning at IKEA and the second section aims to identify IKEA's facilitators and obstacles related to the integration of their short-term planning functions and the inherent processes. The third section focuses on the main facilitators and obstacles, discusses which dimensions within the adapted maturity model IKEA should focus on, and addresses the pivotal role of need planning with regard to integrated SC planning.

5.1 Potential Benefits of Integrated Supply Chain Planning at IKEA

This section describes the potential benefits of integrated SC planning that have been identified in the context of IKEA. Four main benefits are presented, elaborated upon, and together provide the answer to the second research question regarding which potential benefits integrated SC planning can bring for the short-term planning at IKEA.

5.1.1 Increased Executability of Plans

One overarching benefit of integrated SC planning in the context of IKEA is increased executability of plans. This benefit can arise both as a result of supplier capacities being taken into account to a greater extent and as a result of increased collaboration and interaction between need planning and capacity planning. Currently, supplier capacity shortage is a recurring reason for order cancellations meaning that supplier capacity limitations are systematically exceeded in the creation of order proposals. This problem arises even though the need planning function should have knowledge about agreed supplier capacities and the information should exist in DSP Fulfilment. Potential reasons for exceeding capacity limits could be that there is a perception within the need planning function that suppliers have products in stock at their sites or that need planners do not have all the information regarding supplier capacities that order management assumes that they have. If the latter is the case, it is an indication that there might be a communication issue between need planners and supply planners, which means that improved integration in this area has the potential to increase the executability of order proposals. The value of communication is also illustrated by Mohan (2014) who emphasises the importance of having an information exchange among SC actors, which in this case would apply for need planners and supply planners as well as suppliers, to improve SC coordination and performance. Another positive effect of taking supplier capacities into consideration to a greater extent in the creation of order proposals is that the probability of suppliers being put in situations where they risk violating IWAY is reduced. IWAY is the IKEA supplier code of conduct which aims to ensure that suppliers contribute to the social sustainability of their SC and thereby work actively with CSR. Situations placing social sustainability

at risk can occur when ordered volumes exceed the agreed supplier capacities to the extent that suppliers cannot ensure decent working conditions while at the same time completing the placed orders. Reducing this risk is likely to be especially important in cases where suppliers are dependent on IKEA and therefore reluctant to cancel incoming orders.

Increased integration between the need and capacity planning functions increases the chances for the plans to be executable in the plan and manage delivery process. The reason for this is that the ability to book transports in the plan and manage delivery process that meet the need is dependent on the framework agreements the capacity planning function has established with carriers. This means that if the framework agreements do not cover the actual need for transport, problems arise related to ensuring the availability of products, which become visible in the execution stage. With effective communication and consequently high integration between need and capacity planning, the probability increases that the framework agreements established by capacity planning correspond to the transport need and thereby increase the executability of the plans. Previously, framework agreements not meeting the transport need did not constitute a large problem since it was possible to get access to additional transports with short notice in the execution stage. However, as the transport market has now shifted to become a seller's market, it places higher demands on proactive planning and hence on collaboration between the functions to ensure product availability. The integration between need planning and capacity planning will also be critical if the root cause of the problem of orders not being executable arises in the need planning process. Such a situation occurs if the reason for transport capacity shortage is that the supply plan does not reflect the actual short-term need, rather than framework agreements not corresponding to the supply plan. The interaction between the two planning functions will be decisive for whether the feedback from the plan and manage delivery process regarding the identified problems will reach the need planning function. If the feedback does not reach the need planning function and the root cause of the problem is not solved, the execution processes are repeatedly forced to find temporary solutions that might be less sustainable.

5.1.2 A Reduced Silo Mentality and an Organisation Striving Towards Common Goals

A second main benefit of integrated SC planning for IKEA is an organisational culture characterised by reduced silo mentality and functions that strive in the same direction. Currently, signs of silo mentality among different functions are prominent within the organisation and have been emphasised in interviews as well as during the workshop. De Waal et al. (2019) present that integration within an organisation has the potential to reduce silo mentality. Improved integration would mean increased information exchange and interaction across planning functions and enhanced cross-functional collaboration. With these two key components of integration being more present in the organisation,

individual planning functions would become more aware of the operations of other functions, thereby reducing the silo mentality. This in turn facilitates both organisational understanding and alignment of planning processes and their resulting plans. A positive outcome of this is that it becomes easier to comprehend the roles of all planning functions and how they are connected from a holistic perspective. De Waal et al. (2019) emphasise the importance of information exchange to enable sharing of insights across the organisation in order to limit the risk of repeatedly making similar mistakes. The authors also point out that organisational learning is especially important in complex and dynamic planning environments, such as the retail industry. This further demonstrates the benefit of reduced silo mentality in the context of IKEA and also suggests that reduced silo mentality is a valuable benefit of integrated SC planning within the broader context of the retail industry.

With a reduced silo mentality, there is, according to Grimson and Pyke (2007), a potential to increase the level of trust within an organisation. This would be beneficial for IKEA as low trust is recognised in several parts of the organisation. Low trust can in turn cause low compliance since individual planners are likely to deviate from, for instance, working methods if they do not trust them or recognise the value of adhering to them. De Waal et al. (2019) highlight this by explaining that having a company organised into silos risks resulting in different functions developing unstandardised working methods which constitute an obstacle for cross-functional collaboration. Hence, reduced silo mentality as a benefit resulting from integration could also contribute to increased trust in plans and thereby improved compliance.

An increased integration involves alignment of values and goals across the planning functions, which aids in reducing the occurrences of contradictory investments and prioritisations. Integrated SC planning thereby contributes to the entire organisation working in a common direction. Striving in a common direction reduces the risk of high performance of one function undermining the efforts of another function, meaning that it increases the return on investments and ensures favourable circumstances for collaboration between planning functions. Having functions that strive in the same direction should, in the context of IKEA, focus on that all planning functions share the responsibility for ensuring both executability of plans and sustainability. A greater focus on executability can be considered a prerequisite for increasing product availability which in turn has direct implications on the company's profitability. Additionally, both product availability and sustainability are areas that coincide with the core values of IKEA. Hence, by increasing the integration of planning functions, IKEA can improve their SC performance in general and particularly in areas which are considered to be of highest importance.

5.1.3 Higher Market Responsiveness

The third benefit of integrated SC planning that has been identified in the planning environment of IKEA is that it can enable faster decision making and thereby a higher market responsiveness. This benefit can be seen as the consequence of integrated SC planning favouring information exchange as well as visibility. With increased information exchange and a higher visibility, it would be possible to initiate planning processes that are currently sequential before the previous processes are fully completed. This is explained by the planning functions being more aware of the uncertainties the plans may contain and what changes could occur, which in turn enables the postponement of final decisions. IKEA would thus be able to initiate some preparations which would enable faster decision making and a shorter total time for all processes. This in turn has the potential to increase the ability to quickly respond to changes in the market.

Having a high market responsiveness is important for IKEA because of several factors, one being that they, for their distribution, are dependent on a volatile transport market which is currently characterised by being a seller's market. This places higher demands on the ability to react quickly to fluctuations on the transport market. Hence, a short total time for all planning processes is crucial both to achieve market responsiveness and to increase the ability to secure limited transport capacities at an early stage. Another factor increasing the importance of responsiveness is that customer demands are rapidly changing in the planning environment of IKEA as they are part of today's global retail marketplace. IKEA must therefore be able to respond to demand variations in order to meet their customers' needs.

To reach the full potential of a higher market responsiveness, information exchange should be done in real time when it is possible and has the potential to create value. Real-time data is primarily important within short-term planning and execution processes to enable adaptation to the prevailing market conditions. This is supported by Lapide (2022) who argues that as SCs are increasingly being exposed to large uncertainties, companies need to perform more quick response planning which entails an ability to make high-risk decisions in real time.

5.1.4 Larger Potential for the Development of an S&OE Process

The fourth and last main benefit of integrated SC planning that has been identified in the context of IKEA is that integration of the three planning functions demand planning, need planning, and capacity planning, can serve as a first step in the development of an S&OE process. Hippold (2019) explains that the aim of an S&OE process is to strengthen the connection between the tactical and operational level of planning. The author further emphasises the role of S&OE to connect planning with execution. The connections between these processes can also be strengthened through integration of the planning functions at IKEA. This can be done both directly by, for instance, improving the information exchange

and collaboration between planning functions, and indirectly by increasing the executability of the planning functions' output.

Integration can also be seen as an inherent part of S&OE since the possibility to link different levels of planning is dependent on the key components of integrated SC planning. Connected planning processes presuppose continuous interaction, a high degree of collaboration, and clear alignment. Furthermore, by integrating the planning functions as an initial step, and improving the current planning processes and their connections before introducing a new process, the purpose of a potential S&OE process and the problem it would intend to solve could be more clearly defined. This is especially valuable since the previous research on the concept of S&OE is scarce and the absence of a general process design makes it necessary for IKEA to create their own design of an S&OE process. Hence, integrated SC planning improves the conditions, and thus creates a larger potential, for the development of a successful S&OE process at IKEA.

5.2 IKEA's Facilitators and Obstacles Related to Integration of Their Planning

In this section, the current level of maturity at IKEA with regard to the potential for an integrated SC planning and the potentials for increasing the maturity are analysed. This is done through the identification of facilitators and obstacles related to the integration of the short-term planning functions and processes at IKEA.

5.2.1 Increasing Compliance and Trust within the Dimension of Meetings and Collaboration

The dimension of meetings and collaboration in the maturity model developed by Grimson and Pyke (2007) is presented as focusing on the human component of planning. One aspect associated with the humans in the organisation, which is not mentioned in the original model but is essential in the context of IKEA, is compliance. The degree to which individuals working within or in relation to the planning functions comply with established processes and standard operating procedures affect the integration and the extent to which potential efforts towards integration will result in the desired outcome. In interviews with process developers, the topic of compliance was mentioned briefly and during the workshop with additional representatives from IKEA it was further emphasised. In the workshop, it was expressed that a general tendency across the IKEA organisation is low compliance with their working methods and general guidelines. The value of well-structured and integrated processes is undermined if the individuals in the system do not follow the established structures which therefore makes the low compliance at IKEA an obstacle for achieving a higher level of integration.

One area in particular where low compliance is present and causes disturbances is order management where receivers place manual orders because it is convenient instead of adhering to the steps of reporting the need in DSP Fulfilment. By not allowing the orders to be generated in the system and thus be coordinated with the formally recognised need, the optimisation of the distribution of goods is impeded, potentially causing both economic and environmental losses. This obstacle of low compliance could be overcome by increasing the understanding of the value that the working methods and working instructions bring to the organisation. Another approach could be to enforce compliance by limiting the opportunities of circumventing the standard procedures. However, there is a risk that this may cause the planning processes at IKEA to become excessively rigid and consequently also limit the possibility to make exceptions in situations where they are necessary.

A current concern within the planning at IKEA is the large discrepancies between the need plan that is communicated to various stakeholders and what is ultimately executed. These discrepancies are, for instance, derived from the cancellations of orders and the associated daily generation of revised order proposals. Need planning communicates the need plan to suppliers with the purpose of allowing them time to prepare for when the actual orders are placed. However, since the actual orders tend to differ significantly from the plan that the suppliers base their preparations on, the ability for the sharing of plans to fulfil its purpose is reduced. Consequently, the suppliers are likely to trust and rely on the forecasts they are provided only to a limited extent. The discrepancies being a source of low trust is further illustrated by capacity planning finding it necessary to modify the supply plan due to a low trust in its accuracy. This step in the capacity planning process may not have been required if the discrepancies were smaller and the trust higher.

A possible approach to achieve plans that are more stable and thus potentially more trusted by its recipients is robust planning (Van Landeghem & Vanmaele, 2002). The aim of robust planning is to generate plans which remain valid for a larger range of situations and thereby allow the magnitude and frequency of changes to be reduced. Currently at IKEA, all three planning functions obtain input from a broad set of stakeholders. The ability to access information about different types of capacities and related constraints increases if input is collected from several different types of sources. With more information about which constraints exist, it becomes possible to create plans that are valid in more situations. Thereby, the use of input from a broad set of stakeholders serves as a facilitator for implementing a more robust planning approach as the diverse information creates an opportunity to acquire an understanding at an early stage regarding which limitations exist in various dimensions. With more perspectives accounted for, the resulting plans have the potential to be more stable. Robust planning is described by Van Landeghem and Vanmaele (2002) as being especially useful in the context of physically efficient SCs which generally are associated with narrow profit margins and functional

products that are characterised by long life cycles. As the products in the IKEA product range are functional and offered at a low price, resulting in relatively low profit margins, robust planning is considered a suitable approach in the planning environment of IKEA. Additionally, such an approach may be beneficial in terms of enhanced trust and integration.

With regard to robust planning, an important aspect to consider is the trade-off between robustness and flexibility. Robust planning is primarily associated with a more tactical planning horizon as it enables more time to decide how to manage potential uncertainties. However, in addition to the advantages of the development of more robust plans, there is a drawback in terms of reduced flexibility of the plans. Especially when the planning horizon is short and there is an operational focus, such as in the context of a potential S&OE process at IKEA, flexibility may be of particular value in order to be well-equipped when large disruptions occur. Lapide (2022) also emphasises the increased exposure to SC disruptions as a reason for why companies may prioritise flexibility. In contrast to robust planning, quick response planning is an approach that may be suitable to achieve increased flexibility. Quick response planning is associated with an operational horizon and focuses on flexibility and the ability to quickly make decisions based on changed settings, such as immediate disruptions. There is thus a trade-off between robust planning and quick response planning in the sense that the prior will facilitate integration within a range of anticipated variation while the latter may not be beneficial for integration in particular but will allow companies to be responsive and minimise negative impact when large unforeseen disruptions occur. This implies that the increased robustness, facilitated by the broad range of input used by the planning functions at IKEA, and the associated increased trust in plans would be achieved at the expense of flexibility and the ability to limit the effects of SC disruptions.

5.2.2 Cross-Functional Understanding and Formal Processes Facilitate Integration within Organisation

The organisational understanding present across planning functions at IKEA, which is especially prominent between demand planning and need planning, increases the ability of functions to recognise that the plans received as input are not definite and thus may change. Understanding the process which generates the input also provides an understanding for what factors may cause uncertainties and changes. Consequently, with a higher level of cross-functional understanding, the planning functions would be able to more accurately estimate the magnitude of various risks and handle delivered plans and their associated uncertainties without necessarily requiring an updated version as frequently. Cross-functional understanding thus serves as a facilitator for the sharing of plans which are characterised by uncertainties to some extent, which implies that plans with longer time horizons can be shared. A potential positive effect from the sharing of plans with longer horizons is that it enables the sequential planning processes to proceed at a faster pace. This creates, for instance, opportunities for capacity

planning to establish framework agreements for transport capacities and the executional plan and manage delivery process to book these capacities at an earlier stage. Enabling the securing of transport capacities well in advance both aids IKEA in the management of the transport market in situations when the transport providers have a power position and increases the probability that orders will be executable by the plan and manage delivery process.

A common response to high uncertainties in input when the organisational understanding is low is to add high safety margins to the plans, a phenomenon often referred to as the bullwhip effect as the discrepancies grow with each iteration. In the context of IKEA, this could, for instance, be to establish framework agreements for and subsequently book more capacities than originally suggested by the supply plan. This approach to manage uncertainties could negatively affect IKEA both from an economic and environmental perspective, for example by causing low fill-rates due to excess transport capacity. With a high level of organisational understanding on the other hand, the ability to estimate the level of uncertainties increases and there is an awareness of to which extent the plans can be expected to be executed. The tendency to add safety margins can thus be decreased and the bullwhip effect reduced. To be able to achieve these benefits, it is important that the organisational understanding becomes more widely spread across the functions at IKEA and thus extends from characterising individual connections to being a consistent theme.

The part of the organisational dimension concerned with formal processes and responsibilities does not entirely fulfil the criteria associated with the fourth stage of maturity in the adapted model, and IKEA is therefore positioned at the standard level of maturity in this respect. As IKEA has formal planning teams, the criteria for stage four in the model is partially fulfilled, implying that the degree of maturity is approaching the higher stage which also supports the final positioning of them at the fourth level of maturity. Within the different planning functions, there are dedicated teams for each planning process with defined responsibilities which provides a clear structure for the relationships between the planning functions and their processes. The organisational culture characterised by formal and structured processes is a beneficial condition for the use of feedback loops. In accordance with the important component of integration being the information exchange between various planning entities, feedback loops enable information flows to be bidirectional rather than unidirectional. Using feedback loops to a larger extent thus both facilitates integration and adds substantial value by contributing to increased executability of the plans. Hence, the consistently formal and structured processes with associated documentation function as a facilitator for the creation of executable plans. Well-defined planning processes and responsibilities facilitate the determination of which stakeholders should be included in the feedback loops in order for the feedback to provide valuable insight and be taken into consideration. A clear structure also facilitates the design of a feedback loop and decisions regarding what information

to be shared. Additionally, formal responsibilities allow for specific stakeholders to be held accountable for the feedback loops and the use of them.

5.2.3 Achieving Alignment and Accuracy of Measurements to Improve Performance

In relation to both alignment and collaboration as key components of integrated SC planning, having common and aligned goals and measurements across the organisation is important to achieve unity of effort. The current heterogeneity in measurements at IKEA is thus an obstacle for integration and does not contribute to a better performance for the SC as a whole. In the case of IKEA, a revision of measurements should focus on achieving a common goal in improving executability of orders, which consequently ensures availability of products at customer fulfilment units, and more sustainable operations. IKEA currently uses some measurements that benefit from, and require, functions to share information with others. This serves as a facilitator for integration as it incentivises collaboration and would therefore be beneficial to use to a greater extent. An example illustrating this facilitator is that demand planning is measured on its forecast accuracy. This KPI incentivises the demand planning function to involve other stakeholders and to collaborate with the need planning function in order to improve the level of performance.

IKEA currently has multiple performance indicators related to availability that focus on different parts of the SC, which give rise to the heterogeneity in measurements. To achieve alignment, one of these could be emphasised as a main common goal in order to obtain a cohesive perception across the organisation, both of the current performance of the planning processes and of the aspects that need to be improved. In store availability, which is a measurement displaying the number of days an article is actually available in store compared to the number of days it should be available, may be a favourable common goal as the availability of products when customers demand them is directly affecting the sales and consequently the profitability of IKEA. Regarding sustainability, capacity utilisation is an example of a currently used measurement which supports sustainability and thereby SC performance. Performing well in terms of this measurement implies a more efficient utilisation of resources and thus a limited amount of resources being consumed. However, it should be noted that this is a measurement that currently is not followed up as structured and frequently as expected given that it is presented by IKEA as one of their most important KPIs.

In addition to establishing KPIs which in theory strengthen collective goals and priorities, it is necessary to also follow up and evaluate the performance in regard to the KPIs for them to contribute to a satisfactory outcome. Otherwise, the value of the measurements may be undermined by insufficient incentives to prioritise them. An area which highlights the importance of following up on the

performance of measurements is the forecast accuracy of demand planning. Within home furnishing retail, there are strong demand interactions between products which means that if demand planning is not followed up on its forecast accuracy and does not analyse the identified exceptions, aspects such as synergies and cannibalism may be given insufficient attention. This may consequently affect later planning processes and result in significantly reduced in store availability of products.

It was acknowledged during the workshop that the responsibility for selecting KPIs is decentralised, meaning that the silo mentality is increased by allowing performance measurements to be selected independently of each other. To achieve alignment in measurements, the PBSS process should be considered holistically when deciding which KPIs to use and which performance measurements to evaluate different planning processes with. With a decentralised approach, there is a risk that functions choose KPIs which are connected to what they consider to be their main priorities and may discard KPIs which are perceived as being outside of their area of responsibility. This risk stems from that the perception regarding priorities of an individual function may not coincide with the optimal priorities. With a more centralised approach on the other hand, the decision of measurements for each planning process could be driven by what subsequent processes demand in terms of input and thus support process development and improvement that benefit SC performance. An example of where this is not currently the case is the need planning function not being measured on the executability of their order proposals despite order proposals being one of their main outputs and the significant impact the executability has on both the order management process and the resulting product availability.

Aligning the planning functions and encouraging collaboration by making them collectively responsible for availability and sustainability is a way of addressing the obstacle of heterogeneous measurements and an example of how IKEA can increase their maturity within the dimension of measurements. However, the next level of maturity for IKEA, level three, is achieved by specifically measuring sales on forecast accuracy which in the context of this study would correspond to measuring the planning functions on their processes' respective planning accuracy. With common goals and a collective responsibility for availability and sustainability, the planning functions will be held accountable for their output which is the underlying purpose for the measurements on the third level in the maturity model. Noroozi and Wikner (2016) support that this would entail an increased maturity in terms of potential for integration by arguing that cross-functional measurements specifically chosen for the unique context of the organisation can aid in facilitating integration.

Another obstacle for integration identified related to the dimension of measurements at IKEA is the use of measurements which inadequately function as guidance regarding what aspects should be prioritised or what performance should be achieved. Currently, the order management process is evaluated based on order accuracy which is a measurement that partially counteracts the holistic SC performance of

IKEA. Performance in terms of order accuracy increases if a larger share of confirmed orders is directly derived from order proposals, implying that attempts to increase the order accuracy would mean limiting the amount of sent flex orders. The concept of flex orders is associated with a certain part of the IKEA product range, referred to as the flex range, allowing IKEA to manually change delivery dates for future orders in order to send them earlier. This means that the delivery flexibility of IKEA increases with the size of the flex range, which in turn increases the potential for IKEA to achieve higher fill-rates during transport of the orders. Hence, the use of flex orders is ultimately positive from a holistic SC perspective at IKEA but discouraged when using the measurement of order accuracy. An example of a measurement where there exists ambiguity in the desired level of performance is warehouse utilisation since it is not advisable to strive for full utilisation of an inflexible resource. In such a situation, when it is not apparent what level of performance is desirable to achieve in relation to a measurement, it may be beneficial to discard or replace the measurement as it leads to fragmentation and ambiguity rather than collective efforts and integration.

In relation to this, need planning is measured on product availability and OTD while their goal is to achieve highly efficient flows of goods. This goal refers to the minimisation of goods in circulation to be able to satisfy the demand, which means that the level of efficiency affects the sustainability of the IKEA SC as fewer unnecessary transports reduces the total amount of transport resources in use and the associated emissions. However, the current measurements concern neither costs incurred nor resource utilisation in the goods flows. A risk is therefore that too much emphasis is put on the importance of goods reaching the customer fulfilment units and that the aspect of how it is achieved is neglected. An additional factor affecting the suitability of measurements is whether they have positive correlations. For instance, OTD and product availability are positively correlated as the schedule for deliveries of orders is created to ensure product availability. This means that a high performance in terms of OTD is likely to also result in a high product availability, hence the measurements do not complement each other. To conclude, the integration at IKEA in terms of the creation of common goals and priorities could benefit from replacing either OTD or product availability with another measurement that is more closely related to the efficiency of the flows and consequently the sustainability of the operations.

5.2.4 Managing Multiple IT Systems to Improve Integration and Using IT to Increase Visibility

IKEA is currently experiencing difficulties in its execution due to the order proposals generated by need planning not being executable in the order management process. This problem is partially derived from supplier capacity constraints not being taken into enough consideration. A possible solution to this problem can be found within the IT dimension. As supply planners use ESP to compile data related to

the quantities suppliers are able to provide and there is a connection between ESP and DSP Fulfilment, it should be possible for this data to be automatically shared with DSP Fulfilment. This would mean that supplier capacity constraints can be taken into account to a greater extent when planning the need and thereby reduce the number of order cancellations. The existing connection between ESP and DSP Fulfilment thus serves as a facilitator for the creation of executable order proposals. If the information entered into ESP by supply planners would prove not to be of sufficiently high quality, the feedback loop that exists between order management and need planning could be used to follow up discrepancies between placed order quantities and stated supplier capacities. This would mean that order proposals where the quantity exceeds the available supplier capacity would be identified and communicated back to need planners and subsequently to supply planners. This allows for making changes to the order proposals as soon as discrepancies are identified. It also creates greater opportunities to identify the sources of inaccurate information and thereby an opportunity to improve.

The connection between ESP and DSP Fulfilment indicates that there is a potential for DSP Fulfilment to also receive input from other systems. Additionally, as supplier capacities are part of the resource perspective, it shows that the perspective in which the data is expressed does not constitute an obstacle at present. These two aspects indicate that the current limitation mainly lies in the ability of DSP Fulfilment to handle data rather than to connect it to other IT systems. DSP Fulfilment has the ability to include only one level of constraints in the process of generating order proposals and the constraint included in the process is currently supplier capacities. This means that information regarding transport and warehousing capacities is not taken into account and that the process thus is performed based on incomplete information. This in turn leads to the identification of constraints later in the planning processes and subsequently an inability to execute the order proposals. Thus, the limitation in the possibility of only taking one constraint into consideration is an obstacle for the creation of executable order proposals.

A potential solution to the problem of non-executable order proposals is to use the feedback loop that exists between the need and capacity planning functions to a larger extent. With increased use of this feedback loop, more information regarding constraints related to transport and warehousing identified by capacity planning would be communicated back to need planning. This would allow for historical data to be compiled and stored, which in turn could enable identification of patterns regarding which capacity limits tend to be exceeded. While transport and warehousing constraints cannot be included in the automated generation of order proposals due to the limitations within DSP Fulfilment, the collection of historical data could function as a framework for need planning in the creation of order proposals. This framework could, for instance, mean that fixed upper limits for transport and warehousing capacities are included in the need planning process. It would also be of value to explore the possibility of including the fixed values in DSP Fulfilment. One aspect that indicates that it would be possible to

use historical data more as a basis for decision making within need planning is that capacity planning currently uses historical data related to previous changes to the supply plan when aggregating the supply plan into a resource perspective. With more historical data to support the need planning process, it would be possible to achieve executable order proposals to a larger extent. Subsequently, capacity planning could make a more detailed plan for the allocation of capacities and identify constraints at a more granular level based on updated data. The feedback loop between need and capacity planning also has the opportunity to increase the understanding within the need planning function regarding what challenges are encountered in the capacity planning process.

Comparing transport and warehousing capacities and related constraints, it is likely to be easier to take warehousing constraints into consideration in the need planning process. This is due to two reasons, that IKEA owns and operates the DCs within the distribution network and that warehouse capacities have a lower level of flexibility than transport capacities. Since IKEA owns the DCs and is responsible for allocating personnel to them, this capacity is known, and the information is more reliable as it is primary data. Warehousing capacities are also considered less flexible than transport capacities as the latter may vary in terms of both accessibility and the volumes of the transport resources. Accessibility has become especially difficult to estimate in today's business environment where the transport market is a seller's market. For warehousing capacities, both accessibility and volume are considered fixed within a short-term to mid-term horizon, making them easier to estimate. As the upper limit for this type of capacity is less fluctuating than the upper limit for transport, it is valid for longer periods of time and therefore probably easier to include in the planning process while also having the most reliable information. If it is not possible to take both constraints into account, it would still be valuable to include one of them as it would increase the number of executable orders.

Another aspect related to the inability of need planning to include a broad set of constraints and make a comprehensive plan is the complexity of the retail planning environment. Being active in the retail industry poses additional challenges for IKEA to create executable order proposals. The challenges are results of the planning decisions in a retail context needing to be separated into multiple parts because of factors such as different horizons, decision frequencies, and aggregation levels (Hübner et al., 2013). Agrawal and Smith (2015) support this reasoning by presenting that strong interdependencies between SKUs, a large variety of transport routes, and an aim of achieving high fill-rates are factors further increasing the complexity of the retail planning environment. Hübner et al. (2013) also explain that, because of this complexity, a retail SC cannot be optimally planned if all planning activities are performed simultaneously. Applied in the context of IKEA, this means that even if DSP Fulfilment as a system would be able to include several constraints, the need planning function would still not be able to incorporate all parameters in the entire distribution network in the development of their plans. However, it would still be of value to increase the number of constraints taken into consideration since

it has the potential of increasing the robustness of the plan. Another aspect related to this is that the capacity planning process is dependent on having data regarding all needs to be able to optimise the allocation of capacities within the plans. This means that it must be performed posterior to the need planning process and that the planning processes therefore need to be separated, which further illustrates the complexity of the retail industry.

The retail planning environment is characterised by a high dynamic complexity and a high detail complexity as there are both significant demand and supply uncertainties and many sales units to plan for. Since the retail industry has its specific characteristics, it is important that IKEA adapts its planning processes to this context. Kreuter et al. (2021) takes a starting point in S&OP and emphasise the importance for companies to design their planning processes in accordance with their contexts to achieve increased efficiency. One approach IKEA could use to manage the dynamic and detail complexities is to continue to have their planning process separated into distinct parts but to also include additional constraints to make their plans applicable in more scenarios. It is also highlighted by Kristensen and Jonsson (2018) that contexts with high detail complexity are dependent on the IT systems in place as support for integration. However, IKEA is currently at the second level of maturity in terms of IT and would, according to the model, need to store information in a centralised IT system to reach the third level of maturity. A current obstacle for improved integration of the planning functions at IKEA is therefore the use of multiple IT systems and the associated consolidation of information.

A centralised IT system could ensure that all planning processes at IKEA use the same information and thus minimise the risks related to processes using different versions of the same data. It could also reduce the risks associated with repetitive manual input such as manual errors and lower levels of detail. A common IT system could thus theoretically enhance integration at IKEA. However, it was remarked during the workshop that the possibility of implementing a new common IT system aimed at facilitating and improving the planning processes has previously been investigated but that the produced outcome has not been as successful as intended. This implies that despite the value of having centralised information as emphasised in literature, the context of IKEA may instead require a focus on systems which can communicate and share relevant information in order to make it accessible for multiple stakeholders. Regarding the objective of making information accessible, the most important aspect is what information is shared among planning functions. The focus should therefore be on what type of information different planning functions and processes require rather than specifically how the information is shared and stored. A prerequisite for improved integration, and consequently improved planning, is thus that planning functions are aware of how their output is utilised as input in other processes as that knowledge facilitates the identification of what information is required to be shared and how the shared information and plans can be presented.

Based on the premise that having one common IT system for central storage of information is not feasible in the context of IKEA, an alternative approach could be to improve the connections between existing IT systems while also reducing the number of systems. By mapping the network of IT systems currently in use, it would be possible to illustrate what purpose each individual system serves and how they are related to each other. Den Hertog (2019) presents both business processes and IT systems as important change elements associated with integrated planning and describes mapping of how processes are linked and interdependent as a tool that can be used to increase the effectiveness of an organisation. Through a mapping and analysis of the configuration of the set of IT systems, IKEA could review if the set contains multiple systems which have the same characteristics or functions. If that would be the case, some systems could be phased out in order to scale down the set of IT systems and consequently increase effectiveness and facilitate the exchange of information across the organisation.

Apart from having one IT system to centrally store information, the maturity model emphasises the importance of having a well-developed visualisation tool in order to increase the maturity with regard to the IT dimension. Visualisation as a means for increasing the maturity is also supported by Den Hertog (2019) who presents the creation of visual reports as one part of an IT systems roadmap. The visual reports can be used to combine several types of data and display them comprehensibly in cross-functional meetings. Visualisation was highlighted during the workshop with IKEA as an area of low performance which limits the organisational understanding across functions. The limited visualisation is thus potentially strengthening the silo mentality within the organisation and is consequently an obstacle for integration. In the context of S&OP, Grimson and Pyke (2007) present an S&OP workbench for sharing and visualising information as a necessary tool to reach the fourth level of maturity. Another tool which is explained in literature as beneficial for the visualisation of data is a control tower. According to Patsavellas et al. (2021), a control tower could be used as a common platform for data and to both monitor plans and report deviations. It could thereby benefit integration by connecting functions and limiting the silo mentality.

Visualisation can, for instance, be used to communicate uncertainties and increase the transparency across functions. By gathering data regarding previous plans and combining it with data regarding actual outcomes, the planning accuracy of the different planning processes can be visualised. Planning accuracy displayed, for example, as a chart where both the historical variations and the average performance are clearly visible makes it possible for other functions in the organisation that use the plans as input to easier understand the intrinsic uncertainty in their input. This illustrates how visualisation can support the development of the previously discussed organisational understanding of uncertainties and consequently reduce the tendency to add large safety margins.

5.2.5 Different Perspectives as an Obstacle to Achieve Plan Integration

Currently, the demand and need planning functions develop their plans from a product perspective while the capacity planning function applies a resource perspective on its plans. This means that the plans created in the various processes are not integrated to the extent that they can be used directly in the next process. This results in a need for translation between the product and resource perspective before the capacity planning processes can be initiated, implying that the different perspectives of the plans constitute an obstacle for plan integration.

The need planning function has a product perspective since the aim of the need planning process is to generate order proposals for products from suppliers. This leads to the need plan containing more range-specific information than what is needed for the generic capacity planning process. Capacity planning instead requires more resource-specific data with different levels of detail to be able to handle resources of varying flexibility in the different applied capacity planning sub-processes. This could, for example, be information with a high level of detail regarding time horizons for resources associated with a high flexibility and information with a lower level of detail for resources associated with lower degrees of flexibility. This means that need planning has a high level of detail from the product perspective while the applied capacity planning sub-processes demand varied levels of details related to the resource perspective. This implies that one reason for why the need plan is not adapted to capacity planning's requirements on input is that need planning has another purpose and therefore handles the information from another perspective.

Another possible reason for the different perspectives is that the individuals within the need planning function are not aware of how their output is used by subsequent processes. This could be derived from the top-down approach that exists at IKEA with plans being developed from a product perspective, following a sequential process ending with plans with a resource perspective. The fact that the planning functions do not have knowledge about how their output is used in other processes, especially that need planning is not aware of how the need plan is used by capacity planning, indicates a lower level of organisational understanding. This means that the level of plan integration is affected negatively because of deficiencies in the organisational dimension and that the organisational understanding therefore needs to increase since the basis for plan integration is that all functions understand how their plans are used by others. Plan integration is also affected negatively because of deficiencies in the measurements used since need planning is not measured on the quality of input to capacity planning. The presented reasons call for a need of integrating the planning functions to a greater degree in order for the plans to be aligned.

Although the planning functions have different perspectives, which currently constitutes an obstacle, the goal in itself does not necessarily have to be that the functions should have the same perspective. As demonstrated above, there are rational reasons for why the different functions have their respective perspectives. What is important in order to increase the level of maturity in this dimension and thereby achieve a higher plan integration is to combine the perspectives. This would entail a deeper understanding of which type of information the different functions require, which could result in both additional types of information being shared in the plans and a changed prioritisation of which data is gathered by the different functions.

5.3 Recommendations

The focus of this section is to discuss the main facilitators and obstacles that IKEA should focus on leveraging and overcoming, respectively. The section begins with a description of the key role of the need planning function and its implications, followed by an analysis of the main facilitators and obstacles at IKEA. Subsequently, the value for IKEA of increasing the level of maturity within the different dimensions of the adapted maturity model is discussed. Lastly, recommendations are provided regarding within which dimensions IKEA should focus their efforts.

Based on the as-is analysis of the current planning functions and processes at IKEA, it has become apparent that the need planning function has a pivotal role for the integration of the SC planning at IKEA. Need planning is to a large extent a tactical process as it involves the creation of plans for the products flowing through the SC which other functions act upon, but it also has operational elements such as the daily recalculation of the need resulting in a new set of order proposals in DSP Fulfilment every day. This implies that its role is multifaceted in terms of the horizon it concerns. It is also a key function due to its numerous connections with various stakeholders via either input or output, which has led to need planning already being integrated with other functions in many aspects. However, the integration is not necessarily developed to the required degree. There are therefore still areas of improvement connected to the integration of need planning with other functions, despite the multiple positive examples of integration and facilitators for integration found in relation to need planning. These improvement areas should, due to the central role of need planning, be of high priority to address in order to achieve the identified benefits of integrated SC planning at IKEA.

Related to the integration of planning functions within the short-term planning at IKEA, the as-is analysis identified a number of facilitators and obstacles which were presented in the previous section and are summarised in Table 5. Two of the identified facilitators are especially important for the integration of planning functions at IKEA: structured processes which promote the use of feedback

loops and existing connections between IT systems. Additionally, two obstacles are recognised as being particularly prevalent at IKEA: low compliance and heterogeneity in measurements.

Table 5. A summary of the identified facilitators and obstacles related to the integration of short-term planning functions and processes at IKEA with the main facilitators and obstacles marked in blue.

Facilitators	Obstacles
Input from multiple sources	Low compliance
Organisational understanding identified between demand and need planning	Heterogeneity in measurements
Structured processes which promote the use of feedback loops	Measurements that do not guide performance or prioritisation
Measurements that incentivise collaboration	The limitations of DSP Fulfilment to only include one level of constraints
Existing connections between IT systems	Using multiple IT systems
	Limited visibility
	Different functions generating plans from different perspectives

The formal processes and defined responsibilities characterising the PBSS process can be considered a main facilitator for integration as they facilitate the use of feedback loops. These feedback loops have shown to have significant positive effects in the context of IKEA as they function as a tool for overcoming obstacles. An example of this could be a feedback loop between order management and need planning used to communicate exceeded supplier capacities and thereby contributing to increased executability of order proposals. Additionally, the communication of feedback between capacity planning and need planning could generate a historical log of exceeded transport and warehousing capacity limits. This demonstrated importance of feedback loops further strengthens the intrinsic value of the organisational structure at IKEA and its position as a main facilitator. The primary recommendation is for IKEA to use already existing feedback loops and structures to a greater extent as that action would require less investments compared to the establishment of new feedback loops and likely is associated with a more rapid implementation. Secondarily, additional feedback loops should be established where there exists a significant need to maintain a dialogue regarding the shared information.

The existing connections between IT systems, highlighted particularly by the connection between ESP and DSP Fulfilment, is a main facilitator for interaction between planning functions and thereby for integrated SC planning. The magnitude of this facilitator is derived from the circumstances specific to IKEA which makes it infeasible to have a common IT system to centrally store information. In a general

context, emphasis would be on implementing a common IT system to enable more efficient information exchange but in the context of IKEA it is more appropriate to create strong connections between the existing IT systems. It is therefore favourable for future development that there already are existing connections between IT systems which can be further developed and utilised.

The retail industry is characterised by high complexity in planning and a large number of actors, both related to the nodes in the distribution network and in terms of individuals involved in the planning processes. The difficulty for each individual actor to develop a holistic understanding of their impact on others increases with the number of actors involved, which may strengthen the silo mentality. The obstacle of low compliance is partially a consequence of the silo mentality in the organisation, which reduces the level of trust and organisational understanding, implying that it may be derived from IKEA's presence in the retail industry to some extent. The obstacle of low compliance affects IKEA's ability to achieve all four of the identified benefits of integrated SC planning. Furthermore, it risks increasing the costs associated with the changes IKEA may want to implement to improve integration. This stems from that IKEA must consider not only which changes to make but also how to achieve compliance with the changes and, as presented by Danese et al. (2017), changes related to people tend to require large investments in terms of both capital and time.

Heterogeneity in measurements limits the possibility to get all planning functions to work in the same direction and towards common goals. The diversity in measurements is considered a main obstacle for IKEA due to it being a challenge that extends across the entire PBSS process and therefore comprises both complexity and multiple interdependencies. This makes it necessary to adopt a centralised approach when managing the obstacle and aligning the planning processes at IKEA. A recommended next step for IKEA is to overcome this obstacle by revising and optimising the set of measurements while ensuring compatibility. The as-is analysis did not reveal any difficulties related to the actual measuring of different types of performance, but the problem rather concerns the prioritisation of measurements and what level of performance should be achieved within these. The solution thus focuses on changes of guidelines and priorities rather than the implementation of, for example, new data collection techniques or evaluation tools. Taking the actions necessary to overcome this obstacle would therefore likely not require particularly large monetary investments, which supports the recommendation of addressing it.

As noted by Jonsson and Lindau (2019) in the context of S&OP maturity, it is not suitable for all companies to strive towards the highest level of maturity in all dimensions. This is true also in the context of integrated SC planning as it is necessary to evaluate potential benefits of increasing the maturity in relation to the cost of doing so regardless of the context. When assessing how to increase the level of maturity in terms of potential for integrated SC planning, for example by using the adapted

version of Grimson and Pyke's (2007) maturity model, it is therefore also important to evaluate in which dimensions the current positioning may be sufficient. For instance, the formality of the processes and responsibilities at IKEA would be of higher maturity if the criteria regarding participation from executive level was fulfilled. However, the processes having a short-term horizon and the decisions being of operational character imply that support from executive management may not be necessary. Hence, executive management not actively participating in the short-term planning is not considered to negatively affect the quality of the planning processes and the integration of them. This illustrates the limited value for IKEA to increase the level of maturity within the dimension of organisation.

In relation to this, it is also important to consider the potential unintended outcomes of a change when choosing between different actions. This could concern both specific aspects, such as when a set of measurements is revised and the removal of a goal reduces the performance within a previously prioritised area, and more broad outcomes. An example of a broader unintended outcome is the strengthened silo mentality that an increased maturity within the organisational dimension could entail. The current positioning of IKEA at the fourth level of maturity in terms of organisation is to a large extent a consequence of the company being global and of a size that would be unlikely to achieve without certain structures in place. However, these formal structures and the global coverage could not only contribute to the success of the company but also to increased silo mentality as it creates clear boundaries, both physically and mentally, between different departments. This further supports the conclusion that it may not be favourable for IKEA to increase their degree of structure and formality as an unintended outcome of that could be reinforcement of the silo mentality.

Danese et al. (2017) explain that different dimensions of maturity cannot be addressed sequentially because as the maturity increases, the interdependencies between dimensions also increase, leading to that transitions to higher levels of maturity must be done in parallel. Additionally, the overall maturity is determined by the balance between the individual dimensions. It is therefore important to consider the balance between dimensions when deciding which of them to prioritise. In the case of IKEA, there is more value to be realised by increasing the level of maturity within measurements and IT compared to the dimensions regarding meetings and collaboration, and plan integration. Measurements and IT represent the areas in which IKEA currently display their lowest levels of maturity and these dimensions are therefore likely to impede the overall maturity. From the perspective of creating a balance between all dimensions to promote synergies between them, measurements and IT should therefore be prioritised. This prioritisation is supported by that the identified main facilitators and obstacles are associated with the set of measurements and IT systems used at IKEA. Hence, the recommendation for IKEA is to primarily focus on increasing the maturity within the dimensions of measurements and IT while also being aware of how these dimensions and potential changes interact with and affect the remaining parts of the organisation.

6. Conclusions

As part of IKEA's ambition to ensure product availability and sustainability in a planning environment characterised by high complexity and a volatile transport market, this study has aimed to explore how integration of the planning functions at IKEA can improve their short-term capacity planning. This has included the identification of key components of integrated SC planning, the benefits the concept may bring, and facilitators and obstacles at IKEA related to the integration of planning functions. This chapter summarises the main findings of this study and arrives at conclusions that can be drawn based on a combination of theory and empirical findings. The benefits, facilitators, and obstacles are all, at a detailed level, specific for IKEA, but multiple are also applicable in a broader context of the retail industry. The chapter also presents recommendations for IKEA in terms of what dimensions they should increase their maturity within and what their next steps should be. Subsequently, factors that have caused limitations to the study are discussed and areas for future studies are identified.

Integrated SC planning consists of three key components with the first being interaction which focuses on bidirectional communication. Collaboration is considered a second key component of integrated SC planning that emphasises the interdependencies between functions within the organisation and the development of collaborative behaviours. The third key component is alignment which concerns alignment of values, goals, and incentives, to improve information sharing, trust, and cooperation. The as-is analysis of the planning processes at IKEA identified four areas that could benefit from integrated SC planning. One overarching benefit is increased executability of plans leading to improved product availability and sustainability. This benefit stems from improved integration between need planning and capacity planning, and from taking supplier capacities more into consideration. The second main benefit that was identified is reduced silo mentality and the entire organisation striving in the same direction. Alignment has a significant role in this as aligning goals and measurements across planning functions aid in defining a common direction for different initiatives and efforts. A third benefit concerns a higher market responsiveness which is the result of faster decision making enabled by the integration of planning functions. The last identified main benefit is that integrated SC planning increases the potential for developing an S&OE process at IKEA. By improving the current planning processes and their connections, it is possible for IKEA to clarify the purpose of an S&OE process and the problem it is intended to address.

The as-is analysis also resulted in an identification of two main facilitators and two main obstacles related to the ability to achieve these benefits. The first main facilitator is related to the organisation with its formal processes and clear responsibilities. This organisational structure facilitates the use of feedback loops between planning functions which in turn increases the executability of plans. The second main facilitator is that several IT systems used within IKEA are connected to each other, which

increases the executability of plans since more information regarding capacities can be taken into account. This implies that by developing the existing connections and the use of them, the need for implementing a new, central IT system is reduced. One main obstacle that has been identified is low compliance that risks resulting in updated working methods and procedures aimed at improving integration not being adhered to. This in turn limits the ability to reach the full potential of the benefits of integrated SC planning. The second main obstacle concerns the heterogeneity in the measurements currently used, as they limit the possibility for the functions within IKEA to strive towards common goals. In conclusion, in order for IKEA to increase their integration of planning functions, they are recommended to leverage the facilitators of their formal organisational structure and the connected IT systems and overcome the obstacles of both low compliance and the diversity in measurements.

6.1 Limitations

In order for the conclusions to be considered reliable, the limitations of the study must be addressed. This study has been limited with regard to previous research, data collection techniques, and sampling issues. The limited academic literature regarding integrated SC planning and associated frameworks resulted in a broader analysis of the concept. Furthermore, as previous research on S&OE is scarce, it offered limited opportunities to link the implications of integrated SC planning to the development of an S&OE process at IKEA. However, since integrated SC planning has been analysed from a generic perspective in terms of its three key components, it is possible to draw general conclusions regarding what IKEA should focus on in terms of integration to facilitate the development of an S&OE process. This means that the limitation with regard to detailed descriptions of the S&OE concept has not had a negative influence on the reliability of the conclusions.

Regarding data collection techniques, the answers stemming from the semi structured interviews resulted in information of varying detail about the planning functions. This could have inhibited the ability to identify benefits, facilitators, and obstacles in the context of IKEA. To manage this potential limitation, continuous meetings were held with a contact person at IKEA, as well as a workshop with members of the S&OE team, to discuss the findings and potential for improvements. As the findings were validated by these representatives at IKEA, the varying level of detail is not considered to have negatively affected the credibility of the conclusions of this study. In terms of sampling issues, the main limitation has been that multiple interviewees were indirectly rather than directly connected to the demand, need, and capacity planning functions. In some cases, this limited the possibility to obtain exhaustive explanations. However, the workshop made it possible to validate the empirical findings and confirm the resulting findings, which ensured that the interviewee sample did not have a negative influence on the reliability of the study.

6.2 Future Studies

This study has identified facilitators and obstacles related to integration within the short-term planning at IKEA, which provides a foundation for future work within the organisation. This includes a more detailed definition of the activities that are required in order to achieve integrated SC planning at IKEA and thereby increase the potential for a future implementation of an S&OE process. Future studies at IKEA are recommended to primarily focus on addressing the main facilitators and obstacles. This could for example entail a project focused on revising the set of measurements to ensure that the entire organisation prioritises, and is held accountable for, product availability and sustainability. The limitations related to the absence of an established framework for integrated SC planning and a clear definition of the S&OE concept demonstrate a gap in the academic literature. This indicates a need for future studies in this research area, regarding both the individual concepts and how they are linked to each other. With an increased understanding of the concepts, there is a potential to define the role of integrated SC planning more clearly in the development of an S&OE process, which would also facilitate a potential implementation of the process. The need for future studies regarding a general S&OE process and an associated implementation framework is supported by this study as IKEA constitutes yet another example of a company aiming to implement this process.

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Appendix A: Case Description

This appendix provides a description of the current state of the IKEA SC and planning functions related to short-term planning, which refers to a time horizon of three months. The description is based on information collected from employees and different types of internal documents, such as slideshow presentations, working methods, working instructions, and task descriptions.

A.1 IKEA Supply Chain and Planning Environment

The IKEA business idea is to "*offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them*". This involves being present on a global market and focusing on accessibility and affordability. The IKEA SC thus needs to have cost-efficient sourcing and supply a variety of IKEA products to different markets. This requires the SC planning to be performed in a global context and be able to accommodate various products needs and delivery solutions.

A.1.1 Distribution Network

The IKEA supplier base for home furnishing products comprises approximately 1.000 suppliers dispersed globally, excluding the suppliers of food and indirect purchases. The supplier base is diverse as it includes both highly flexible suppliers and highly efficient suppliers. IKEA has the ambition to develop long-term partnerships with its suppliers, to both secure supply and be able to sustain the supplier base to enable SC improvements.

There are three types of fulfilment units for customer orders within the IKEA SC: retail stores, customer distribution centres (CDCs), and parcel units. The fulfilment units can be replenished either directly from the suppliers or via DCs, see Figure A1. Direct supply has increasingly been used as it minimises the transport distance and the need for storage, translating into reduced costs and lower CO_2 emissions. The DCs are owned by IKEA and function mainly as intermediary storage points but can also be used for transit flows. There is a distinction between high-flow and low-flow DCs depending on the sales characteristics of the products they handle. Storage can also occur at other nodes in the SC, such as suppliers and stores. Regardless of whether the fulfilment units are supplied directly or indirectly, mid-receivers can be used to increase the fill-rate of transports when individual suppliers do not have high enough volumes to fill a transport unit. With mid-receivers located close to suppliers, multiple shipments of low volume can be consolidated into larger shipments. Close to fulfilment units, DCs can function as transit points, enabling high fill-rates by combining transit volumes with stored goods.

Figure A1. Flowchart of the distribution of goods from first-tier suppliers to IKEA fulfilment units.

A.1.2 The IKEA Range

IKEA has a diverse customer base as they aim to reach many people. This involves different customer segments with unique needs. In order to fulfil the different customer needs, IKEA offers a wide range of products within home furnishing. As their assortment includes a large variety of products, ranging from low-cost products and consumables to large and more complex furniture, they have divided their range into different BAs. Some examples of BAs are Living Room, Bedroom, and Home Smart, and the BAs are further broken down into smaller product groups which are referred to as home furnishing businesses (HFBs). For instance, the BA Bedroom contains the HFBs Bedroom Furniture and Beds & Mattresses. The HFBs are responsible for developing their assigned range in more detail.

Range classification is an area related to the IKEA business plan which aims to develop a commercial range offer in all markets. In the range classification process, which occurs once a year, each article is assigned its range offer classification and commercial classification. The range offer classification divides, on a global level, the range into three categories: core range, market preference range, and market specific range. These categories indicate if an article is sold by all retailers or only partially in the world. The commercial classification defines, on retail unit level, if the article is mandatory or complementary. The process is carried out through cooperation between the HFBs and retailers with the aim of enabling each retailer to offer a unique and relevant range to their market. The range thus drives positioning, growth, and profitability.

IKEA offers functional products with long life cycles and relatively predictable demand. Although their range includes products within a number of different BAs, there is a limit to how many articles may be included. This is referred to as the range frame per retail unit which is defined by Core Business Range. The range frame is the same for all retail units although the content may differ and is used to balance

the total offer between HFBs, create the store layouts, and enhance the goods flow capacity plans. A limited range size allows for volume advantages, lower prices, and increased simplicity.

The demand for IKEA products varies with different markets and seasons, meaning that the products are subject to varying demand fluctuations. Some products experience a constant demand with low variation which means that sales are stable around a mean value. Others experience a more volatile demand which may be caused by seasonal variations. Lastly, products can be subject to sporadic demand with high variation and without any evident seasonal components.

Within the range, IKEA has grouped articles based on availability requirements into the five categories S1-S5. S1 includes both bestselling articles and articles classified as “must haves”. These articles must always be available in store as they either account for a large share of sales or because they enable the sale of multiple other products. For example, a midbeam is classified as a must have since it is necessary in order to assemble beds, and therefore always needs to be available in store. The second category is S2, which includes the remaining bestselling articles. The categories S1 and S2 together account for about 85% of the total sales. S3 includes products that are currently promoted, the rest of the assortment constitute S4, and the outgoing products are demoted to category S5.

A.1.3 Performance

Various measurements are used to measure and evaluate the performance of the IKEA SC, for example, capacity utilisation, lead time, OTD, and availability. Capacity utilisation regards the usage of volume storage capacity. The global average capacity utilisation for DCs and CDCs was 49.45% in 2021, compared to 71.29% in 2019. Lead time is a measurement consisting of several components, thus enabling a comprehensive assessment of the performance of the SC with regard to time. The total lead time and lead time deviations are used as inputs for the calculation of safety stocks, among other things, where larger variations in lead time results in higher safety stock levels. Inaccurate values of lead times and related deviations risk resulting in lower product availability and higher costs. It might also cause higher CO_2 emissions as there is a risk for lower equipment utilisation with calculations based on inaccurate lead times.

The lead time is defined by IKEA as consisting of five components: preparation, assembly, dispatch, delivery, and receiving. The preparation lead time begins when an order is received and ends when the product is ready for dispatch. Assembly is a lead time that may be added if there is a need to extend the preparation lead time for a certain sender-receiver combination. The dispatch lead time starts when the order is available for dispatch and ends when the loading unit is planned to be dispatched from the sender. It is used to accumulate enough orders to achieve optimal equipment utilisation at the suppliers

and the dispatch lead time is therefore referred to as volume driven. Together, the preparation, assembly, and dispatch lead times constitute the total sender lead time. The delivery lead time starts with the order's planned dispatch date at the sender and ends when the products arrive at the receiver's location. Lastly, the receiving lead time begins with the products arriving at the receiver and ends with the products being available. The total lead times are planned to fall within a range of 0-6 months.

OTD is a KPI used by IKEA that measures how well the actors within the SC together execute the supply plans. The performance is evaluated by comparing the ordered article quantity with the received quantity and by comparing the planned receive date with the actual receive date. Together, these two comparisons check for cancellations and lead time deviations. There are four variants of this KPI which are used depending on the context and part of the SC that is being measured.

Product availability can be measured with several performance indicators depending on the location in the SC and KPIs used by IKEA include service level, in store availability, and CDC availability. Service level measures how well the availability in stores and CDCs matches the forecasted demand. In store availability is defined as the ratio between the number of days an article is actually available in store and the number of days it should be available, while CDC availability follows a similar logic but for CDCs. The categorisation of the IKEA range allows for follow-up of the performance of each specific category, where the availability targets are the highest for category S1 and then stepwise reduced until category S5.

A.1.4 Core Business Supply

This section provides a description of the functional organisation Core Business Supply which is slightly different from the legal structure. Inter IKEA Group consists of three core businesses: franchise, range, and supply, see Figure A2. Inter IKEA Systems B.V. constitutes the Core Business Franchise and owns the IKEA brand. It is responsible for the development of the IKEA concept and is the IKEA franchisor owner. IKEA of Sweden AB develops products and manages the product range. It is further responsible for leading the HFB development process through BAs. Core Business Supply consists of IKEA Supply AG and IKEA Industry AB and is responsible for sourcing and distributing IKEA products according to the IKEA concept.

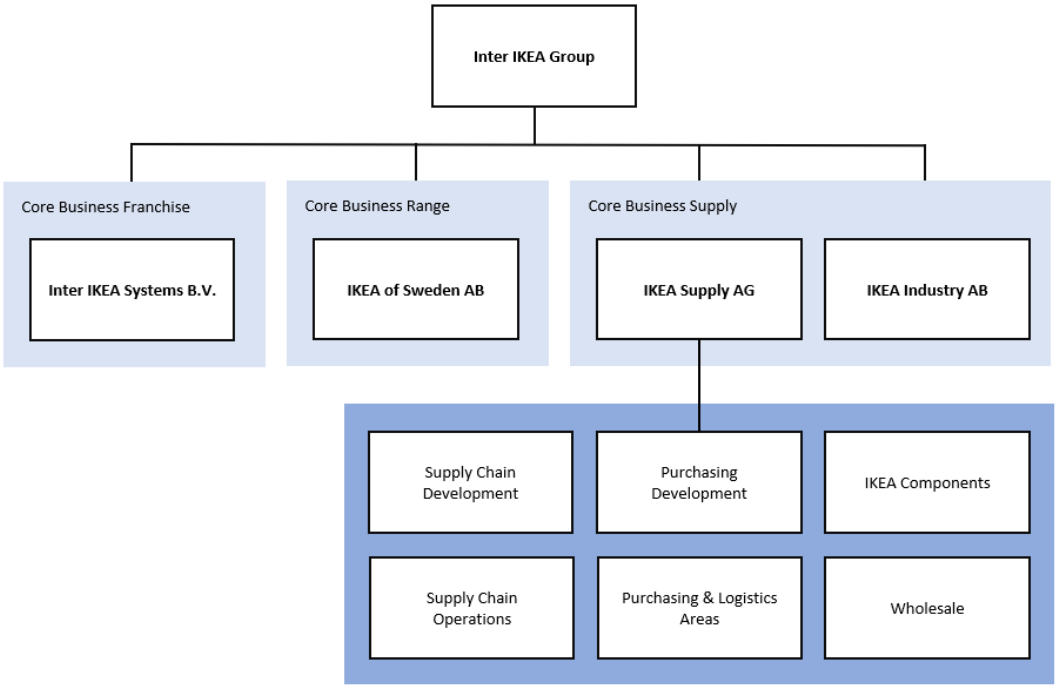

Figure A2. The functional organisational context of IKEA Supply AG.

IKEA Supply AG owns the products in the IKEA DCs and CDCs globally. It is the main wholesaler within Inter IKEA Group and is organised as six supply business units: Supply Chain Development, Supply Chain Operations, Purchasing Development, Purchasing & Logistics Areas, IKEA Components, and Wholesale. IKEA Supply AG is responsible both for sourcing and leading the purchase development process within all purchasing categories, and for creating a balance between sales and supply throughout the value chain. This entails a responsibility for the planning processes addressing both long-term and short-term planning.

The supply business units that are involved in the planning processes are Supply Chain Development, Purchasing Development, and Supply Chain Operations. The assignment of Supply Chain Development is to design and create favourable conditions for a well-functioning SC. This entails, for example, to establish a logistical infrastructure, secure an optimal network design, and develop processes related to order, replenishment, and delivery. Furthermore, Supply Chain Development is also responsible for managing and developing the sourcing of the IKEA range. However, the actual purchase of materials and production capacity for both food and home furnishing is carried out by Purchasing Development. With the purchasing activities comes a responsibility for developing the suppliers and ensuring that there is a focus on affordability, accessibility, sustainability, and quality throughout the production and distribution of IKEA products. Purchasing Development is organised as categories based on sourced raw materials and production technique, where each category has close collaboration with the HFBs and global development teams to leverage economies of scale and develop the sourcing strategies.

The aim of Supply Chain Operations is to supply IKEA products to end customers with a focus on simplicity, affordability, and sustainability. This entails a wide responsibility including transport of raw materials, deliveries from suppliers to retail stores, and management of logistics units within the IKEA SC, such as DCs, mid-receivers, and warehouses. Some related assignments concern determining the capacity needed for the flow of physical goods as well as sourcing and developing the transport and logistics capacities. Supply Chain Operations thus functions as the operational link between Purchasing Development from a supplier perspective and the IKEA franchisees from a receiver perspective.

The second part of the Core Business Supply, IKEA Industry AB, constitutes a vital part of the IKEA SC and is closely connected to IKEA Supply AG. It is IKEA's own manufacturer with nearly 40 production units across 21 sites in Europe and China. Their operations include forestry, sawmills, boards, components, and furniture production.

A.2 Planning Functions

IKEA has established eight core processes that aid in, for instance, developing business plans, designing the product offering, and ensuring availability. The PBSS process is one of these and aims at securing a balance between sales and supply, and thus contribute to reaching the sales goals at the lowest cost. The PBSS process is constituted by five sequential sub-processes: sales planning, demand planning, need planning, capacity planning, and balancing of plans, each with their own main focus. The planning functions are connected by consecutively using the output from the previous process as input, see Figure A3.

Figure A3. A process overview of the planning functions included in the PBSS process.

Sales planning decides what commercial actions to take in order to reach sales goals, while demand planning quantifies the planned sales in terms of what, when, and where. Following demand planning is need planning which, in contrast, quantifies what to purchase. Need planning is also responsible for assessing what, where, and when products need to be stored and replenished in order to meet defined availability targets at the lowest cost. The fourth sub-process is capacity planning which is responsible for determining the capacities required in order to produce, store, and transport goods according to the preceding plans. Ultimately, a balancing of plans is performed to ensure that the plans are executable and that discrepancies between need and capacities are managed. The capacities in focus within the

short-term capacity planning at IKEA lie within four types: supplier, transport, warehousing, and fulfilment units. The main planning functions which are contributing to the planning of these are demand planning, need planning, and capacity planning.

A.2.1 Demand Planning

The main objective of the demand planning function is to generate demand forecasts in order to quantify the planned sales on an article level.

A.2.1.1 Output

The output of the demand planning process is the demand plan, containing both forecasts and forecast uncertainties, which is utilised as support in both the need and capacity planning processes. Additionally, the demand forecasts provide valuable input to the IKEA core process "Convert visitors to happy customers" as they enable the products to be available at the right location in a timely manner. The demand planning process covers the entire IKEA home furnishing range, which means that the function is responsible for continuously monitoring and adjusting the forecast for the running range, but also for generating forecasts for discontinued articles and initial forecasts for new articles.

A.2.1.2 Input

The workflow within demand planning is exception-based, meaning that the forecast cycle may be initiated by exception messages. Forecast exceptions are monitored every week via exception reports or exception searches. The forecast cycle comprises four steps: check exception, improve forecast model by cleaning historical data, update future market information, and finalise forecast. During the forecast cycle, inputs are retrieved from multiple sources, for instance sales planning, business plans, retail markets, and the IKEA core process focused on developing the product offering. Hence, factors such as historical sales, planned commercial activities, macroeconomic conditions, and range changes are taken into account when finalising the forecast. The statistics regarding historical sales include the previous three years and the resulting forecasts are aggregated on global, country, or fulfilment unit level, with a time horizon of 105 weeks.

Furthermore, demand planners collaborate with need planners to gain insight into product availability and capacity constraints that may affect the actual sales and the demand forecast. However, in order for supply limitations to influence the demand forecast, certain criteria must be fulfilled. The capacity limitations must be considered long term, meaning that they extend over several months rather than weeks, and will not be solved within the lead time. The business impact of the limited capacity must also be evaluated to be significant, for example by affecting the sales of other complementary or substitutional products in the range. Resulting changes to the demand forecast that derive from the

supply constraints should be communicated back to the need planners if they are considered substantial. To increase the demand planners' ability to accurately assess what does and does not need to be communicated, collaboration between the demand and need planners is necessary.

A.2.1.3 Planning Processes

Demand planning uses DSP Demand, which is part of the demand and supply planning platform, to create forecasts for individual demand forecasting units. The demand forecasting units contain information regarding which item should have a forecast for which location. The demand forecast created by demand planning specifies what, where, and when to sell in the future. This forecast is then aligned with the sales forecast for range and supply within IKEA at HFB level. The alignment may require changes to be made to either the demand forecast or the sales forecast. The objective is to dimension the SC to current sales performance and plans.

The forecasts are continuously adjusted based on how the actual sales deviate from the estimated sales. In 2020, the number of demand forecasting units on a selling unit level amounted to 5.300.000. As demand planning manages this large number of forecast units, it is necessary to prioritise between them, both regarding their forecast frequency and when exceptions occur. To make it possible for demand planners to identify which task within exception management that has potential to add the most value, the IKEA products are classified along three dimensions: value, quantity, and demand pattern. The value is assessed through a yearly revised ABC-classification where the total quantity in a forecast of one year is multiplied with the inventory value of the product. The quantity is assessed similarly but only takes the quantity into account and is revised weekly rather than yearly. The third dimension concerns the forecastability of a product, referring to the degree to which it can be forecasted with accuracy. The products within the range are classified based on the fluctuations of their previous sales. Products with regular demand may not need to be revisited with a high frequency while products with sporadic demand may require substantial manual intervention. In general, the classification of the range results in products with high volatility combined with either high value or quantity being reviewed the most frequently, typically weekly, while it is sufficient with monthly revisions for products with low value or quantity.

Different sub-processes within demand planning are used to generate demand forecasts depending on the situation. Some situations that require specific working methods are initial forecasts for new products, initial forecasts for new selling units, and demand planning for staggered sales start. For instance, when forecasting the demand for new products, the demand planners should gather input from customer specialists, sales specialists, and market communicators as well as consider historical data for comparable articles. In the case of new selling units, the forecasting process is initiated by identifying the new unit, its opening date, and its characteristics. Subsequently, the range needs to be defined and

shared to be able to create the initial forecast. When planning the demand for a staggered sales start, meaning that there is not one common global sales start date, it is important to begin with analysing and assessing the forecast impact that might come from a progressive launch or seasonal perspective.

A.2.1.4 Quality of Planning

A KPI used to assess the performance of demand planning is demand forecast accuracy, which is a measure comparing the forecasted volumes with actual sales volumes. It can aid in identifying large deviations, finding explanations for shortages or overstocks in the SC, and facilitating forecast improvements based on the learnings. In addition to having digital tools indicating potential exceptions, selected articles are regularly monitored. When an exception is identified, the associated analysis includes three main steps. Initially it is examined whether the exception stems from a low forecast quality or a change in sales pattern. If there is a recent change in sales, the next step is to identify the cause of this change. This could, for instance, be consequences of range changes such as cannibalism or synergies, external factors such as weather or politics, or unexpected outcomes of commercial activities. Lastly, it is evaluated whether the change is permanent or temporary, thus indicating to what extent it needs to be considered in future proceedings.

A.2.2 Need Planning

Products cannot be purchased and sold simultaneously because of factors such as lead times, high volumes, and uncertainties. This requires planning of the need throughout the SC.

A.2.2.1 Output

The aim of need planning is to first decide what quantities need to be purchased, stored, and replenished and subsequently create a plan for purchasing, storage, and replenishment that secures sufficient levels of products in stock such that the forecasted sales in the demand plan can be sold. By optimising stock levels, costs derived from stock-outs or excess tied up capital can be reduced. The need plan displays the need from a product perspective and is communicated to the suppliers before the actual orders are confirmed. This gives the suppliers time to purchase necessary raw material and plan the production and transports, which in turn ensures that the products can be transferred to the right place at the right time. The need plan functions as input for the subsequent planning process, capacity planning, and is necessary for it to be carried out successfully. In this context, the need plan can also be referred to as the supply plan. The plan provides detailed information regarding both the individual products to be delivered and the timing of these deliveries, with the emphasis being on achieving a high planning accuracy with respect to the product aspect.

A main focus of the need planning process is to generate output in terms of order proposals which serve as input to the order management process. This output is created in and communicated through a system called DSP Fulfilment. The system performs safety stock calculations and constraint planning based on continuously updated parameter values. DSP Fulfilment is however limited as it can only include one level of constraints, which currently is supplier capacity. Order management is an executional process and includes creating actual orders based on the order proposals. The output from need planning is however incomplete and thus has to be complemented with manual orders. Approximately 85% of the actual orders are derived from order proposals and the remaining orders are divided into 10% being manual orders and 5% being orders based on vendor managed replenishment. Apart from order creation, the order management process also concerns order confirmation and cancellation from goods senders as well as prioritisation of orders from dispatch.

The process DORS also receives input from need planning. DORS both designs and implements solutions aimed at optimising the flow in the SC based on various constraints, in order to increase availability and decrease costs. To achieve this, DORS requires input in terms of for instance information about inventory and safety stock levels as well as supply plans where constraints regarding needed volumes and article overstock limits are retrieved.

A.2.2.2 Input

The need planning process uses the demand plan as input regarding the quantity of goods that is required and compares that with data on the quantity already available in storage in the SC. This means that even though the forecasted demand may be high, the planned purchasing quantity may not be, and vice versa. Further input is collected from multiple sources. Sourcing specialists provide information regarding supplier matters, such as which suppliers are connected to which customer regions, and product development teams provide information regarding new products and their timelines. Supply planners are responsible for compiling data on the quantities the suppliers are able to provide and related sender lead times and for keeping these updated in the ESP system which is connected to DSP Fulfilment. DORS provides optimised replenishment solutions which are used as manual input when the need planning function plans and manages the flows in the SC.

A.2.2.3 Planning Processes

The need plan is automatically generated based on given input data and the plan is recalculated on a daily basis. The daily planning frequency is necessary to avoid subsequent processes basing their decisions on inaccurate data. For instance, to avoid order proposals being executed without considering orders sent earlier than planned. The need plan specifies the need for each article at each node in the SC, from supplier to fulfilment unit, which means that it contains the need of millions of combinations. If the need planners have more information than the system for any of these combinations, it is possible

to make manual changes to the plans, for instance when additional stock of a product is needed to fill excess space in a store. Need planners are organised according to categories of products where the articles share the same material, production technique, or supplier base. Within their assigned range, the need planners are responsible for managing inventory levels and safety stock, proactively following up need plans and acting on deviations, as well as collaborating with stakeholders to secure agreed service levels. Hence, with only a limited part of the range to focus on, the number of stakeholders to be in contact with is minimised.

As a part of need planning and balancing of plans, need planners also lead groups that perform CCP, where each group is responsible for managing constraints affecting one of four regions: Europe, Middle East, Asia, and North America. Within CCP, the focus is known and yearly repeating constraint periods when, for example, suppliers are closing or transports are constrained. The purpose is to deliver a plan which describes how to proactively manage these unbalanced situations and ensure availability during these periods at the lowest cost. The CCP is performed approximately eight months ahead of the constraint period and the plan is handed over to stakeholders within short-term planning, for example other need planners, who may in turn revise their plans based on the content of the CCP. The scope of the CCP process includes the full product range and all constraints which affect either multiple receiving markets or multiple senders. Hence, the list of identified constraints managed in CCP mostly comprises holidays, such as Christmas, Ramadan, Lunar New Year, and the Golden Week. How the constraints and their resulting imbalances are managed varies between years, depending on which weekdays are part of the holidays and the overall state of the SC. The plans produced by CCP are thus affected by general disruptions in the SC.

A.2.2.4 Quality of Planning

Need planning is accountable for the service levels within the IKEA SC and is therefore evaluated based on two main KPIs: product availability and OTD. The aim of the need planning function is also to achieve high efficiency in the goods flows, which refers to the minimisation of goods that is in circulation to be able to satisfy the demand. This means that the efficiency also affects how IKEA performs from a sustainability perspective. To reduce the demand for transport, several principles are followed when planning for the goods flows. One of these is for instance to avoid sending goods between DCs that are separated by long distances to the extent it is possible. Another principle within need planning is to only use air freight in exceptional cases since it is both economically and environmentally costly.

The quality of need planning also affects the order management process and the measurement order accuracy. The measurement displays the correspondence between order proposals and actual orders, and it can be influenced by multiple factors. Currently, its value may be considered low which can

partially be explained by the use of flex orders. Flex orders are used to increase the operational efficiency in the SC by sending future orders earlier than planned, with the aim to achieve higher equipment utilisation in the transports. This can only be done for a smaller selection of the total product range and within a certain time frame. However, when orders are not shipped on the predefined day according to the order proposal, it is defined as a manual order, thus causing a deterioration in performance in terms of order accuracy. Furthermore, approximately 10% of all order proposals generated through DSP Fulfilment are cancelled by suppliers for several different reasons, such as internal supplier problems or orders exceeding the capacities provided by suppliers. Besides these 10%, there are additional order proposals that are not executable due to transport and warehousing constraints. These constraints are not taken into consideration in the need planning process because the transport and warehousing capacities are managed in systems which are not connected to DSP Fulfilment.

A.2.3 Capacity Planning

The purpose of capacity planning is to quantify the capacities that are necessary to be able to produce, store, and transport products according to the plans.

A.2.3.1 Output

The capacity planning results in several capacity plans, for example, an operational production capacity plan, a supplier capacity plan which presents the products that are planned to be purchased, and a logistics capacity plan which displays the need in cubic metres in relation to warehouses and transports. Well-developed capacity plans make it possible to optimise the use of square and cubic metres and thereby create conditions for reaching sales goals and availability goals at lowest possible cost. Capacity planning also provides output to DORS in terms of available capacities regarding stores, CDCs, and mid-receivers, enabling DORS to define capacity constraints. This output enables more constraints to be taken into consideration in the optimisation of replenishment solutions, which capacity planning then receives. Additional outputs from capacity planning are short-term plans for transport and DCs which aim to secure capacity for the flow of goods throughout the IKEA SC. These plans are created based on decisions regarding transport needs in volumes and decisions regarding the quantities that need to be replenished in the DCs as well as the need of warehousing personnel. The DC short-term plans present the goods flows and inventory projections for each DC per week within the upcoming horizon of three months. The plans are communicated with SC stakeholders, securing efficient operations among, for example, service providers. This creates value for IKEA as it enables efficiency in DCs which contributes to availability of products at the lowest possible price for the customers. Value is also created for the receiver when the plans are accurate and communicated in time.

Capacity plans made for longer time horizons are used to establish framework agreements and subsequently to source different types of resource capacities. For instance, framework agreements for transport resources are negotiated with carriers based on yearly volumes per transport route. In addition to these long-term agreements, the ambition is to continuously share available information and updates about the current transport needs with the transport providers to increase cooperation and flexibility. The framework agreements are outcomes of capacity planning that provide a basis for the plan and manage delivery process. This process performs the booking of specific transports according to orders created in the order management process. More specifically, the capacity planning secures capacity at a tactical level while the delivery processes secure capacity at an operational level. It is important that the resources secured through framework agreements cover the transport needed in order for the plans to be executable in the plan and manage delivery process.

In the short-term, the capacity plans typically include the volumes that each DC needs to handle per week expressed in cubic metres. These plans are then used to create staffing schedules to ensure that there are enough personnel available at the DCs to manage the slots booked by the plan and manage delivery process. Another outcome of capacity planning is the identification of resource constraints related to production, transport, warehousing, and customer fulfilment. These constraints should be reported to the balancing process and subsequently communicated with need planning.

A.2.3.2 Input

The supply plan created by need planning serves as input to capacity planning. Based on the supply plan, the different processes within capacity planning identify the total resource requirements to fulfil the product need. The identification of resource requirements is the first step in securing the necessary capacity at a tactical level. To create DC short-term plans, the common tool TFP is used. TFP includes information about the transport needs in volumes which is used as input to ensure that the short-term plans for DCs are aligned with the corresponding plans for transport. It also includes results provided by DORS which have been broken down to the correct aggregation level and manually transferred into the tool. The data providing the necessary input to the planning process is shared via QlikView and additional communication is carried out through the market operations forum. To enable evaluation of the DC short-term plans, multiple types of data regarding the current state are used as input: inventory levels, storage capacity, handling capacity, picking order lines, container queues, and logistics flows.

A.2.3.3 Planning Processes

Within the SC, there are multiple types of physical production resources that need to be considered in planning. Examples of physical production resources are transport resources, manufacturing equipment at supplier sites, DCs, mid-receivers, trucks, fulfilment units, and personnel throughout the entire SC. These resources have different capacity acquisition lead times, meaning that they have varying

flexibility. For instance, the storage capacity in DCs is more fixed in the short term compared to resources such as trucks or personnel. Within capacity planning, there is one generic capacity planning process and multiple applied sub-processes which are all based on the generic process. The individual sub-processes focus on different parts of the SC, time horizons, and resource types. Although these sub-processes are established, the documentation of them is scarce. Two sub-processes which are more well-documented are the operational warehousing capacity planning process and the OSCP.

The generic capacity planning process is initiated by converting the product need into volumes, aggregating the supply plan into a resource perspective. While doing so, historical data regarding which changes that have been made to the need plan are also taken into consideration. By not using the supply plan directly, but instead modifying the input based on previous events, this first step in the capacity planning process contributes to an increased planning accuracy. The next step in the capacity planning process is to calculate the capacities that are required to be able to fulfil the supply plan. Subsequently, actual capacity is allocated to the required capacity. The allocation of capacity varies in aggregation level depending on the resource type. For example, supplier capacity is allocated in terms of manufacturing equipment per product group while DC storage capacity is allocated on a more general level because the use of storage space generally is more flexible. Then, actual capacity is secured to ensure that IKEA can access it when needed. In the case of flexible resources, such as transport capacities, the securing refers to the establishment of framework agreements. If a resource is not flexible enough for the required capacity to be secured, a constraint is identified.

A.2.3.3.1 Operational Warehousing Capacity Process

Flow capacity planning within Supply Chain Operations is responsible for carrying out the operational warehousing capacity process which creates, distributes, and follows up the DC short-term plans. The operational warehousing capacity process is initiated with the flow capacity planner reviewing actual data and making a comparison with the previous DC short-term plan. The next step of the process concerns the gathering and review of input data, to prepare for the upcoming short-term plan. The input is used to adjust the transport needs defined in TFP. When adjustments have been made, the flow capacity planner completes and reviews the DC short-term plan and communicates it with relevant stakeholders. The last step of the process concerns the follow-up of the latest short-term plan while preparing for the next short-term plan. This includes creating awareness of capacity constraints among stakeholders and ensuring that actions for mitigating capacity constraints are taken into consideration in the coming planning cycle.

Flow capacity planning is also responsible for the creation of a transport short-term plan. The planning frequency for the DC short-term plans is four weeks while the transport short-term plans are created every two weeks. The DC short-term plans are aligned with every second transport short-term plan and

these two planning processes are coordinated with the mid-term planning for transport which is performed four times a year following a three-week process. Flow capacity planning uses a transport visualisation tool for communication and information sharing for the mid-term and short-term plans.

A.2.3.3.2 One Supplier Capacity Process (OSCP)

Each supplier in the IKEA SC performs their own internal capacity planning of their manufacturing resources. OSCP is a planning process intended to connect these plans with the global operational production capacity plan on an appropriate aggregation level. OSCP is a common framework for registering, maintaining, and planning supplier capacities with the aim of both enabling fact-based decisions regarding what, where, and when to produce, and enabling increased availability at a lower cost. If the available production capacities are too high, the excess costs will diminish the profit margins, while too low capacities will negatively impact the delivery performance. The aim of the OSCP is to proactively identify potential capacity problems, thus allowing for time to investigate potential solutions, such as increasing or reallocating production capacity. The supplier capacity dedicated to IKEA for a given period of time has to be compliant with IWAY which is the IKEA supplier code of conduct. This means that it, for example, does not require overtime or extra shifts that are not currently used by the supplier.

The supplier capacity information and related identified risks are communicated to need planning via the ESP system and need planners can then adjust their plans accordingly. Apart from mapping supplier capacities, the OSCP also enables a translation between need planning, in terms of products, and capacity planning, in terms of supplier resources. The translation is made possible by using production rates. The production rate of a certain resource group refers to the rate at which a set of production resources grouped based on similar characteristics can produce a type of IKEA product.

A.2.3.4 Quality of Planning

A performance measurement which is continuously followed up and used to assess the quality of the capacity planning process is planning accuracy. The plans containing calculated required capacities are compared to the actual outcome executed in the plan and manage delivery process. Prior to the COVID-19 pandemic, the planning accuracy was high but the performance has since then declined.

The KPI that is most important to capacity planning in terms of performance over time is capacity utilisation. However, there is currently no structured follow-up process of this KPI. Capacity utilisation is associated with the fundamental aim of capacity planning which is to maximise the utilisation of resources while minimising the cost of them. There are several established measurements connected to capacity utilisation, for example fill-rate which is used in regard to transport capacity and for which the ambition is to always achieve as high performance as possible. For other resource types, the optimal

performance is more ambiguous, for example in the case of warehouse capacity where the ambition is not to have maximum capacity utilisation. This is due to the resource having low flexibility in the short-term to mid-term and thus being dimensioned to cope during peaks in demand.

The performance regarding capacity utilisation in terms of transport directly affects both costs and the environment, since more efficient utilisation of resources reduces the cost per transported cubic metre and since using less resources results in less emissions. By generating plans of high quality that allow the appropriate resources to be secured in time, the executional processes can achieve high capacity utilisation. Planning in general, and capacity planning in particular, can thus affect both costs and the environmental impact positively by creating favourable conditions for execution.

Appendix B: Interview Guide

This appendix contains the primary questions which formed a guide for the interviews conducted with process developers at IKEA. Each interview was initiated with a brief introduction of the researchers, the topic of this study, and the aim of the internal prestudy it was a part of. The interviews then followed the below guide consisting of seven sets of questions. At the end of each interview the respondents were given the opportunity to raise any further issues they found relevant.

The respondent

Can you introduce yourself and your position?

What are your key processes?

What are your contributions and key stakeholders connected to short-term planning?

Usage of plans

How are you using short-term plans?

Which business decisions do you take based on short-term planning data?

In what frequency do you need plans in order to revise your decisions?

What are your challenges related to the usage of plans?

Characteristics of plans

What capacities are you planning for?

In which unit of measurement and level of detail do you work?

In which time horizon and unit do you work?

Is your plan complete or is anything missing?

How do you secure that your planning parameters are up to date?

What is your main purpose?

What key performance indicators/performance indicators are used to measure your planning success?

How do your plans contribute to IKEA's sustainability ambitions?

Planning

Which tools and solutions related to short-term planning do you use?

Who are your connected planning functions and end users?

What kind of inputs do you receive to your planning process?

What decisions do you take during planning?

What could be changed in your current way of working?

Working methods

Do you have documented processes or working methods related to short-term planning? (The respondents were asked to provide these documents beforehand.)

Improvement areas

What improvement potentials do you see for the short-term planning at IKEA?

What would you like to be changed in your work connected to short-term planning?

What is working well in your organisation?

Closure

Do you think it would be possible to have one common integrated planning process?

What would you recommend to change for the short-term planning at IKEA to be more successful?

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