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Master Thesis

A Strategic Framework for Improving Inventory Management Decisions at IKEA

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Acknowledgements

This Master Thesis is the final part of the Master of Science degree in Mechanical Engineering and has been written during the spring semester of 2016 at the Department of Industrial Management & Logistics at Lund University. The thesis has been conducted on behalf of and in collaboration with IKEA of Sweden.

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Lund, June 3rd, 2016

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LUND UNIVERSITY

Abstract

Title
A Strategic Framework for Improving Inventory Management Decisions at IKEA

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Background
IKEA has realized the potential benefits of improving inventory management on a strategic level. For IKEA as a market leader in the home furnishing business, an efficient supply chain and proper management of inventory is of crucial importance in order to support their business idea of offering low-priced products to the many people. Inventory management at IKEA is characterized by an ad-hoc and reactive approach. A new way of working proactively, including clear responsibilities, with inventory management is therefore needed to guide IKEA employees on how to organize, store and replenish inventories and ultimately keep an adequate supply to secure availability of their products. As a measure of approaching the problem and evolving this work, a new *strategic framework for inventory management* has been constructed by the company.

Problem description
IKEA has, with its new inventory concept, a clear vision of where to be in their future work with inventory management. However, a definite strategy of reaching this position is lacking and the company has identified the need of clearly mapping present day's inventory work before proceeding as something vital.

IKEA is well aware that many of the problems experienced are related to strategic inventory management and not operational (mathematical). Directions of how to properly steer and plan inventories on a higher level, taking the entire supply chain into account, is lacking and clearer organizational responsibilities need to be defined. Further, the hope is that, by visualizing the problems and questioning high inventory levels, a change in behavior and mindset of employees when it comes to inventory management can be achieved.

Purpose
The purpose of this study is to highlight current problems in steering and planning inventories within IKEA and to propose practical solutions and a strategic framework in line with IKEA's new inventory concept to improve their organizational work and strategic decisions related to inventory management in order to reduce inventory costs.

Methodology
This thesis has been conducted with a systems approach and was carried out in an inductive research process. Addressing the research questions required collaborative action research with IKEA to finalize concluding theory. The process was divided into two phases, a primary exploratory phase with quantitative data analysis and qualitative mapping interviews, followed by an explanatory and normative phase with qualitative interviews and workshops.

Conclusions
The underlying reasons to high inventory levels at IKEA consist of lack of proper planning, follow up and guidelines related to excess stock situations. There is a clear mindset of securing availability of products for customers to almost any cost due to clearer consequences for potential shortages. This attitude is related to the lack of clear cost support for keeping inventory in the company.

Solutions dealing with the high inventory levels in the company were proposed with focus on reducing inventory related costs by defining new stock strategies and suggesting measures to take to reduce existing stock. Moreover, by improving and establishing a deeper collaboration between different parts of the organization involved in the inventory planning activities, and by defining clearer guidelines for planning stock and prioritizing articles, inventory planning was made more efficient.

Keywords
inventory management; inventory planning; supply chain management; organization; inventory strategy; consumer goods; seasonal demand

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List of Abbreviations

IoS	**I**KEA **o**f **S**weden
HFB	**H**ome **F**urnishing **B**usiness
DD	**D**irect **D**eliveries
DT	**D**istribution **T**erminal
DC	**D**istribution **C**enter
CDC	**C**ustomer **D**istribution **C**enter
CS	**C**ombined **S**upply
CP	**C**onsolidation **P**oint
DCG	**DC G**roup
KPI	**K**ey **P**erformance **I**ndicator
DSP	**D**emand and **S**upply **P**lanning
SPI	**S**upply **P**lan **I**nformation
BA	**B**usiness **A**rea
SDR	**S**upply **D**evelopment **R**eceiving
DME	**D**istribution **M**ode **E**xception
MPS	**M**aster **P**roduction **S**chedule
MTS	**M**ake **T**o **S**tock
MTO	**M**ake **T**o **O**rder
PUA	**P**urchasing **U**nit **A**greement
OTD	**O**n **T**ime **D**elivery
SC	**S**upply **C**hain
RFQ	**R**equest **F**or **Q**uotation
MSI	**M**anaging **S**upply **I**mbalance

Important Terms

HFB	Business areas at IoS directed downstream in the supply chain: planning for warehouses, stores and the logistics. Each HFB is responsible for products used in a similar fashion when furnished in the homes.
Category	Business areas at IoS directed towards sourcing of products. Each category covers a group of articles belonging to the same industry, i.e. they share similar materials, production techniques and/or supplier base.
High-flow DT	Warehouses located close to the markets supplying one or a few countries. Used for higher selling goods requested on pallets.
Low-flow DT	Warehouses located centrally supplying entire regions. Used for lower selling goods requested in pieces or multi-packs.
Front-loading	Arranging or planning so that a large portion of an activity occurs in an early period. In terms of inventory, front-loading means taking in stock earlier than needed to navigate around constrained periods.
Hedge stock	Additional stock with the purpose to shield from extraordinary uncertainties.
Anticipation stock	Inventory produced earlier than the scheduled need to cover for known restrictions.

Chapter 1

Introduction

This chapter contains the background on the topic and problem of this master thesis and defines the purpose and goals with the study. It further lists the questions that will be addressed and explains the directives and delimitations. Lastly, an outline of the report is provided.

Supply chain management has during the last decades risen to prominence. Trends such as global sourcing, emphasis on time and quality-based competition and their respective environmental impact are reasons for this increased attention. Further, globalization has forced companies to find more efficient ways to handle and coordinate the flow of goods in order to meet customers' constantly increasing demand for lower prices, quicker deliveries and damage-free products (Mentzer et al., 2001). As today's markets become more dynamic and competitive, companies are pressured to remain responsive and efficient and well-performing supply chains have become a necessity for success (Jaber, 2009, pp. 2-3).

Inventory management is still one of the key challenges in supply chain management. It is not uncommon that large amounts of working capital are tied up in goods throughout the supply chain and proper management of inventory is therefore vital for the success of a company - the opposite could inhibit the growth of the company and reduce its profitability (Thonemann, 2011). Today, there is enough information about changes in enterprise management to put inventories in a new perspective, seeing them not as assigned a passive role but including them as an active part of the company strategy. The emergence of supply chain management and reverse logistics as tools that provide sustainable competitive advantages for companies, and changes in the economy and business activities, require researchers to think outside the classical box of inventory management. However, with a lack of coverage of inventory issues and concepts, particularly at the strategic level, hope is expressed that the current emphasis on supply chain management (with its surrounding issues) will help to remedy this critical gap in knowledge about a firm's structure and operation (Jaber, 2009, pp. 2-3, 25-26).

1.1 Background

IKEA is one company that has realized the potential benefits of improving inventory management on a higher level. For IKEA as a market leader in the home furnishing business, an efficient supply chain and proper management of inventory is of crucial importance in order to support their business idea of offering low-priced products to the many people. To continue growing and to offer lower prices and reach more customers, IKEA has in line with the *Growing IKEA - 2020 Together* direction, where the aim is to double the revenue (2011) before 2020, realized inventory management will play a central part in the future of their work and that there are possibilities to develop smarter ways to approach the topic compared to how the enterprise works today. For example, in 2014 IKEA held almost 9 million cubic meters of stock throughout their supply chain, which corresponds to an estimated value of nearly €5.5 billion. Inventory management at IKEA is, despite these high numbers, characterized by an ad-hoc and reactive approach. A new way of working proactively, including clear responsibilities, with inventory management is therefore needed to guide IKEA employees how to organize, store and replenish inventories and ultimately keep an adequate supply to secure availability of their products (*Strategic Framework for Inventory Management* 2015).

As a measure of approaching the problem and evolving this work, a new *strategic framework for inventory management* has been constructed by the company. It consists of new ways of classifying stock, guidelines for how these new structures should be approached in the practical work and a clearer division of responsibilities for employees. However, IKEA lacks the strategy of how to approach the task of closing the gap between the current way of working with the future wished position.

1.2 Introduction to IKEA the company

IKEA has grown to become a multinational furniture company since being founded by Ingvar Kamprad in Elmtaryd, Agunnaryd (hence the name IKEA) in 1943 (*IKEA history - how it all began*). In line with the company's vision and business idea, the Swedish company has found success which has resulted in a global presence in the industry (*Welcome inside our company*):

> *"To create a better everyday life for the many people" (Vision)*

> *"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" (Business idea)*

Today, the company has 328 stores in 28 countries and in FY2015 reached sales of €32.7 billion. Europe is by far the largest market, accounting for two thirds of the total sales, followed by the American (18%) and the Asian & Australian (10%) market. Due to the size of the company, IKEA has an extensive supplier base of nearly 1000 suppliers in 50 countries. 60% of the sourcing is done in Europe, mainly Poland, and 35% originates from Asian

countries where China alone stands for 25% of the world total (*IKEA Group Yearly Summary 2015*).

IKEA is not listed on the stock market, which is explained by Ingvar Kamprad as follows (*Welcome inside our company*):

> *"I decided that the stock market was not an option for IKEA. I knew that only a long-term perspective could secure our growth plans and I didn't want IKEA to be become dependent on financial institutions."*

The organizational structure of the IKEA Group along with some key figures is shown in Figure 1.1. Stitching INGKA Foundation in the Netherlands is the owner of the IKEA Group and its funds can only be used in two ways: to be reinvested in the IKEA Group or donated for charitable purposes. The ownership structure has been established to ensure independence and guarantee a long-term approach (*Welcome inside our company*).

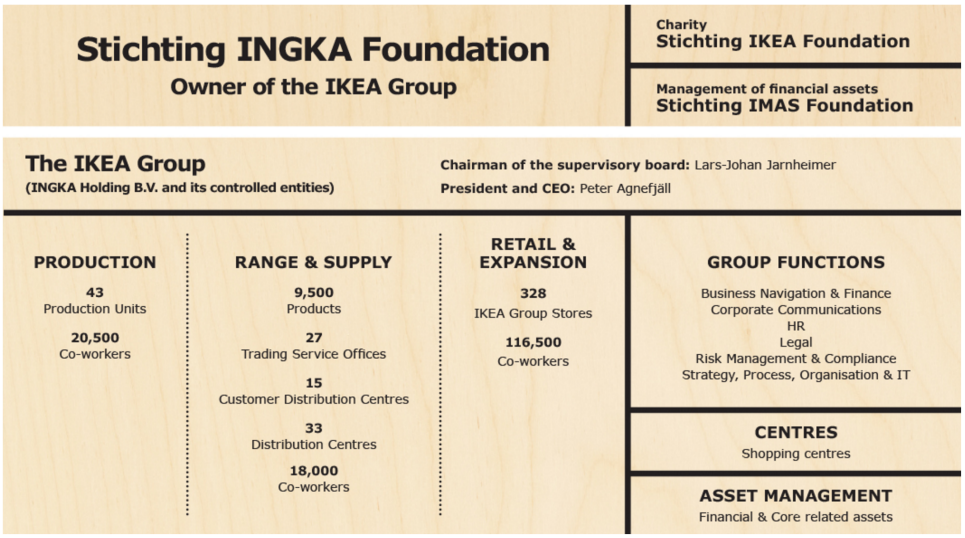

FIGURE 1.1: The structure of the IKEA Group and some related key figures (*Welcome inside our company*).

This thesis is carried out on behalf of IKEA of Sweden (IoS) which is part of Range & Supply in Figure 1.1. It is the part of the IKEA Group responsible for developing and deciding on the product range, and making it available to all IKEA stores and customers worldwide (*Who we are*). The organisation at IoS related to all product ranges is divided into several Home Furnishing Businesses or HFB. Each HFB is responsible for products used in a similar fashion when furnished in the homes. They are also related to the structures of stores, which are divided into sections where certain types of articles are presented in each. There are 20 HFBs within IoS, where Living Room, Kitchen and Bedroom Furniture are some examples. Employees within the HFBs are working with planning downstream in the supply chain: for warehouses, stores and the logistics.[1]

[1] Holm, 2016.

The organisation towards sourcing of products is divided into other business areas working outside and together with the HFBs. These are structured into so called Categories which cover a group of articles belonging to the same industry, i.e. they share similar materials, production techniques and/or supplier base. There are 34 different categories within IoS, where some examples are Plastic, Toys and Green Plants to mention a few. All categories belong to Category Areas based on connections through material or other strategic areas. Each material area and category has its own leader located at IoS and in each trading region.[2]

1.3 Problem description

IKEA has, with its new inventory concept, a clear vision of where to be in the future work with inventory management. However, a definite strategy of reaching this position is lacking and the company has identified the need of clearly mapping present day's inventory work before proceeding as something vital.

Despite many guidelines and plans related to inventory management, a clear overview of how the company actually approaches everyday situations is missing. Details of what situations occur and what challenges are faced and how these are handled are not clearly defined or conveyed in the organization. It stands clear however that the inventory work has great improvement potential (hence the creation of a new framework) and before continuing with the future framework, shortcomings and problems in the current way of working need to be brought up to the surface.

IKEA is well aware that many of the problems experienced are related to strategic inventory management and not operational (mathematical). Directions of how to properly steer and plan inventories on a higher level, taking the entire supply chain into account, is lacking and clearer organizational responsibilities between HFBs and categories need to be defined. Further, the hope is that, by visualizing the problems and questioning high inventory levels, a change in behavior and mindset of employees when it comes to inventory management can be achieved.

1.4 Purpose

The purpose of this study is to highlight current problems in steering and planning inventories within IKEA and to propose practical solutions and a strategic framework in line with IKEA's new inventory concept to improve their organizational work and strategic decisions related to inventory management in order to reduce inventory costs.

1.5 Research questions

Inventory management is widely recognized as an essential part of supply chain management in organizations and dealing properly with this topic is vital for successful businesses to develop. However, IKEA clearly seem to have encountered problems in their inventory work which is visible through

[2]Holm, 2016.

high inventory levels in their supply chain. Thus, the following research questions have been formulated:

1. What are the underlying reasons related to strategy and organization behind IKEA's high inventory levels?

Based on the identified reasons and IKEA's new inventory concept:

2. How should IKEA plan and steer inventory to improve their strategic decisions related to inventory management?

1.6 Directives and focus areas

This thesis is carried out on behalf of IKEA and is thus founded on directives from the company. The study focuses on strategic inventory management and the organizational work related to this topic for one IKEA category called Paraffin/Stearin. The study considers inventory and planning activities in the majority of the value chain related to this category excluding sourcing of raw materials, hence from suppliers of finished goods to IKEA sales units. Furthermore, the thesis is limited to two of IKEA's suppliers situated in Poland and to the warehouses and sales units on the European market.

1.7 Target group

The main target group of this thesis is the stakeholders at IoS from whom the thesis was formulated. The stakeholders consist of employees working with inventory and supply chain tasks in the organisation. These are not limited to the category studied in this thesis, but originates from several business units that can benefit from the outcome of the study. Moreover, the aim is for the result of the thesis to be valuable and applicable to other companies with similar conditions and limitations in their supply chain.

In addition to the business sector, the study may prove interesting to an audience at universities studying or researching similar topics within inventory management. Research of inventory management on a strategic level is scarce and the results of this thesis will hopefully prove useful for future theses and research by filling a gap in strategic inventory management research and thus contribute to academia.

1.8 Thesis outline

Chapter 1: Introduction
This chapter contains the background on the topic and problem of this master thesis and defines the purpose and goals with the study. It further lists the questions that will be addressed and explains the directives and delimitations. Lastly, an outline of the report is provided.

Chapter 2: Methodology
The purpose of this chapter is to define and describe the fundamental frame and principles of how the study is conducted to guarantee the trustworthiness of the thesis. It aims to give the reader an understanding of how the problem

has been approached and to provide a brief discussion of advantages and disadvantages of various methodologies and methodical approaches.

Chapter 3: Empirical framework - IKEA
This chapter provides an introduction to how IKEA works with logistics, supply and inventory planning in general and describes the roles and responsibilities of various employees involved in this work. The aim is to identify and explain the strategies and guidelines related to planning used in the organization.

Chapter 4: Empirical framework - the paraffin/stearin category
This chapter describes how the logistics and supply planning activities are carried out in the paraffin/stearin category specifically. It provides an initial overview of the conditions and challenges faced with planning and logistics related to this category.

Chapter 5: Analysis of IKEA inventory levels
This chapter concerns the IKEA DT inventories related to the paraffin/stearin category and seeks to provide a deeper analysis of how planning activities and strategies have affected the stock levels. It aims to investigate decisions made and the reasons behind situations that have caused high inventory levels to be able to identify problems and potential areas of improvement.

Chapter 6: Category specific solution proposals
This chapter presents proposed solutions, based on the analysis in the previous chapter, intended to tackle some of the problems experienced by the paraffin/stearin category when it comes to inventory planning. The solution proposals are motivated with cost savings where applicable to emphasize the potential of improved inventory management.

Chapter 7: Future inventory planning in IKEA
Based on the previous chapter with solution proposals for future inventory work, this chapter includes a defined plan for how to specifically prepare for periods that require additional planning. It also provides guidelines for the inventory planning in line with the new IKEA inventory concept.

Chapter 8: Conclusions
This chapter summarizes the results and conclusions and discusses the generalizability of these. It also covers the contributions and recommendations to IKEA and to the academia and aims to reflect on the outcomes of the thesis compared to what was set up in the first chapters.

Chapter 2

Methodology

The purpose of this chapter is to define and describe the fundamental frame and principles of how the study is conducted to guarantee the trustworthiness of the thesis. It aims to give the reader an understanding of how the problem has been approached and to provide a brief discussion of advantages and disadvantages of various methodologies and methodical approaches.

It is important to point out the different meanings of the terms methodology and method. Methodologies are philosophical principles that underlie any study and shape the diversity of the entire body of knowledge. Methods are the techniques and procedures followed to conduct the research and are determined by the methodology (McGregor and Murnane, 2010). This chapter describes the methodological and methodical approaches and choices used in and affecting the conduction of this thesis.

2.1 Scientific approach

People conducting research may have different goals for their study depending on both the nature of the study as well as the underlying approach to knowledge and the reality. These differences can be illustrated by defining three different scientific approaches: analytical, systems and actor approach (Björklund and Paulsson, 2014, p. 65).

2.1.1 Analytical, systems and actor approaches

A researcher applying an *analytical approach* attempts to explain the reality as objectively and completely as possible. Emphasis is put on finding relations of cause-and-effect, and looking at the problem as parts which together constitute the whole - each part becomes a smaller and easier problem to solve. Moreover, knowledge is considered independent of the observer and subjective views are disregarded (Björklund and Paulsson, 2014, p. 65).

When applying a *systems approach*, the researcher, much like the analytical approach, strives to explain the world objectively, but considers the whole to be separate from and often greater than the sum of its parts. The problem perception differs in that the focus is on the synergy effects between the parts,

considering these and the relations between these as of equal importance. The aim is to be able to understand the fundamental factors of various forms of behavior by investigating the connections and relations of the system parts (Björklund and Paulsson, 2014, p. 65).

Lastly, an investigator using an *actor approach* involves their own prior experiences and actions in the explanation of the truth. The reality is not assumed objective but as a social construction affected by, and affecting, the individual (Björklund and Paulsson, 2014, p. 65).

2.2 Research approach

According to Höst et al. (2006, p. 29) the methodology serves as a foundation and helps setting up steps to take in order to obtain more knowledge around the problem. The type of methodology chosen depends on the objectives of the solution and nature of the problem as well as on the existing body of knowledge regarding the subject. The nature of the study may vary as presented below (Björklund and Paulsson, 2014, pp. 64-65):

- *Descriptive* studies have the main purpose of finding out or describing how something works or is performed.
- *Exploratory* studies aims at in depth understanding how something works or is performed.
- *Explanatory* studies seek causality and explanations of how something works or is performed.
- *Normative* studies are used when some understanding and knowledge already exists of the research area and aim to suggest measures and provide guidance.

2.3 Research process

The relationship between theory and research is another factor that affects the approach of the study. When conducting a study, the researcher is likely to combine theory (the general) and empirical material (the concrete) in different ways. The wandering between different levels of abstraction between these two end-points, or how the researcher approaches the relationship and conducts his research, is commonly referred to as either a deductive, inductive or abductive approach, see Figure 2.1 (Björklund and Paulsson, 2014, p. 68).

2.3.1 Deduction, induction and abduction

The most common of the three approaches is deduction. With the deductive approach, the researcher, based on theoretical considerations and what is known about an area, establishes hypotheses and propositions about the empirical material to then be attempted to be scrutinized and verified with help of the collected facts (Björklund and Paulsson, 2014, p. 68; Bryman and Bell, 2015, p. 23). As mentioned by Kovács and Spens (2005), a deductive approach goes from a general law to a specific case, following a conscious

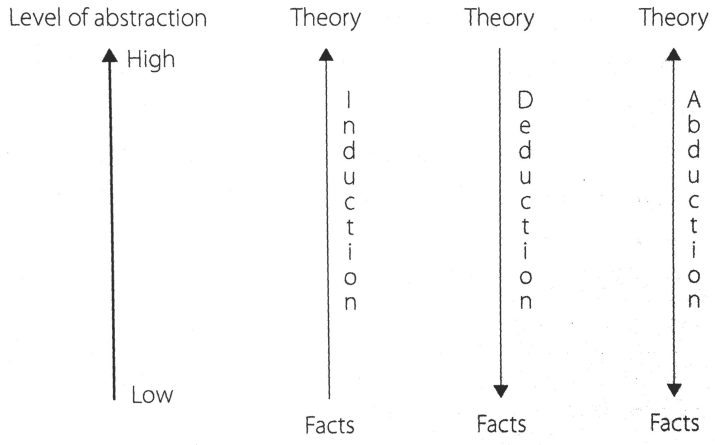

FIGURE 2.1: Deduction, induction & abduction (Björklund and Paulsson, 2014, p. 69).

direction. This entails that deduction is suitable for when theory exists, rather than for establishing new understanding.

Contrary to the above procedure is induction, where the researcher starts in reality and attempts to discover patterns to be summarized in new theory. The inductive approach implies areas can be studied empirically without the need for previous knowledge of literature or existing theory. Instead a theoretical frame is formulated based on the collected information and observations (Björklund and Paulsson, 2014, p. 68; Kovács and Spens, 2005).

The abductive approach is considered a combination of deductive and inductive reasoning. Here, the level of progression goes back and forth across the abstraction levels; abduction is an iterative process of studying both theory and empirical data simultaneously (Björklund and Paulsson, 2014, p. 69). The objectives of the approach is to obtain understanding of the area and to suggest new theory in shape of propositions or new hypotheses. Conclusions can then be drawn from these hypotheses or propositions using the empirical setting (Kovács and Spens, 2005).

2.4 Research method

Research methods describe guidelines for how studies should be carried out and include defined processes and approaches to follow. Before starting a study, it is essential to look into different research methods and the advantages and disadvantages of each approach. Each is different from the other in the logic behind the procedures of collecting and analyzing empirical evidence. To get the most out of the method chosen, one has to consider these differences (Yin, 2009, p. 6). Before choosing research method, Yin (2009, p. 8) proposes to review the following three conditions that distinguish various methods from one another:

1. the type of research questions posed
2. the extent of control
3. the degree of focus on contemporary as opposed to historical events.

Since methods tend to overlap in procedures and reasonings, the answers to the above conditions may not be unique for each method. Instead, they imply clear boundaries between methods do not exist, but are meant to serve as guidelines for selecting the more appropriate methods over the others. Some of the most common research methods are briefly reviewed below.

2.4.1 Survey research

A survey gathers information about individuals or the social unit that the individuals belong to. This is commonly done through questionnaires and personal interviews, such as e-mail questionnaires and phone calls. According to Forza (2002), survey research can be used for three purposes: 1) to obtain a preliminary insight into a topic or to understand how to further research a phenomenon, 2) to test developed theories, concepts and models in the end of a study and 3) to better understand the relevance of a phenomenon or the distribution of a phenomenon within a population (Forza, 2002).

2.4.2 Experimental research

An experiment is a modelled reality with given variables, where these variables can be varied under controlled conditions. In order to develop this modelled reality, a simplification of the reality is often needed (Björklund and Paulsson, 2014, p. 75). Experimental research can be based on two types of experiments: laboratory experiments, which are conducted in a laboratory or similar under controlled conditions, and field experiments, which are conducted in real-life settings (Bryman and Bell, 2015, p. 53).

2.4.3 Action research

Action research can be viewed as research in action, rather than research about action (Coughlan and Coghlan, 2002). Action researchers do not only observe what is happening, they actively participate in making it happen. There are always two goals in action research: the first is to solve a problem and the second goal is to contribute to science. This defines one of the challenges with action research, since a researcher needs to take action while at the same time taking a step back from the action to reflect on it. The aim is to solve the problem and contribute to knowledge (Karlsson, 2009, p. 240). In difference to many other research methods, action research lets the concerned personnel participate in the study rather than viewing them as objects of the study (Coughlan and Coghlan, 2002). Action research is moreover not limited to certain types of data gathering methods, instead both qualitative and quantitative methods are used. Since action research takes action, the research should be conducted in real time, although a retrospective research is also accepted. In general, action research can be described as a real-time case study, or alternatively be viewed as a case study written in retrospect (Karlsson, 2009, p. 241).

2.4.4 Case study research

Case study research is commonly used to understand or acquire knowledge about a phenomenon, for example an organizational phenomena (Yin, 2009,

p. 4). Case studies are characterized by having an explanatory purpose, seeking to explain the *how* and *why* of contemporary circumstances without having control or being able to manipulate what is studied (Yin, 2009, pp. 4,11). Yin (2009, p. 18) gives the technical definition of a case study as "an empirical inquiry

- that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident and
- that copes with the technically distinctive situation in which there will be many more variables of interest than data points and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis."

In a case study research, single or multiple case studies can be conducted including one or several embedded units of analysis (Yin, 2009, p. 47).

2.5 Data collection methods

Data collected is either categorized as quantitative or qualitative. Quantitative data comprise of data that can be counted or classified, such as amount, proportion or weight and can be processed with statistical methods. Qualitative data on the other hand consist of words and descriptions and is rich in detail. Analyzing qualitative data requires methods based on sorting and categorization (Höst et al., 2006, p. 30).

There are various techniques for collecting data and these can be separated according to the relation to its source. Information collected from all forms of written and reproduced material (literature), such as books, articles and documents, are considered secondary data. These literature studies lead to information being obtained that has been produced for another purpose than that of the current study. Primary data is information that has been observed or gained directly from first-hand experience for the purpose of being used in the study. There are several ways of conducting a primary data collection, where the number of respondents and the structure of the collection varies. These are described further below (Björklund and Paulsson, 2014, p. 47).

2.5.1 Interviews

Interviews are the questioning of individuals and the questions are usually asked in direct contact with the interviewee. An interview can have different forms, depending on the choice of and number of respondents. It is common to define three types of interviews: structured, semi-structured and unstructured interviews (Björklund and Paulsson, 2014, p. 74).

- *Structured interviews* are interviews where the questions and the order in which they are asked are predetermined.
- *Semi-structured interviews* are interviews where the subject areas are determined beforehand. However, the questions and the order in which

they are asked are decided by the interviewer during the course of the interview, taking the respondent's answers and reactions into account.

- *Unstructured interviews* are interviews which can be compared to a conversation and the interviewer formulates the questions during the progress of the conversation.

Disadvantages with interviews are that they often are expensive to conduct and that they are time-consuming. They do however provide a deeper level of understanding, due to the possibility to interact with the interviewee and the interpretation of body language and other signals (Björklund and Paulsson, 2014, p. 77).

2.5.2 Observations

Observation is the studying and documentation of events. The observer can be either a participative observer, where the observer is a part of the studied event, or complete observer, where the observer only studies and documents the event from the outside (Höst et al., 2006, p. 35). The method can provide more relevant and unbiased information than other methods, but is generally very time-consuming (Björklund and Paulsson, 2014, p. 77).

2.5.3 Surveys

A survey consists of a set of predetermined standardized questions with alternative answers. Scales, such as a scale from 1 to 10, and yes/no alternatives are commonly used to answer questions, but it is also possible to ask questions where the respondent can answer in an open and more descriptive way. The advantage of using surveys is that an extensive amount of primary data can be collected with relatively little effort. The disadvantages are however that the response rate often is low and that there is a risk for misinterpretation (Björklund and Paulsson, 2014, pp. 75,77).

2.6 Method of analysis

Analyzing data requires different methods depending on the data on hand. The methods are divided into two main categories based on the nature of the data: *quantitative* and *qualitative* (Höst et al., 2006, p. 110).

2.6.1 Quantitative and qualitative analysis

Quantitative techniques are used on quantitative data and usually consist of standardized and structured methods from statistics. The analysis is used in two principal ways; to explore the data to establish an understanding or reveal causal connections and to prove or disprove set hypotheses. The exploration of the data can be made with measurements or visualized with for example histograms or plots (Höst et al., 2006, p. 110). This means quantitative data analysis adopts a deductive research approach, setting out to build on an existing body of knowledge (Karlsson, 2009, p. 66).

By contrast, qualitative approaches instead focus on the existence and in some cases the frequency of certain words, terms and descriptions and is concerned with interpretation and perception rather than with identification

(Höst et al., 2006, p. 110; Karlsson, 2009, p. 66). Qualitative analysis is hence often associated with inductive research strategy (Bryman and Bell, 2015, p. 25). Information analysed comes in the form of text documents, either in terms of transcribed interviews or archived material. In general, it is difficult making comprehensive conclusions in this kind of analysis due to the small selection of participants. Instead, conclusions are drawn on a more profound level. It is important to remember traceability in the analysis; it should be clear from where or whom conclusions have been drawn (Höst et al., 2006, pp. 114-116).

2.7 Credibility

When conducting research, it is always important to establish the quality of the empirical study (Yin, 2009, p. 40). Primarily, this consists of maintaining the objectivity during the course of the work. The objectivity of a study is to what extent the study has been affected by personal values and opinions. By clarifying and motivating choices made, the objectivity of a study can be increased (Björklund and Paulsson, 2014, pp. 66-68). Moreover, ensuring credibility of a study is essential to establishing the quality. There are different measures or aspects of this, where Yin (2009, p. 40) puts emphasis on four concepts particularly important when conducting case study research: *construct validity*, *internal validity*, *external validity* and *reliability*.

2.7.1 Validity

The validity of a study is to what extent the study is measuring what it is intended to measure. Using a dartboard as a metaphor, validity can be described as how close to the bull's eye the darts hit the board. Illustrations of low and high validity can be found in Figure 2.2 (Björklund and Paulsson, 2014, p. 66). Further, Yin (2009, pp. 40-44) identifies three types of validity concerning case studies and how to increase the credibility of these.

Construct validity addresses whether the used measures reflect the reality or if they are a reflection of what the researcher wants to measure. To increase the construct validity, Yin proposes three tactics, where the first is to use multiple sources of evidence, the second is to use a chain of evidence and the third tactic is to have key informants review a draft of the study report.

Internal validity deals with the validity of the study's findings and assures that the findings corresponds to the reality. This is mainly a concern when doing explanatory studies. In order to increase the internal validity, Yin suggests four tactics: pattern matching, explanation building, addressing rival explanations, and using logic models.

External validity is to what extent the findings of a study can be generalized, meaning how applicable the findings are to other cases. To support the generalization of findings, Yin proposes to use theory in single-case studies and to use replication logic when multiple-case studies are conducted.

2.7.2 Reliability

The reliability of a study is to what extent the study can be repeated while generating the same results. Using the same dartboard metaphor, reliability can be viewed as how close to the same spot the darts hit the board. Illustrations of low and high reliability is illustrated in 2.2 (Björklund and Paulsson, 2014, p. 66). Yin (2009, p. 45) mentions two ways to increase the reliability of case studies: first is to in detail document the case study by using a protocol and second is to develop a case study database.

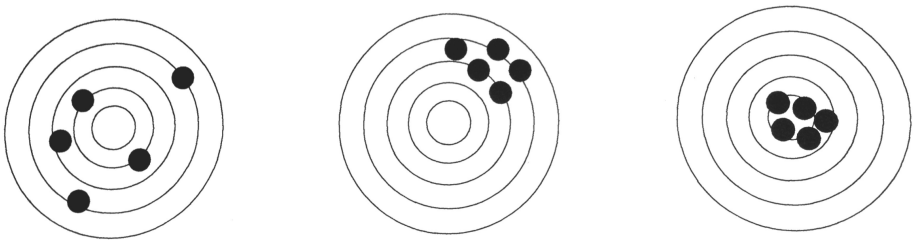

FIGURE 2.2: Illustrations of validity and reliability using a dartboard metaphor: (left) Low validity and reliability, (middle) Low validity and high reliability and (right) High validity and reliability (Björklund and Paulsson, 2014, p. 66)

2.8 The methods and methodologies of this thesis

The following sections describe the methods and methodologies that have been used and followed to carry out this thesis related to the previously discussed approaches in this chapter.

2.8.1 Scientific approach

The supply chain and its various inventory points can beneficially be viewed as a system. The inventory at one point in the supply chain is dependent on the inventory at other points and decisions made and changes in one part of the chain may have effects on other parts of the chain. Moreover, one of the fundamental concepts of supply chain management is that by optimizing the whole supply chain, a greater benefit can be obtained than if every part is optimized separately. These views that focus on the connections and relations of a system clearly steered this thesis towards a system approach.

2.8.2 Research approach

Due to the purpose of this thesis, the procedure could beneficially be outlined into phases to provide a simpler structure of the work. This entailed however that the study could not be generalized to one certain type according to the listed approaches in Section 2.2. Instead, since each phase had a different objective, the nature of the study varied from phase to phase. Initially, the study strived to explore and explain the present situation. Thereafter, the objective was to suggest improvements and provide guidelines of how to work. This meant that the thesis was characterized by a combination of an exploratory, explanatory and a normative approach.

2.8.3 Research process

This thesis was conducted according to an inductive research process. The study used empirical data and conditions as its starting point, where it began with understanding the current planning strategy at IKEA and how they worked with inventory management. When a fundamental understanding had been acquired, analyses were conducted to identify problems and improvement areas in their strategy. This hereafter resulted in a proposal of a new inventory management strategy, followed by a generalization to final theory.

2.8.4 Research method

The question of how to improve IKEA's work with inventory management could be viewed as a problem and in order to solve this and come up with an applicable solution, research needed to be conducted in collaboration with IKEA. However, the research did not only aim at solving the problem expressed by IKEA, but it also aimed at generalizing the solution in order to contribute to theory. This implied that action research was an appropriate research method to apply to this study.

Action research can be viewed as a real time case, which means that the framework within case study research was also applicable. The nature of the thesis entailed that a single case study with a single unit of analysis was the approach most clearly describing the thesis. Single case studies are appropriate when a case is representative of a typical everyday or commonplace situation (Yin, 2009, p. 48). Since the thesis was written on behalf of IKEA and due to its scope being limited to investigating the inventory processes, the thesis process followed that of a single holistic case study. Moreover, due to the fact that the thesis focused on a profound analysis of an inventory system, a multiple case study would have been too extensive to carry out. Finally, the inventory management was the unit of analysis in the case study, since this was the topic to be investigated.

2.8.5 Data collection methods

The data used for the analysis was collected through various data collection methods. Both quantitative and qualitative data were collected by conducting interviews and by retrieving data from documents and archival records. Quantitative data were collected from different internal databases at IKEA, while qualitative data were gathered through semi-structured and unstructured interviews with employees at IKEA and two suppliers in Poland. The data gathered through interviews were collected directly from the sources and were therefore considered to be primary data. The secondary data handled in this thesis were the data gathered through documents, archival records and literature during the course of the project.

2.8.6 Method of analysis

The previous section entailed that both quantitative and qualitative analysis were conducted during the course of the project. The data gathered from databases were of a quantitative nature, and were mainly analysed by visualization in figures and tables. The processing and analysis of qualitative

data gathered from interviews and documents were analysed by comparing and contrasting between different sources. This meant that the development of a strategy was based both on quantitative and qualitative analysis.

2.8.7 Credibility

The exploratory and explanatory part of this thesis served as basis for the proposals, which entailed securing construct and internal validity in this phase was of importance. This was achieved by analyses being based on multiple sources of evidence and information from various parts of the company and by having regular feedback meetings with supervisors of the project. Moreover, by letting key informants within the organisation read drafts of the report helped validate the conclusions. External validity was not be achieved to the same extent, since extensive theory about the subject was lacking and replicating the study in other case studies was not included in the scope. However, the plausibility of results was discussed with employees at the university and stakeholders within the company to evaluate the level of generalizability of the findings.

Assuring the reliability of the thesis was done by in a structured manner documenting how the study was carried out. It includes the type of data collected and provides an overview of the persons interviewed and the topics discussed in the interviews. Following this section, a more detailed description of how the entire study was carried out is made.

2.9 Thesis work outline

The work in this master thesis was structured into two separate phases with different outputs in each phase, see Figure 2.3. The purpose of this section is to provide a clear overview of the tasks and procedures to illustrate the workflow of this thesis.

2.9.1 Phase 1 - Current situation mapping

The first exploratory phase consisted of gaining an understanding of the current operations and processes within IKEA related to supply planning, the characteristics of the category studied and the structure of its supply chain, including the two suppliers. The main focus was on analysis of the inventory levels, how these developed over time and the reasons behind them.

The process of establishing the empirical framework to serve as basis for this current situation analysis consisted of three activities. Primarily, the work consisted of gathering data, mainly from IKEA's extensive BI-system *QlikView* but also from other sources. QlikView contained several applications that compile and summarize data from many of the company's supply chain and sales related activities around the world. This process allowed for the mapping of the inventory levels and stock development to be made. To gain a fundamental understanding of how IKEA currently work with supply planning, interviews with IKEA employees were conducted in parallel to the quantitative data collection. This helped to provide a more detailed picture of the plan and guidelines behind the inventory planning and to explain the tasks and responsibilities of different employees. Lastly, a visit to the

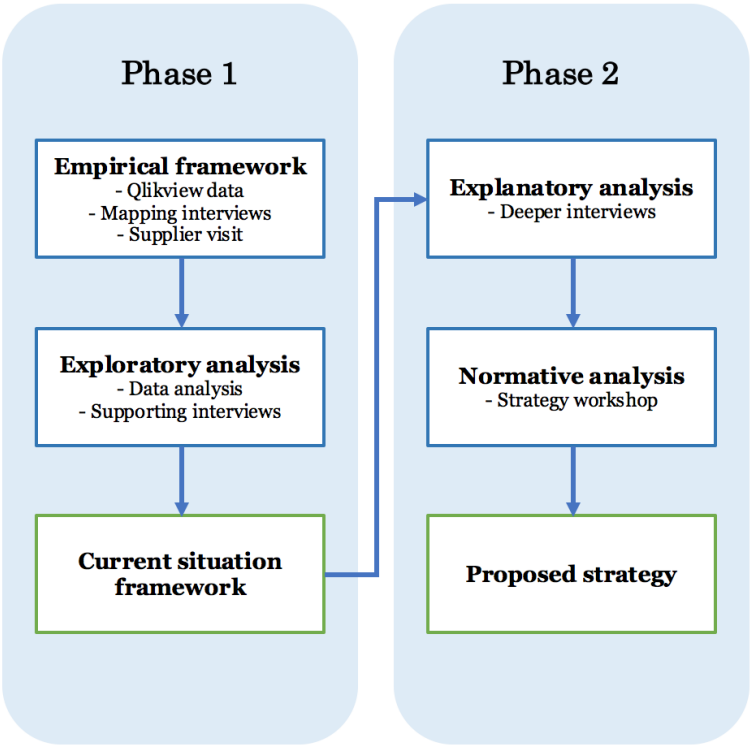

FIGURE 2.3: The workflow of this thesis, divided into two separate phases.

suppliers in Poland was made with the purpose of observing how and why they work the way they do and seeing their perspective of IKEA's supply planning.

With a completed empirical framework, an exploratory analysis was carried out. The analysis consisted of looking into the data collected and finding deviations or patterns, focusing on data related to inventory levels. By conducting interviews with employees and having discussions related to the visualized data, the aim was to gain an understanding of the underlying reasons for the high inventory levels.

2.9.2 Phase 2 - Future strategy development

The second phase was explanatory and finally normative in its approach and concluded in a final theoretical strategy. The completed current situation mapping from the first phase was the foundation of the explanatory analysis. This consisted of further interviews with employees to identify challenges, problems and potential improvement areas to focus on in the normative analysis. This concluding analysis was conducted through final workshop discussions to set up the final framework of an inventory strategy from the perspective of IKEA. Lastly, a generalization of the results was made to make it as applicable as possible to theory.

Chapter 3

Empirical framework - IKEA

This chapter provides an introduction to how IKEA works with logistics, supply and inventory planning in general and describes the roles and responsibilities of various employees involved in this work. The aim is to identify and explain the strategies and guidelines related to planning used in the organization.

Due to the huge range of products and with stores and suppliers worldwide, IKEA has immense requirements on their work with logistics and planning in order to secure availability of products and ultimately keep their customers satisfied. The foundation for this work is making accurate forecasts of sales and having a well-structured and efficient supply chain.

3.1 The IKEA supply chain

IKEA's supply chain is vast and far-reaching. It comprises of activities from sourcing of raw materials to the handover of a finished product to the final customer. The supply chain of IKEA is illustrated in Figure 3.1. The sourcing of raw materials and components is not looked into in this thesis and will not be described further. For finished goods on the other hand, there are different ways for a product to get from a supplier to a customer. These different types of flow are called *replenishment setups*. For IKEA, the main selling point is in stores. If the ordered volume is large enough the goods are transported directly from the supplier to the store, which is referred to as *Direct Delivery* or DD. Alternatively, the goods can be transported through *Transit*, which means that the transport from the supplier goes to an IKEA distribution terminal/center, a DT or DC, where the goods are offloaded. Within 24 hours, the goods are loaded and consolidated with other goods onto new trucks before being transported to the store. For lower ordered volumes, the goods are transported from supplier to a DT where they will be stored until requested from stores, after which the goods will be consolidated and transported to the store. These are referred to as *DT deliveries*. Depending on the sales quantities of articles and the order volumes of stores, there are two types of DTs within IKEA that goods can flow through: *high-flow* or *low-flow* DTs. Higher selling goods are shipped on

pallets and are stored in high-flow DTs which are located close to the markets and commonly supply one or a few countries. Low-flow DTs are on the other hand located more centrally, supplying an entire region and handles lower selling goods that are requested in pieces or multi-packs. Finally, customer orders that are ordered at stores, by phone or at the IKEA website are supplied by Customer Distribution Centers or CDCs. These *CDC deliveries* are similar to the ones going via DTs, but instead of transporting the goods to a store, the goods are transported by external distributors directly to the customers.[1]

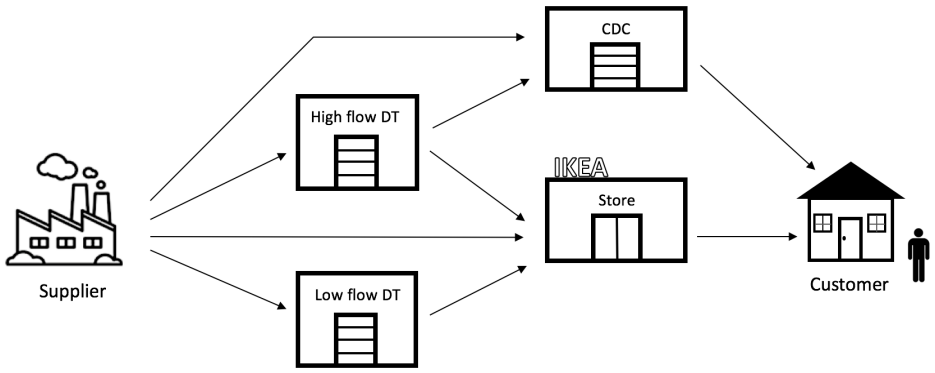

FIGURE 3.1: Replenishment setups illustrating: high-flow, low-flow, direct and CDC deliveries.

The replenishment setups can also be combined, allowing stores to be supplied with both direct deliveries and DT deliveries. This is referred to as *Combined Supply* or CS and is usually set as percentages, for example 20/80, where 20% is the minimum quantity taken from DT. Combined supply is a common solution when having deviations in lead times from suppliers, particularly for long lead times, since stores can be replenished from DTs if needed.[2]

In general, IKEA aims at keeping low selling articles with a yearly volume of less than around 500 m^3 at low-flow, including many seasonal articles such as winter and summer collections. Low-flow DTs are more efficient in its handling operations, due to it being semi-automatic.[3] Further, the total safety stock at low-flow, compared to the sum of safety stock at high-flow DTs, is lower since variations in demand is reduced when demand is aggregated, meaning that high demand from one store can be offset by low demand from another store (Ho-Yin and Zuo-Jun, 2012). These facts together with the flexibility the low-flow DT provides towards supplying stores from its central location is the reason for it being the best option for lower selling articles. However, the costs related to low-flow DTs are significantly higher compared to high-flow DTs due to goods being picked and consolidated instead of being shipped directly on pallets.[4]

[1] Holm, 2016.
[2] Ibid.
[3] Petersson, 2016.
[4] Ibid.

In order to establish optimal replenishment setups, not only lead times are taken into account by IKEA. An important aspect is the volume utilization of trucks, which has a large impact on transport efficiency and costs. This is one reason why IKEA also uses *Consolidation Points* or CPs in their replenishment solutions. These are externally owned warehouses located close to the suppliers that are used by IKEA to consolidate shipping. These are generally used when suppliers do not have the possibility to fill up a truck to a store or DT within a certain time period.[5]

3.2 Sales and capacity planning

Balancing demand and supply is both an important and difficult task. Having too little in stock leads to lost sales and perhaps bad reputation, and having too much is related to large costs of storage and capital tie up. The activities that determine this balance are the forecasting of future sales and the related planning activities. Before describing the forecasting and planning processes in IKEA, some definitions need to be clarified. These are also illustrated in Figure 3.2 (*The common planning concept* 2011).

- A **Selling Unit** is a term used for a store or a CDC.
- A **Retail Unit** is a group of Selling Units located in the same country.
- A **DCG** (DC Group) is a geographical grouping of DCs (or DTs) that jointly have the responsibility to supply a group of related Selling Units with a certain article. Each DCG is often connected to one sub-region.
- A **Supply Chain Matrix** is the tool that connects the supplier and item with the receiving market, defining the sourcing for IKEA products. The items can be sourced either directly from supplier to receiving market or via a DCG. The matrix holds information regarding each supplier's market responsibility share for each article. It also includes information about which DT within the DCG that each selling unit should prioritize replenishment from.

3.2.1 Forecasting

In Figure 3.3, the construction of the regional forecast is illustrated. Sales forecasts for all articles are based on sales history for the last three years (156 weeks) and are all aggregated from the bottom up to easier take seasonal patterns into account. The weekly sales history for each article and for each selling unit is aggregated to regional level (e.g. Europe). Market information, such as activities, catalogue changes and promotions, is added on regional, retail unit or selling unit level to create the regional weekly forecast. The sales history for each retail and selling unit in relation to the aggregated sales history on each level makes up their forecast share (dotted arrows).

[5] Wilczak, 2016.

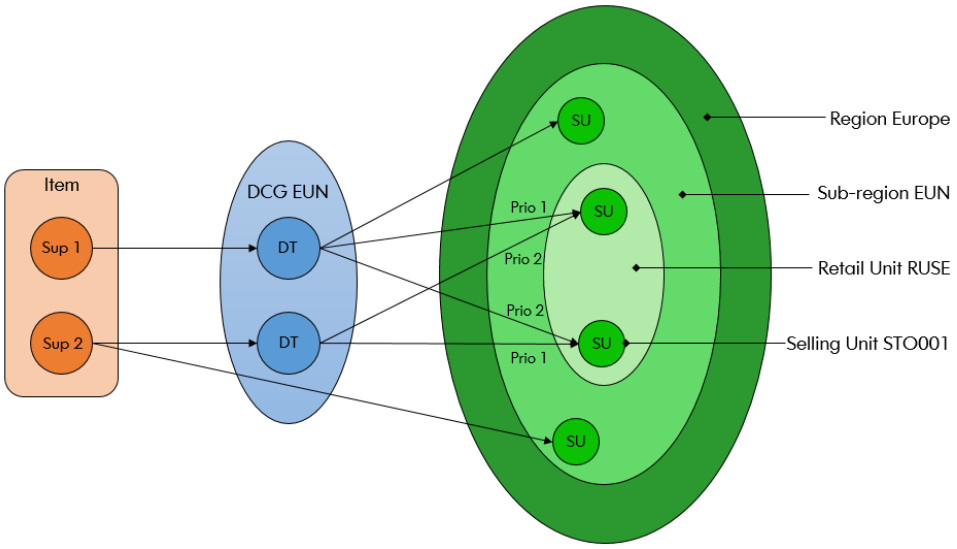

FIGURE 3.2: Illustration of a supply chain matrix.

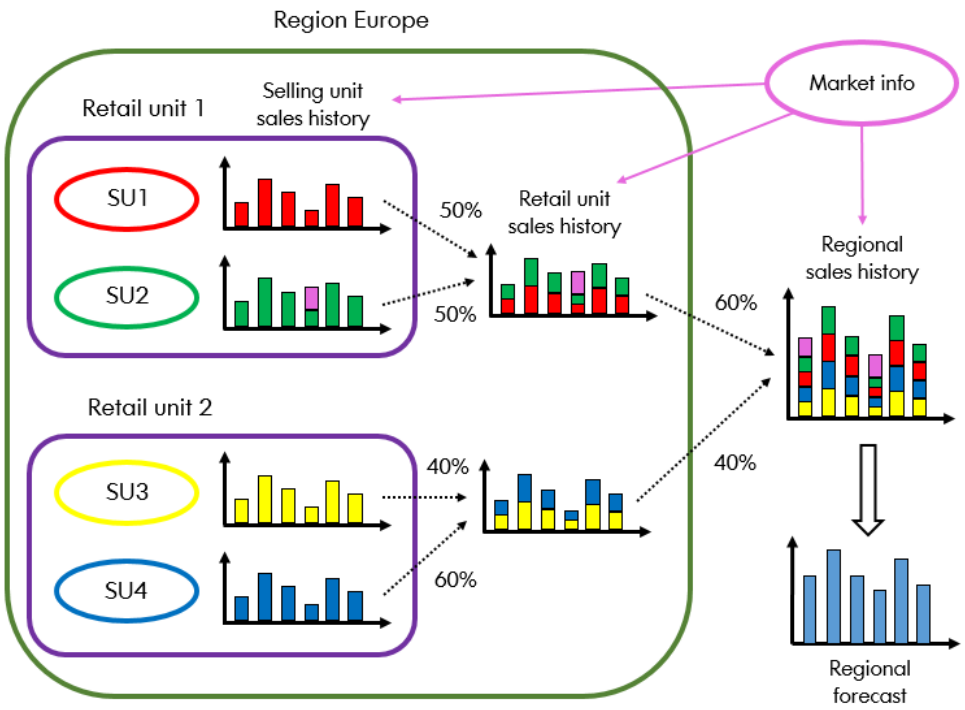

FIGURE 3.3: Illustration of the construction of the regional forecast.

The established regional forecast, including all market information, is thereafter broken down based on the forecast share for each retail and each selling unit to establish a final forecast of article per selling unit per week. The broken down forecast on selling unit level can be adjusted in short term perspective and if needed be further broken down to a daily level. This is illustrated in Figure 3.4 (*The common planning concept* 2011).[6]

[6]Carlsson, 2016.

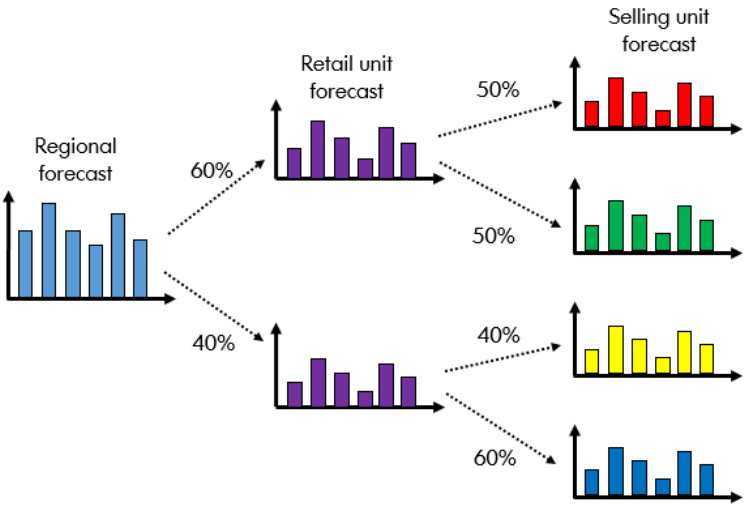

FIGURE 3.4: Illustration of forecast breakdown from regional to selling unit level.

3.2.2 Need planning

Based on the broken down forecasts for each article, the need calculation for each selling unit is made. This is illustrated in Figure 3.5. The planning frequency for the need calculation is daily for a planning horizon of approximately three weeks and weekly for the full planning horizon of 84 weeks. The need for all selling units that are replenished from DTs are summed up on DCG level to create the DCG need. Both the DCG and selling unit need takes current stock, planned orders, goods in transit and safety stock into account to establish the order proposals. Finally, the accumulated DCG need together with the need for selling units replenished with direct deliveries from suppliers are then aggregated to order proposals towards each supplier. The combined need to all suppliers is what makes up the total IKEA need for each article (*The common planning concept* 2011).[7]

3.2.3 Order and capacity planning

When the total IKEA need has been established, various input parameters for planning are taken into account. These consist of checking capacities for suppliers and transportation, and planning for stores and warehouses. Possible imbalances between these factors and the total IKEA need lead to adjustments being made in the order creation, which are then further allocated to DCG level based on certain rules. Orders for suppliers are then accumulated and sent as block orders for a certain time period. This means they are given as most commonly daily or weekly and in some cases monthly orders depending on the capacity and flexibility of the supplier. The orders are created within the replenishment lead time, all according to the supply chain matrix (*The common planning concept* 2011).[8]

Capacities for the suppliers are especially impacting the order proposals since these determine the upper limit for the amount that IKEA can order. The

[7] Ibid.
[8] Ibid.

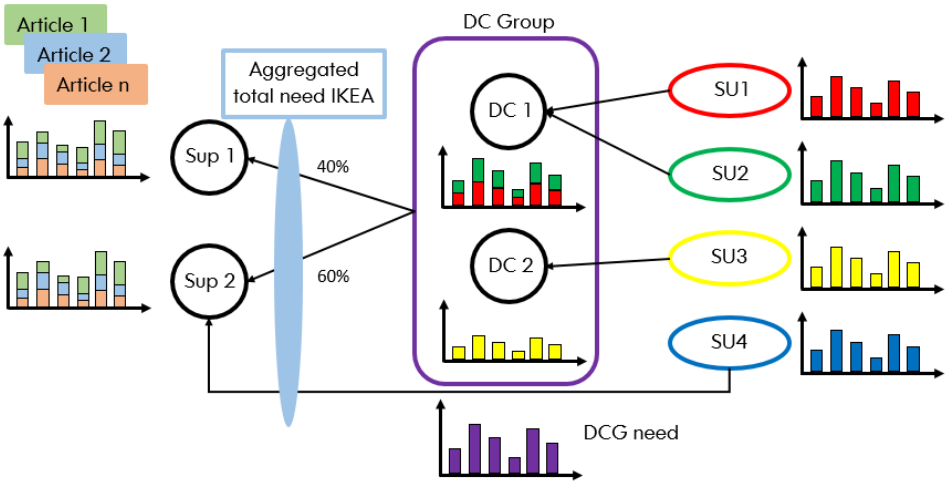

FIGURE 3.5: Illustration of need planning.

capacities are established 52 weeks ahead by the suppliers and are commonly given as weekly or monthly or in some cases yearly numbers for the largest suppliers, enabling IKEA to set the weekly capacity plan themselves. The capacities are based on production, storage and shipping limitations and the fact that suppliers have the goal of having a more or less constant production during the year. Suppliers are asked by IKEA to have available capacity to produce about 10-15% above the forecasted amount to allow for some flexibility.[9] If the need exceeds the available capacity for a supplier a certain week, order adjustments has to be made and the excess quantity has to be produced earlier. In general, this quantity cannot be stored by the supplier and is instead distributed to DCGs. This is illustrated in Figure 3.6. In the rare cases of when pre-production is not possible, for example if the supplier has production capacity constraints during a longer period of time, the orders must instead be cancelled or alternatively renegotiated to still be timely produced but to a higher cost (*The common planning concept* 2011).

IKEA has in some cases purchasing commitments with suppliers. These establish an agreed amount in volume, number of articles or most commonly money between IKEA and the supplier to be purchased in a certain period of time. Commitments are beneficial to both parties by ensuring certain order quantities from IKEA to suppliers which in turn guarantees a good price for IKEA.[10] They usually include warranties from the supplier to ensure that quality targets are met and that other KPIs (Key Performance Indicators), such as delivery performance and service level, reach good results. A common requirement from IKEA is that a negative price development is included in the commitment, meaning both parties should focus on making logistics and production activities more efficient to reduce costs and thus the price. Finally, a commitment may sometimes be needed to support a large investment for the supplier, such as implementing a new production line or building larger storage facilities.[11]

[9] Wilczak, 2016.
[10] Petersson, 2016.
[11] Nilsson, 2016.

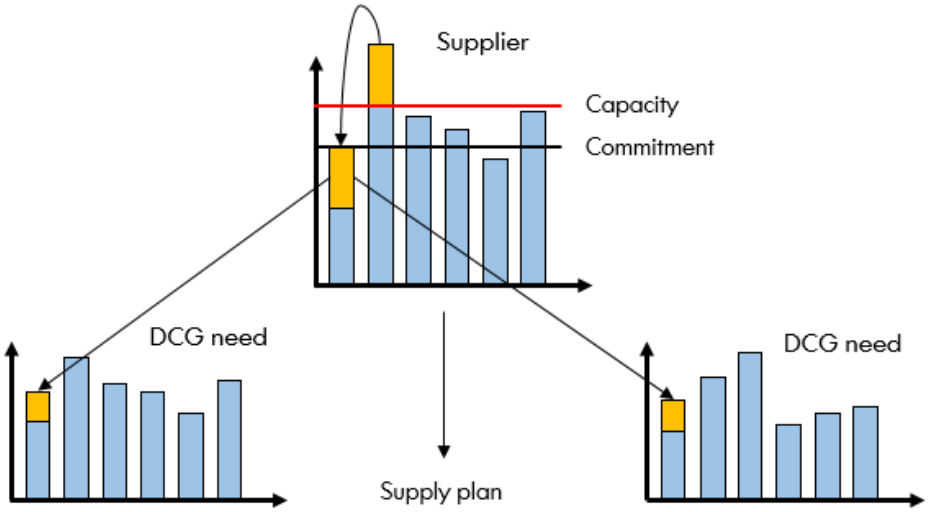

FIGURE 3.6: Order balancing due to capacity limitations at supplier. The bars in the figure represents orders where the yellow bar above the capacity line shows the order volume that exceeds the available capacity. This volume needs to be produced earlier when capacity is available and, if storage at suppliers is limited, be distributed to DCGs.

3.2.4 Planning roles

In order to gain a better perspective of the decisions influencing the planning processes and why and by who these decisions are made, the roles of different employees involved in the planning activities will be described. Furthermore, some essential internal applications and tools will be named together with the role descriptions. This will help concretize the planning operations, responsibilities and strategies for the reader.

Demand planner

Demand Planners are responsible for the forecasting of the IKEA range broken down to article per country according to the process in Section 3.2.1. The forecasts are set up in an application called *DSP (Demand and Supply Planning)*. One part of DSP is called *Fulfillment* which is used within the IKEA supply chain for need and safety stock calculation, as well as planning for capacities and constraints for warehousing, transport, suppliers and categories. The calculations and planning are made on store, CDC, DCG and supplier level where the output of those processes are stock exceptions and order proposals. The latter comes in the form of an *SPI (Supply Plan Information)*, which is the plan communicated to suppliers, containing the information of when IKEA wants what quantities produced or delivered (*Competence profile: Demand planner*; *Fulfillment*).

Stores also make their own forecasts without the participation of demand planners. Like the demand forecasts, these are based on sales history but include the stores' own analyses and perspectives. These mainly consist of an estimate of weekly sales and a sales index of how this estimation is distributed

over the weekdays and serve as input parameters for the forecast in Fulfillment. The forecasts tend to exceed the country forecasts made centrally, and with stores having the possibility to overwrite the demand forecasts, it is the store forecasts that make up the SPI to suppliers. This is particularly noticeable before large sales periods when stores tend to overestimate their projected sales which in turn affects the suppliers.[12]

Need planner

Based on the demand forecasts, the need is calculated in Fulfillment. The purpose of need planning is to balance need versus capacity through inventory and replenishment planning, enabling availability to the lowest total cost. *Need Planners* are accountable for defining the replenishment solutions and planning the stock structures in all DCGs. This includes identifying potential overstock or out-of-stock situations and acting on deviations outside the lead time. They are also responsible for planning goods flow in product change processes as well as securing availability during activities and sales plans, and setting up stock development plans on DCG levels (*Competence profile: Need planner*).[13]

BA specialist

To support the need planner, there are *BA (Business Area) specialists* for each region which act as a link between need planning and retail. Their main task is to assure availability to end-customers to the lowest possible supply chain cost by driving and adding value to the replenishment process from supplier to DTs and selling units. This includes securing availability of agreed articles used in global or country activities and setting priorities between stores/CDCs/DTs within the region in case of limited supply. Furthermore, they are assigned to ensure a healthy stock structure at DCG levels, initiate sales steering activities concerning regional overstock/shortages in collaboration with retail logistics, follow up orders, secure that replenishment setup changes are executed in an optimal way, ensure that new articles arrives to stores before sale start and that discontinued articles are phased out as planned (*Competence profile: Supply BA specialist*).

SDR specialist

For each region, there are also *Supply Development Receiving specialists (SDRs)* which contributes to availability at the lowest cost by leading the work at the regional level to define, implement and follow-up optimal replenishment solutions. They are responsible for making replenishment setup analysis per article per selling units three times per year (*Competence profile: Supply development receiving specialist*).[14]

[12] Petersson, 2016.
[13] Ibid.
[14] Ibid.

Supply planner

The communication and collaboration part of the planning between IKEA and the suppliers are handled by *Supply Planners*. These are the link between need planners and suppliers, and are responsible for operational and tactical capacity planning based on supplier capabilities and performance. Responsibilities also include preparing the best replenishment and delivery solutions for the suppliers, and working towards developing the collaboration and the logistical competence of the suppliers based on IKEA experiences (*Competence profile: Supply planner*).[15]

Category manager

On a more strategic level, the *Category Manager* is responsible for the entirety of the category. This mainly involves establishing and developing a healthy and well-performing supplier base, securing the optimal sourcing setup regarding price and availability and ensuring that quality and safety requirements are met. The role also consists of managing her/his cost budget, striving for optimal resource utilization to reach business goals. Furthermore, the work includes close collaboration with the HFB to assure that the category plan is in line with the HFB business plan, and establishing sourcing assignments with relevant HFBs (*Competence profile: Category manager*).[16]

3.2.5 Specific planning situations

During the course of the year, certain recurring and non-recurring sales activities need to be planned for. Activities consist of promotions, sales offers and campaigns in stores and are requested on country level to the planners at IoS. Smaller activities are handled automatically by Fulfillment, adjusting orders for the extra need and freezing the sales history for the coming weeks. For key activities, the request must include the time period and the predicted sales quantity, and must be communicated at least six months ahead since the additional quantities needed must be approved by affected suppliers. The additional amounts of goods are distributed according to the replenishment setups to the stores. If a key activity is large enough however, some quantities are supplied to the DTs before sale start to ensure that orders are produced in time and securing availability to stores during the activity periods.[17]

Each year, three major activities, namely Christmas, Chinese New Year and the catalogue release in August/September, especially require IKEA to plan ahead. The first two are holiday events where many of the personnel in manufacturing and logistics in the affected regions are on holiday leave. The limitations in sourcing require IKEA to front-load goods at DTs to secure availability in stores during these periods. With the catalogue release on the other hand, extra planning is required since with the release, IKEA promises products to be available and has to stand by this commitment to avoid customer dissatisfaction. In a similar way, front-loading at DTs are used to secure store replenishment.[18]

[15] Wilczak, 2016.
[16] Nilsson, 2016.
[17] Petersson, 2016.
[18] Ibid.

Another specific planning situation arises when launching a new product or when connecting or changing a supplier in a supply chain matrix, a so called first-buy. The purpose of first-buys are to buffer against initial uncertainties in sales and supply. The first-buy quantity should be large enough to fill the sale areas in stores and to cover the sales during the lead time. The quantity covering sales are usually accumulated for some stores and put on DTs. After a period of four to six months, sales have usually stabilized and possible supplier issues been resolved, and thus the additional stock can be removed.[19]

3.2.6 Replenishment setup planning

The replenishment setups, describing how products are distributed, are set and updated for each store three times a year. This is done centrally by SDRs in coordination with BA specialists. Supply planners have the possibility to add valuable input and suggest changes of these setups, since they are working closer to suppliers and hence have deeper insight in the capabilities of these. Stores generally strive to have as much DD as possible and tend to push planners to increase this share of replenishment. This is principally due to DD being cheaper for the stores than DT deliveries because of lower supply chain costs. If some constraints or problems would arise concerning replenishment setups, brief changes of these can be made during a specified time period of maximum eight weeks. These are called *Distribution Mode Exceptions (DME)* and are set up by the BA specialist together with the participation of the supply planner to prevent large impacts on the affected supplier's production. They are used for occasions when a DD setup needs to be changed to a DT setup due to for example quality problems at the supplier or traffic bans in a region or for building down stock levels at DTs.[20]

3.3 Inventory planning

IKEA keeps stock with the purpose to secure availability of products in stores to the lowest possible cost. This is closely related to the IKEA concept, stating that products offered in IKEA stores shall, as a fundamental rule, be available the same day so that customers can bring their purchase home and enjoy them immediately. Finished goods stock is kept at each point in the supply chain: at suppliers, DTs, CDC and stores (*Strategic Framework for Inventory Management* 2015).

3.3.1 Current inventory strategy

IKEA categorizes stock in relation to replenishment and ordering, where "stock on hand", or the total quantity of an item in a business unit, is categorized as either available, reserved or blocked stock. Reserved stock is the part of the stock on hand that is reserved for existing future orders and blocked stock is the quantity stopped for reasons related to quality, customs, license, sales etc. Hence, the available stock is the stock on hand minus the reserved and blocked stock (*Strategic Framework for Inventory Management* 2015).

[19] Petersson, 2016.
[20] Ibid.; Wilczak, 2016

There are also views on stock related to other aspects of inventory in the organization, regarding the judgement of whether IKEA needs the stock they have or not. These stock classifications are illustrated in Figure 3.7. IKEA Asset stock is what makes up all stock that is physically in a stock keeping unit (On Hand stock) or moving between IKEA units (IKEA Road stock). The part of IKEA Asset stock that is considered needed is referred to as Calculated stock, which is composed of Turnover stock and Original Statistical Safety stock. Turnover stock is the quantity required to meet demand under conditions of certainty and is steered by lot size, delivery frequency and order coverage duration. Safety stock is inventory to protect against stockouts caused by unpredictable fluctuations in demand or lead time, and is steered by lead time and forecasted demand and deviations in these, together with the article service level. Stock exceeding the calculated stock is called Overstock and consists of Blocked goods, Extra Used Safety stock and Other stock. Similarly, Understock is a term used when calculated stock exceeds the asset stock (*Strategic Framework for Inventory Management* 2015).

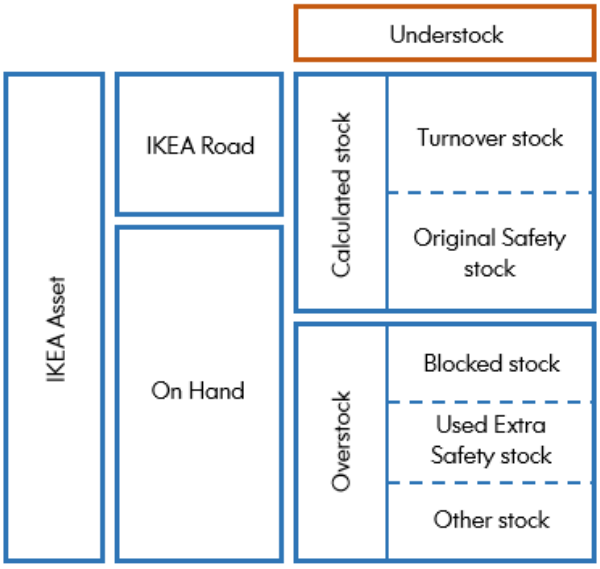

FIGURE 3.7: IKEA's current stock structure.

3.3.2 Future inventory strategy

IKEA's current setup to monitor and manage stock involves multiple systems, reports and measurements, which has led to multiple stock terms and definitions being used for the same stock. This in turn has resulted in different calculations and presentations of stock in the company. This is the reason why a new approach to managing inventory has been developed in line with industry standards (APICS) to guide IKEA employees how to organize, store and replenish inventory and ultimately keep an adequate supply to secure availability. This is part of the strategic framework for inventory management developed by IKEA mentioned in Chapter 1. It consists of a new stock structure and terminology with clear rules and guidelines for the use, monitoring and management of inventory across the supply chain. It will also assist in identifying and categorizing wanted and unwanted stock in a clearer way (*Strategic Framework for Inventory Management* 2015).

The future classification of stock is made according to Figure 3.8. Stock or Finished Goods inventory is kept for several purposes and reasons. According to the figure, the proposed dimensions of finished goods consist of Cycle stock, Safety stock and Excess stock. Cycle stock is similar to turnover stock in the previous section and represents the estimated stock to meet customer demand. Like in the current structure, safety stock is kept to prevent stockouts due to the uncertainties mentioned previously. Excess stock in turn consists of Hedge stock, Anticipation stock and Other stock. These last three terms will play an important part in the future planning at IKEA and will thus be explained further (*Strategic Framework for Inventory Management* 2015).

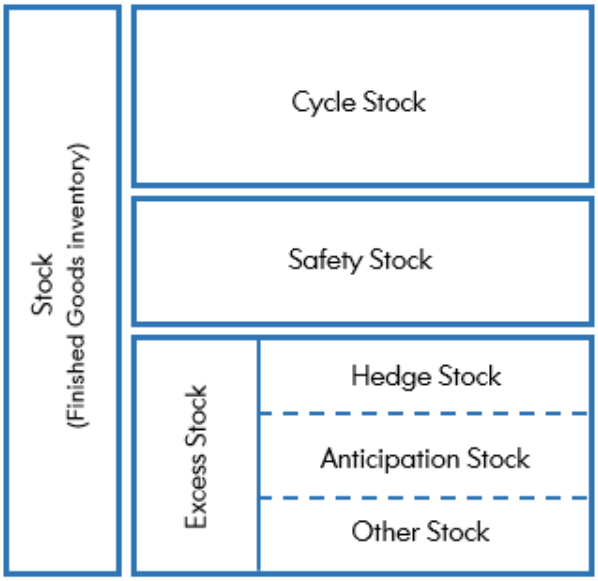

FIGURE 3.8: IKEA's future stock structure.

Hedge stock

Hedge stock is additional stock with the purpose to shield from *extraordinary uncertainties*. These are unknown events that may or may not occur and are not covered by the system calculated safety stock. Examples of situations that hedge stock may be kept for are (*Strategic Framework for Inventory Management* 2015):

- uncertain sales potential during catalogue release and news
- uncertain transport restrictions caused by traffic bans
- uncertain production capacities for news
- strike risk (DT, Transport, Customs etc.).

Anticipation stock

Anticipation stock is inventory produced earlier than the scheduled need to cover for known restrictions. Situations for when anticipation stock is kept include (*Strategic Framework for Inventory Management* 2015):

- planned shut downs at supplier (e.g. Chinese New Year)
- production limitations in relation to strong seasonal sales pattern (e.g. outdoor furniture)
- transport limitations (e.g. European Christmas)
- receiving limitations at selling units (e.g. major activities and catalogue drop).

Other stock

Finally, other stock is the part of excess stock that exceeds hedge and anticipation stock, and should be kept at a minimum level. This includes inventory generated by occasions when (*Strategic Framework for Inventory Management* 2015):

- IKEA buy more than they sell (e.g. commitment)
- IKEA sell less than planned
- replenishment solution changes (e.g. stock left in DT when changing to DD)
- human error (e.g. entering of article number in wrong field)
- system error.

Additional guidelines and principles are to be implemented regarding this stock structure for each of the three terms named above. These can be found in Appendix A.

Chapter 4

Empirical framework - the paraffin/stearin category

This chapter describes how the logistics and supply planning activities are carried out in the paraffin/stearin category specifically. It provides an initial overview of the conditions and challenges faced with planning and logistics related to this category.

With 34 different categories, the supply chain and the related work is highly varying in the company. With unique preconditions and challenges in each category, problems and shortcomings is differing and it is thus essential to establish the framework that characterizes the specific category studied.

4.1 Introduction to the category

The product area investigated in this thesis is candles since within IKEA this range is managed by the *paraffin/stearin* category in *HFB 16, Decoration*. The category includes several candle products of different sizes, shapes, colors and scents, where some of the most popular product families are SINNLIG, GLIMMA, JUBLA and FENOMEN, see Figure 4.1. The nature of the product area means it is characterized by significant seasonal demand variations during the year, see Figure 4.2. During the darker months of the year, especially before the Christmas holidays, customers are purchasing large amounts of candles and demand reaches peaks of three times the weekly sales compared to calmer periods of the year. This leads to great strains on the planning activities at IKEA, in order to meet demand but simultaneously avoid large stock build ups.

The product range of candles is large and is representative for IKEA in general, where few articles account for the majority of sales followed by a very long "tail".[1] As Figure 4.3 illustrates, the four biggest product families account for about 80% of the volume and the volumes for two thirds of the families are extremely low. The sales volumes are also partly related to the service levels set for articles, where in general articles with high sales

[1] Carlsson, 2016.

(A) SINNLIG (*IKEA homepage*)

(B) GLIMMA (*IKEA homepage*)

(C) JUBLA (*IKEA homepage*)

(D) FENOMEN (*IKEA homepage*)

FIGURE 4.1: Examples of candles within the four top-selling product families.

volumes have high service levels and products with low volumes have low service levels. The IKEA service level is defined as the number of days out of the 365 days in a year an article should be available. These are set primarily based on the turnover or alternatively the importance of articles, for example articles needed to make a family complete (e.g. hinges). There are four service levels in IKEA: S1 (99%), S2 (98%), S3 (97%) and S4 (95%).[2]

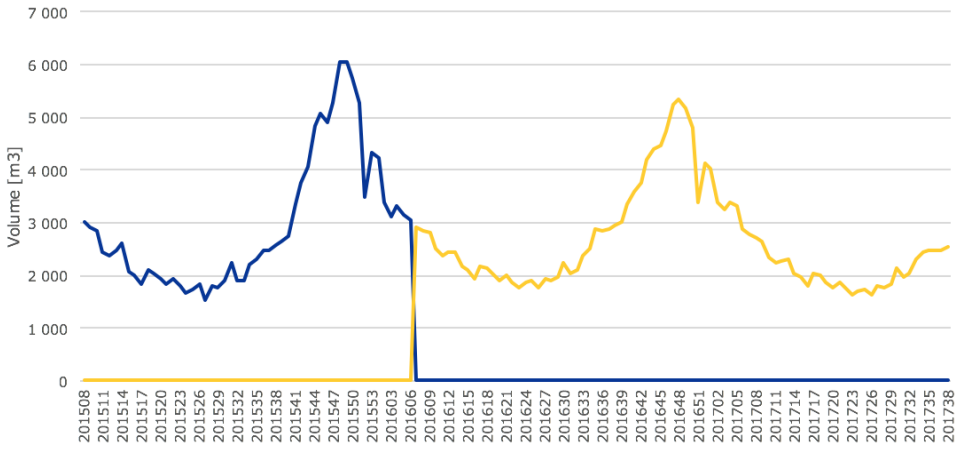

FIGURE 4.2: Weekly sales from 2015 week 8 to 2016 week 7 and forecasted weekly sales from 2016 week 7 to 2017 week 38 (QlikView, 2016).

[2]Petersson, 2016.

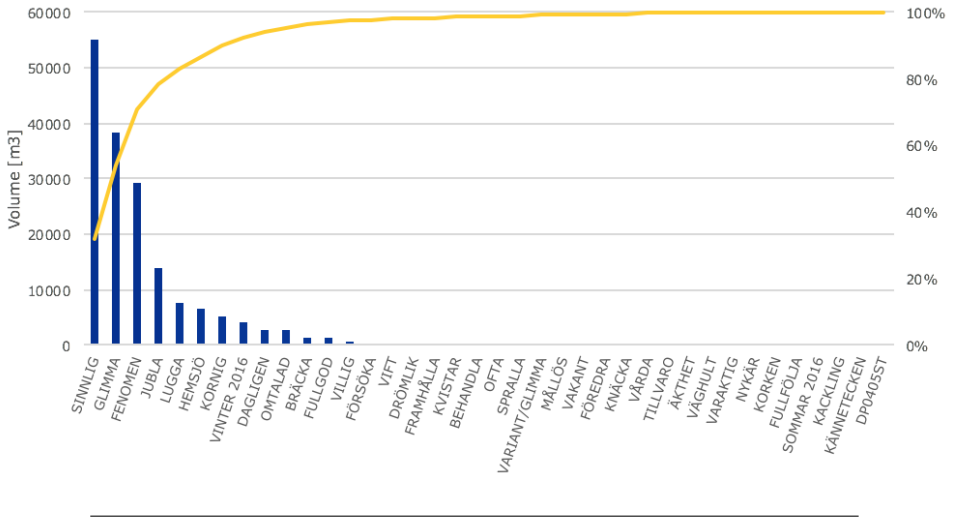

FIGURE 4.3: Yearly order volume per product family sorted by volume from highest to lowest (QlikView, 2016).

4.2 Supply chain

This thesis will focus on operations within Europe since it is IKEA's biggest market for candles, around 80% of deliveries have European IKEA stores and warehouses as destination. IKEA uses about 15 suppliers for the European market, thus in order to further limit the study, two of IKEA's biggest suppliers of candles will be used in the study: hereby referred to as *Supplier A* and *Supplier B*. These are both located in Poland, the largest sourcing market of candles, and together they account for 30% of the yearly supply of candles in Europe. They both supply most of the European countries via 12 DTs or with direct deliveries to around 250 stores (QlikView, 2016).

4.2.1 Supplier A

As IKEA's second largest candle supplier, Supplier A has a daily production of 9.000.000 pieces. The facility holds 19 production lines, some which are dedicated to producing for IKEA only, their biggest customer. The most produced item is white tealights, in the IKEA case GLIMMA, with a capacity of 1.000.000 pieces per day.[3]

Supplier A does not at the moment make any forecasts themselves but plans to implement a system to make their own forecasts for IKEA, based on deviations between orders and the SPI. Instead, production is planned based solely on the SPI and planning is done both in the long and short term. The long term planning sets a plan for the coming 12 months for each product family. This includes investigating needed production and warehouse capacities and the need for additional staff. The short term planning is made weekly as a master production schedule (MPS), with a horizon for the coming 8-10 weeks. Here, the capacity of the production is split up for each article. Supplier A freezes the coming two weeks of production based on the MPS plan.[4]

[3] Supplier A, 2016.
[4] Ibid.

The production runs 24 hours a day split into three shifts with a minimum production batch set to two shifts. Due to the characteristics of candles as a product, the production is relatively seasonal: 40% of the volume is produced in low season and 60% in high season. Supplier A aims at being flexible, allowing the possibility to implement changes 1-2 shifts ahead if raw materials are available or have short lead times, alternatively making changes between different groups of articles with similar components. Each production order consist of at least 50 pallets, whereas each customer order is at least one pallet. For IKEA, the production is make-to-stock (MTS), meaning that pallets are stored in a finished goods warehouse next to the production facility, in general for 1-3 weeks depending on the season. When it comes to seasonal products, the production is instead make-to-order (MTO) meaning the goods are manufactured when the order is placed by IKEA. These candles are usually produced in low season when Supplier A has some available capacity. The capacity of the finished goods warehouse is 10.000 EUR pallets, whereas 70% is used for IKEA. The stock level is kept at 3-4 weeks based on the expected demand. If needed, Supplier A has the possibility of using an external warehouse in peak periods, but this is related to an additional cost for the customer.[5]

4.2.2 Supplier B

The Chinese candle producer Supplier B has one European factory located in Poland, with IKEA as its main customer. Supplier B is IKEA's third largest supplier of candles with eight production lines and a daily production of around 2.000.000 pieces.[6]

Supplier B has during the last year used an internal forecasting process for IKEA to more accurately plan production. It is made based on comparisons between the orders received and Supplier B's last year's forecast as well as the IKEA SPI. This processes produces the monthly sales forecast which in turn serves as basis for the monthly production and stock plan. The production forecast is prepared for each article and every production line.[7]

The purpose of the stock building plan is to prepare for the peak season when production capacities are limited. The aim is to reach a reasonable stock level at the end of August, just before the peak season begins, which allows for a constant production to be kept during the year. Hereafter, the stock levels decrease until the end of December, marking the end of the peak season. A maximum stock level for finished goods has been set by Supplier B to prevent them from producing too much stock. The warehouse has a capacity of 5.000 EUR pallets whereof 4.000 are finished goods storage for IKEA, Supplier B's only customer with MTS production. There is also an additional external warehouse in use when needed, but in the coming year Supplier B will replace the use of this with a newly built warehouse with an additional capacity of 4.000 pallets.[8]

[5]Supplier A, 2016.
[6]Supplier B, 2016.
[7]Ibid.
[8]Ibid.

4.2.3 Flow of finished goods

The distribution of goods for the two suppliers within Europe during the last year is summarized and illustrated in Figure 4.4 to provide a perspective of the replenishment flow. Deliveries to CDCs are disregarded in this thesis since these accounted for less than 1% of the flow. Most of the orders, around 80-85%, were supplied via direct deliveries. In order to easier consolidate goods for store deliveries, all the DD orders passed through an externally owned warehouse or consolidation point called DD Point Company C, also situated in Poland. Moreover, around 7% of the direct deliveries from Supplier A were shipped through transit, whereas Supplier B used no transit whatsoever. The rest of the flow had the different DTs as destination whereof one of these is the European low-flow warehouse located in Germany. In terms of volume, the low-flow DT was the greatest destination point for the two suppliers' deliveries (QlikView, 2016).

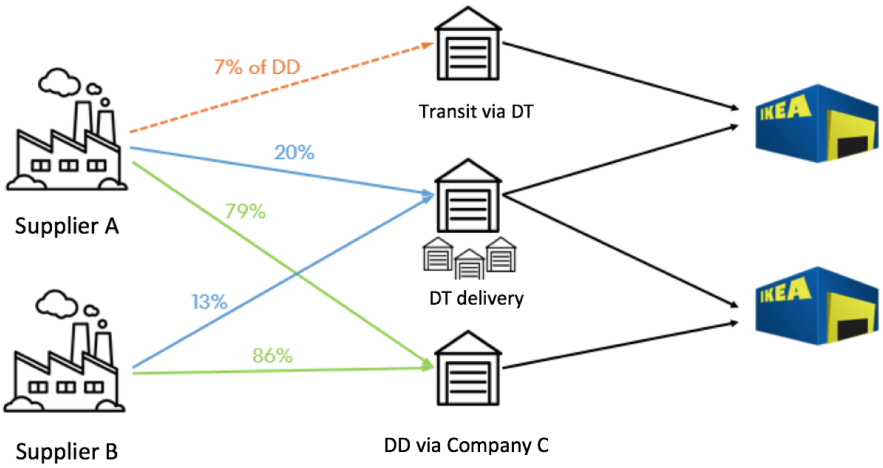

FIGURE 4.4: Percentage of DD, Transit and DT deliveries from each supplier based on historic data of the last year. Green lines represent DD deliveries which all passed through DD point Company C. Orange line represents the percentage of DD deliveries that was shipped via Transit, and the blue lines represent the percentage of DT deliveries (QlikView, 2016).

4.2.4 DD point Company C

Company C is a large supplier of sofas for IKEA located in western Poland. Its facilities include a large warehouse widely used by many of IKEA's suppliers in Poland and nearby regions as a consolidation and storage point. It is used for goods that are shipped directly to stores and is known within IKEA as a DD point. Since Poland is one of the largest sourcing regions for IKEA, Company C has become IKEA's largest consolidation point with shipping windows every day, providing flexible transport solutions. It provides the possibility for smaller suppliers, that could otherwise not deliver via DD or

transit with short lead times, to achieve better delivery performance and increase the volume utilization of trucks.[9]

The above reasons make Company C a good option for both suppliers when shipping DD, especially since candles are high density products and consolidating shipping with bulky and lightweight products allows for better volume utilization of trucks. A maximum stock quantity of two weeks of sales, based on data of the last three weeks, is kept at Company C. However, IKEA is rather aiming for this number to not exceed one week, especially for well-rotating articles. This means that in the peak season, the following storage spaces are available for the two suppliers:[10]

- Supplier A: 350 EUR pallets and 1500 half pallets with 3 daily shipping slots.
- Supplier B: 150 EUR pallets and 800 half pallets with 2 daily shipping slots.

The transport to Company C and the costs related to handling and storing are paid by the supplier. This means IKEA pays a deviating PUA (see following paragraph) price for goods shipped via Company C, which in the Supplier A and Supplier B case amounts to an increase of 2% on the total PUA price per cubic meter. The transport from Company C to IKEA stores are handled and paid by IKEA.[11]

Purchasing Unit Agreement or PUA in short is a price agreement between IKEA and the supplier, and is reviewed once a year for each article. For candles, smaller fluctuations in raw material prices are covered by the PUA, however if the raw material price deviates with ±5% or more, a discussion is initiated and a new PUA price is agreed upon.[12] Sourcing of goods does not only take PUA prices into account, it also considers the logistical costs related to the location of the supplier. IKEA strives to avoid region to region sourcing to the largest extent possible.[13]

4.3 Order planning strategy

Planning for the paraffin/stearin category requires extra effort due to the tremendous seasonalities experienced by the products. Before and during Christmas is as discussed the busiest period, not only due to the large demand peaks but also due to it being a holiday period in most European countries. Front-loading has to be made to buffer for the rise in sale but also to account for the strains that the Christmas period brings in form of various limitations and constraints. The largest constraint is the transports, which prevents ordering to be made as usual or planned. A major example of this is in Germany, where trucks are not allowed to enter the country on red days which is particularly tough during Christmas with many consecutive red days. Thus, it is difficult to find transportation for long deliveries, especially direct deliveries, during these days. This means, since many deliveries

[9] Wilczak, 2016.
[10] Ibid.
[11] Ibid.
[12] Nilsson, 2016.
[13] Wilczak, 2016.

pass through Germany to other European destinations, that goods have to be ordered in advance to be able to replenish stores in these periods. The front-loaded quantities are put on DTs which are easier to plan shipments from, since transports to stores are shorter and also allowed within Germany itself.[14]

Suppliers strive to keep a more or less constant production during the year to avoid periods of machinery standstill and to provide employees with a secure employment. Consequently, due to the seasonal demand, products are produced in low season that are not needed until weeks or months ahead. This generally requires suppliers to store these goods in their own facilities until needed by IKEA. But for some products, these are shipped when produced and thereafter stored at IKEA DTs for later use. This is especially the case for seasonal products. These are produced and distributed before the suppliers' vacation periods in July, since thereafter production capacities are limited to prepare for peak demand.[15]

Figure 4.5 below depicts the weekly orders to the two suppliers during the last year. It clearly illustrates the two order peaks discussed above.

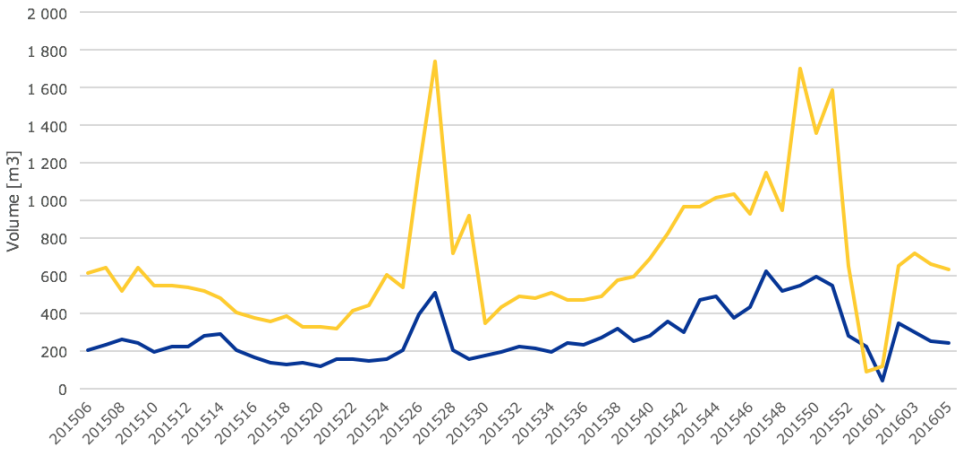

FIGURE 4.5: Weekly orders from 2015 week 6 to 2016 week 5 to Supplier A (yellow) and Supplier B (blue) respectively (QlikView, 2016).

4.4 Follow-up

The process of following up work and planning is mainly done by monitoring certain KPIs (key performance indicators). The most common KPIs monitored by the HFB and category are:[16]

- Availability in terms of measured service level
- Number of stock weeks (how many weeks of sale that the stock level covers)

[14] Petersson, 2016; Wilczak, 2016
[15] Petersson, 2016; Wilczak, 2016
[16] Petersson, 2016; Nilsson, 2016

- OTD Sender (percentage of On-Time-Deliveries from sender, i.e. the supplier)
- OTD SC (percentage of On-Time-Deliveries in the Supply Chain)
- DD share (percentage of direct deliveries for all articles)
- Overall price development
- Equipment utilization (volume utilization of trucks).

Furthermore, a stock meeting takes place around week eight to review the amount of stock on DTs, check if there are any candles close to expiration, and to evaluate the stock build up and build down for the peak. If there is excess stock or candles close to expiration, an analysis is made to balance the reduction of stock without large interruptions of the order flow to suppliers.[17]

[17] Petersson, 2016.

Chapter 5

Analysis of IKEA inventory levels

This chapter concerns the IKEA DT inventories related to the paraffin/stearin category and seeks to provide a deeper analysis of how planning activities and strategies have affected the stock levels. It aims to investigate decisions made and the reasons behind situations that have caused high inventory levels to be able to identify problems and potential areas of improvement.

Analysis of the current way of managing inventory has been made with focus on the European DTs for the two suppliers. This demarcation was made due to the stock at DTs being the only inventories managed by IoS; inventory levels at suppliers and stores are visual to and influenceable by IoS but are controlled by the suppliers and stores themselves. The initial analysis has primarily been based on quantitative inventory data for the investigated DTs[1] in order to identify patterns and high inventory levels. Since, with the current inventory structure at IKEA, it is difficult to identify if inventory on-hand is wanted or not, this was followed by qualitative interviews with responsible employees within the organization to gain an understanding of the stock, the reasons behind the identified situations and if the results were planned or not. After the initial analysis, additional qualitative interviews were conducted to gain an understanding of the responsibilities and tasks of different roles, current guidelines and processes as well as problems and challenges commonly faced.

5.1 Stock development overview

In order to provide an initial overview of the current way of managing inventory, weekly stock history of candles at the European DTs related to the two suppliers has been illustrated in Figure 5.1. The weekly amount of DT stock provides a good picture of when and how much stock is built and for what the build up is related to. As presented in Chapter 4, the paraffin/stearin category's replenishment flow in Europe is characterized by mainly direct deliveries, meaning that stock in IKEA DTs mainly consist of

[1] all DT data compiled in a Microsoft Excel file, available via Holm (2016)

front-loaded stock before Christmas or stock to buffer against uncertainties (thus categorized as excess stock) and not cycle or safety stock. Figure 5.1 only illustrates high-flow DTs, since the low-flow DT has significantly larger stock levels and its yearly stock development differs due to the nature of the warehouse. The analysis will go further down on DT level, including the low-flow warehouse, in the following sections to clarify deviations from planned levels and highlight problems.

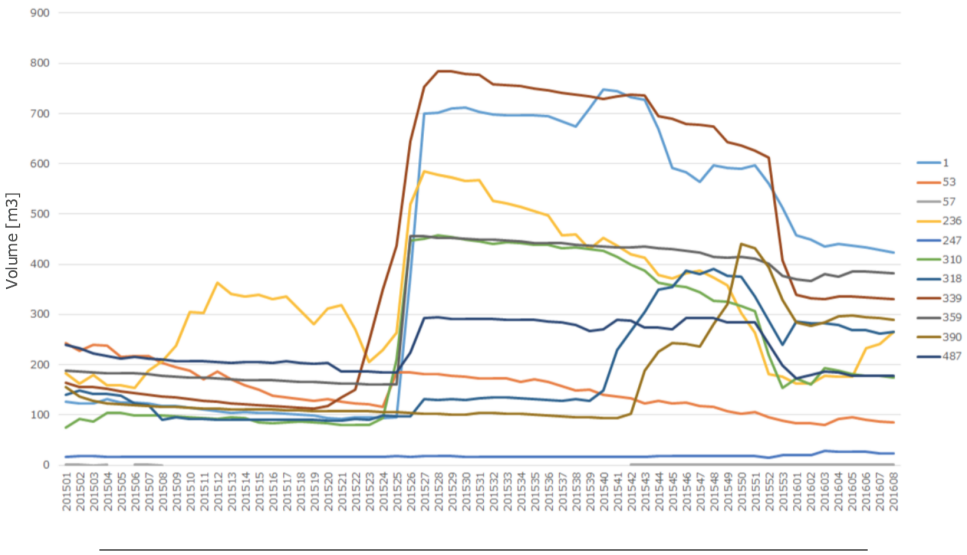

FIGURE 5.1: Stock levels for eleven high-flow DTs in Europe, from week 1, 2015 to week 8, 2016.

The number linked to each colored line in Figure 5.1 is each DT's identification number. As discussed in Chapter 4, IKEA's use of supply chain matrices means that one supplier supplies each DT with a specific article.This implies each DT's stock in Figure 5.1 is highly related to one of the two suppliers in this study.

The two DTs with slightly lower and later occurring peaks (DT318 and DT390) are mainly supplied by the smaller supplier Supplier B while all the other DTs are mainly supplied by Supplier A. Common for all the DTs in the figure is that the stock build up is completed before week 50 followed by a stock decrease until week 1 (2016). The purpose of the build up is to prepare for the peak in sales and the constraints of limited transport capacity around Christmas as discussed in Chapter 4. However, there is a clear difference between the DT front-loads related to each supplier. Stock levels related to Supplier A are built up around week 25 while the stock build up from Supplier B does not start until week 40. Build up for peaks are commonly planned to start in the fall which is the case for Supplier B, meaning the increase in stock for Supplier A is due to other reasons. In this case, the explanation of the large stock build up is that a commitment purchase was made before the end of the supplier's financial year as a support to the supplier (commitments are explained in Section 3.2.3).[2] This commitment purchase will be further discussed in Section 5.2.3.

[2]Petersson, 2016.

5.2 Insufficient build down of stock

The purpose of Figure 5.1 is to serve as basis for the analysis of the inventory strategy used by IKEA, particularly in the peak periods where stock is front-loaded at DTs. Comparing the stock levels after the peak (far right in figure) to the same period last year (far left in the figure), stock levels are substantially higher after the most recent peak. Essentially, this means too much stock was front-loaded compared to the actual sales in the period. Sales are uncertain and therefore not controllable by companies, however inventories should still be reduced in a good pace before the peak demand has past. This illustrates a problem in IKEA's work, namely the insufficient build down during the peak season. This recurring situation is in turn caused by various reasons which will be further analysed in the following sections.

5.2.1 Peak season front-load

A representative case of insufficient build down after the peak season is the DT located in Great Britain. The stock levels per article for the last year can be found in Figure 5.2, and as the figure shows, a front-load of some prioritized articles is built before week 50. When the stock has sufficiently been acquired, a DME (see Section 3.2.6) is carried out to navigate around the transport limitations during Christmas, from week 50 to week 1. This means that during this period, stores are supplied by DT deliveries instead of the usual direct deliveries. At the end of this DME, the aim was for the stock to have reached the same levels as before the build up since the front-loaded quantities are taken in to DTs to cover for the forecasted demand during the limitation period only. However, as seen in the figure, the stock levels of the front-loaded articles were not reduced to the appropriate levels. The reason for having large quantities left was due to lower sales than forecasted, which in turn resulted in lower replenishment from the DTs during the DME period. Thus when the DME ended in week 1, the stock levels for some articles were higher than planned.[3] It is evident that follow-up of the stock development during the DME period was lacking, which otherwise could have allowed the stock to be adjusted to more appropriate levels during and after the peak when the demand was still high.

5.2.2 First-buy

Figure 5.3 illustrates what usually occurs at a DT when making a first-buy. When a new product is introduced or when a new supplier is added to a matrix, it is typical to build a first-buy stock at DTs, even if there is a DD-setup from start and the supplier is well-performing. The purpose of the first-buy stock is to shield against uncertainty in sales and supply, and for larger first-buys, the stock is placed on DTs. After approximately four to six months, with sufficient supply, the sales in stores are stabilized and the sales forecast accuracy has increased. However, the stock built to buffer against the initial uncertainty is in most cases not reduced to an adequate level by this time. This is what the example in the figure illustrates, where a change in a supply chain matrix was made for the supplier Supplier A to take over the supply of GLIMMA in sub-region North Europe. It provides a

[3] Ibid.

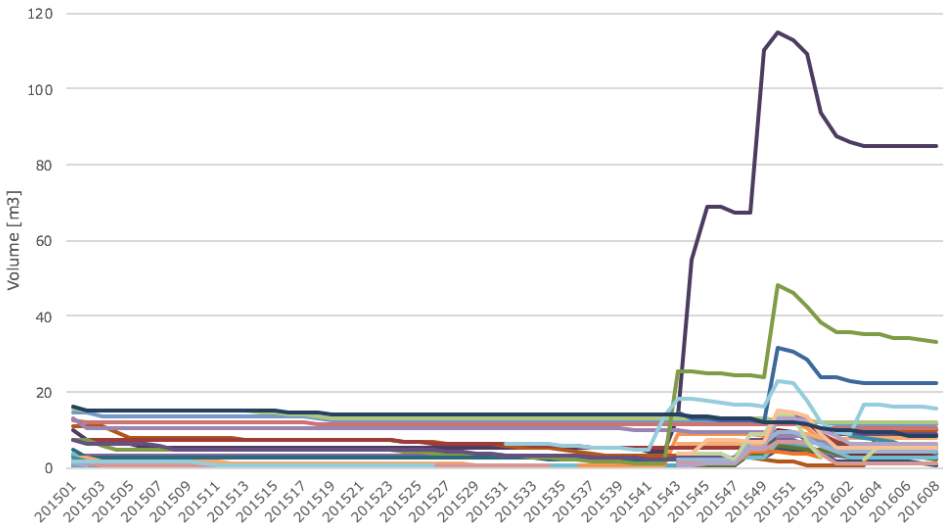

FIGURE 5.2: Stock levels per article for DT390 Great Britain from week 1, 2015 to week 8, 2016.

good perspective of the insufficient build down, where the levels are barely reduced to half of the initial quantity after the first-buy period has expired.[4] The case in Figure 5.3 is a common occurrence at IKEA DTs for several categories [5]. It is clear that unnecessary stock is kept at DTs after the initial uncertainty due to the lack of a distinct stock reduction plan and follow-up, resulting in high inventory costs.

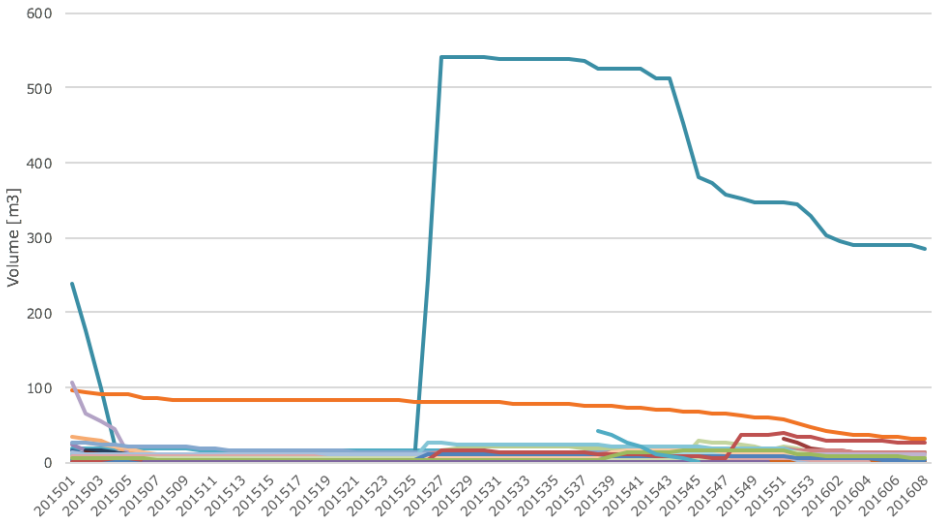

FIGURE 5.3: Stock levels for DT001, Sweden from week 1, 2015 to week 8, 2016.

[4]Petersson, 2016.
[5]Ibid.; Szczepkowska, 2016

5.2.3 Commitment purchase

Commitments within IKEA are not uncommon and as mentioned in Section 5.1, Supplier A is one supplier IKEA has a commitment with. Last year, a large commitment purchase was made to support Supplier A before the end of their financial year. The supplier had made a big investment and asked for support in order to show good figures towards the bank. The volume of the purchase amounted to around 2.800 m^3, which, even though the volume consisted of the more popular candle articles, was a significant quantity (compare to yearly sales volumes in Figure 4.2). This quantity was ordered and shipped to IKEA DTs around Europe, firstly since the goods needed to be dispatched before the supplier could send the invoice and secondly since the large quantity could not be distributed to stores directly. This resulted in very high stock levels at many DTs from week 25 and forward, as seen in Figure 5.1. In order to build down this massive stock, adapting the future orders towards suppliers had to be done to take this already purchased stock into account but at the same time not make a complete order stop towards suppliers.[6] However, the build down was for the majority of DTs not sufficiently quick and during the entire autumn the levels were barely reduced at all. This was due to that the orders to suppliers were not adequately adjusted to account for the large amount of stock already in possession. Thus, before the peak, large quantities still remained which got to serve as the DT front-load for the Christmas peak. But as discussed in Section 5.2.1, the DME during the peak was not sufficient to reduce the stock, which in combination with the previous insufficient build down resulted in large inventory levels after the peak.

5.3 Low-flow stock development

In Figure 5.4, the stock development at the European low-flow DT located in Germany is illustrated. Its yearly stock levels are clearly distinguishable from the previously discussed high-flow DTs, with an earlier build up and a distinct build down. The warehouse is used for products with low sales and replenishment frequency and for candles, it is especially used for seasonal articles produced for the winter/Christmas season. The seasonal range of candles is kept at low-flow due to the high flexibility of replenishment opportunities to all European stores which enables the predetermined quantity to be sold out as efficiently as possible. This is the case since the goods can be distributed according to how well they sell in each country or store instead of having a certain quantity planned for each one.[7]

The seasonal range is usually produced during the summer in order for the suppliers to utilize their machines during the low demand period of the year. Since suppliers have limited storage capacity for the large amounts produced in such a short period of time, the finished goods are shipped to IKEA to be stored in their DTs. This is the reason behind the early stock build up of candles at low-flow, starting already in week 15 even though the stock is not needed until around week 30 to prepare for the sale start in week 40.[8] However, with low-flow warehouses being characterized by high operational

[6] Petersson, 2016.
[7] Ibid.
[8] Ibid.

cost as mentioned in Chapter 4, keeping goods for long periods of time is a huge expense. Even though the build down of the low-flow DT is well-performed, the width of the peak in Figure 5.4 is considerably large.

As mentioned, the figure also illustrates a more distinct build down of the inventory levels than the high-flow DTs. The seasonal articles kept at low-flow are sold during a predefined period and the articles have an end-of-sales date, stating when the articles are no longer offered at IKEA stores. Due to this end-of-sales date, all seasonal articles that are left need to be removed from the low-flow DT and pushed to the stores before the end of the season. This is the reason why stock at the low-flow DT is properly reduced to previous levels.[9]

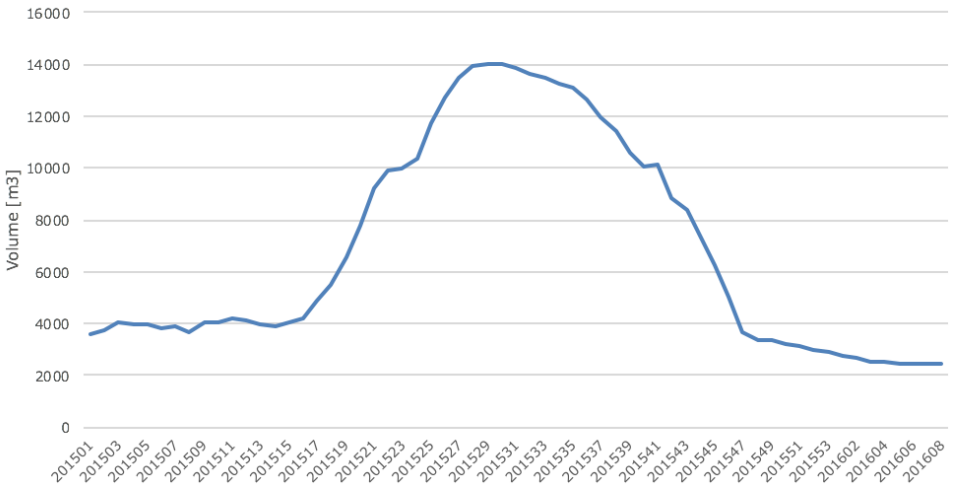

FIGURE 5.4: Stock levels at low-flow DT064 from week 1, 2015 to week 8, 2016 for all suppliers.

Despite the stock development being distinctly better for the low-flow DT compared to the other DTs, it is of importance to also look at the overall stock levels in this DT in contrast to the high-flow DTs. Comparing the stock levels of candles in all European DTs, for all suppliers, the stock levels at the low-flow DT are significantly higher than the others. Even with the large front-loads being built on the regular DTs, the low-flow peak is about five times larger than the levels at the largest high-flow DT. Due to the substantially larger costs related to keeping goods at low-flow, a reduction of the peak, both width and height, should be investigated.

5.4 Other reasons for excess stock

Besides the problems identified above through quantitative data, other situations related to long lasting high inventory levels were identified during the qualitative interviews with responsible employees. The causes behind the occurrence of these excess stock situations are briefly covered below.

[9]Petersson, 2016.

5.4.1 Store orders

One of the problems experienced previous years was related to the orders placed from the stores. After periods of low availability of certain goods, stores tended to temporarily change their order parameters to generate extra pallets in order to assure that they got the number of pallets they needed, especially before the peak season. When several stores simultaneously changed their order settings, larger orders were requested than what the SPI previously predicted, resulting in a sudden increase of order quantities for the supplier. To handle this problem and avoid similar situations in the future, extra stock was in following periods placed at DTs before the peak season, enabling stores to order extra pallets from DTs instead of directly from the suppliers. However, the stores kept ordering directly from the suppliers due to the cheaper prices of direct deliveries, resulting in excess stock at DTs in the end of the season. Since then, stock has been placed at DTs before the peak and the communication to sales leaders in each country has been very clear; temporary changes to order settings can create problems for the suppliers and if the store needs extra pallets these should be ordered from DTs.[10] Other categories are experiencing similar problem, for example soft toys.[11]

5.4.2 Overestimation of sales

Stores' forecasts commonly exceed the forecasts produced by the demand planner and demand forecasts for activities are no exception. The reason for this is that if stores underestimate the sales during the activity, sales are lost, but if they overestimate the sales potential, the unneeded pallets are left in DTs and are thus the responsibility of IoS. This means that it is more beneficial for the stores to overestimate than to underestimate. Moreover, if the quantities needed for a large activity exceeds the production capacity at suppliers, the excess quantity is produced earlier and stored at DTs until the activity starts. Stock are also placed at DTs before bigger activities to assure availability and avoid stockouts during activities due to higher sales than expected. Thus, tendency to overestimate the sales potential, especially during activities, has the consequence of excess stock being left in DTs after the end of the sales activity and tends to be untouched thereafter.[12]

5.4.3 Replenishment setup switch

Another common situation causing excess stock levels are when stock is not reduced for articles with DT replenishment setup before they are changed to DD replenishment setup. As mentioned in Section 3.2.6, replenishment setups are analysed three times per year, where it is looked into if a DT article has large enough volumes to have a DD replenishment setup or not. DD-setups are often pushed for from stores due to lower prices but are also pursued by the category to improve their DD-share KPI.[13] The process of switching the setups are hence often hasty and does not include a build down plan of the already existing DT stock, resulting in it being left over.

[10] Ibid.
[11] Szczepkowska, 2016.
[12] Petersson, 2016.
[13] Ibid.

5.4.4 Static hedge stock

A certain few iconic articles in the IKEA range are more or less never allowed to be unavailable to customers since these are considered to be an important part of the IKEA brand and may even cause bad reputation if unavailable. When it comes to candles, the GLIMMA 100-pack is such an iconic article and can be found on most customers' shopping list. To avoid stock-outs of this iconic article and some other high selling candle products, especially during peak seasons when the demand is significantly larger, a hedge stock of 1-2 weeks of sale is kept at some DTs to secure availability against unpredicted problems upstream, such as quality problems in production or sudden traffic bans. This stock is placed at DTs in Sweden and Germany due to them being the biggest markets for candles. However, this hedge stock is kept at a constant level all year, where the level is based on the weekly peak demand and not dynamically adjusted to weekly demand. The stock may even only be needed during the peak, since thereafter, with stable sales and over-capacities, larger problems can more easily be dealt with. Moreover, since need planners are avoiding shortages to the largest extent possible, it is not uncommon to hedge for several articles and not only the more important ones.[14] This delimitation is another aspect lacking today.

5.5 Underlying reasons of high stock levels

In the analysis in the previous sections, several recurring reasons behind the situations discussed can be identified. These are summarized and discussed below in order to concretize the current problems experienced by IKEA and visualize possible improvement areas.

5.5.1 Lack of plans and follow-up

On an overall level, it is clear that common for the inventory related problems is the lack of an established plan and proper follow-up of the outcome. There are few or no defined guidelines to follow when managing inventories in different situations, particularly for reducing unneeded stock. Decisions are instead made spontaneously and are commonly based on routine or feeling. In the case of when a plan does exist, instead further follow-up is a lacking activity or carried out too late. The plan does not include set goals or possible deviations to consider, and hence the inventory is left as it is. The lack of clear guidelines also means no prioritization is made between different articles in the work. This is also an example of inefficient work, since, as mentioned in Chapter 4, a few articles account for the majority of sales and the rest are very low-selling.

5.5.2 Unavailable cost data support

An important factor missing in the central planning and decision making related to excess stock is the consideration of precise cost data. The cost of storing in different parts of the supply chain is not directly available, meaning decisions are made without estimated cost support. This cost together with costs for supply chain activities affect where the stock should be placed,

[14] Petersson, 2016.

which means that knowledge of where to keep stock most cost efficiently is missing. The lack of cost support also means IKEA has little knowledge of the consequences of decision taken towards suppliers. It usually leads to IKEA "being nice" and helping suppliers, even though they know it is related to some costs. Moreover, different decision makers in the organization can influence the orders which makes planning more difficult compared to if the orders were left automatically generated.

5.5.3 Unclear division of responsibilities

The main reason that clear guidelines or targets are missing is that there is no person in the organization that has a clear overview or responsibility of all activities related to a specific product area. Instead, responsibilities are split between the HFB and category with infrequent communication between the two. The two business areas work with different targets and objectives on different levels. To work more efficiently with planning, these two business areas need to balance and plan this work more jointly, taking the effects of outer constraints into account.

5.5.4 Company mindset

After interviews with various employees at IKEA, it stands clear that a fear for shortages is a clear representation of the attitude in the company. It is common among planners to favor excess stock over stockouts, resulting in inventory planning often being approached with a mindset of "availability to any cost". It is therefore not uncommon that need planners put extra stock on DTs in order to buffer against all potential problems that may arise. This does not only result in higher inventory costs, it also conceals recurring problems since inventory levels are high enough to cover these kind of issues. With a constant excessive stock level, the inventory position is rarely low enough to reach the level of safety stocks and will not expose problems. After all, the purpose of safety stocks is not to be untouched but used from time to time (Farahani et al., 2011, pp. 55-56). This also entails that the forecasts made in the organization are seldom completely followed or trusted.

5.6 Conclusions

To sum up, the current work with inventory planning is characterized as reactive and ad-hoc instead of being proactive with clear guidelines and decision support. In order to change this way of working, with the aim of reducing the inventory levels, a planning process including clear follow-up is needed. Cost support for storing at different parts of the supply chain needs to be developed so that IKEA can make more informed decisions and reduce their inventory costs. With this as a basis, an action plan should be defined including guidelines of how to act on deviations from the developed inventory plan. Furthermore, directions are needed for how to select articles to prioritize, so that the time spent on inventory management is utilized in the most efficient way. These plans and guidelines along with proposed solutions to the problems discussed in this chapter will be covered in the following chapters.

Chapter 6

Category specific solution proposals

This chapter presents proposed solutions, based on the analysis in the previous chapter, intended to tackle some of the problems experienced by the paraffin/stearin category when it comes to inventory planning. The solution proposals are motivated with cost savings where applicable to emphasize the potential of improved inventory management.

In order to provide a perspective of how representative the conditions behind the category studied in this thesis are of IKEA in general and to provide a clearer foundation for the solutions proposed in this chapter, some of the characteristics of the candle product area will firstly be discussed.

6.1 Characteristics of the paraffin/stearin category

Candles are first and foremost a highly seasonal product in difference to many other products offered at IKEA. Further, candles are cheap, decorative products that are not essential in the home compared to other products in the IKEA range, meaning customers usually do not visit IKEA stores for the sole purpose of buying candles. Instead, it is more of a product customers take the opportunity to grab while they are in the store. This means, that if a certain candle of a certain color or scent is not available in the store, customers will in general not notice and usually end up picking another candle instead. This goes for most decorative articles, especially those that have substitute variants. However, it is not the case for all articles, for instance GLIMMA tealights. This is one of the iconic products in the IKEA range and has higher requirements of availability.

Another factor that characterizes the analysis is the conditions of the supply chain. The majority of both sourcing and sales take place on the European market. In general, Europe is characterized by a more automated production compared the Asian market, which is the most common alternative of sourcing within IKEA. Higher automation signifies higher efficiency and less quality issues compared to manual production (Hopp and Spearman, 2008, p. 156). Sourcing in Europe generally entails that PUA prices are slightly

higher, but it comes with lower logistics costs related to distribution since suppliers are closer to the end customers. Having the sourcing of products close to customers also comes with the benefit of shorter lead times. This allows for smaller buffer stocks to be kept since if any issue with shortages would to arise, the shorter distance upstream would permit a quicker solution.

The two suppliers included in this study are both representative of the sourcing base for candles. Shipping primarily consist of direct deliveries to IKEA stores during the course of the year when conditions allow it. They are both well-performing with high values of supplier KPIs such as OTD (On-Time-Delivery) and service level. This despite the fact that it is not uncommon that IKEA requests quick changes in the production plan, over a year the actual orders may differ 20% from the initial SPI.[1] Thus, they are both flexible in their production and have free capacity most of the year, allowing IKEA to have some flexibility in their orders. The toughest period of the year, around Christmas, is the only period when the production capacity is limited.

Another factor that affects inventory management is transportation conditions. As discussed, having available trucks or other means of transport is essential but it is not the only shipping factor to consider. One factor highly regarded in IKEA is equipment utilization, one of the KPIs used to follow up. Volume utilization of trucks is a large cost driver and is highly affecting overall supply chain efficiency, which is part of the reason why there are different replenishment set-ups. More specifically, if the order quantities distributed by direct deliveries are not large enough to fill a truck within a competitive lead time, another distribution set-up, which consolidates order quantities, is used. For the paraffin/stearin category, shipments of candles are normally low in volume and direct deliveries would be inefficient. However, using DD point Company C, as discussed in Chapter 4, has given the possibility of consolidating goods which enables efficient shipping to stores. This has greatly benefited the distribution conditions of candles.

6.1.1 Conclusions on the work with candles

With the above analysis in hand, it is clear that the inventory planning and steering related to candles in Europe has excellent preconditions and potential to be well executed. Even though the seasonalities experienced are challenging, the sales patterns are repetitive year by year without large deviations.[2] This means that the forecasts of demand can be made accurately without the need to conduct several manual adjustments. Moreover, the category has a broad supplier base to meet the demand where the majority are located in the region. The supplier base has great performance with high values of DD-shares (due to using Company C), OTD and service levels, giving IKEA great potential to develop and progress their work. Additionally, the frequent overcapacity in production enables IKEA to have order flexibility during most parts of the year.

[1] Supplier B, 2016.
[2] Petersson, 2016.

Despite this, certain things stand clear. Employees are in general avoiding shortages or stockouts to the largest extent, since the other side of the coin, i.e. overstock, is not noticeable in the same way. Shortages lead to complaints or critique from other parts of the organization while overstock on the other hand often is overlooked and disregarded. As an example, the hedge stock being kept the year around to assure availability of many products results in high values of availability KPIs, such as measured service levels. Having values of 99.9% for S1s (refer to Section 4.1 for definition), which is the case for candles, is considered a good indicator of a well-performing category, but the costs this brings is not recognized. Having a service level of 99% for an article should mean 99% and not 99,9%. This, since increases in service level is related to exponential increases in safety stock, according to the mathematical definition of safety stocks (Axsäter, 2006, pp. 96-97), and these "small" increases comes with great additional costs for storage. This goes for all the other service levels (S2, S3 and S4) as well, where for candles the values are in general several percentage points above the set levels. The concrete costs related to overstocking have not been available as support in the inventory work, which is part of the reason for overstock being left untouched. This is the reason behind many of the excess stock situations covered earlier, despite the good conditions related to candles.

Finally, it is important to point out that all categories face different challenges related to inventory management and the paraffin/stearin category, compared to other categories, is not bad-performing. As opposed to several other categories, stock levels of candles are overall low (on average about 4-5 stock weeks compared to an overall IKEA average of 7-8 stock weeks).[3] This clearly motivates the importance of this study, not only for the paraffin/stearin category, but for other categories as well and thus for IKEA as whole.

6.2 Cost support

Based on the identified problems from the analysis in Chapter 5, a few solution proposals were established with input from employees. These aim to reduce the inventory levels related to some of the problems and thus reduce the cost of inventory. To motivate these solution proposals, resulting savings of inventory cost were calculated where applicable. These calculations were based on weekly storage cost per unit volume at the different inventory locations in the supply chain. The estimations of these numbers were obtained from both IKEA and the supplier Supplier A. As mentioned in earlier chapters, these numbers have previously been unavailable to employees in IKEA and will for the first time quantify the storage costs related to different decisions taken. Thus, they will help serve as support for choosing location of storage in future planning as well as support for decisions regarding when products should be kept in storage. The costs are compiled in Table 6.1.

The solution proposals and, if viable, estimations of savings related to the problems in Chapter 5 are discussed and presented in following sections.[4]

[3] Ibid.

[4] Due to secrecy, all savings and costs are presented with indices and percentages. Exact figures are available in non-public version via IKEA.

TABLE 6.1: Indexed cost data including storage cost at IKEA stores, high-flow DT, low-flow DT , DD-point Company C and Supplier A. The costs are excluding any activities outside storage, such as handling or shipping.

Location	Indexed weekly storage cost	Source
IKEA high-flow DTs	100	Holm, 2016
IKEA low-flow DTs	158.8	Holm, 2016
IKEA sales units	117.6	Holm, 2016
DD Point Company C	118.2	Wilczak, 2016
Supplier	110.6	Supplier A, 2016

6.3 Reducing size of low-flow stock peak

As discussed in Section 5.3, the inventory peak at the low-flow DT is both high and wide. Considering the cost support in Table 6.1, it stands clear that keeping articles at low-flow comes with a significant expense and is in contrast to high-flow considerably more costly. Reducing the height and width of this peak is one goal expressed by the interviewees, while keeping in mind the effects this will have on distribution for the articles. Since the seasonal range, being the main part of low-flow stock, is intended to sell out, service level is not a requirement to consider.

6.3.1 Relocating some of the seasonal range to high-flow

After deeper analysis of the inventory kept at low-flow, it is clear that a few seasonal articles account for a large portion of the stock volume. The volume of these articles are even great enough to be on high-flow according to the rule of thumb in IKEA of around 500 m^3 sold yearly. Hence, large savings could be obtained by moving some of the high selling seasonal articles to high-flow in the coming years.

Based on this reasoning, the Need planner and Category manager selected five seasonal articles that for Christmas 2016 will be distributed through high-flow instead of low-flow. To gain an understanding of the saving this will result in, calculations of storage costs were made based on stock levels for the previous year. The weekly stock levels for the five articles selected are visualized in Figure 6.1.

Based on the storage costs provided in table 1 and previous stock levels, the costs of storing selected articles in high-flow DTs respectively in low-flow DT were calculated. A comparison of the two costs shows savings of 37% of original costs. The calculations are presented in more detail in Appendix B.

There are however advantages and disadvantages with storing in each type of DT which should be considered. One of the major benefits of having seasonal articles at the centrally located low-flow DT instead of at high-flow DTs is the flexibility to distribute the products according to how well they sell in different countries or stores. Products kept at a high-flow can only be used to replenish stores included in that specific DCG. On the other hand, a disadvantage with having seasonal articles on low-flow is the risk

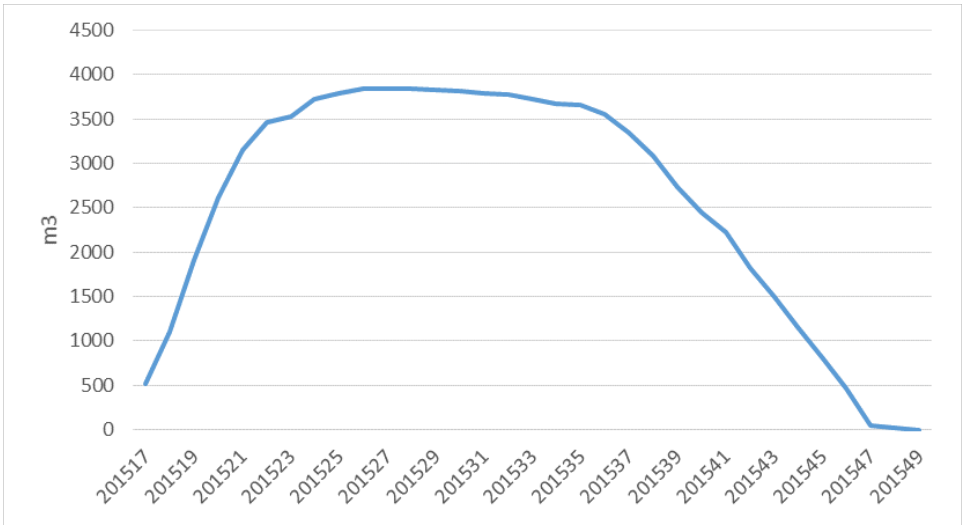

FIGURE 6.1: Weekly stock levels for the five selected seasonal articles relocated from low-flow to high-flow.

that countries order more than their previously set share, meaning that other countries in the end receive less than they originally requested. These aspects have to be considered when selecting or moving articles between different DTs.

In this case, the five articles selected by the category are of high enough volume to justify distribution through high-flow DTs which together with a steady, predictable demand mean they have a lower need for flexibility. This together with the great potential saving motivates the moving of these five articles from low-flow to high-flow.

6.3.2 Delayed and narrow receiving window for seasonal range

After interviews, it stands clear that the width of the low-flow DT peak could and should be narrowed down as discussed in Chapter 5, due to the high costs of storing at low-flow. To achieve this, a postponed and narrower receiver window for suppliers of seasonal products should be communicated when the sourcing of this range is made. This may affect the PUA prices of goods purchased, but with weekly storage cost data as support as in Table 6.1 the procurement decisions can be well-founded by weighing potential storage costs during a period against suppliers' price offers.

To investigate if a postponed and narrower delivery window would result in cost savings, a new delivery window between week 25 and 30 was proposed by the category instead of between week 15 and 30. Based on this new delivery window and using historical weekly stock levels for 2015 (excluding the five seasonal articles moved to high-flow), illustrated as the blue line in Figure 6.2, new weekly stock levels were estimated, illustrated as the orange line in Figure 6.2. The yearly cost of storing was then calculated for the current and new delivery window respectively and the difference between these resulted in savings of 4.6%. For details regarding the calculations and assumptions, see Appendix B.

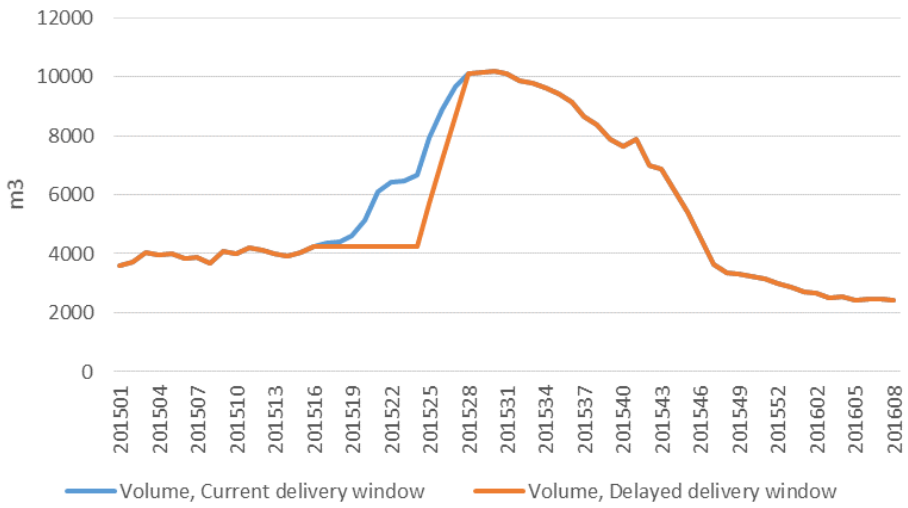

FIGURE 6.2: Blue line shows the weekly stock levels for articles on low flow excluding the five seasonal articles and the orange line shows the same stock but with a postponed and narrower delivery window.

The potential saving of a new delivery window also needs to be calculated for the five articles moved to high-flow DTs in the previous section. Based on the stock levels used in the calculations in Section 6.3.1, the stock levels for the new delivery window were calculated and are illustrated as the orange line in Figure 6.3. After calculating the cost of storing for the current and the new delivery window for the five articles in question, savings amounted to 30%. See Appendix B for details on the calculations.

Based on the results of the analysis carried out, the category wanted to investigate if a postponed and narrower delivery window would result in cost savings in practice. Since the procurement of the seasonal range of candles for 2017 was conducted during the course of this thesis, the category took the opportunity to communicate a delivery window between week 25 and 30 to the suppliers in their RFQ (Request for quotation). Based on the response from the RFQ, one supplier was selected for the majority of the seasonal articles. The request of a new delivery window between week 25 and 30 resulted in IKEA missing out on a negative price development of almost 1% compared to last year's prices. However, with a decrease in storage cost of 30% and 4.6% respectively compared to the missed out saving from price development, the deal still resulted in that savings of 12.7% and 1.5% respectively could be obtained by having a new delivery window between week 25 and 30. Naturally, other aspects coming with the delayed reception of such large quantities of products in a shorter time period need to be considered, for example transport availability (preparations for catalogue release is taking place in parallel). For more detailed calculations, see Appendix B.

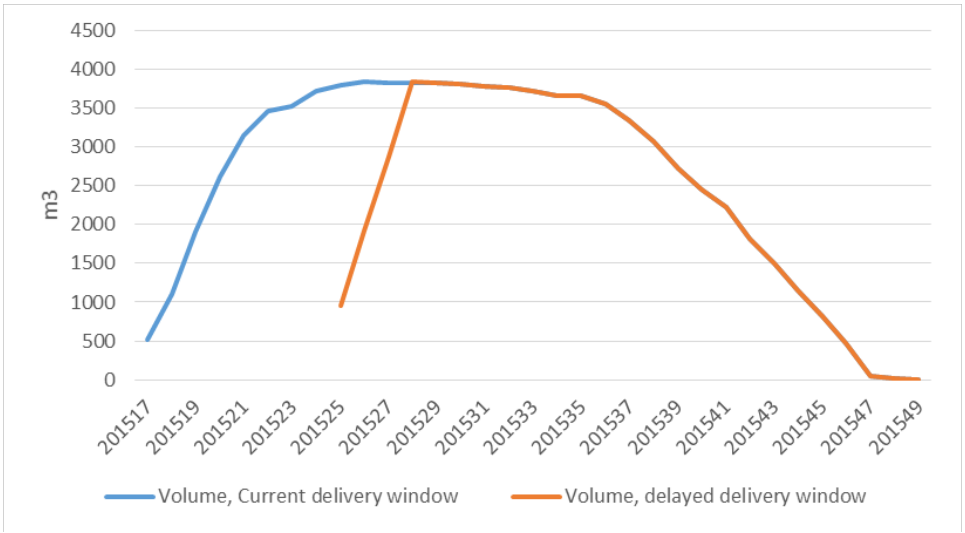

FIGURE 6.3: Blue line shows stock levels for selected articles moved from low-flow to high-flow and the orange line shows the same stock but with a postponed and narrower delivery window.

6.4 Reducing hedge stock

The stock kept to hedge against extraordinary uncertainties is an additional problem that should be dealt with as discussed in Section 5.4.4. Within the category of candles, there are some articles such as GLIMMA that should more or less be available at all times due to them being important for the IKEA image. However, keeping a constant stock of several articles is costly and thus a more distinct stock development as well as a clearer prioritization of articles to hedge for is needed.

6.4.1 Dynamic hedge stock instead of static hedge stock

The levels of hedge stock kept for articles are based on peak sales quantities and are further kept on constant levels during the year. This means large costs can be avoided by having a more dynamic hedge stock related to the sales pattern instead of a static hedge stock since candles are experiencing such extreme seasonalities. It may moreover only be necessary to keep hedge stock during the busier period of peak season, since it is here potential problems have the greatest effect on the operations. During the rest of the year, problems can more easily be solved since suppliers have free capacity and backup suppliers are available.

An illustration of a proposed dynamic hedge stock is shown in Figure 6.4. Based on sales data for candles (refer to the sales pattern in Figure 4.2), a larger hedge stock is needed during the high season, approximately between week 40 and week 1, while a lower stock should be kept during the low season. To facilitate the work of follow-up, stock build up and reduction, two different stock levels are proposed for candles instead of having a weekly dynamic stock. It is estimated by IKEA, based on experience, that the flow of goods can be resolved within a week in case of a supply problem. Therefore the higher stock level is proposed to be equal to the demand during the week

with the highest sales and the lower stock level to be an average of the weekly demand during the remaining weeks of the year.

To calculate the savings of a more dynamic stock, a selection of articles and markets (based on reasoning in Chapter 7) were made together with the category followed by sales data analysis for the selected articles in order to determine the two hedge stock levels mentioned above. In total 10 articles were selected to be hedged for. Since hedge stock should be kept at a minimum, the German and Swedish markets were selected, like for current hedging in the category, since these are the two major markets for candles and therefore the most critical markets to secure availability on. All 10 articles selected were not included for both countries since sales were varying and thus also the importance of each.

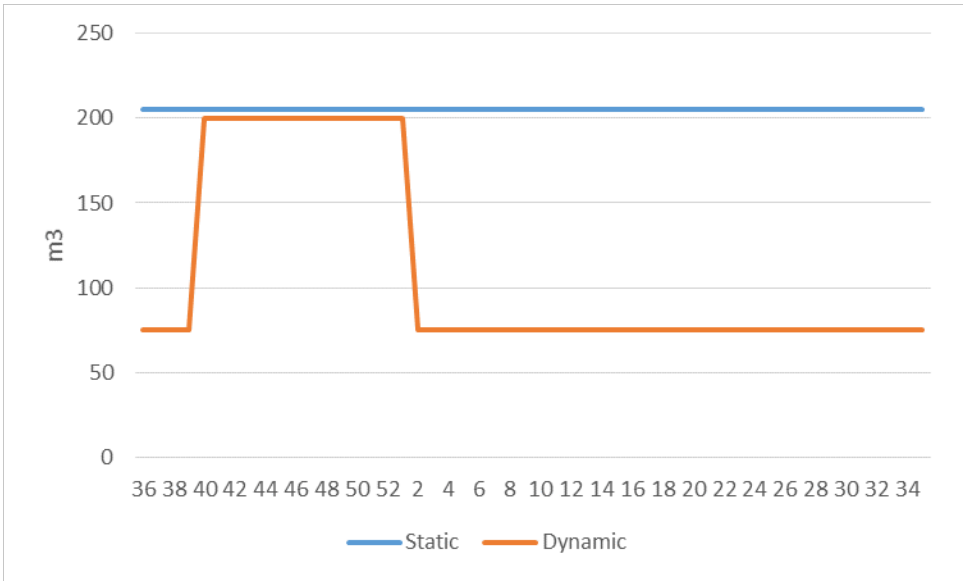

FIGURE 6.4: Illustration of dynamic hedge stock for one article starting in week 40 and ending in week 1 (orange) versus static hedge stock (blue).

With the calculated levels as a basis, as illustrated in Figure 6.4, storing costs for the static and the proposed dynamic hedge stock were calculated for each article and each market with the storage cost for high-flow. Since exact numbers of what stock is hedge stock are unavailable in the current inventory data, the static stock was estimated as keeping a constant stock level equal to the maximum peak weekly sale for 52 weeks. The dynamic stock was calculated as keeping the high stock level between week 40 and week 1, corresponding to 14 weeks, and the low stock level for the remaining 38 weeks. The difference between the two resulted in a total potential saving of almost 47% for all 10 articles. For more detailed calculations, see Appendix B.

6.4.2 Reducing the number of articles in hedge stock

As mentioned, another aspect of the problem with excessive hedge stock is the amount of articles that are currently hedged for. The hedge stock is not limited to the iconic or even top selling articles but are kept for many more.

With more distinct prioritization of selecting articles to focus on and letting the others be handled automatically by the system, this can be avoided. This reasoning was used in the work with the dynamic hedge stock in the previous section when the articles to be used in the calculations were decided upon together with the category. The reasoning behind prioritizing certain articles in general will be discussed in Chapter 7.

6.4.3 The need for hedge stock

The purpose of hedging, according to the future inventory concept, is to be a proactive tool to be used to mitigate extraordinary risks in supply. This means it is critical to build it down when the period has passed to avoid overstock for the future. Hedge stock is not supposed to be a constant buffer. Instead, by reducing inventory, problems are exposed as discussed in Section 5.5. Thus, it is essential to first consider if hedging is needed or not.

For candles, a category with such high amounts of direct deliveries, safety stocks in DTs are kept very small due to stores not being replenished from DTs. Thus, in order to keep some buffer stock, the solution is hedge stock. In the peak season, IKEA sells such large quantities that if something would occur that would hinder supply, it would result in large lost sales. Since the period comes with various constraints in supply, quick solutions are not always available like they are in other periods of the year. Thus, keeping some hedge stock here is a reasonable safety measure. However, during the low season, hedge stock should not be needed, but the category in question stressed that this was something they desired. This is due to the consequences that comes with a potential shortage of iconic articles, such as GLIMMA. Having a slight hedge stock will come with otherwise avoidable costs, but the category is willing to take these in exchange of securing availability. Estimating a probability of something extraordinary occurring is difficult since statistical data is not directly available, but the reasoning behind the category wanting a yearly hedge stock is based on their experiences with this kind of problems.

6.5 Reducing other stock

As pointed out, the inventory levels in many DTs are not only unnecessarily high, but usually remain constant during longer periods. This stock consists of many articles of very low quantities that together make up large inventory levels. Some of these articles serve as the constant hedge stock that is needlessly kept according to previous discussions, some are remaining after activities or front-loads. The point is that the stock is not known to be existing or is just disregarded by IKEA and stays in warehouses without any purpose whatsoever. This is one of the reasons why the new inventory concept will be implemented in IKEA to provide a clearer perspective of what stock is needed or planned and not. Reducing this excess or other stock should thus be a priority, perhaps through a major clean out by pushing goods to stores. After all, the quantities in question are for most articles very small, such as a few pallets at most, which should enable a seamless push out to stores.

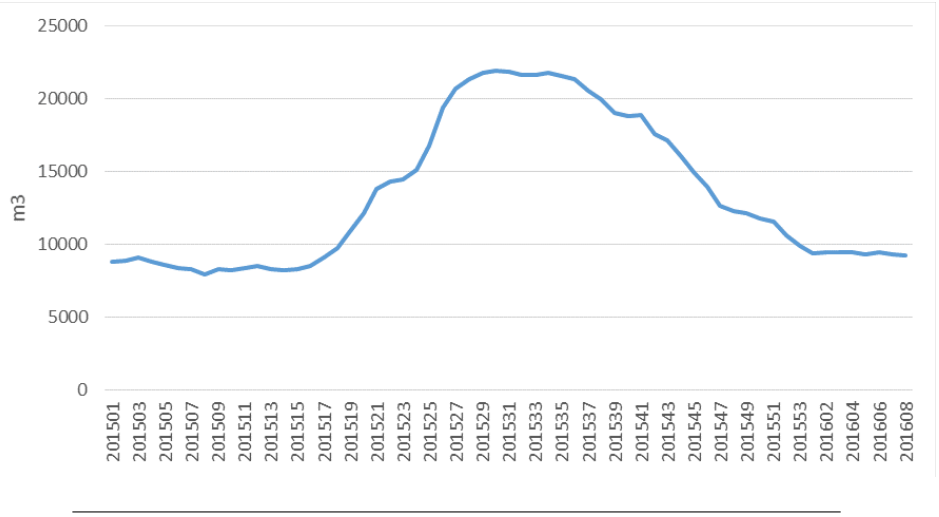

FIGURE 6.5: Total stock levels at European DTs for all candle suppliers from week 1, 2015 to week 8, 2016.

Figure 6.5 illustrates the overall DT stock in Europe where stock levels are staying on a constant level of 8.000-9.000 m^3 throughout the year apart from the peak. For a product family with mostly direct deliveries, this amount is quite large (compare with sales in Figure 4.2). Calculating the actual needed amount of this stock and identifying the overstock in each DT would be an extensive process since the current inventory structure does not allow stock to be clearly identified, as discussed in Section 3.3.2., and was thus not carried out in this thesis. Instead, an estimation of potential stock reduction was reached through discussions with Need planner.[5] It was estimated that a stock reduction of 2.000-3.000 m^3 at the various DTs in Europe seemed plausible, which is equivalent to a yearly saving of roughly 9.8% (2.000 m^3 removed from high-flow) to 17.5% (2.000 m^3 removed from high-flow and 1.000 m^3 from low-flow). Even though the quantity is roughly estimated, it clearly shows that there are great potential savings to be made by identifying and reducing stock that has no clear purpose. This will be possible after the implementation of the new inventory concept, where it will be possible to identify unnecessary stock (classified as other stock).

6.6 Improved interaction between retail & supply

Many of the problems of previous years are clearly related to the absence of mutual support between stores and IoS when it comes to sales and supply as discussed in sections 5.4.1 and 5.4.2. Stores or *retail* are autonomous in the sense that they order what they want themselves and control their own inventory. The mission for the planners at IoS or *supply* is to make sure the stores receive what they have ordered. However, if retail realizes some future quantities are later not needed, these are left to be handled by supply. This imbalance has led to stock being added up in DTs during the years. This is a organizational problem that IKEA is aware of but has a hard time solving due to the organizational structure.

[5]Petersson, 2016.

One example of a situation illustrating this interaction problem is the activity planning. Securing availability of needed quantities for an activity is not always easy, therefore a better collaboration between supply and retail is needed. Currently supply supports retail by securing the requested quantities, however this support is not mutual. Since stores tend to overestimate the sales potential during activities, it is not uncommon that stock is left at DTs after activities. When this happens, retail should support supply by trying to push sales of those articles left at DTs in order to reduce this excess stock. Through interviews with various employees, it is clear that it is hard to reach this mutual support. Instead, better communication between supply and retail is proposed when an application for an activity is filed. After supply has received the application and has confirmed approval from the supplier side, a request for confirmation of the quantity should be sent to retail. By confirming the quantity, retail understands that stock left after the activity might be pushed out to stores. This communication will hopefully change retail's behavior of overestimating sales, meaning better estimations of sales potential will be made since overestimating will now lead to stores more clearly seeing the consequences compared to before.

Another way of dealing with the store related problems from a perspective of minimizing company inventory would be a complete centralized steering by IoS of all supply. One advantage with this is that there would be fewer decision makers and less manual adjustments, which would mean supply related planning could to a larger extent than before rely on the system. Further, by having orders placed centrally instead of by each store, the problem with overestimation of sales would be solved. On the other hand, a disadvantage with centralized steering is that local knowledge from each store related to culture and customers is not utilized in the same way. Nevertheless, since this centralized steering is not possible with the organizational structure of IKEA today, the reasoning in the previous section would be a large first step improvement compared to current way of handling the problem with stores overestimating sales.

6.7 Utilizing existing plans

As discussed in Chapter 5, many of the issues encountered in the analysis are related to insufficient build down of stock and the lack of plans for doing this properly. The hasty switch from DT deliveries to direct deliveries as well as the first-buys are good examples of this problem. However, after interviews it stands clear that there are existing working routines in IKEA for many of these situations, for example how to conduct replenishment setup switches. However, these are not directly available to concerned employees and therefore not followed but instead situations are solved on routine. Many problems could therefore be solved by making these working routines available to employees and by making sure that they are actually followed.

Chapter 7

Future inventory planning at IKEA

Based on the previous chapter with solution proposals for future inventory work, this chapter includes a defined plan for how to specifically prepare for periods that require additional planning. It also provides guidelines for the inventory planning in line with the new IKEA inventory concept.

The analysis in Chapter 5 and solution proposals in Chapter 6 served as basis for a workshop meeting together with responsible employees both from the HFB and the category. This workshop had the purpose of establishing a structured planning process for inventory to be used for major activity planning - in the case of candles particularly the Christmas peak. Since deeper collaboration has before been lacking between the two, responsibilities and interactions between the organization areas were defined in the plan. The workshop resulted in the construction of a planning process, including clear guidelines of follow up, deviations and various decision support, established in line with the new IKEA inventory management concept discussed.

7.1 Inventory planning process

The underlying purpose of establishing a more structured plan for managing tougher periods was to in the future avoid keeping large amount of excess stock in DTs. With more distinct guidelines, both for building and reducing inventory for certain occasions, unnecessary stock can be reduced and costs can be avoided. To obtain the best results in planning for these specific periods, the most important factor is the collaboration between the HFB and the category, something that before has not been included in this kind of planning. This will ensure that knowledge and goals from two different directions in the organization are used in the best way. The employees from the two business areas that are included in this process are illustrated in Figure 7.1.

The inventory planning process, developed during the workshop together with IKEA, was constructed in line with the internal IKEA working method MSI (Managing Supply Imbalance). This method describes the coordinated

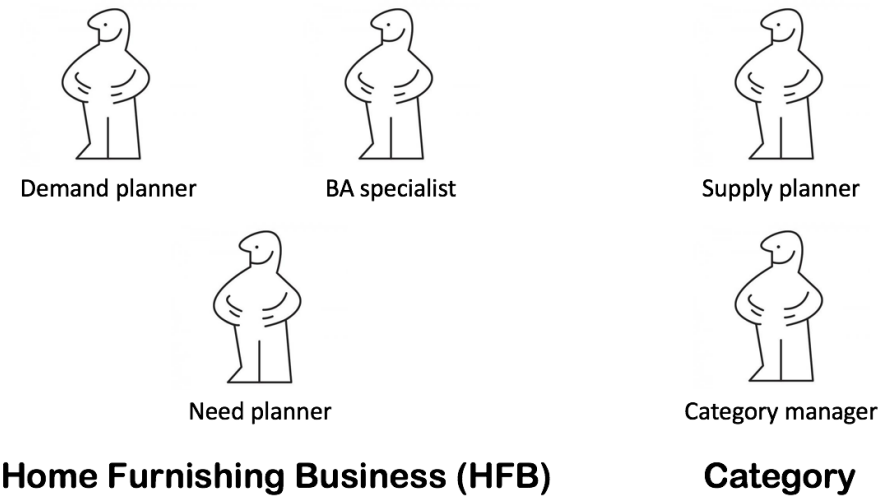

FIGURE 7.1: The employees from the HFB and the category included in the inventory planning process.

way of working when solving imbalances in supply, improving the use of available capacities in the supply chain - not only at suppliers but also in transports, DTs and selling units. A major part of the method is visualizing the plans in the replenishment system DSP Fulfillment to provide a better overview for employees and to allow more proactive work. The workflow of the method consists of the following steps that should be repeated three times per year, preceding the three major activities within IKEA, with a planning horizon of eight months (*Manage Supply Imbalance* 2014):

- Adapt the supply plan to accommodate supplier constraints.
- Perform a coordinated selling unit front-load on constraint items including commercial front-loads.
- Adjust the supply plan for receiving constraints.
- Keep front-loaded stock according to the priority: 1.Supplier 2.Stores 3.DC, thus keeping the direct flow to a maximum.

The MSI work is performed in the following weeks: 1) Week 5-13 to prepare for the Catalogue release, 2) Week 22-25 to prepare for the Christmas season. 3) Week 42-45 to prepare for the Chinese New year (*Manage Supply Imbalance* 2014).

The reason for using the MSI working method as foundation is that the first two steps in the planning process are included as preparation for the MSI work and that the planning horizon of eight months together with the MSI timeline offers a good planning structure. Since the first two steps of the planning process are carried out regardless, the connection of the MSI and the inventory plan facilitates the work needed and saves time. The planning process is of course still applicable without the MSI or similar working methods.

The planning process developed was made from the perspective of the paraffin/stearin category and is illustrated in Figure 7.2. As discussed, the toughest period for this category to plan for is the Christmas season, which is why the plan was constructed in line with the MSI schedule for this activity period. The MSI planning for Christmas takes place between week 22 and 25 (eight months before the Christmas period). However, the planning process in this chapter is meant to also be useful to other categories and before other large activities or periods that require more thorough planning, thus with different weeks along the time axis displayed in Figure 7.2. The various steps in the time-plan are explained in the following sections.

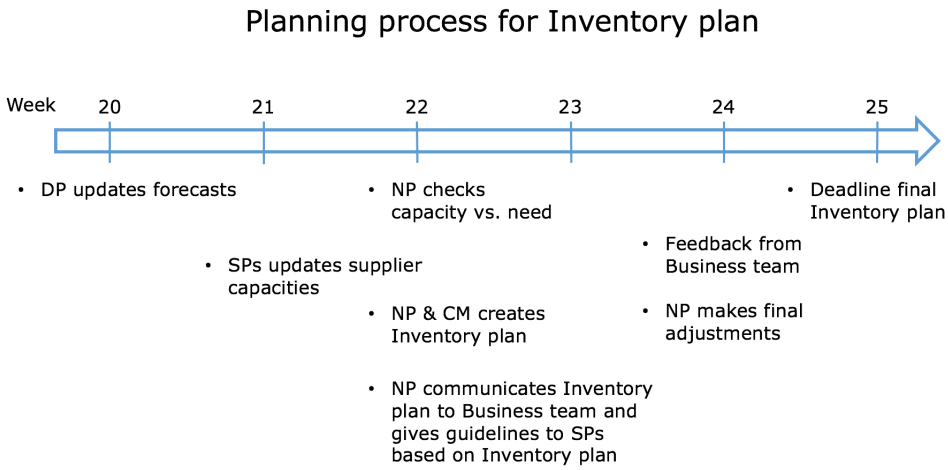

FIGURE 7.2: The planning process that was developed for the Christmas peak (similar as for other activities but different weeks). DP = Demand planner, SP = Supply planner, NP = Need planner, CM = Category manager.

7.1.1 Demand forecast and supplier capacity updates

Before the planning for the coming eight months can start, demand forecasts and supplier capacities need to be updated. The Demand planner is responsible for reviewing and updating the demand forecasts in DSP for all articles during week 20. After this, the Supply planner is responsible for making sure that the supplier capacities in Fulfillment are updated before week 22. These are activities included in the MSI concept and needs to be performed before the MSI work can start in week 22.

7.1.2 Balancing need versus supplier capacities

When the demand forecasts and supplier capacities are updated, the Need planner determines the need and checks how this matches the capacities of suppliers. This will be done in the beginning of week 22. If the need exceeds the defined capacities in Fulfillment, the Need planner should inform the Supply planner in order to check if the suppliers can handle the extra need or if it needs to be balanced against capacities. Balancing the need is commonly done by ordering the extra needed quantities earlier when there is free capacity at suppliers.

7.1.3 Establishment of inventory plan

Once the need is balanced against the capacities at suppliers, the Category manager together with the Need planner are responsible for creating an inventory plan for the following eight months. This will be done during a meeting in the middle of week 22. Since the Category manager is responsible for the supplier base and the Need planner is responsible for the inventories at DCG level, these are best suited to set the inventory plan. The inventory plan consists of three parts: an anticipation stock plan, a hedge stock plan, and setting target goals and matrix changes. These different parts of the inventory plan will be further discussed in Section 7.2.

7.1.4 Communicating plan and setting guidelines

After the inventory plan is determined, the Need planner is responsible for communicating the plan to the business team in each region (the part of the category that works closely with the suppliers, including Supply planners). Moreover, the Need planner sets guidelines based on the inventory plan to guide the Supply planners in their work.

7.1.5 Feedback and final adjustments

When the inventory plan has been presented to the business team, the team has one week to review the plan and check potential problems with the suppliers. The feedback from the team needs to be communicated to the Need planner in the beginning of week 24 so that final adjustments can be made to the inventory plan before the final deadline in week 25.

7.2 Inventory plan

The following sections will cover the parts of the inventory plan that will be established in the planning process which is created in line with the new IKEA inventory concept in Chapter 3. The benefits of using the new stock structure is that predefined guidelines and principles regarding the inventory classified as excess stock, which is the stock covered in this process, can be applied to this plan. An example of these is that all excess stock must have a start- and end-date, which will allow a clearer stock development, similar to low-flow currently. The plan includes three different parts, namely an anticipation stock plan, a hedge stock plan, and target goals and matrix changes. Moreover, guidelines to consider in the selection of articles to prioritize and for selecting storage location in the supply chain are provided later in this chapter.

7.2.1 Anticipation stock plan

As mentioned in Chapter 4, anticipation stock is inventory produced earlier than the scheduled need to cover for known restrictions in the supply chain. There can be restrictions in production, storage, transport, shipping or receiving, and the restriction may concern single or multiple articles and/or markets. One example of this is the limitation of long distance trucks during the Christmas holidays in Europe, which results in inventory being built earlier and stored at DTs. The purpose of making a plan for anticipation

stock as such, compared to already existing guidelines for front-loading, is primarily to obtain a more thorough structure of what to include and not include. This will be achieved by the collaboration between the category and the HFB, something currently lacking in stock planning. The contents of the anticipation stock plan include the following parts:

- Selection of articles
- Selection of storage location
- Establish stock quantities
- Set start- and end-date of stock

To avoid keeping excessive amounts of anticipation stock and allow a proper build down of inventory, the anticipation stock plan should first and foremost consist of a set of articles and not the whole range in a category. Stock for certain articles may not be needed, even though the restrictions may affect them. The selection of articles will be discussed in Section 7.2.4. Moreover, sales of articles are mostly market or country dependent, meaning building the stock should be made with a geographical delimitation. With the agreed selection of articles for each market, the needed quantities and location of this anticipation stock are to be determined based on the scope of the restriction. Guidelines to consider when selecting where to keep the stock will be discussed further on in Section 7.2.5. Lastly, as proposed in the new inventory concept, all anticipation stock should have a start- and end-date to allow better control of inventories. In line with this concept, a time period for the stock is to be specified in the inventory plan together with a plan for how this stock is to be built and later reduced. This will lead to proper build up and build down of stock in contrast to earlier.

7.2.2 Hedge stock plan

The definition of hedge stock states that hedge stock is additional stock with the purpose to shield from extraordinary uncertainties. As identified earlier, IKEA has a tendency to constantly hedge against potential problems for a large range of their articles. To avoid excess hedge stock, careful planning of hedge stock is included in the new established inventory planning process. The parts in the hedge stock plan are as follows:

- Selection of articles
- Selection of storage location
- Establish stock quantities
- Set start- and end-date of stock

Similarly to anticipation stock, only a selection of articles and markets will be included in the hedge stock and the number of articles and markets depend on the scope of the uncertainty. It is important to point out that hedge stock is only to be kept for extraordinary uncertainties, meaning only when it is really needed, and not for all uncertainties. When the selection of articles and markets are completed, hedge stock quantities need to be estimated and determined. The quantities in the hedge stock depends on the uncertainty, but a suggested rule of thumb is one stock week, meaning that IKEA has one

week to handle potential problems, see discussion in Section 6.4.1. If hedge stock is needed during a longer period of time, it is proposed to analyze the magnitude of the uncertainty over time in order to see if a dynamic hedge stock can be used, meaning that a larger hedge stock is only kept during the most critical time period. As for anticipation stock, a time period for the hedge stock needs to be specified in the inventory plan together with a plan for stock build up and reduction.

7.2.3 Target goals and matrix changes

As mentioned in Section 4.4, the category and HFB monitor certain KPIs, for example DD-share and stock weeks, and they also set target goals for each of these KPIs. However, these are usually not aligned, meaning they differ between the HFB and the category. For instance, the HFB's inventory targets apply to all categories meaning no differentiation is made based on the preconditions of each category. Thus, since the inventory planning is made collaboratively and since it takes place three times per year, it is appropriate to review and set common target goals during this planning process. Moreover, once the inventory plan for anticipation and hedge stock is set, supply chain matrix analyses should be conducted to identify if any changes to these matrices are needed in order to meet the plan.

7.2.4 Guidelines for article differentiation

As previously discussed and as illustrated in Figure 4.3, a few articles account for a large part of the sales volumes at IKEA, and barely no differentiation in the way of working is made on the basis of this fact. This means that there is potential to utilize the time spent on inventory planning in a more time efficient manner, by putting a larger focus on important articles instead of working with all articles in the same way. Thus, by disregarding non-prioritized articles, more accurate plans for the articles related to the majority of the costs can be achieved. The differentiation between important and less important articles are not solely based on sales volume but are based on different criteria which in turn may differ from product to product and/or market to market.

Since the selection of articles will be performed during the inventory planning meeting, the selection will benefit from the deeper knowledge of the category. The selection of articles should be analysed and made for each market, i.e. on sub-regional level or, for larger countries, on country level. This geographical delimitation is necessary since ranges of articles as well as sales of an article differs from market to market or country to country.

The factor that will serve as an initial foundation for the selection of articles is the service level. Since articles with higher service level are naturally prioritized by IKEA and with service levels also being country specific, meaning an article may have different service levels in different countries, this measure is a good first support to use. In order to further distinguish between articles, various criteria to consider have been produced after interviews with employees [1]. These criteria are listed in Table 7.1, but as they may differ in relative relevance from category to category, they will not be presented in

[1] Petersson, 2016; Szczepkowska, 2016

any specific priority order. The important thing is to take all of them into account when deciding on what group of articles to work with.

Table 7.1: Guidelines for selecting articles to prioritize on in inventory planning.

Criteria	**Motivation/explanation**
Profit margin	Articles with a larger profit margin may be worth focusing on since these are the articles that contribute the most to the company's profit.
Turnover volume	Articles with highest turnover in terms of volume are the best selling and most popular articles.
Turnover money	Articles with highest turnover in terms of money are the articles that generate the most value in terms of money.
Image	Certain articles are iconic in the product range and a shortage of these could lead to unsatisfied customers and bad reputation.
Substitution	The existence of similar articles in the range, e.g. in different colors or sizes, that could act as substitutions for a sold-out article.
Key components	Some articles make up product families and are thus needed in order to sell other articles, for example cabinet frames or fittings - these are needed in order to sell kitchens.
Sourcing conditions	The certitude in sourcing is directly affecting the availability of articles. This is primarily related to possible uncertainties in production or distribution. Moreover, single or multiple sourcing should be considered, since with multiple suppliers, issues can be navigated around more easily.

The guiding principles in Table 7.1 are meant to aid in the selection of articles for both anticipation and hedge stock planning. Due to the different purposes of these, each criteria is of different importance and relevance depending on if selecting articles for hedge stock or anticipation stock build up.

7.2.5 Guidelines for selecting storage location

Where in the supply chain to keep inventory for the special circumstances that anticipation and hedge stock is used for depends on both the replenishment setup and the conditions and limitations that characterize the supply chain as well as the situation stocked for. Commonly, stock is built by IKEA in their DTs and the possibility to keep stock at suppliers is overlooked. Most suppliers have their own or use external warehouse spaces and utilizing these

upstream storage capacities should be an option to consider. However, keeping stock in different parts of the supply chain comes with both benefits and disadvantages depending on the characteristics of the supply chain.

Keeping stock further upstream (towards the suppliers) in the replenishment flow grants several advantages. Since one supplier supplies several stores and warehouses and one warehouse supplies several stores, upstream storing provides the advantage of more flexible distribution. Keeping stock at a supplier or consolidation point may enable distribution of these goods to an entire market where keeping goods in warehouses limit the distribution to a sub-region or country. Keeping the stock in stores on the other hand means this amount of goods are solely usable for this store to sell, since in IKEA internal distribution is not utilized due to the related high costs.

Storing closer to the origin of the goods also entails less total stock can be kept. The total safety stock for a unit upstream is lower since variations in demand is reduced when demand is aggregated, meaning that high demand from one store/DT can be offset by low demand from another store/DT (Ho-Yin and Zuo-Jun, 2012).

There are naturally also disadvantages with keeping stock upstream and not closer to the end-customer. With downstream storage, replenishment is less susceptible to disturbances or problems in the supply chain. By keeping goods in warehouses instead of at suppliers, one can more easily navigate around for example transport restrictions. It also means one can respond quicker when deviations and problems do occur by having stock closer to stores. This could guarantee availability of goods in periods with upstream problems.

There are several factors to consider in the selection of where to store the anticipation and hedge stock. Depending on the preconditions of the supply chain, each factor points toward one direction - either upstream towards the suppliers or downstream towards the stores. However, it should be pointed out that storage at suppliers and other externally owned facilities is not always possible due to for example space limitations or difficulties in integration. The factors were expressed during interviews and are compiled in Table 7.2.[2]

7.3 Follow-up and evaluation of plan

In order to guarantee that set inventory plans are followed and to identify improvements for coming years, follow-up and evaluation is an important activity to carry out. The follow-up should focus on the inventory levels and compare these to the set plan. The amount, frequency and depth of this process should be established by the responsible employees involved in the planning process. This depends on the size and scope of the period planned for, something that is highly varying for each category and organization. IKEA emphasizes that too frequent and comprehensive follow-up will usually lead to this being disregarded completely.[3] Thus, employees need to find a balanced plan for this process to guarantee the efficiency of the inventory plan. However, it is of importance to plan the follow-up for the most

[2]Petersson, 2016; Holm, 2016
[3]Ibid.

TABLE 7.2: Factors to consider regarding storage location.

Criteria	**Motivation/explanation**
Lead time	If the lead times are *long* (such as for region to region distribution) it can be beneficial to keep finished goods *downstream* in the supply chain, since if any problems would occur requiring extra supply of goods, nearby storage could provide a solution more quickly. In contrast, *short* lead times permit quick response even if stored *upstream* (which enables flexible replenishment solutions).
Supplier performance	*High* supplier performance means less uncertainties in supply and distribution and stock can hence be kept *upstream*, which allows taking advantage of the benefits of keeping stock early in the supply chain. *Low* supplier performance implies more uncertainties are present that has to be navigated around by *downstream* storage.
Restrictions	For anticipation stock it is of course important to consider the known restriction and where this restriction is located. It is also important to consider if there are any other restrictions in the supply chain, such as transport, shipping/receiving windows or production capacities that may affect the placement of inventory. If this restriction is *located at the supplier*, for example restriction in production capacity, it is possible to keep inventory *upstream* in the supply chain. However, if the restriction is *located later in the supply chain*, for example a restriction in transport from supplier, inventory needs to be kept *downstream* in the supply chain.
Uncertainties	Similar to restrictions, it is important to consider if there are any uncertainties in the supply chain and where these are located. An uncertainty *in the beginning of the supply chain*, such as a potential shortage of raw material, offers the possibility of keeping inventory *upstream* in the supply chain while an uncertainty *closer towards the end of the supply chain* motivates *downstream* storage.

constrained period (e.g. Christmas in the case of candles) since it is here adjustments have the largest possibility to impact the inventory levels.

For example, in the case of the inventory plan for the Christmas season for candles, follow-up was agreed to take place in week 50 in the peak period, carried out by the BA-specialist who is the employee responsible for inventory follow-up. This process would consist of looking at current inventory

levels together with the projection of these over the coming weeks, and comparing with the inventory levels set in the plan. The purpose is to assure that stock is reduced in an efficient way and to identify potential overstock situations in time so that the overstock can be reduced when demand is still at its peak.

7.3.1 Action plan for deviations of stock levels

In the follow-up process of inventory levels, deviations may be identified and determining the underlying reasons for these is important. Based on these reasons, certain pre-established measures should be available to aid the navigation around potential problems.

Probably the most impactful event is when the company experiences lower sales than forecasted. This will lead to slower reduction of stock compared to the plan and hence make up a deviation. To handle this stock deviation the Need planner brings up the problem during "deviation meetings" with the HFB in order to requests a sales push.

7.3.2 Evaluation

An evaluation of the inventory plan should be carried out after the end of the period planned for. The purpose of the evaluation is to generate learnings and provide stakeholders with valuable information for coming planning periods. The process should include evaluating the three parts of the inventory plan, namely the anticipation stock plan, hedge stock plan and the target goals set for the period. In this it is suggested to question: *did things go as planned?; if not, why did it not go as planned?* and *what are the learnings for future planning periods?* Further, the following topics should be considered:

- Were the articles correctly chosen? Should some have been excluded from the plan and were there any articles that should have been included?
- Was the time-period appropriate?
- Was the build up correctly timed? Can goods be taken in later to save costs or does the build up need to be made earlier to avoid problems?
- Were the quantities correctly estimated?

Chapter 8

Conclusions

This chapter summarizes the results and conclusions and discusses the generalizability of these. It also covers the contributions and recommendations to IKEA and to the academia and aims to reflect on the outcomes of the thesis compared to what was set up in the first chapters.

This thesis has researched and formulated results related to organizational and strategic inventory management work for one category at IKEA. To review the purpose and goals of the study and the discuss the generalizability of the outcomes, the results and conclusions will be discussed from both a company and academic perspective.

8.1 Fulfillment of purpose and research questions

Throughout this research, the objective has been to fulfill the purpose of this thesis formulated in Chapter 1 in order to have a consistent and clear theme and to reach the final conclusions in a straight manner, not branching out of topic. The purpose was defined as follows:

> *The purpose of this study is to highlight current problems in steering and planning inventories within IKEA and to propose practical solutions and a strategic framework in line with IKEA's new inventory concept to improve their organizational work and strategic decisions related to inventory management in order to reduce inventory costs.*

To fulfill the purpose, two research questions were formulated. These are briefly discussed in the upcoming sections.

8.1.1 RQ1: What are the underlying reasons related to strategy and organization behind IKEA's high inventory levels?

Based on the empirical study, a deeper analysis of IKEA's DT inventories was conducted by interviewing several employees in the organization. It

stood clear most of the reasons behind high inventory levels were not related to bad forecasting or calculations, but linked to planning activities on a more tactical or strategic level and the mindset of employees. More specifically, and as discussed in Chapter 5, the lack of established plans with clear guidelines and proper follow up is a common factor of the issues. Decisions and plans are made spontaneously based on routine and feeling with a pervasive fear for shortages. The clear representation of the attitude in the company is the mindset of "availability to any cost" leading to stock being put on DTs to buffer against all potential problems instead of letting safety stocks suffice. A major reason for this mindset and the decisions taken related to this attitude is that cost support is not present in the inventory planning, leading to planners prioritizing high inventory levels over having just sufficient stock.

8.1.2 RQ2: How should IKEA plan and steer inventory to improve their strategic decisions related to inventory management?

Many of the high stock levels encountered in the analysis were related to insufficient planning or follow up. These can easily be avoided and several proposals of solutions were thus defined in Chapter 6 to address some of these issues. These specific solutions consisted of:

- Using a dynamic instead of a static hedge stock based on the sales, especially for highly seasonal products
- Reducing the stock peak at the costly low-flow DT by:
  - narrowing the width, thus taking in seasonal products later from suppliers
  - cutting the height, thus moving viable articles to high-flow
- Reduce overall unused stock in DTs
- Better interaction between retail and supply

These solution proposals were motivated with cost savings where applicable. Based on these, a structured inventory planning process was constructed in Chapter 7 to be utilized for periods with major constraints in supply. This process included clear guidelines, responsibilities of employees and a time frame for planning hedge and anticipation stock for the coming eight months to avoid building too much stock or not reducing the stock in proper time.

8.2 Benefits and recommendations to IKEA

The inventory planning process established in Chapter 7 will be implemented as a pilot project for the category paraffin/stearin and used for the upcoming Christmas season of 2016. Depending on how well the plan and process fulfills its purpose, it is meant to be used for other IKEA categories where applicable. To further proceed with the results of this thesis, the benefits of the planning process are discussed hereafter, followed by recommendations to IKEA.

8.2.1 Benefits of the inventory planning process

Since clear collaboration between the category and HFB has previously been lacking in deeper planning for inventory, the inventory planning process will resolve this gap between the two directions. The plans will be set with input from both sourcing and retail, taking advantage of knowledge and experiences from both. Instead of having company-wide goals and targets for all categories, inventories will be appropriately controlled with respect to both upstream and downstream limitations and conditions.

Another benefit of using the process is that guidelines and rules from the new IKEA inventory framework are included, since the process is based on terms and definitions in this framework. There are clear principles defined for what situations hedge stock and anticipation stock should and should not be kept, along with the requirement for start- and end-date of this additional stock. This means stock has to be properly built up and reduced, which in turn requires continuous follow up in order to make sure this is done according to plan. The process also comes with clearer stock structure compared to current structure, where it is hard to see what stock is actually needed or wanted. This means that excess stock left over can be identified and followed up conveniently.

The last benefit being pointed out is the prioritization of articles in the new planning process. By distinguishing important articles from not-so-important articles, a much more efficient planning can be achieved. The articles with the greatest impact on the costs will be planned for more thoroughly and others will be left automatically handled by the system.

8.2.2 Recommendations of future actions

As mentioned above, the process will be piloted for the paraffin/stearin category this year (2016). It will thus be highly important with a thorough evaluation of the work to assess the usefulness of the plan and process. Adjustments or clarifications may be needed in order to improve or simplify the plan for coming use. If the testing process is successful, the next step is to implement it gradually for other categories. When the process has been verified for the paraffin/stearin category, the recommendation is to widen its purpose and use it as guidelines for other large activities or situations that require additional planning. Even though the process consists of defined activities, it is still general enough to be applied to other activities.

Along with evaluation, it is also important with proper documentation in order to maximize the benefits from the planning process. It is recommended to ensure users understand the need of documenting the results and evaluations to make it easy for others to access the findings after the completion of planning periods. Especially if the process is to be implemented for the entire company, the willingness to collaborate by sharing competence and knowledge is vital for success in future work.

Lastly, further recommendations is for other categories and the organization in IKEA as a whole to take advantage of the solution proposals discussed in Chapter 6. Many of the ideas are applicable to other categories since high stock levels are not unique to the stearin/paraffin category. Moreover,

concrete costs of storing in different parts of the supply chain have been provided, which should be reviewed by the other categories and HFBs to better support future decisions regarding inventory planning. For example, reducing so called other stock is a relatively easy procedure with low risk and high reward in terms of savings, since the stock is not needed. Another stock related recommendation is to gather statistical data of situations related to extraordinary uncertainties occurring. With a statistical probability for these extraordinary uncertainties, the cost of keeping hedge stock can be compared against the cost of potential shortage (the probability multiplied with the cost for one week of lost sales). By doing such a cost comparison, the decision of keeping hedge stock will be made based on cost data and not intuition or feeling. Finally, on a higher level, some solutions discussed should result in new specific and clearer guidelines or working methods in line with the new strategic framework for inventory management in IKEA, such as communicating smaller receiver windows for suppliers.

8.3 Generalizability

Despite this thesis being conducted on behalf of and together with a specific category at IKEA, the aim is to also apply the results and conclusions to other categories within IKEA as discussed above. The results and conclusions may also prove interesting to other organizations, organizations that experience similar challenges with strategic inventory management, something that is clearly not unique to IKEA (Thonemann, 2011). However, since the results reached, more specifically the inventory planning process and related guidelines, are based on operations and the organizational structure for IKEA particularly, they would need small adjustments to be applicable to other companies. With this stated, the process would be more useful for companies similar to IKEA and for others it should instead be seen as a concept. To enable other interested parties to identify the applicability of the results to their specific situation, the limitations and conditions that characterizes IKEA are hereafter discussed.

8.3.1 Characteristics of IKEA

IKEA as a consumer goods company is unique due to their size and, in relation to the topic of inventory management in this thesis, they are particularly distinguishable when looking at their supply chain and related activities. Firstly, as opposed to many other large actors, IKEA is responsible for and controls more or less their entire supply chain, from raw material to end-customer. This centralization means they have the benefit of being able to streamline many of the activities related to supply chain themselves. Other companies may be more decentralized since certain parts of the chain is somewhat outside their control. This in the end means IKEA is working very well with supply chain management which has led to the company becoming a model for other companies in this regard. However, it is clear that their way of working with inventory management leaves room for improvement.

Another important characteristic to consider is that IKEA applies a pull strategy regarding the flow of finished goods from suppliers to stores. This

means that goods are *pulled* from downstream and not *pushed* from upstream and outwards in the supply chain. A more profound motivation is the fact that the stores decide how much they should order and are then supplied with that amount of goods instead of the central organization determining a certain amount of goods to be sold by each or all stores. This is the case since IKEA stores are not owned and controlled by the central organization at IoS, but instead act as individual units. Their work is centered around achieving the best results for themselves and not IKEA as a whole.

8.3.2 Potential similar companies

As mentioned previously, proper inventory management is not a unique challenge to IKEA and the planning process may therefore be useful for similar companies. Examples of such companies are Nestlé, Unilever and Whirlpool Corporation, which are all big global consumer goods companies that produce and sell wide ranges of products in large quantities on a widespread market. Further, in resemblance to IKEA, they have an extensive supply chain network with a large supplier base. However, in difference to IKEA, the named companies above do not own the stores where their products are sold. Considering that IKEA stores acts as individual units and uses a pull policy, meaning that orders are placed by the stores themselves and not IoS, these can be resembled to the stores supplied by e.g. Nestlé etc. Further, it could be argued that IKEA does not own their supplier base, unlike e.g. Unilever. Nonetheless, it is clear that IKEA in many cases works closely with their suppliers since many suppliers have IKEA has their only or main customer.

Another company that may find the planning process useful is the Swedish retail company Biltema. Similar to IKEA, Biltema offers a large range of consumer articles, specializing in tools, household hardware and leisure products, to a low price. Biltema much like IKEA, sell products under their own brand and own the stores where these are sold. Another similarity is that neither Biltema or IKEA own their suppliers. However a big difference between the two companies is that Biltema only operates on the nordic market, while IKEA operates on the global market.

8.4 Credibility

As discussed in Chapter 2, the approaches taken to ensure credibility in this thesis consist of achieving validity in the analyses and results reached, and proving that the thesis has been performed in a reliable manner.

The results of this thesis are established and based on the way IKEA works presently. The current situation analysis was made in collaboration with affected employees who assisted with knowledge and data. This analysis was the foundation of the workshop meeting together with the concerned employees where the final results were reached. All involved employees were during the course of the project well-informed and acquainted in the work that preceded this meeting, which implies construct validity was continuously achieved. More concretely, this was achieved in an ongoing process by collecting information from various parts of the company, basing analyses on

multiple sources of evidence and continuously discussing thoughts and conclusions with concerned employees. Moreover, letting these key informants read drafts of the report helped validate the contents of the report as well as verifying the extent of the potential savings that were calculated.

External validity is, as mentioned in Chapter 2, not achieved in the same extent, since theory about the specific topic is lacking and replicating the study in other case studies is not included in this scope. However, the plausibility of the conclusions was discussed with employees at the university and stakeholders within the company to evaluate the level of generalizability of the findings.

The strive for assuring the reliability of the thesis has been done by in a structured manner describing how the study has been carried out. The role of each employee interviewed and the topics discussed in these interviews have been documented in this report, see Appendix C. The QlikView applications and internal documents used to collect data have also been listed, see Appendix D. Moreover, the procedure and reasoning behind the calculations of the cost savings are explained and motivated to provide support for these results, see Appendix B.

8.5 Limitations

The main limitation of this thesis has been the time period due to the defined size of a master thesis. The mapping and initial analysis of how IKEA works today was made for one category which was sufficient to identify underlying and representative problems for the entire company when it comes to inventory management. However, the lack of time prevented the further research from taking a wider perspective, such as including other categories in the analysis and applying or adjusting the results to these in a more valid way. The aim was for the final result and conclusion to be as generalizable as possible, but without vital input from other directions, this cannot be guaranteed to the extent desired.

8.6 Contributions and future research

The aim for this master thesis was, from the perspective of not only the authors but also IKEA and the university, for the results to be interesting both for practice (thus for IKEA) and for the academia (for future research). The contributions of the study will hereafter be discussed along with suggestions of future research within the topic.

8.6.1 Empirical/practical contributions

The topic of strategic inventory management was stressed to be important for IKEA to improve and it stood clear that the research already during the course of the project had effects on IKEA in several ways, clearly changing how employees look at inventories. Particularly the mindset of "availability to any cost" and the results of this fear of shortage attitude in terms of costs have gradually been understood by employees by evidently highlighting many of the problems encountered in the analysis. Further, the company

has realized that proper inventory management is vital to be able to continue growing IKEA and meeting the goal of doubling the revenue (2011) by 2020 according to the *Growing IKEA* direction. The mindset has also brought changes towards both sourcing and sales. IKEA will in the future avoid "being nice to suppliers" to the same extent, by having stricter delivery windows and being tougher regarding commitments. Similarly, IoS will be tougher towards the stores regarding overestimated sales, by potentially pushing leftover products to the responsible stores.

More specifically, the proposed solutions will save costs in the future work and the inventory planning process constructed will aid the paraffin/stearin category with their main challenges regarding inventory management in the coming peak periods. The category and related HFB have expressed the importance of such a plan and with candles as a form of pilot project, the aim is for the planning to be implemented for other categories.

8.6.2 Academic/theoretical contributions

This study is focused on the organizational aspects of inventory management and defines results on a more strategic level compared to other research within this topic. Existing theory are on an operational level and mostly consist of mathematical models and processes. Even though the field of research is the same, this theory is not applicable on a higher level. Theory for inventory planning that considers uncertainties and restrictions in the supply chain, other than deviations in lead time and demand, seems to be very rare, which implies that research regarding tactical and strategic inventory management is needed. The results and conclusions of this study may provide a foundation or inspiration for similar research.

8.6.3 Future research

With the limited information and research on the topic of strategic inventory management, the field is still vastly unexplored and undescribed. Operational inventory management theory commonly consists of mathematical models established through data simulations and similar, methods that are not applicable in the same way when researching on a higher level. To research with focus on organizational and strategic aspects, researchers have to look at how the industry works today and what problems and challenges are experienced before generalizing solutions. Moreover, as mentioned by Jaber (2009, p. 26), reviewing and getting inspiration from supply chain management and lean philosophies are useful tools, such as visualizing problems by reducing inventory levels. Even though the topic is challenging, inventory management is and will become a more popular part of supply chain management research.

However, the higher level of the topic makes it hard to specify or concretize knowledge and outcomes to theory as narrowly as operational inventory management would allow. Defining specific knowledge that is generalizable is difficult when only looking into a single case. Instead, learnings must be obtained by widening the scope and looking into more examples of working with the subject from other perspectives. This means case studies or research

at/with other companies or organizations should be carried out to understand how they work with the topic and to identify problems experienced by them specifically and the reasons underlying this result. This widening of the research could end in more general guidelines for how companies should work with inventory management on a higher level.

8.7 Concluding remarks

Carrying out this thesis has been an interesting and highly experiencing task. Researching a rather unexplored topic proved to be a challenge and from the start identifying what to do and what the thesis should result in was complicated. Performing a supply chain analysis at one of the world's largest home furnishing companies was an extensive assignment where problems of varying character were encountered along the course of the project. Learning how to approach and manage them and to cooperate with the employees are all valuable experiences for our future careers. We also highly value the opportunity to conduct our thesis at IKEA, being able to be part of a major company and experiencing how things are carried out in the industry. Especially being able to visit suppliers and seeing the production was an enjoyable and interesting experience that helped motivate us.

We feel very satisfied with how the project turned out and that IKEA expressed the usefulness of our conclusions. It has been extremely fascinating and fun to observe how, during the course of the project, many employees have changed their mindset regarding inventory and that the results achieved already have been implemented in company.

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Appendix A

Principles for new stock structure

In their strategic framework for inventory management IKEA list principles, related to the new stock structure, that should be investigated and considered for implementation.

The below general principles should be further investigated and considered for implementation:

- Safety stock is statistically calculated and does not include any manual adjustments.
- Cycle stock is calculated based on system parameters and is not possible to override manually.
- No extra Safety Stock is to be calculated for Activities.
- Enable identification of Stock (unplanned stock) that lacks proper structure, i.e. does not belong to any DCG and thus is not available for planning.

The below principles related to Hedge Stock should be further investigated and considered for implementation:

- All Hedge stock need to have a Start Date and End Date
- Hedge stock is to be used as a proactive tool.
- Hedge stock is to be consumed during the defined period.
- Hedge stock should not be used to cover for poor quality, bad design, lengthy set ups or the event of supplier production breakdown.
- All hedge stock exceeding X€(or exceeding the approved stock budget) needs to be described and approved by the appropriate authority.

The below principles related to Anticipation Stock should be further investigated and considered for implementation:

- All Anticipation stock needs to have a Start Date and an End Date.
- Anticipation stock should be delivered to final destination as close to consumption as possible.
- Anticipation stock mean that we move stock volume in time, not buying more.

The below principles related to Other Stock should be further investigated and considered for implementation:

- Other stock should always be kept at minimum level.
- By keeping this at minimum level inventory is optimised from inventory management perspective.
- Work actively with other stock

Appendix B

Calculations of potential savings

Due to secrecy, all savings and costs are presented with indices and percentages or removed completely, see Chapter 6. Exact figures are available in non-public version via IKEA.

B.1 Relocating some of the seasonal range to high-flow

For Christmas 2016, the following five seasonal articles have been selected to be distributed through high-flow instead of low-flow: FENOMEN red s5,15cm and 20cm, VINTER s5 grey and VINTER 7.5 red. The volume is illustrated in Figure B.1.

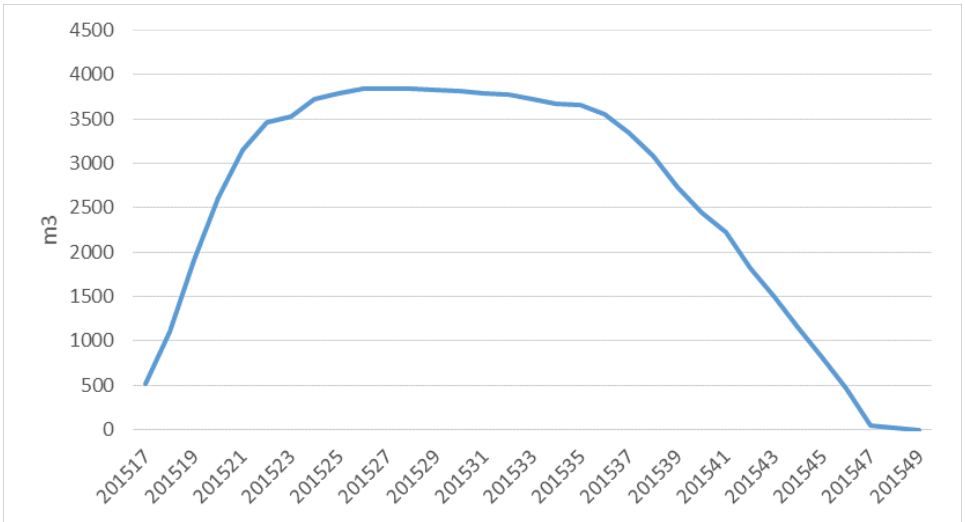

FIGURE B.1: Weekly stock levels of five seasonal articles for Christmas 2015.

C1 = Cost of storing at high-flow: [€/m^3/week]

C2 = Cost of storing at low-flow: [€/m^3/week]

V_i = stock volume for week i

The total storage cost at high-flow respectively low-flow were calculated according to the following formulas:

Total storage cost at high-flow = $\sum_{i=1}^{52} V_i * C1$

Total storage cost at low-flow = $\sum_{i=1}^{52} V_i * C2$

Saving = Total storage cost at low-flow - Total storage cost at high-flow

The saving of moving five selected articles from low-flow to high-flows were calculated by subtracting the total storage cost at high-flow from the total storage cost at low-flow. This resulted in a saving of almost 37%.

B.2 Reducing hedge stock

Weekly sales of the best selling articles during high and low season in Germany and Sweden respectively can be found in Table B.1. These figures were used to determine the high and low level of hedge stock.

An example of static and dynamic hedge stock for one article is illustrated in Figure B.2. The static hedge stock is equal to keeping the high level of hedge stock throughout the year, while the dynamic hedge stock is equal to keeping the high level for 14 weeks and the low level for 38 weeks.

Articles sold at the Nordic and European market differs in some cases, for example FENOMEN is sold in white in the Nordic countries but is sold in natural to the rest of Europe since white block candles in Europe are associated with cemetery candles. Further, the dinner candle JUBLA is sold in packs of 50 to the Nordic market while it is sold in 20-packs to the rest of Europe, this since the Nordic countries consumes larger amounts of dinner candles.

For the German market the following articles were selected: GLIMMA 100-pack, FENOMEN natural in 15cm and 20cm, JUBLA 20-pack, and SINNLIG 7.5, 9, 30-pack in natural and red.

For the Swedish market the following articles were selected: GLIMMA 100-pack, FENOMEN white in 15cm and 20cm, JUBLA 50-pack.

The volumes sold of SINNLIG articles in Sweden is low compared to the sales of these in Germany and the sales of other articles, therefore no hedge stock of SINNLIG articles will be kept in Sweden.

H (High level) = Weekly sales during peak week [m^3]

L (Low level) = Average weekly sales during low season (week 2 - week 38) [m^3]

C = Cost of storing at high-flow: [€/m^3/week]

High season = week 40 to week 1, equals 14 weeks

Low season = week 2 to 38, equals 38 weeks

Assumes 52 weeks per year

Cost of static hedge stock = C*H*52

Cost of dynamic hedge stock = C*H*14 + C*L*38

Table B.1: High and low level of hedge stock.

Article	Germany High	Germany Low	Sweden High	Sweden Low
GLIMMA 100p	200	75	200	75
FENOMEN 15 white/nat	69	20	65	15
FENOMEN 20 white/nat	50	20	65	15
JUBLA 50p/20p	50	25	230	80
SINNLIG 7,5 nat	50	20	10	2
SINNLIG 9 nat	45	20	6	1
SINNLIG 30p nat	32	12,5	8	2
SINNLIG 7,5 red	23	10	6,5	1
SINNLIG 9 red	19	10	5	1
SINNLIG 30p red	16	7,5	5,5	1

Saving = Cost of static hedge stock - Cost of dynamic hedge stock

The cost of static hedge stock and dynamic hedge stock were calculated, according to the defined formulas above, for each article and each market. After that, the saving for each article and each market were calculated. These savings were then summed up to a total saving of almost 47%.

B.3 Delayed and narrow receiving window for seasonal range

For Christmas 2017 a new delivery window between week 25 and week 30 is proposed. To investigate the potential saving of a new delivery window for the seasonal articles new stock levels needed to be calculated for the new window. An illustration of the stock levels at low-flow for the current and new delivery window can be found in Figure B.3. This new delivery window also affects the five seasonal articles on high-flows and an illustration of the stock levels for the five seasonal articles at high-flow for the current and new delivery window can be found in Figure B.3.

To simplify the calculations of new stock levels, the stock build up is assumed to follow a linear line. Deliveries of seasonal articles starts in week 17, it was therefore assumed that the stock level for week 16 is kept until week 25 when the new delivery window starts. Further, it is assumed that the stock levels for the new delivery window, as for the current window, reaches its peak in week 28. With these two stock levels set, the stock levels between week 25 and 28 could be calculated using a linear line. The new delivery window only affects the stock levels between week 17 and week 28, and due to this it is assumed that the stock levels previous to week 17 and after week 28 is the same for the new delivery window as for the current delivery window.

C = Cost of storing at low-flow: [€/m^3/week]

V_i = stock volume for week i (current delivery window)

V_j= stock volume for week j (new delivery window)

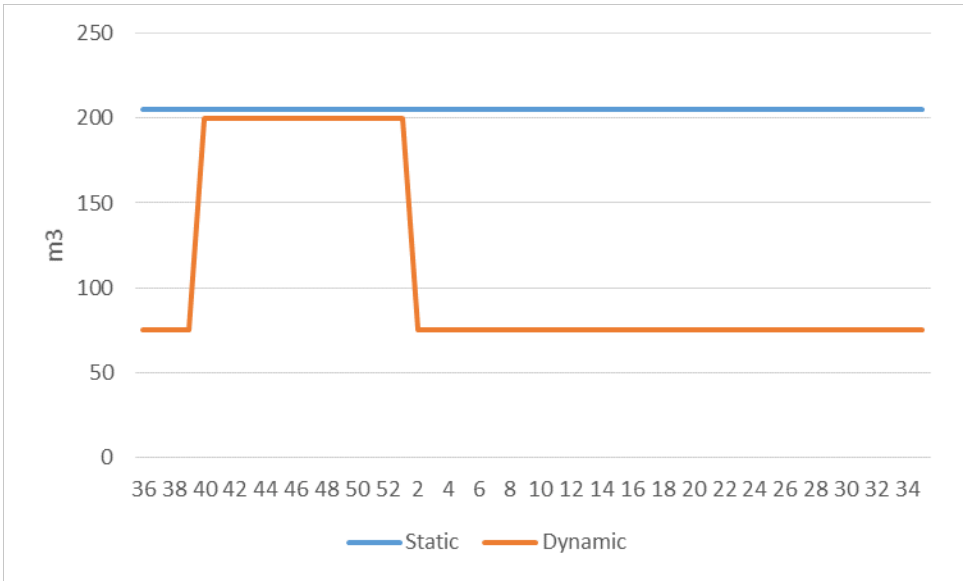

FIGURE B.2: Illustration of static hedge stock (blue line) and dynamic hedge stock (orange line).

Total storage cost for current delivery window = $\sum_{i=1}^{52} V_i * C$

Total storage cost for new delivery window = $\sum_{j=1}^{52} V_j * C$

Saving of new delivery window at low-flow = Total storage cost for current delivery window - Total storage cost for new delivery window

Based on the stock levels for the current and new delivery window, the total storage cost for the two delivery windows were calculated according to the defined formulas. The saving of new delivery window at low-flow was calculated by subtracting the total storage cost for new delivery window from the total storage cost for current delivery window, and this amounted to 4.56%.

This potential saving of a new delivery window also needs to be calculated for the five selected articles on high-flow. Similar to the calculations for low-flow, a linear line is used to simplify calculations. It is assumed that the stock level in week 25 for the new window equals the level in week 17 for the current window. Further it is assumed that the stock levels reaches it peak in week 28. From this the stock levels between week 25 and week 28 were calculated using a linear line. See Figure B.4.

C = Cost of storing at high-flow: [€/m^3/week]

V_i = stock volume for week i (current delivery window)

V_j = stock volume for week j (new delivery window)

Total storage cost for current delivery window = $\sum_{i=1}^{52} V_i * C$

Total storage cost for new delivery window = $\sum_{i=1}^{52} V_j * C$

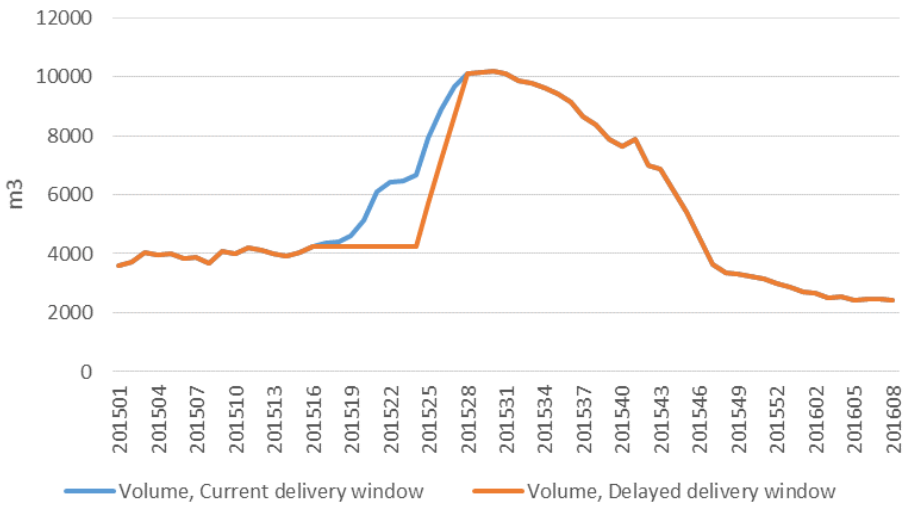

FIGURE B.3: Illustration of stock levels at low-flow for: the current delivery window (blue line) and the new delivery window (orange line).

Saving of new delivery window at high-flow = Total storage cost for current delivery window - Total storage cost for new delivery window

Based on the stock levels for the current and new delivery window, the total storage cost for the two delivery windows were calculated according to the defined formulas. The saving of new delivery window at high-flow was calculated by subtracting the total storage cost for new delivery window from the total storage cost for current delivery window, and this amounted to 30%.

However, this new delivery window affected the PUA prices for the seasonal articles. In the RFQ (Request for quotation) for Christmas 2017, IKEA requested additional PUA prices with the new delivery window. The new delivery window meant that IKEA would lose a negative price development. Since the seasonal range and quantities slightly differ from year to year, an average price development was calculated to be used for the quantities used previously to calculate savings.

Firstly, a comparison between prices for the current and the new delivery window was made for seven seasonal articles. Then an average price per volume unit was calculated according to the formulas below. Further, an average price development was calculated by taking the average of the price differences. This average price development of 0.76 % was then multiplied with the quantities of the seasonal articles for Christmas 2015, in order to calculate the missed saving from the price development.

However, with a decrease in storage cost of 30% and 4.56% respectively compared to the missed out saving from price development, the deal still resulted in that savings of 12.72% and 1.49% respectively could be obtained by having a new delivery window between week 25 and 30.

Calculations of average price of seasonal articles

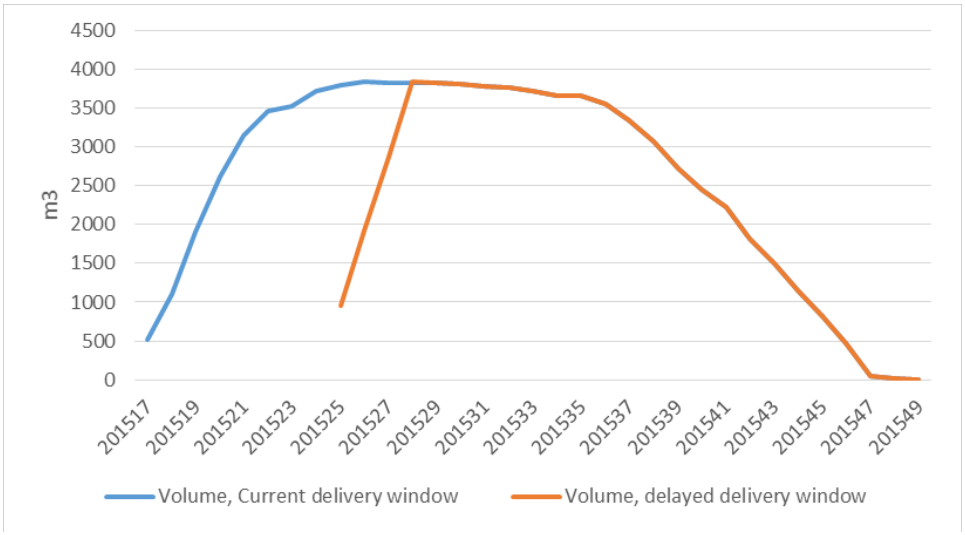

FIGURE B.4: Illustration of stock levels for the five seasonal articles at high-flow for: the current delivery window (blue line) and the new delivery window (orange line).

Q_i = Quantity of article i in pieces

V_i = Quantity of article i in m^3

K_i = Number of pieces per m^3 for article i = Q_i/V_i

P_i = Price of article i expressed as PLN/piece

[1 PLN= €0.23]

Average price of seasonal articles [€/m^3] = average of (sum of (P_i∗0.23∗K_i))

B.4 Other stock

The total stock levels at European DTs for all candle suppliers can be found in Figure B.5. As seen in the figure the stock levels are staying on a constant level of 8.000-9.000 m^3 throughout the year apart from the peak. Through discussions with concerned employees it was estimated that a potential stock reduction of 2.000-3.000 m^3 would be feasible, which is equivalent to a yearly saving of roughly 9.75% (2.000 m^3 removed from high-flow) to 17.5% (2.000 m^3 removed from high-flow and 1.000 m^3 from low-flow). Calculations of yearly saving of this 2.000-3.000 m^3 stock reduction can be found below.

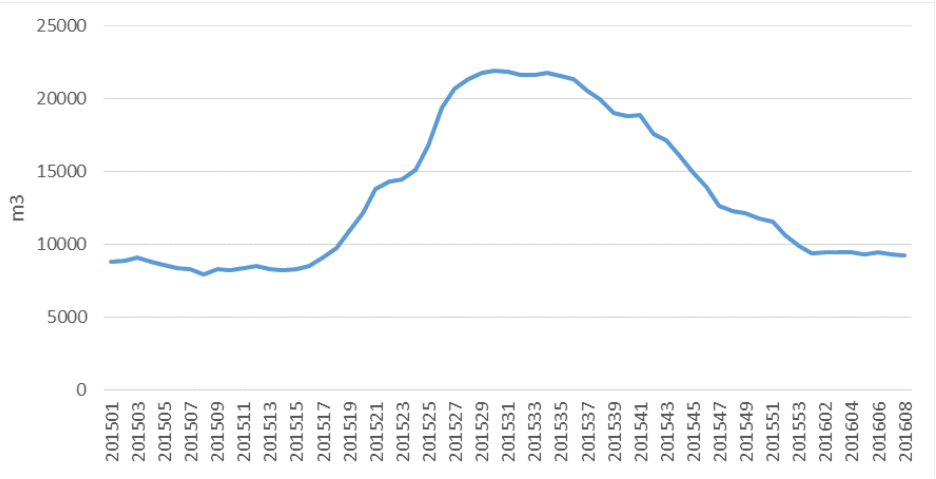

FIGURE B.5: Total stock levels at European DTs for all candle suppliers.

Calculations of yearly saving of 2.000-3.000 m^3 stock reduction:

C1 = Cost of storing at high-flow: [€/m^3/week]

C2 = Cost of storing at low-flow: [€/m^3/week]

Assumes 52 weeks per year

Yearly saving of 2.000 m^3 stock reduction at high-flow:

S1 = 2000*C1*52

Yearly saving of 2.000 m^3 stock reduction at high-flow and 1.000 m^3 stock reduction at low-flow:

S2 = (2000*C1 + 1000*C2) *52

Appendix C

Interviews and workshops

C.1 Interviewees and participants in workshops and feedback meetings

Listed below are interviewed employees and suppliers, and participants in workshops and feedback meetings:

- Ann-Kristine Nilsson - Category Manager, Category Paraffin/Stearin IoS
- Anna Szczepkowska - Need Planner, Supply CHD IoS
- Eldin Topic - Sales & Supply Support Manager, Sales & Supply Support Älmhult Store
- Fredrik Sagerström - Deputy Supply Manager, Supply CED 2 IoS
- Jonas Carlsson - Solution Owner, Solution Area Plan & Balance S&S IoS
- Mats Holm - Category Area Logistics Manager, Cat Area Specific HFB Logistics IoS
- Piotr Wilczak - Supply Planner, CAT Candles
- Roger Petersson - Need Planner, Supply CED 2 IoS
- Stefan Holmberg - Process Leader, Need & Capacity IoS
- Stefan Nilsson - Process Developer, Need & Capacity IoS
- Supplier A
- Supplier B

C.2 Interviews

The name of the interviewee, dates of the interviews and topics discussed during these interviews are listed below:

Mats Holm - Feb. 2nd and Feb. 29th

- Qlikview
- IKEA supply chain
- Replenishment set-ups

- Supply chain candles
- Costs in IKEA supply chain
- Problems and challenges with inventory planning

Jonas Carlsson - Feb. 24th

- Forecasting
- Fulfillment
- Need planning
- Order and capacity planning
- Problems and challenges with inventory planning

Roger Petersson - Feb. 25th, Mar. 7th, Mar. 9th, Mar. 30th, Mar. 31st, Apr. 4th and Apr. 8th

- IKEA supply chain
- Characteristics of candles and their supply chain
- Storage at DTs
- Replenishment set-ups
- Problems and challenges with inventory planning
- Stock development at high-flow DTs and low-flow DT
- Supplier capacities
- Commitments with suppliers
- Sales activities
- Major activities
- Specific planning situation
- New products and outgoing products, and the work related to these
- First-buy
- Service level
- DD Point Company C
- Order planning
- Suppliers' production schedules
- Replenishment set-up analysis
- Problems and reasons for high inventory levels
- Buffer stock/ Hedge stock
- Overstock
- Current stock structure

- Tasks and responsibilities of Need Planner
- Guidelines for inventory planning
- KPIs and target goals
- Quality-problems suppliers (how these are handles)
- Seasonal articles
- Orders
- Follow-up
- Factors to consider for prioritization between articles

Eldin Topic - Mar. 14th

- Replenishment of candles in store
- Problems related to candles or replenishment in store

Piotr Wilczak - Mar. 14th, Mar. 17th and Apr. 4th

- Information about suppliers
- Supplier performance
- IKEA supply chain
- Supply chain related to candles
- Replenishment set-ups
- IKEA logistics
- Logistics related to candles
- DD Point Company C
- Supplier capacities
- Order planning
- Suppliers' production schedules
- Tasks and responsibilities of Supply planner
- Guidelines for inventory planning
- KPIs and target goals
- Follow-up
- Supplier performance
- Supplier capacity

Supplier A- Mar. 15th

- Production
- Production planning

- Inventories
- Shipping
- Price for purchasing extra capacity
- Price for delayed delivery window
- Any problems or issues related to IKEA and candles

Supplier B- Mar. 16th

- Production
- Production planning
- Inventories
- Shipping
- Price for purchasing extra capacity
- Price for delayed delivery window
- Any problems or issues related to IKEA and candles

Stefan Nilsson - Apr. 4th

- Problems and challenges with inventory planning
- Guidelines for inventory planning
- KPIs and target goals

Stefan Holmberg - Apr. 12th

- Replenishment of candles in store
- Problems related to candles or replenishment in store

Ann-Kristine Nilsson - Apr. 14th

- Tasks and responsibilities of Category Manager
- Responsibilities Category vs. HFB
- Inventory planning
- KPIs and target goals
- PUA prices
- RFQ for Christmas range 2017
- Quality-problems and deviations (how these are handled)
- Uncertainties related to supply
- Commitments with suppliers
- Factors to consider for prioritization between articles

Anna Szczepkowska - Apr. 20th

- Characteristics of Soft toys and their supply chain
- Seasonal range
- Problems and challenges in inventory planning
- Factors to consider for prioritization between articles

C.3 Workshops and Feedback meetings

Workshop 1 - Feb. 2nd
Participants: Fredrik Sagerström, Mats Holm, Roger Petersson, Stefan Holmberg

- Problem background and description
- Strategic framework for inventory planning

Feedback meeting 1 - Mar. 22nd
Participants: Ann-Kristine Nilsson, Mats Holm

- Presentation of identified problems related to inventory levels at DTs
- Discussion of next step in project

Feedback meeting 2 - Apr. 15th
Participants: Ann-Kristine Nilsson, Mats Holm, Roger Petersson

- Presentation of identified problems related to inventory levels at DTs and the underlying reasons
- Discussion of next step in project

Workshop 2 - Apr. 29th
Participants: Ann-Kristine Nilsson, Mats Holm, Roger Petersson

- Discussion and development of planning process and its guidelines
- Presentation of potential savings

Appendix D

QlikView applications and internal documents

Listed below are QlikView applications and internal documents at IKEA that were used in this thesis.

D.1 QlikView applications

- OTD Supply Chain
- Stock Central Warehouse
- Supply Chain Overview
- Supply Plan Sender

D.2 Internal documents

- Manage Supply Imbalance - between Supply capacity and Retail need, 3rd Ed.
- Strategic framework for inventory management
- Competence profile:
  - Business area specialist
  - Category manager
  - Demand planner
  - Need planner
  - Supply planner
  - Supply development receiving specialist
- The common planning concept p7.4
- Excel file containing inventory levels for candles (Document owner: Mats Holm)