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The impact of LCC sourcing in combination with high customer service on inventory performance - A case study of a global company sourcing from China

Master of Science Thesis

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Göteborg, Sweden, 2013

Report No. E2013:109

MASTER'S THESIS E2013:109

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Chalmers Reproservice
Göteborg, Sweden 2013

Preface

During the spring of 2013 we had the opportunity to perform our master thesis project for a company which in this report has the fictive name Focal. The project has been very interesting and educative, and we will take these valuable experiences with us into our upcoming working life. We would like to thank all the employees at Focal, their supplier and Focal Asia Pacific headquarters for providing us with valuable information. The interviews were definitely one of the most important sources in our data collection process and the aim of this report would not have been possible to achieve without you all. Also, we greatly appreciate the kindness and hospitality you showed us during our stay.

We would especially like to thank our supervisor at Focal, Marcus Alexandersson, for being an immense support throughout the project and for guiding us with valuable knowledge about the company.

We would also like to thank our supervisor at Chalmers University of Technology, Anna Fredriksson, for her great support and for her important feedback throughout the project.

Lastly, we would like to thank Jonas Persson and Allen Wong, the initiators of this project, for believing in our ability to accomplish the task and for giving us the opportunity to achieve real-life working experiences in a multicultural environment. We hope that the findings of our project will be of great value for your company!

Göteborg, August 2013

Emma Grönlund, Andrea Sjöberg and Carolina Ståhlberg

Abstract

The company Focal has as part of the Focal Group's unified cost rationalization strategy, started to outsource parts of their production to low cost countries. This strategy transformation has entailed new challenges for Focal, since low cost country sourcing (LCC sourcing) entails longer lead times, reduced flexibility, and increased uncertainty. These challenges are amplified by the fact that the competitive strategy of Focal has remained unchanged. The organization is still offering their customers a broad range of high quality products with a delivery time of just one day. With this new supply chain strategy in combination with the remained competitive strategy, Focal has experienced problems regarding inventory performance. They are struggling with excess stock as well as backlogs and lost sales at the same time. The company therefore has a desire to understand what factors are driving inventory and how the inventory performance can be improved. The case study of this research is the supply chain between Focal and its largest Chinese intra-group supplier, Supplier X.

This study aims to *evaluate how Focal's LCC sourcing strategy in combination with its competitive strategy affects its inventory performance, in order to provide suggestions of how to improve the performance*. In order to realize the purpose, two research questions has been formulated; *What are the major drivers affecting Focal's inventory performance?* and *How can the inventory performance at Focal be improved?*. Based on these questions, empirical data has been collected mainly through extensive interviews during a field study. During the field study the researchers spent eight weeks at Focal in Australia, one week at Supplier X in China, and one week at the Focal Asia Pacific headquarters in Hong Kong. The data was then analyzed by using an analytical framework consisting of drivers of inventory, developed during the theoretical study of this research.

Six main factors; lead times, uncertainties, forecast, lack of coordination and information sharing, service level, and product range, have been identified as drivers of inventory at Focal. The factors affect inventory both directly and indirectly, as a result of their interdependence. The six factors can be divided into two clusters adhering to the company's LCC sourcing- and competitive strategy respectively. Focal's use of a LCC sourcing strategy increases the lead times but also contributes to increasing supply and demand uncertainties, lack of information and coordination as well as poor forecast accuracy. Focal's competitive strategy, consisting of a large product range in combination with a high generalized service level for all goods, amplifies the effect of the four factors that are driven by LCC sourcing.

In order for Focal to improve its inventory performance the company is recommended to initially focus on reducing the lead time from Supplier X. This as the supply lead time is identified as the main driver of inventory both individually but also since the lead time amplifies the effect of the other drivers. Focal is further recommended to develop a closer relationship with Supplier X in order to reduce uncertainties and improve coordination within the supply chain. Moreover, the company is recommended to review the competitive strategy and differentiate the offered service level for the products as well as evaluating the size of the offered product range.

Key words: *supply chain management, LCC sourcing, inventory management, inventory performance*

Table of Contents

1 Introduction.....	1
1.1 Problem Discussion	2
1.2 Purpose.....	3
1.3 Research Questions	3
1.4 Scope of the Study.....	4
1.5 Limitations	4
1.6 Thesis Structure.....	5
2 Methodology	6
2.1 Research Characteristics	6
2.2 Research Strategy.....	6
2.3 Research Design	7
2.4 Research Process and Methods	7
2.5 Validity and Reliability	12
3 Theoretical Framework	14
3.1 Supply Chain Strategy - Trend Towards Increased LCC Sourcing	14
3.1.1 Performing Business in China	15
3.2 Inventory	15
3.2.1 Different Types of Inventory	16
3.2.2 Inventory Carrying Cost	17
3.2.3 Inventory Turnover Rate	17
3.3 Drivers of Inventory.....	17
3.3.1 Lead Times.....	18
3.3.2 Uncertainties	19
3.3.3 Forecast	21
3.3.4 Lack of Coordination and Information Sharing	22
3.3.5 Service Level	24
3.3.6 Product Range	25
3.4 Analytical Framework.....	25
4 Empirical Study.....	28
4.1 Background Focal Group	28
4.1.1 Focal	28
4.1.2 Supplier X.....	30

4.2 Lead Times.....	30
4.2.1 Procurement and Planning Lead Time at Supplier X.....	31
4.2.2 Production Lead Time at Supplier X.....	31
4.2.3 In-Transit Lead Time.....	32
4.3 Uncertainties.....	32
4.3.1 Demand Uncertainties at Focal.....	32
4.3.2 Supply Uncertainties Related to Supplier X.....	33
4.4 Forecast.....	34
4.4.1 The Forecasting Process at Focal.....	34
4.5 Lack of Coordination and Information Sharing.....	36
4.5.1 Lack of Internal Coordination and Information Sharing at Focal.....	36
4.5.2 Lack of External Coordination and Information Sharing with Supplier X.....	36
4.6 Service Level.....	37
4.7 Product Range.....	37
5. Analysis.....	39
5.1 Lead Times.....	39
5.1.1 Recommendations.....	40
5.2 Uncertainties.....	41
5.2.1 Demand Uncertainties.....	41
5.2.2 Supply Uncertainties.....	42
5.3 Forecast.....	43
5.3.1 Recommendations.....	44
5.4 Lack of Coordination and Information Sharing.....	44
5.4.1 Lack of Internal Coordination and Information Sharing at Focal.....	44
5.4.2 Lack of External Coordination and Information Sharing with Supplier X.....	46
5.5 Service Level.....	47
5.5.1 Recommendations.....	48
5.6 Product Range.....	48
5.6.1 Recommendations.....	49
5.7 Interdependence Between the Drivers of Inventory.....	49
5.7.1 Effects of the Supply Chain Strategy.....	50
5.7.2 Effects of the Competitive Strategy.....	51
5.7.3 The Impact of the Combined Strategies.....	51
5.7.4 Actions to Reduce Inventory are Interconnected.....	52

- 6 Discussion 53
 - 6.1 Purpose..... 53
 - 6.2 Recommended Actions 54
 - 6.2.1 Breaking the Vicious Circle 54
 - 6.2.2 Reduce the Complexity Caused by the Competitive Strategy..... 56
 - 6.3 Analytical Framework..... 56
 - 6.4 Contribution to the Academia and Supply Chain Practitioners 58
 - 6.5 Further Research 58
- 7. Conclusions and Recommendations 59
- References..... 62

List of Figures

Figure 1. The lead time gap.	2
Figure 2. The scope of the study.	4
Figure 3. The phases of the research process.	8
Figure 4. Different types of inventory.	16
Figure 5. The components of inventory carrying cost.	17
Figure 6. The lead time gap, figure inspired by Christopher (2010).	18
Figure 7. Lead time gap reduction, figure inspired by Christopher (2010).	19
Figure 8. Risk spiral, figure inspired by Christopher and Lee (2004).	19
Figure 9. Breakdown of demand and supply uncertainties.	20
Figure 10. Forecast error, figure inspired by Christopher (2010).	21
Figure 11. Outcomes of forecast errors, figure inspired by Kahn (2003).	22
Figure 12. The six interdependent drivers of inventory.	26
Figure 13. The interdependency between the factors.	26
Figure 14. The divisions within the Focal Group.	28
Figure 15. Breakdown of the supply lead time of goods sourced from Supplier X.	31
Figure 16. Planning and execution of production at Supplier X.	32
Figure 17. The forecasting process at Focal.	35
Figure 18. The impact of the supply lead time on Focal's inventory performance.	39
Figure 19. Focal's inability to reduce demand uncertainty drives inventory.	42
Figure 20. Supply uncertainties create a need for inventory at Focal.	43
Figure 21. Lack of coordination and information sharing with Supplier X drives inventory at Focal.	46
Figure 22. Strengths and weaknesses of Focal's broad product range.	49
Figure 23. The two clusters of factors driving inventory.	50
Figure 24. The vicious circle.	51
Figure 25. The service level and product range jointly affect inventory levels.	51
Figure 26. The joint effect of the two clusters on inventory performance.	52
Figure 27. Breaking the vicious circle.	55
Figure 28. The six interdependent drivers of inventory.	57

List of Tables

Table 1. Interviewees at Focal.	10
Table 2. Interviewees at Supplier X.	11
Table 3. Breakdown of inventory at Focal.	29
Table 4 Breakdown of the ABC-classification for finished goods.	37

1 Introduction

In this chapter the background to this study will be introduced. First, a brief introduction to sourcing and the need of sourcing within the Focal Group will be presented. Thereafter, the problem discussion will follow which focuses on Focal and the organization's business transformation towards low cost country sourcing. The problem discussion builds up to the two following sections describing the purpose and research questions, which together constitute the foundation of the research. Finally, the scope of the study, its limitations and a short description of the structure of the report will be presented. Note that the name Focal is a fictive name created to keep the identity of the company confidential. Focal is a unit situated in Australia but belongs to a global group which in this report is named the Focal Group. The report also discusses Focal's largest Chinese supplier which is named Supplier X.

The globalization during the last decade, resulting from the increased international trade, has opened up opportunities for businesses to reach new markets (Fredriksson 2011). However, at the same time, the globalization has resulted in increased competition pressuring companies to become more cost efficient. In order to respond to the growing competition a trend among manufacturing organizations is to outsource all, or parts of the production (Trent & Monzcka 2003). This trend towards a sourcing strategy entails, in alignment with Trent and Monzcka (2003), an opportunity to improve a firm's supply chain performance in several ways. Firstly, outsourcing includes an opportunity for the company to focus resources on its core activities, by outsourcing production or services that are beyond the core business. Secondly, outsourcing is viewed as a great possibility to reduce costs (Trent & Monzcka 2003; Fill & Visser 2000; Fredriksson 2011). In search for this cost reduction another trend within supply chain strategy has evolved; to source from low cost countries, further on denoted as LCC sourcing. LCC sourcing implies that products or services are purchased from countries with relatively low wages. By utilizing the low wages within these countries prices can be kept low to the benefit of the purchasing organizations (Fredriksson & Jonsson 2009).

Within the academia, opinions regarding to what extent LCC sourcing is beneficial are conflicting. This is partly due to the number of challenges the shift to a LCC sourcing strategy entails, since a LCC supply chain is characterized by long geographic distances, increased delivery times, decreased flexibility, and decreased delivery precision (Fredriksson & Jonsson 2009; Ruamsook et al. 2009). New challenges also arise due to differences in culture, language, practices, regulations and time zones. These challenges may increase costs in terms of increased transportation cost, unfulfilled demand, and increased inventory to compensate for reduced flexibility and responsiveness (Levy 1995; Alguire et. al 1994). To be noted is, hence, that outsourcing leads not only to a reduction of costs but to a redistribution of costs. This may result in that sought competitive advantages are not achieved (Steinle & Schiele, 2008).

To decrease costs is an important part of the Focal Group's corporate strategy. In order to accomplish costs reductions, the Group has started to outsource parts of the production to low cost countries. The use of LCC sourcing within the Group has hence increased extensively during the last couple of years, from 38 percent in 2008 to 55 percent in 2012 (Focal Group Årsredovisning 2012). The majority of the remaining production facilities located in high cost countries have, as a result of this shift towards sourcing, changed from performing full production into mainly performing final assembly and customization of products (Focal Group

Årsredovisning 2012). This strategic transformation entails extensive challenges for the Group as the basic premises of the business changes. Therefore, an interest has arisen regarding how this new organization should be managed most efficiently. One part of this new challenge facing the Group is related to inventory; how inventory is affected by the new LCC sourcing strategy and how the inventory should best be managed.

1.1 Problem Discussion

Focal is part of the Focal Group and is the company this report will investigate. Focal has moved more and more production abroad, mostly to China, as a part of their goal to reduce costs. Focal’s sourcing from low cost countries has therefore, during the last couple of years, increased significantly and the organization’s supply chain strategy is transforming towards overseas sourcing.¹ Currently, 51 percent of sales consist of sourced goods, mainly from low cost countries, while 49 percent of sales are still manufactured in Australia. However, raw material and components used in the local manufacturing are mainly purchased from low cost countries.²

This strategy transformation has led to new challenges for Focal, since LCC sourcing among other things leads to longer lead times, reduced flexibility, and increased uncertainty. These challenges are amplified by the fact that even though the supply chain strategy has changed, the competitive strategy of Focal has remained. The organization is still offering their customers a broad range of high quality products with a delivery time of just one day.³

The new supply chain strategy of sourcing goods in combination with the remained competitive strategy of delivering goods to customers within a few days has as mentioned by Christopher (2010) resulted in a lead time gap within the supply chain, as illustrated in Figure 1 below. Christopher (2010) further states that this gap needs to be filled with inventory in order to be able to meet customers’ expectations. The strategy transformation has hence increased the complexity of Focal’s business, since the supply chain strategy is not fully aligned with the competitive strategy, entailing great challenges regarding inventory management.



Figure 1. The lead time gap.

To cover this lead time gap, Focal today holds inventory to a worth of 10 percent of sales. The organization had an inventory turnover rate which was 14 percent below target in 2012, and was during the first quarter of 2013 struggling with backlogs and lost sales.⁴ At the same time, the organization strives to reduce their tied up capital. The complexity of managing inventory efficiently has contributed to an interest at Focal to investigate what factors that drives the

¹ General Manager, Focal, 25th of March 2013
² Supply Chain Business Manager, Focal, 25th of March 2013
³ General Manager, Focal, 25th of March 2013
⁴ Supply Chain Business Manager, Focal, 25th of March 2013

organization's inventory levels. The management team of the Focal Asia Pacific Division therefore wants to investigate the inventory performance at Focal.

1.2 Purpose

The purpose of this thesis is to *evaluate how Focal's LCC sourcing strategy in combination with its competitive strategy affects its inventory performance in order to provide suggestions of how to improve the performance.*

Inventory performance is in this study defined as if the right inventory is held at the right time, to the right cost. Whether the levels are assessed as justified depends on Focal's goals and assessment of acceptable levels. The inventory performance is mainly measured by four main performance measurements; slow moving and obsolete inventory⁵, backlogs, lost sales and inventory turnover rate.

1.3 Research Questions

The lead time gap and the challenges this gap entails are not unique for Focal. The problematic scenario that the lead time gap implies is also the reality for many other companies who are increasing their LCC sourcing (Christopher 2010). Many organizations are caught in this complexity where a lead time gap forces them to increase inventory levels. But at the same time, the firms strive towards minimizing their tied up capital without jeopardizing customer satisfaction. Hence, organizations in general strive to find a balance where they hold the right inventory, at the right time, to the right cost for optimizing their businesses. The challenge of managing the complexity of a strategy transformation towards LCC sourcing has caught the researchers' interest. And by studying the case of Focal's inventory management, the researchers hope to get an insight into the area even on a more general level.

In order to fulfill the purpose of this study two research questions have been formulated. The questions are interrelated, and in order to achieve the purpose the questions were dealt with in consecutive order.

RQ1: What are the major drivers affecting Focal's inventory performance?

RQ2: How can the inventory performance at Focal be improved?

The first research question aims to identify what factors that drive inventory at Focal. In order to ensure that the right inventory levels are obtained, it is important to thoroughly investigate the problem and find the root causes of the current inventory levels. This is essential in order to affect the inventory levels on a long term basis, instead of just "curing the symptoms" by reducing inventory levels without solving the actual problem. Furthermore, it is important to identify all major drivers in order to approach the problem from different angles. One essential part of answering the first research question is to create an analytical framework covering drivers of inventory.

⁵ Slow moving and obsolete inventory is according to Focal's definition excess inventory that is either obsolete or has not been sold for at least three years. When calculating the slow moving inventory 25 percent of the value of products moving slowly for three years is included, 50 percent of the value of items moving slowly for four years, 75 percent of the value of items moving slowly for five years, and 100% of the value of items moving slowly for more than five years.

The second research question aims to identify suggestions for how to handle implications of the defined drivers of inventory, and thereby improve Focal’s inventory performance. This final research question will hence focus on the root causes identified by the preceding research questions and how the effect of these factors can be reduced or eliminated.

The answers to the research questions will support the ability to answer the study’s purpose and simplify the process of reaching the goal of this research.

1.4 Scope of the Study

This study focuses on Focal’s inventory performance and how the performance can be improved. However, in order to investigate the performance and potential of Focal to improve, Focal’s supply chain with Supplier X has constituted this research’s case study. To enable a thorough analysis of the supply chain between Focal and Supplier X, the scope is limited to these two actors; their suppliers and customers are not included, as illustrated in Figure 2 below.

The choice of Focal as the main focus of the study was based on a discussion with the project initiator at the Focal Asia Pacific Division, the headquarters in the Asia Pacific region. Focal was chosen primarily since this firm has experienced a vast increase in LCC sourcing during the last couple of years. The supply chain between Focal and Supplier X was chosen since Supplier X is by far the largest LCC supplier with which Focal trades. During 2012, 24 percent of Focal’s total spend was made at Supplier X.⁶

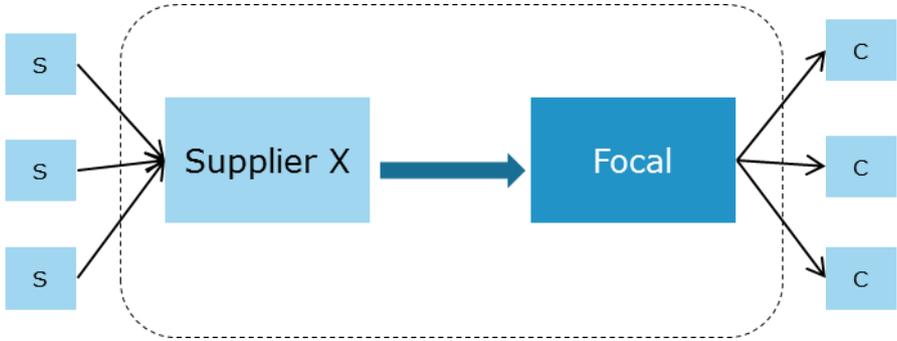


Figure 2. The scope of the study.

1.5 Limitations

During the case study of the supply chain between Focal and Supplier X a further limitation was made to exclude transportation when analyzing the supply lead time for goods sourced from Supplier X. This limitation was made due to the fact that the transportation lead time of one month mainly consists of pure transportation time that cannot be shortened without spending a huge amount of resources. Furthermore, the transportation lead time consists of uncertainties such as customs and port queues which are difficult to influence. In addition, the transportation is managed by a third party logistics company (3PL), which is not included in the study’s scope.

The recommendations for improving inventory management are developed for Focal and based on the specific case study of the supply chain between Focal and Supplier X. Hence, the

⁶ Supply Chain Business Manager, Focal, 25th of March 2013

generalizability of the thesis result is limited. Furthermore, to be noted is that the recommended actions for improving Focal's inventory performance, on behalf of the project initiators request, will not violate the supply chain strategy of Focal, i.e. the LCC sourcing strategy is viewed as set. Suggestions for improvements will only consider incremental changes to the businesses and aims to be implementable within a relatively short time horizon.

1.6 Thesis Structure

This report is structured as follows; after this chapter introducing the purpose and research questions, a chapter describing the method used during this study will follow. Thereafter, in the third chapter, Theoretical Framework, theory regarding aligned strategies, LCC sourcing, inventory and factors driving inventory will be presented. The third chapter will end with a presentation of an analytical framework created based on the previous described theory. This chapter will be followed by empirical findings in chapter four, Empirical Study, which are analyzed in relation to the analytical framework and presented in chapter five, Analysis. The analysis will thereafter be discussed in chapter six, Discussion, followed by a summary of the research in chapter seven, Conclusions and Recommendations.

2 Methodology

In this chapter, the research methodology will be presented. First, the research characteristics will be described briefly. Thereafter, the research strategy will be presented, followed by a description of the research design and a presentation of the research process and methods. Finally, the quality of the study will be discussed in terms of validity and reliability.

2.1 Research Characteristics

The exploratory nature of this study, focusing on the supply chain of a single organization, implied a need for creating an in-depth understanding of the company and its operations as well as gathering theoretical data to compare the current operations with theoretical best practice. Therefore, this research has characteristics of a deductive process, i.e. the relationship between theory and research is defined by theory driving the research process (Bryman & Bell 2011). According to Bryman & Bell (2011) this viewpoint of the relationship between theory and research is the most common one used within business research.

The research adheres to the characteristics of positivism, implying that the research was conducted by independent researchers viewing the situation objectively and value free (Bryman & Bell 2011; May 2011). Furthermore, regarding ontological considerations, by Bryman and Bell (2011) explained as the nature of social entities, the research follows the constructionism approach. This approach implies, according to Bryman and Bell (2011), that social phenomenon and categories are produced and continually revised by social actors through social interaction.

These characteristics of the research as a deductive study, with a positivistic approach and a constructionist position, affected the choice of research process and methods. The characteristics of the research as defined above, implied that the research consists of a somewhat mixed methods research, which will be described in more detail in the next section.

2.2 Research Strategy

The research strategy sets, according to Bryman and Bell (2011), a general orientation of the study's execution; guiding the choice of methods during the business research. Research strategy is mainly defined by the distinction of two contrasting research strategies classifying different research and analysis methods; quantitative and qualitative research. Quantitative research is a research strategy focusing on quantification in the collection and analysis of data (Bryman & Bell 2011). According to Creswell (2009) a quantitative research strategy is suitable when measures such as time and money are analyzed; this type of research often requires a larger sample to provide relevant conclusions.

Qualitative research, on the other hand, is a research strategy that emphasizes words and their meaning rather than quantification in the collection and analysis of data (Bryman & Bell 2011). A qualitative approach can be applied when the sample is smaller, hard to quantify and the investigated aspect has a softer focus (Creswell 2009). Furthermore, a qualitative research is suitable when trying to understand and explain situations involving groups of people (Kumar 2011).

The main purpose of this research is to evaluate Focal's LCC sourcing strategy and high customer service offer, to identify drivers of the existing inventory levels within the supply chain between

Focal and Supplier X, and to create suggestions for how to improve the inventory performance. To accomplish this purpose, this research used a mixed methods research approach, i.e. aspects of both quantitative and qualitative research were combined (Bryman & Bell 2011). This method was used since both quantitative and qualitative data were required in order to map the factors affecting inventory levels within the supply chain and create an understanding of the context and processes of the specific company and case study. The underlying reason for the need of a mixed research strategy was based on the following factors. Firstly, in alignment with Creswell (2009) quantitative methods were used to evaluate the supply chain and investigate factors such as lead times, inventory levels and inventory carrying costs. Secondly, in order to create an in-depth understanding of the supply chain, its processes and its context, the use of a qualitative approach was essential. Furthermore, given the scope of the project, its limitation to a specific company and a specific case, a qualitative research strategy enhances better utilization of the relatively small number of employees and subject experts, being the primary source of information. Therefore, even though the research followed a mixed methods research, the main focus was on collecting and analyzing qualitative data.

2.3 Research Design

The choice of research design puts a framework in place that structures the collection of data, the choice of research methods, and the analysis (Bryman & Bell 2011). This thesis has a case study research design. According to Yin (2008, p.13) a “case study is an empirical inquiry that investigates a contemporary phenomenon with its real-life context”. This definition is in alignment with the aim of gaining an in-depth understanding of the supply chain of one of Focal Group’s global operations. The case study approach, focusing on a detailed and intensive analysis of a single case, is widely used within business research (Eisenhardt & Grabner 2007). A case study design is often used when a single company or organization, a unique event, or a separate unit such as a factory, a process or a single project is to be examined. Case studies are furthermore typically associated with both quantitative and qualitative research strategy, which is in alignment with the mixed methods approach that this thesis adopted (Bryman & Bell 2011).

2.4 Research Process and Methods

This study is practice oriented, as a key aspect of this research is to identify weaknesses in the current supply chain and find solutions that will improve Focal’s inventory performance. This research draws on Björkdahl and Holmén’s (2011) problem finding approach, as it stresses the importance of identifying problems in order to create knowledge that can lie as foundation to improve a specific situation.

Inspired by the PFIA methodology (Björkdahl & Holmén 2011), this study was conducted in a series of modules following a linear process, in which each module provided input to the subsequent phase. However, features of iteration were introduced when gaps or needs aroused. The study was conducted in five modules, applying different research methods, as illustrated in Figure 3. In parallel to the modules, a continuous literature research and documentation of gathered information, interview material etcetera, was conducted.

The stepwise data collection adopted a funnel-like structure. It started with a relatively open approach, covering general literature and questions regarding supply chain management, factors affecting inventory levels and working processes at Focal and Supplier X. During the progression of the study, however, the scope was continuously narrowed down in order to focus

the research on what was considered most important. This approach allowed the research to adopt a flexible and iterative process structure. Furthermore, the different sources and methods for collecting data used within the different modules were slightly overlapping each other. This resulted in triangulation, enabling the results to be cross-checked, increasing the validity of the research (Bryman & Bell 2011).

Besides the division of the study into modules, the research was conducted in two main phases; a pre-study (module one), and a field study (modules two, three, four and five). The pre-study was performed in Sweden, while the field study was executed in Melbourne, Australia, and Zhongshan, China. During the field study of ten weeks, the first eight weeks were spent at Focal in Australia. Of the last two weeks, one week was spent at Supplier X in China, and one week at the headquarters of the Focal Asia Pacific Division in Hong Kong, where the findings of the project were presented to the board.

In parallel with the study, continuous meetings were held with a supervisor at the Focal Asia Pacific Division as well as with a supervisor provided by Chalmers University of Technology to ensure that the project maintained on the right track. Furthermore, an interim presentation was held for the headquarters, and presentations were held for both Focal and Supplier X during the project to ensure that the project proceeded in alignment with the stakeholders' expectations.

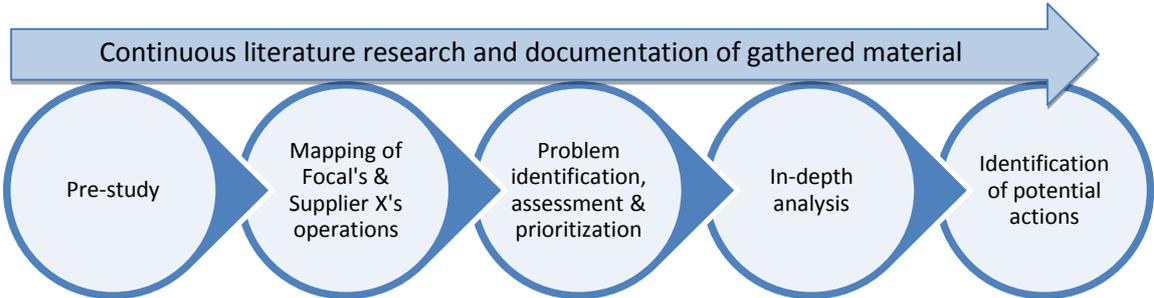


Figure 3. The phases of the research process.

The first module, the initial pre-study, focused on an extensive literature search in order to create an analytical framework enabling identification of factors affecting inventory levels within the studied supply chain. This framework was initially created based on literature, and later complemented and modified during the field study. During the first module, field study preparations were also conducted by creating a basic understanding of Focal, their products and processes, and the context within which they operate.

During the pre-study, both primary and secondary data were collected. The analytical framework was created based on mainly secondary data collected through an extensive literature study on relevant subjects and theories. The literature study was initialized by asking the supervisor at Chalmers University of Technology for advice and recommendations regarding literature relevant to the scope of the study. In accordance with Davidson and Patel (2003) a number of keywords (supply chain management, LCC sourcing, inventory management, inventory performance) were identified in order to search for relevant literature via Chalmers

University's databases and the web. When relevant literature was found, the references of the book/article were used in order to further find new literature. This form of back-tracking, also referred to as snowballing (Streeton et al. 2004), was found helpful in order to progress with the research. The main focus on literature research took place during the pre-study. However, the literature research has also been a continual working process when iteration, further in-depth information or new information was needed during the project's progression.

The analytical framework was furthermore complemented by primary data gathered through open interviews with people within both the academia and the industry who are experienced within supply chain management. These interviews were held in the first module as well as in the second and third one. Hence, the framework was updated and validated as the study proceeded in order to ensure the validity of the analytical framework and its usability in practice. An example of how the framework developed due to this form of iteration when new information appeared is that an additional factor was added during the second module, the product range. When the analytical framework was finalized it comprised of six factors that direct and indirect affects inventory performance; lead times, uncertainties, forecast, lack of coordination and information sharing, service level, and product range. This framework will be described in detail in chapter 3.4 Analytical Framework.

Background information regarding Focal mainly consisted of secondary data (annual reports, internal documents and presentations) provided by the company. In addition, a number of open interviews were performed with designated contact persons at Focal to create an understanding of the organization, its structure and the supply chain between Focal and Supplier X.

The primary and secondary information gathered during the first module consisted of both quantitative and qualitative data. However, due to the nature of the study, and the focus on creating an analytical framework as well as an understanding of Focal and the organization's context, the focus of this phase was on qualitative data.

The second module, mapping of Focal's and Supplier X's operations, was the first part of the field study. This module aimed to create a holistic understanding of the supply chain and its operations as well as to answer the first research question; *What are the major drivers affecting Focal's inventory performance?* This first step of the field study was important since mapping the supply chain's current processes and operations is, in alignment with Jonsson and Mattsson (2005), essential in order to be able to improve the supply chain's operational efficiency.

In order to create a holistic view of the supply chain between Focal and Supplier X, and to identify which factors that affect inventory levels within the supply chain, a collection of both quantitative and qualitative data was required. Quantitative data (inventory levels, lead times, performance measures etcetera) was gathered mainly through accessing secondary data via Focal's internal systems. However, the focus during this module was to collect a vast amount of qualitative data in order to create an in-depth understanding of Focal's and Supplier X's processes, operations and overall context.

At Focal, a total number of 26 semi-structured interviews were held with one or two employees at the time. The interviews were held face-to-face and all researchers took part in each interview. The interviews lasted for one to three hours. A semi-structured interview form was

chosen since it is a flexible type of interview technique where open questions can be asked in any order, not constraining the interviewees to any particular format (Bryman & Bell 2011). See the interviewees at Focal in Table 1 below.

Interviewees at Focal (titles)

Business Manager Product Management	National Sales Manager
Business Manager Supply Chain	Procurement Coordinator
Demand Planner	Product Development & Quality Manager
ERP Analyst	Product Manager
General Manager	Purchasing Officer
Manufacturing Manager	Purchasing & Planning Manager Finished Goods
Material Planning Manager	Strategic Purchasing Analyst
Melbourne Warehouse Supervisor	Supply Manager
National Logistics Manager	

Table 1. Interviewees at Focal.

Interview guides were compiled for each interview, and parts of the guides were shared with the respondents before the interview to enable them to prepare properly. The interview guides were constructed with a funnel-like structure, beginning with more general questions before probing deeper into more specific and detailed questions. In alignment with the guidelines by Bryman and Bell (2011), emphasis was put on the formulation of questions, in order to make them easy to understand for the interviewees. All interview guides were tested before use, which resulted in the re-formulation of some of the questions.

In order to create a holistic understanding of Focal, employees within different departments were interviewed. By interviewing respondents from different areas information regarding operations and procedures from different viewpoints were gathered allowing a broader perspective of the business as well as triangulation to increase validity.

With regards to Bryman and Bell’s guidelines (2011) a combination of convenience and snowball sampling was used to choose interviewees. A dedicated contact person at Focal scheduled a first set of interviews for the researchers’ first couple of weeks in Australia. Respondents were found based on which functions within the organization the researchers requested to meet. During the interviews, the respondents were asked to recommend other individuals with valuable knowledge, whereas an additional number of interviews were scheduled.

At Supplier X, a total number of ten interviews were held, whereof nine face-to-face and one by phone, see Table 2 below. These interviews also adhered to a semi-structured format and lasted for one to two hours. A combination of convenience and snowballing sampling was used for these interviews as well, where a contact person at Supplier X scheduled interviews upon the researchers request before arrival. However, a number of additional interviews were planned as the project preceded based on recommendations by respondents during previous interviews.

Interviewees at Supplier X (titles)

Acting Production Director	Lean Manager
Asia Pacific Workshop Manager	Operations Director – Architectural Hardware Group (Acting GM at Supplier X in 2012)
Design Team Leader	Production Planning
GM Office Manager	Project Manager
General Manager Operations and Export	Supply Chain Director
International Sales & Business Department Director	

Table 2. Interviewees at Supplier X.

Due to practical reasons this module took place during two separate points in time. First an extensive data collection was performed in Australia. During this time, a phone interview was also held with the previous General Manager of Supplier X in order to confirm findings from interviews held in Australia. However, the rest of the necessary interviews for mapping Supplier X's operations were held a few weeks later when the project team visited Zhongshan in China.

The third module, problem identification, assessment and prioritization, subsequently used findings from the pre-study and the mapping of Focal's and Supplier X's operations aiming to create a list of improvement areas within the investigated supply chain. During this phase the identified problems were also assessed by probing deeper with follow up interviews and analysis of gathered information. Furthermore, during this module the focus of the study was determined in cooperation with the management team at Focal. An essential part of this module was hence to create a foundation in order to be able to answer the second research question later; *How can the inventory performance at Focal be improved?*, and identify problem areas where inventory levels potentially could be reduced.

During the third module both quantitative and qualitative information was gathered through internal documentation, internal systems, and semi-structured interviews with employees. The purpose with this data collection was to identify and assess problem areas in the supply chain experienced by the employees and/or indicated by quantitative data. When a list of problems within the supply chain between Focal and Supplier X was summarized a prioritization of the identified areas were made in collaboration with the management team at Focal and the project initiator at the headquarters in Hong Kong. This prioritization was based on urgency, expected outcome, if actions were already taken by the organization and the possibility to identify and implement solutions to decrease the inventory levels in a near future.

In *the fourth module*, in-depth analysis, the focus areas chosen during the previous module were further investigated and analyzed. The goal of this module was to further investigate the identified problem areas, understand the extent of the problems and find the root cause of the problems in order to later on be able to compile recommendations for improvement. Hence, this module aimed to provide additional material in order to later on be able to fully answer the second research question, in other words to describe in which areas inventory performance could be improved.

During this phase, the problem areas were concretized which required both quantitative and qualitative data. Most data was collected internally, i.e. via interviews with employees and internal systems at Focal and Supplier X. However, to investigate the problem areas on a deeper level, and in order to compare the performance of the investigated supply chain towards industry, this phase also consisted of additional literature research.

The fifth module, identification of potential actions, was the final step of the field study. This module aimed to develop a set of suggestions for how to reduce the inventory levels within the mapped supply chain. Consequently, this module aimed to answer the second research question, and identify actions for how to improve inventory performance.

The information collected in previous modules was essential for the formulation of a potential action plan, in combination with information regarding for example best practices according to the academia and the industry. In addition to information from previous modules, this phase hence required further literature research in order to analyze collected information and to identify possibilities for improvement. During this module several discussions were held with employees at both Focal and Supplier X working with the prioritized problem areas, enabling the employees to contribute and be a part of the improvement plan and at the same time enabling the researchers to test the feasibility of identified recommendations. This involvement will hopefully contribute to an easier implementation of selected recommendations in the future.

The output of this final module was an action plan consisting of a set of proposed recommendations for how to improve inventory performance within the investigated supply chain. All recommendations are closely related to the identified drivers of inventory that the analytical framework constitutes of, in order to address the core of the problems driving inventory to hence be able to improve inventory performance within the supply chain in the long run.

2.5 Validity and Reliability

Validity is by Bryman and Bell (2011) defined as the integrity of a research's conclusions. To ensure a high validity several features of triangulation was applied. Firstly, several data collection methods were used to triangulate findings from different sources. Secondly, the data analysis was performed independently by different researchers in order to maintain high inter-coder validity.

By conducting most of the research in Australia and China, in the natural environment of the research participants, the ecological validity of the research is strong. The external validity is low since a specific problem within a specific company is studied. However, it is possible that there exist a domain within which the findings can be generalized. Such a domain would consist of similar companies facing similar problems, e.g. another manufacturing company sourcing from low cost countries aiming to create a more efficient supply chain by improving inventory performance.

In order to ensure reliability, i.e. the repeatability of a study (Bryman & Bell 2011), descriptions of interview guides and used methods are documented. Furthermore, all interviews were recorded and documented. However, given the context specific situation and the case study

research design, the replicability will always be dependent on external factors which are beyond this specific case.

3 Theoretical Framework

This chapter aims to introduce the analytical framework that has been created and applied during this study, and the theory on which the framework draws upon. However, first a short description of supply chain strategy, LCC sourcing and the complexity of doing businesses in China will be presented, aiming to set the scene of the research by explaining the conditions under which the study was conducted. Thereafter, an introduction to inventory will be presented, followed by a detailed description of six factors driving inventory levels. Finally, the interconnection between the factors, and how they drive inventory both directly and indirectly via each other, will be described in order to present the analytical framework.

3.1 Supply Chain Strategy - Trend Towards Increased LCC Sourcing

The primary goal of supply chain management is to support the organization's customer service goals efficiently (Lambert et al. 1998). This implies that strategic fit and aligned goals are required between the organization's competitive and supply chain strategy (Chopra & Meindl 2013). According to Chopra and Meindl (2013) customer priorities that the competitive strategy aims to satisfy hence needs to be consistent with the supply chain capabilities that the supply chain strategy hopes to create. When designing the supply chain, a trade-off is necessary between two main features of the chains capability; balance between responsiveness and efficiency. To fully reach a strategic fit of the competitive and supply chain strategy, goals across the whole supply chain need to be aligned. Departments should hence not have conflicting but aligned goals, and the scope of strategic fit should cover the whole supply chain (Chopra & Meindl 2013).

Increased international competition, boosted by increased globalization and international trade, pushes companies to become more cost efficient (van Weele 2010; Bengtsson et al. 2005). This has entailed an increased focus on supply chain strategy and a trend towards sourcing goods and services to a large extent. This trend is based on that outsourcing of goods and services enables firms to focus on their core business but also to reduce costs (Fill & Visser 2000). The authors further explain that this trend of focusing on core activities fosters economies of scale, and is one step towards the increased globalization and specialization which are developing around the world. This is an inevitable step in the evolution of the global economy where companies need to reduce costs.

A further action to reduce costs that has grown popular is to source goods from low cost countries (Fredriksson & Jonsson 2009). LCC sourcing is further explained by Fredriksson and Jonsson (2009) and involves buying goods from countries that have relatively low wages and material costs implying low prices. However, LCC sourcing does not only entail cost reduction; the decrease in cost and increase in efficiency is made on behalf of reduced responsiveness. This loss of responsiveness is due to longer lead times resulting from the increase in geographical distance that LCC sourcing in general causes. Furthermore, LCC sourcing entails several other challenges such as quality issues, decreased delivery precision, decreased flexibility, and challenges due to cultural differences (Platts & Song 2010). According to Platts and Song (2010) these factors may result in increased transportation, handling and administrative costs as well as increased inventory. Hence, when taking a more holistic view of the effects of LCC sourcing, these costs that may arise due to for example difficulties in communicating within the supply chain and infrastructural problems, contributes to a re-distribution of costs and not only a cost reduction. This redistribution of costs may result in that the organization does not achieve the

desired cost benefits of LCC sourcing. Furthermore, when changing the supply chain strategy it is important to validate the fit between the competitive and supply chain strategy to ensure high efficiency. If this is not the case, the possibilities of increased efficiency and cost reductions may diminish (Chopra & Meindl 2013).

To summarize, outsourcing to low cost countries entails several challenges and effects besides the desired cost reduction. Regarding the case study in this research, the supply chain between Focal in Australia and Supplier X in China, factors such as increased lead time, uncertainty and cultural differences will have an impact on the outcome of the LCC sourcing. China is an attractive country to source from due to the fact that it is a low cost country (Focal Group Årsredovisning 2012). However, doing businesses with suppliers in China entails cultural challenges which will be briefly described in the next section.

3.1.1 Performing Business in China

When sourcing from China, culture constitutes an important factor to consider when evaluating the supply chain performance⁷. This as the business culture in China is quite different compared to western countries and an understanding of the Chinese culture is essential in order to perform businesses efficiently within the region. The importance of relationships, the need of keeping face, and the relatively short planning horizon in many Chinese business are three characteristics that have been identified as important in this study. These characteristics will be further discussed in the following section.

Fang (2006) describes the Chinese business culture as consisting of networks that are very people dependent. Fang (2006) also identifies organizational trust, called *guanxi*, as a factor that will influence the thinking and behavior of Chinese business men. The personal connections of a person will play an important role in the exchange of favors between people on a long term basis (Giannakis et al. 2012). Giannakis et al. (2012, p.834) further explains that “*guanxi* acts as ‘gate-keeper’, ‘door-opener’ and ‘peace-maker’ in business practices in China”.

To uphold social harmony through controlling feelings, avoiding conflict and appearing humble is a common part of the Chinese culture called *face* (Faure & Fang 2008). Faure and Fang (2008) further explain that emotions should be controlled to make sure that the harmony in a group is upheld or to avoid disrupting hierarchies. Saying no can for example be perceived as rude, and it can thus be more important to be polite than to tell the truth. The persons who do not follow these customs will be regarded as shameless and *face* losing. *Face* can therefore cause misunderstandings when doing business in China.

Lang (1998) stresses that many Chinese firms have a relatively short planning horizon which is another important aspect to consider when doing business in China. Due to the lack of long term planning the use of forecasts are limited.

3.2 Inventory

Inventory is part of a business’s assets and includes raw materials, work-in-process goods and completely finished goods that are ready or will be ready for sale (Investopedia 2013A). Having high levels of inventory may improve the responsiveness of the supply chain as products will be available when the customer wants it (Chopra & Meindl 2013). However, high levels of

⁷ Doctoral student, Technology Management and Economics, Chalmers University of Technology, 12th of February 2013

inventory increases the risk of products running obsolete, also referred to as excess inventory (Investopedia 2013B). On the other hand, having low levels of inventory may in turn result in backlogs, meaning that the company will not be able to deliver the products to the customer on time (Chopra & Meindl 2013). It may also result in lost sales, causing a loss of profit. Managing inventory is therefore of strategic importance. The main goal of a good supply chain strategy is, according to Chopra and Meindl “to find the right form, location, and quantity of inventory that provides the right level of responsiveness at the lowest possible cost” (2013, p.59).

Inventory can serve several purposes within a company, such as achieving economies of scale, balance demand and supply, provide protection from uncertainties and act as a buffer (Chopra & Meindl 2013). According to these authors, inventory will hence impact the assets held, the costs incurred, and the responsiveness of the supply chain. For example, large amounts of finished goods inventory close to customers allows a supply chain to be responsive, but at a higher cost than if inventory is held in a lower form. The form, location, and quantity of inventory play a major role in how cost efficient and responsive a supply chain can be. Inventory planning is hence critical (Lambert et al. 1998).

3.2.1 Different Types of Inventory

Inventory can be classified based upon why it occurs. Examples of inventory are cycle inventory, safety stock and obsolete inventory, see Figure 4. These types of inventory have been identified as the most relevant types for this study and will be further discussed in this section.

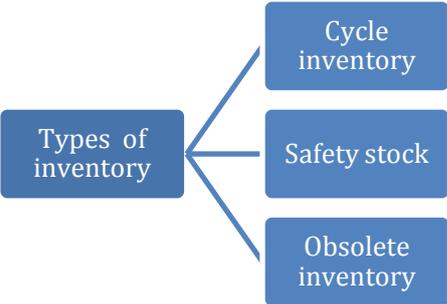


Figure 4. Different types of inventory.

Cycle inventory is the average amount of inventory used to satisfy demand between incoming supplier shipments (Jonsson 2008). According to Jonsson (2008) cycle inventory arises because inbound deliveries take place at a different pace and in larger quantities than demanded. Decoupling between inventory replenishment and consumption is motivated by that every order, transportation and delivery is associated with an ordering costs, regardless of the quantity. By ordering large quantities the ordering cost per unit will be lower. Cycle inventory is required to meet demand under conditions of certainty, which is when the firm can predict demand and replenishment lead times (Lambert et al. 1998).

Safety stock is held in excess of cycle inventory due to uncertainties in demand or lead time (Chopra & Meindl 2013). Safety stock is, as discussed by Chopra and Meindl (2013), needed as future consumption cannot be perfectly predicted and as there can be delays in deliveries. Determining the right level of safety stock involves making a trade-off between the costs of having too much inventory and the costs of losing sales due to shortages.

Obsolete inventory is inventory for which no demand has been registered for a long time (Jonsson 2008). According to Jonsson (2008) obsolete inventory can either be obsolete throughout the company or only at one stock-keeping location. If it is the former it will be accounted as scrap while if it is considered to be the latter it can be transshipped to another location to avoid obsolescence penalty or mark down at current location.

3.2.2 Inventory Carrying Cost

The cost of holding inventory, the so called inventory carrying cost, is an important aspect to consider when making decisions regarding inventory. The inventory carrying cost can, according to Jonsson (2008), be divided into three parts: a financial, a physical and an uncertainty part, see Figure 5 below. Jonsson (2008) further explains that the return on investment that the company demands on capital tied up in stock makes up the financial cost. The physical costs are related to the costs of the physical storage of the stock, i.e. warehousing cost, handling cost, administrative costs etcetera. The uncertainty costs depend on the risks that appear as a result of keeping stock (Jonsson 2008).

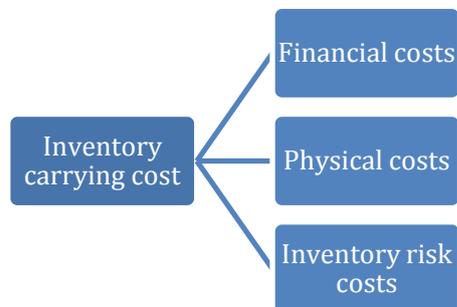


Figure 5. The components of inventory carrying cost.

3.2.3 Inventory Turnover Rate

Inventory is part of a company's tied up capital. According to Jonsson and Mattsson (2009) using tied up capital as a measurement for inventory have its limitations since it is difficult to put into relation to anything. The authors therefore, in order to assess the tied up capital on a more thorough basis, advocate the use of inventory turnover rate as a measurement. The inventory turnover rate states how many times per year the average inventory is sold (Jonsson, 2008). It is a measurement depicting the values of the total flow of materials over a time period, often one year, in relation to the average tied up capital (Jonsson & Mattsson, 2009). The turnover rate can either be calculated for individual items or for groups of items.

A company that is inefficient and holds too much inventory will benefit from increasing the inventory turnover rate as it will have a positive impact on the company's profitability (Lambert et al. 1998). Lambert et al. (1998) further explains that there is, however, a point at which continued increases of the inventory turnover rate will not be beneficial any longer and instead have a negative impact on the logistics system due to too low levels of inventory. According to Lambert et al. (1998) one weakness with using inventory turnover rate as a measurement is that it only measures inventory effectiveness and does not reflect customer service concerns.

3.3 Drivers of Inventory

In the following section the six main drivers of inventory that have been identified during the research are described; lead times, uncertainties, forecast, lack of coordination and information sharing, service level and product range. An explanation of how each driver affects inventory is

presented together with actions that can be undertaken in order to manage the impact of the drivers on inventory performance.

3.3.1 Lead Times

Many companies in today’s business environment face a fundamental problem, the time it takes to procure materials, produce and deliver finished goods to customers is longer than the time the customers are willing to wait (Christopher 2010). According to the author this time difference is in theory referred to as the lead time gap, see Figure 6. The most common way for companies to cover for this lead time gap and mismatch between supply and demand is to hold inventory (Chopra & Meindl 2013).

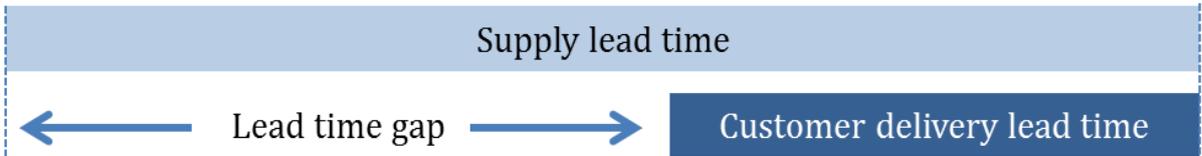


Figure 6. The lead time gap, figure inspired by Christopher (2010).

The supply lead time, see the figure above, is in this study referring to the time it takes for a company to procure materials, produce and also deliver finished goods to customers, which Christopher (2010) refers to as logistics lead time. The customer delivery lead time refers to the time customers are willing to wait for the product from when they have made the order until they receive the goods, by Christopher called customer order cycle. Christopher (2010) further explains that the lead time gap increases with an increase in the length of the supply chain. The use of global sourcing is an example of how companies extend their supply chains, as the distance to the supplier increases, resulting in longer supply lead times. This in turn creates a build-up of inventory.

According to Bragg (2011) companies have put little focus on reducing the supply lead time from the supplier. Instead, Bragg (2011) claims that companies go to great lengths to reduce its internal lead times by using a variety of just-in-time techniques, while they tend to accept the lead time that is given by the supplier. The given lead time does not necessarily need to reflect the supplier’s actual production capabilities. Instead the lead time is based on what the sales people that the company is dealing with has decided.

Closing the Lead Time Gap

The lead time gap and its impact on inventory can be reduced by decreasing the supply lead time (Christopher 2010). Christopher (2010) further explains that the gap also can be reduced by simultaneously extending the customer delivery lead time, see Figure 7. This can be accomplished by increasing visibility of demand and obtain earlier notifications of requirements. A perfect match between supply lead time and customer delivery lead time would result in no need of forecasts and keeping inventory.

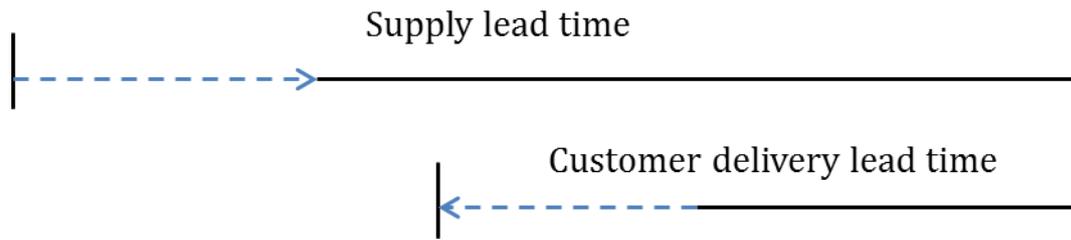


Figure 7. Lead time gap reduction, figure inspired by Christopher (2010).

Supply lead times can be reduced in several ways (Bragg 2011). The purchasing department can, according to Bragg (2011), shorten the lead time by including reduced delivery time in their request for quotes to suppliers. Furthermore, the supplier can keep raw materials inventory for the customer. This can for example be achieved through that the customer commits to certain volumes and provides reliable forecasts that the supplier can use for planning purposes. Both parties also need to make contractual agreements regarding inventory ownership in the case of goods becoming obsolete. According to Christopher (2010) it is important to understand what processes during the supply lead time that are actually value adding and identify non-value adding processes that create waste. By eliminating non-value adding processes the supply lead time can be reduced.

3.3.2 Uncertainties

The amount of uncertainties that must be managed in a supply chain drastically increases when a firm moves from a domestic to a global environment. However, the control that the company has over the supply chain will decrease (Fawcett 1992). This is supported by Christopher (2010) who claims that uncertainties are caused by low visibility in the supply chain and that low visibility will be amplified with a long supply chain. Low visibility makes it difficult to make informed decisions; with a lack of confidence in the supply chain as a result. According to Christopher and Lee (2004) the increased complexity and uncertainty within a supply chain contributes to overreactions, second guessing, mistrust and distorted information. Christopher and Lee (2004) summarizes the impact of uncertainties in a risk spiral, see Figure 8 below.

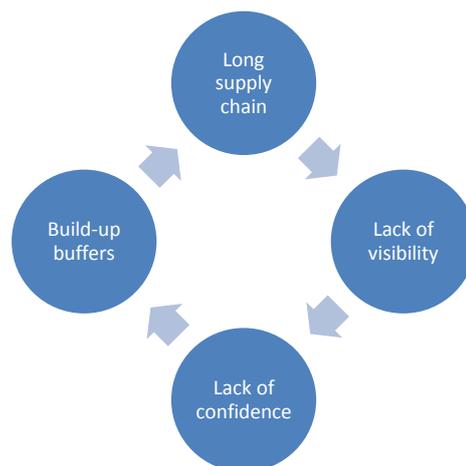


Figure 8. Risk spiral, figure inspired by Christopher and Lee (2004).

As illustrated in the figure above a long supply chain increases the lack of visibility. This will in turn lead to a lack of confidence, i.e. the parties in the supply chain do not trust each other. If there is no confidence in the supply chain there is, according Christopher and Lee (2004), a risk

that sales people for example start over ordering since they cannot estimate the true demand or because they do not know if suppliers will deliver on time. Furthermore lack of visibility and control in the supply chain can cause inflated production lead times. Production planners can add so called safety lead time in their production plans as they do not want to be held accountable for production delays. In order to cope with the uncertainties inventory will be used as a buffer. Building up buffers in the supply chain creates a longer supply chain, which further obscures visibility and more inventory is hence built up.

Chen (2004) categorizes uncertainty into three major parts; demand, supply and technology uncertainty. Aspects of the technology uncertainties will in this study be discussed in relation to the product life cycle which is part of the demand uncertainty, see Figure 9. Hence, further on only the concepts of demand and supply uncertainty will be used.

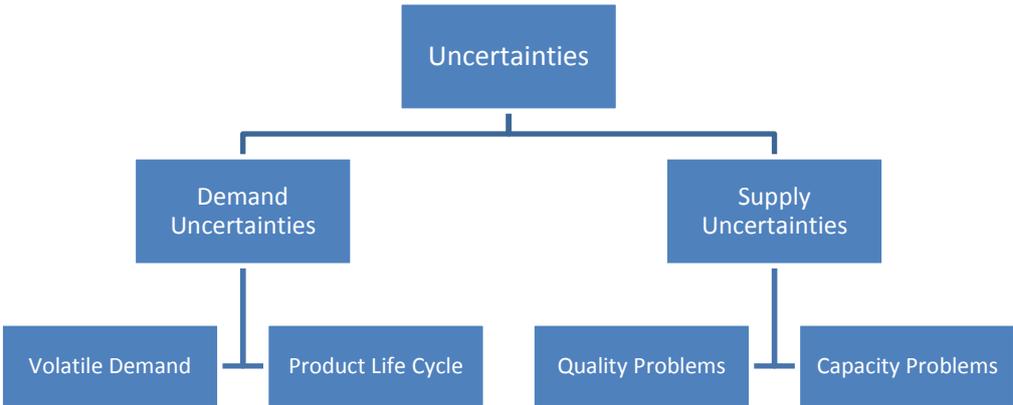


Figure 9. Breakdown of demand and supply uncertainties.

Demand Uncertainties

Market turbulence has tended to increase in recent years and volatile demand is now more or less present in every industry sector (Christopher 2010). According to Chen (2004) demand uncertainty arises from forecasting errors and irregular orders. Christopher (2010) discusses shorter product and technology life cycles and competitive product introductions as major inhibitors to predict demand. Estimating true demand is also distorted by sales promotions, quarterly sales incentives or decision rules such as reorder quantities (Christopher 2010).

According to Lee et al. (1997) demand uncertainty occurs when information signals regarding future demand observed by supply chain members vary from actual consumer demand. The major cause of variation is the overreaction of each decision in response to the demand information. This phenomenon is called the bullwhip effect and exemplifies how uncertainties results in fluctuating order patterns that amplifies upstream in the supply chain (Chopra & Meindl 2013). The fluctuations will be further amplified with longer lead times (Lee et al 1997).

Supply Uncertainties

Supply uncertainty is another type of uncertainty afflicting the supply chain (Chen 2004; Weng & McClurg 2003). According to these authors supply uncertainty is a well researched topic and they claim that supply uncertainties with poor delivery performance as a result are due to a number of different reasons. Factors such as capacity constraints, scheduling difficulties, uncertain material supplies and production processes as well as quality problems all cause supply uncertainties. Weng and McClurg (2003) further explain that if the supplier cannot

deliver on time the buyer has to face the consequences of backlogs or lost sales. In order to prevent this from happening buyers will then compensate with keeping inventory as a buffer.

Visibility is Key to Reduce Uncertainties

By improving visibility in the supply chain uncertainties can be reduced and less inventory such as safety stock needs to be kept (Christopher & Lee 2004). Visibility can, according to Christopher and Lee (2004), be accomplished by sharing information. Traditionally, companies have been reluctant to share information as they have lived by the notion that “information is power”, which implies that power diminishes if information is shared. However, the reality is the reverse and information sharing between members in the supply chain increases power significantly. This view is supported by Jones and Towill (1998) who claims that supply chains that share information have a much higher performance compared to those who are reluctant to share information beyond their company borders.

3.3.3 Forecast

The purpose of forecasts is to help match supply and demand; this is achieved through creating inventory against the forecast (Christopher 2010). The inventory can thus act as a buffer so that goods can be available when they are demanded. With an accurate forecast less inventory need to be carried, resulting in cost savings (Moon et al. 1998).

Forecasts should initially be based on statistical projections using past data. Modifications are often necessary and are made based on specific market intelligence (Christopher 2010). However, most companies struggle with receiving reliable information about demand (Moon et al 1998; Houlihan 1985). These authors further discuss how today’s economic uncertainty causes fluctuations in demand. In turn, companies have a tendency to overact to these swings and respond to the ups and downs in demand with inventory. Due to inadequate information sharing, marketing might for example boost forecasts to secure large orders. In response manufacturing and distribution functions may not trust the forecast and create their own independent forecast. This behavior of different functions trying to secure their own operations results in accumulated inventory and low forecast accuracy.

According to Christopher (2010) there are few forecasting methods that can predict irregular changes in demand on a short term basis with any accuracy, no matter how sophisticated the forecasting technique. Furthermore, the forecast error will be enhanced with increasing lead times, see Figure 10.

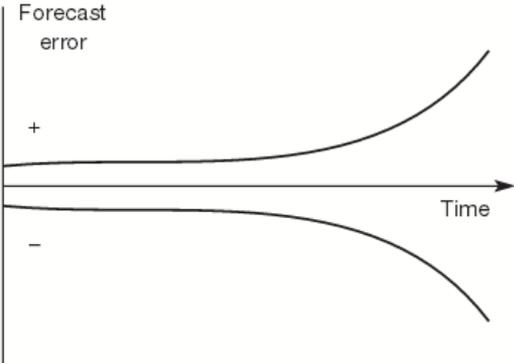


Figure 10. Forecast error, figure inspired by Christopher (2010).

A high forecast error can hurt a company’s business in several ways. Kahn (2003) discusses several negative outcomes of either over- or under forecasting, which can be seen in Figure 11 below.

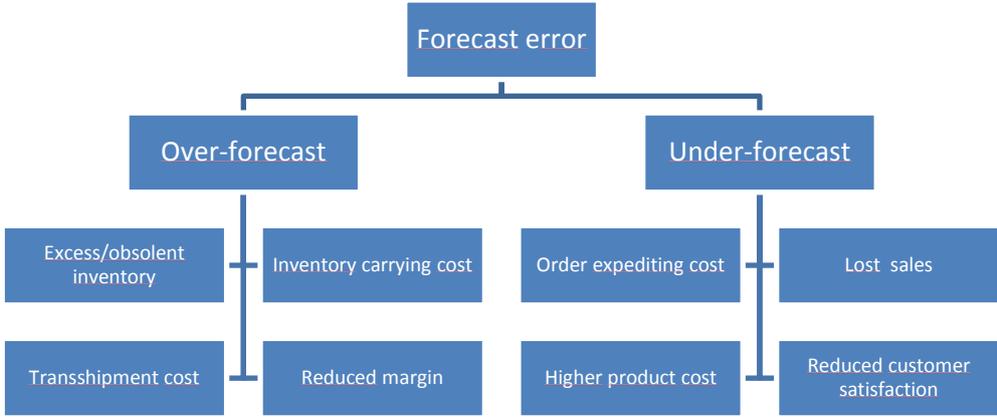


Figure 11. Outcomes of forecast errors, figure inspired by Kahn (2003).

One possible reason for forecast errors is that companies try to forecast at a SKU level too far ahead in time, which is an impossible mission according to Christopher (2010). He further explains that companies need to make plans to ensure material supply and capacity requirements. The plans should, however, instead be based on forecasts on product family level as they are aggregated and therefore easier to predict.

Moreover, companies’ inability to reduce forecast error can be explained that companies are focusing too much on choosing the right computer software to support forecasting rather than understanding the management process (Moon et al. 1998). The authors further discuss that even though companies implement sophisticated computer systems they fail to deliver accurate forecasts. The reason for this is that the system is not supported by a robust forecasting process. Successful forecasting is dependent on information and insights from people in different departments. However, working together across the board is easier said than done and employees are often unable or unwilling to communicate and work to achieve a better forecast performance.

Forecast Improvements

There are several ways to improve the forecasting process. The major solutions discussed by Moon et al. (1998) are to acknowledge the importance of forecasting and establish a forecasting team and build systems to capture key demand data. Furthermore, it is important to educate people to understand the implications of poor forecasting and include forecast performance as an indicator in people’s individual assessment plans as well as implement reward systems. Christopher (2010) supports Moon et al.’s (1998) discussion regarding that the answer to improving forecast accuracy does not lie in investing in advanced forecasting techniques. Christopher (2010) instead advocates lead time reduction as the primarily goal to reduce forecast errors and hence reduce inventory levels.

3.3.4 Lack of Coordination and Information Sharing

Lack of coordination and information sharing can permeate both the internal organization (Moti 2013) but also the company’s entire supply chain. This contributes to a poor inventory

performance at the company as it needs to carry more inventory to cover for inefficiencies and uncertainties (Chopra & Meindl 2013; Moon et al.1998)

Internal Lack of Coordination and Information Sharing

Organizations that have a weak alignment of goals and objectives run a high risk of having employees working at conflicting goals (Moti 2013). Moti (2013) further discusses if different functions within the organization lack clear priorities or have conflicting objectives it will be difficult to move the whole organization to work towards common goals. Instead employees may take actions that will not benefit the overall organization which in turn makes the company less competitive.

Furthermore, lack of coordination within the organization is caused by poor information sharing (Chopra & Meindl 2013). Lack of communication and information sharing in turn limits the company's ability to reduce inventory. As discussed earlier in section 3.3.2, reliable information and insights from people in different departments are needed to accomplish successful forecasting and reduce the impact of uncertainties (Christopher & Lee 2004).

External Lack of Coordination and Information Sharing

The key to a successful outsourcing strategy is the firm's ability to effectively coordinate worldwide operations (Fawcett 1992). Uncoordinated supply chains, however, are caused by poor information sharing or distorted information. As Christopher (2010, p 184) puts it "time lapses in information flows are directly translated into inventory". Using inventory to cover time lapses does not only result in higher inventory costs but it also distorts the view of real demand between production and customers. Lack of coordination may also, according to Chopra and Meindl (2013) occur because members of the supply chain have conflicting objectives. These conflicting objectives arise as every stage in the supply chain has a different owner and every owner wants to maximize its own profits. This behavior will reduce the total profits of the supply chain.

Many companies are today faced with uncoordinated supply chains (Bragg 2011). According to Bragg (2011) one possible reason for this is that companies have more suppliers in their supplier base than they have time to manage. Hence, purchasing departments struggle to coordinate deliveries of a large supplier base. The lack of coordination is caused by inadequate levels of communication which in turn will result in late or incorrect deliveries by the supplier. Bragg (2011) explains that companies try to overcome this problem by reducing the supplier base. However, what companies tend to miss is that even though they reduce the number of suppliers, they do not change the way they treat suppliers. If a company treats suppliers with indifference the supplier will in turn not go to any lengths to give the company special treatment. It may be difficult for the company to get rush deliveries if needed, be able to order smaller quantities or gain insight from the supplier when designing new products.

Improve Coordination and Information Sharing

In order to create coordination, top management need to understand how to strategically align strategies and goals, and how to implement these throughout the organization so that they are acknowledged and followed by the staff (Moti 2013). Functions will have different objectives regarding for example facility, transportation and inventory decisions. These objectives have to be aligned with the company's overall objective (Chopra & Meindl 2013). The same reasoning

applies to the whole supply chain where aligning goals and incentives will increase the efficiency and profitability of the supply chain (Chopra & Meindl 2013).

As presented earlier in section 3.3.2, reliable information can create visibility throughout the supply chain. This can help the company to reduce its need of inventory (Christopher 2010). Better demand visibility can for example be created if the company starts to share its production schedule with the supplier (Bragg 2011).

In order to create a more collaborative environment all members of the supply chain need to start sharing information and start working together (Weng & McClurg 2003). According to Christopher (2010) buyers and suppliers are recognizing the opportunities for achieving mutual benefits by sharing information regularly. Trends show an increasing willingness of the members of the supply chain to move away from a traditional arm's length relationship towards a partnership alliance where openness and trust characterizes the relationship, i.e. creating a strategic relationship (Christopher & Lee 2004; Chen 2004). With a continuous information flow, the supplier can attain a better insight to the end of the supply chain and be more responsive to actual demand. This increases the supplier's ability to achieve higher customer service (Christopher 2010).

3.3.5 Service Level

Service level is by Jonsson and Mattsson (2009, p.48) defined as "the extent to which products can be delivered to the customer directly from stock". A unified service level for all products may impose unnecessary high costs as the company will carry more inventory for certain products than what is demanded (Jonsson & Mattsson 2005). Having more inventory than needed furthermore increases the risk of products becoming obsolete. A unified service level may also result in that the service level is too low for certain products, meaning there will not be enough inventory in place to meet the demand.

One way to balance the service level is to classify the products, and assign different service levels to the different classifications. The company can then manage the costs of offering a certain service level more efficiently, and adapt the inventory levels to meet customer demands. The cost of holding inventory will for example increase significantly if a company wants to increase the service level offered to customers. The trade-off is then to offer a service level that can give a competitive advantage (Houlihan 1987). It is therefore important for a company to understand the significance of the different products for the end-customer in order to be able to make informed decisions regarding needed service levels (Holmström 1997).

Differentiate the Customer Service Level

A frequently applied method for classifying products is to use ABC-classification based on the volume value per item (Flores et al. 1992). A commonly occurring situation is that 20 percent of the products stand for 80 percent of the margin, the so called Pareto rule. These 20 percent of the products hence moves fast and can be classified as A-items etcetera. The service level can then be differentiated so that products with a higher margin, the A-items, are given a higher service level than the slower moving B- and C-items. The needed safety stock levels, and hence the capital tied up in inventory as well as the cost of holding inventory, can be directed towards the products that have a high profit impact (Jonsson & Mattson 2005).

3.3.6 Product Range

The width of the product range that a company offers will directly impact the inventory levels that need to be kept. Furthermore, a wide product range in combination with a high service level will enhance the need to keep inventory (Houlihan 1987).

The complexity of the products will also affect the inventory levels of components and raw material (Closs et al. 2010). According to Closs et al. (2010) the number of different components required in a product in combination with variations in replenishment lead time affects the necessary stock levels. Hence, more complex products require correspondingly higher levels of inventory. The combination of product complexity and a broad product range therefore drives inventory levels.

Managing the Product Range

The combination of meeting high customer service level demands for a broad product range, and at the same time reduce inventory levels is problematic. If a company wants to reduce the number of products offered to customers, the ABC-classification, described in section 3.3.5, can be used to determine which products that is of high importance to the profitability of the company (Jonsson & Mattson 2005). According to the authors products that move slowly can then be reviewed to see if they are necessary to keep in the product range or if they should be phased out.

The need for components and raw material inventory can be reduced through standardizing the components needed for several different types of products. Hence, the variety of different components needed in inventory can be reduced (Closs et al. 2010).

3.4 Analytical Framework

All the six factors; lead times, uncertainties, forecast, lack of coordination and information sharing, service level and product range, which have been presented above drives inventory in two ways; directly but also indirectly since they affect one another. The factors are intertwined which amplifies the affect they have on inventory, see Figure 12.

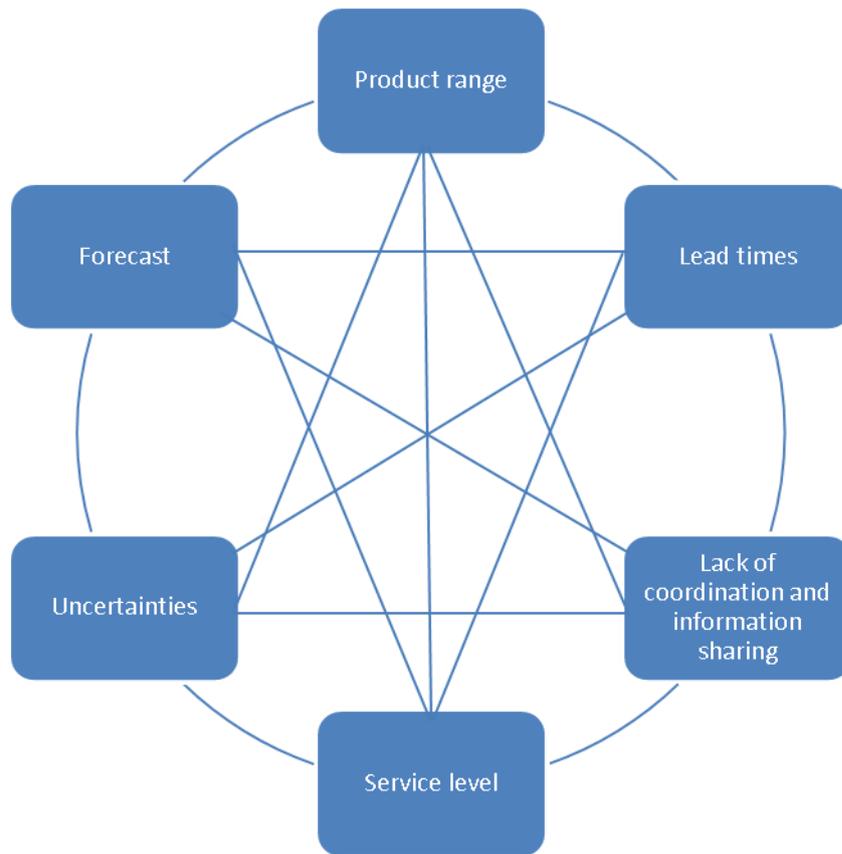


Figure 12. The six interdependent drivers of inventory.

Lead times, for example, do not only drive inventory through high safety stocks due to that a long delivery time entails reduced responsiveness. Lead times also drive inventory by increasing the uncertainty when ordering goods, and by amplifying the dependency on a forecast since orders need to be placed a long time before actual demand is known see Figure 13. Furthermore, the dependency on the forecast entails challenges for the management who needs to facilitate the internal coordination. This is in order to enable an accurate forecast which is dependent on that several departments communicate and collaborate. It will also hamper the external coordination when compiling the forecast which is reliable of valid external information shared by customers, and also when communicating the forecast to suppliers and ensure it is fully understood. Hence, long lead times drive inventory in several ways, directly as well as indirectly.

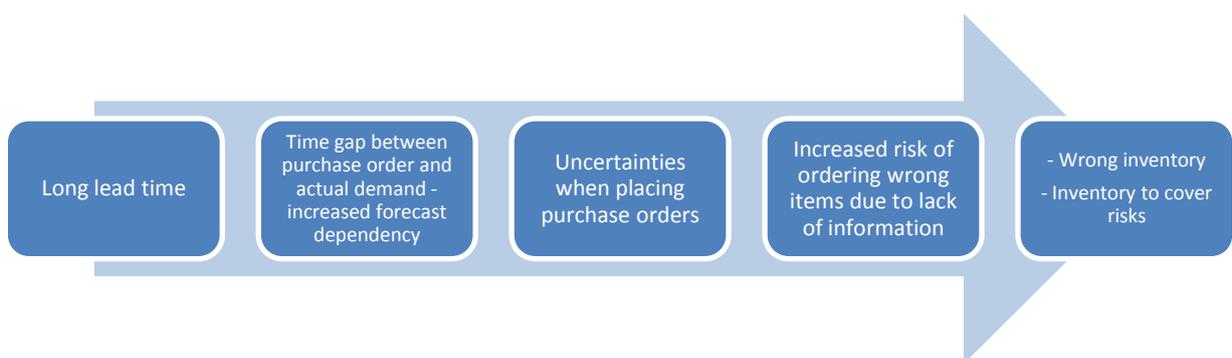


Figure 13. The interdependency between the factors.

The effect of the drivers will not only be amplified by their interdependency, but also by the use of LCC sourcing. In general, LCC sourcing entails longer geographical distances, i.e. longer lead times, uncertainties, and challenges for coordination due to cultural differences (Fredriksson & Jonsson 2009). By affecting lead times, uncertainty and coordination, LCC sourcing will hence amplify the effects of these drivers on inventory levels since they are intertwined with the other factors as well.

The interconnection between the factors product range and service level is another example of how the factors are intertwined. Inventory will increase by offering a large product range with a high unified service level for all products. As this is part of the company's competitive strategy, the strategy can be seen as an amplifier of the impact of the two factors. The two factors will also amplify the effect on the other four factors. For example having a broad product range increases the complexity of the forecast and hampers the company's ability to share information and coordinate products.

To enable an improvement of the inventory performance in the long run it is important to identify the actual drivers of inventory and solve what is causing the problem instead of just trying to cure symptoms. Therefore, the understanding of the individual factors direct effect on inventory and how they via their interplay indirectly affect inventory is essential in order to identify the root causes to the existing inventory levels. These factors and their interdependency form the basis of the created analytical framework. This framework, illustrated in Figure 12, will be applied during the case study and constitutes a crucial tool when identifying and assessing the drivers of inventory at Focal. The framework is therefore essential in order to enable the researchers to compile suggestions for how to improve the inventory performance of Focal.

4 Empirical Study

This chapter starts with a background description of the Focal Group, the focus company Focal and Supplier X, which constitute the case study of this thesis. The six main drivers of inventory, identified in the analytical framework, are then explored one by one in order to identify the root causes of the current inventory levels at Focal, and hence fulfill the purpose of the thesis.

All the empirical information is based on written and oral statements obtained during the interviews conducted at both Focal and Supplier X.

4.1 Background Focal Group

The Focal Group offers door opening solutions to markets across the globe. The Group has over 43,000 employees and an annual turnover of 47 billion SEK in 2012 (Focal Group Årsredovisning 2012). The Group is divided into five divisions: EMEA, Asia Pacific, Americas, Global Technologies and Entry Systems, as can be seen in Figure 14 below.

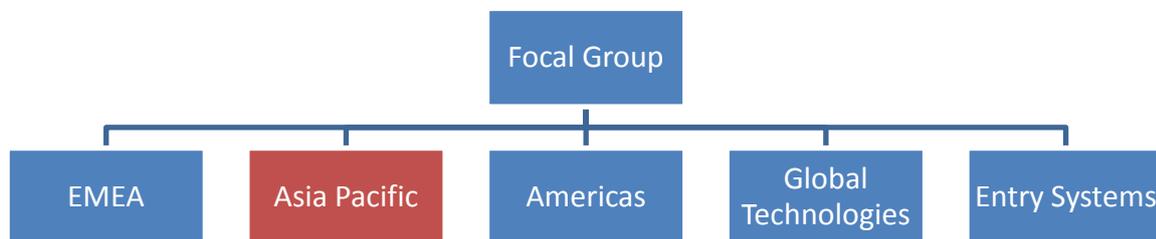


Figure 14. The divisions within the Focal Group.

The Asia Pacific division constituted 21 percent of the annual sales during 2012 (Focal Group Årsredovisning 2012). The Asia Pacific division sells mechanical and electronic locks, digital locks, as well as high security doors to markets within Asia, Australia and New Zealand. China is the largest market with 50 percent of the sales, while Australia and New Zealand make up 30 percent of the sales within the division.

4.1.1 Focal

Focal has been a part of the Focal Group since 2001. The main operations are located in Melbourne, where R&D, manufacturing and the central distribution center are located.

Focal offers products within premium, mid-range and low cost brands. The company has a broad product range compared to its competitors and offers approximately 25,000 SKUs. Brand X is the company's premium brand which is also the most famous and profitable one. The quality of the goods is therefore of high importance, and the Brand X products are seen as the "bread and butter"⁸ of Focal. The different brands that Focal markets contain products within five major areas:

- Mechanical locking solutions
- Electromechanical solutions
- Door furniture, lever handles and knobs
- Padlocks, outdoor and portable security

⁸ General Manager, Focal, 25th of March 2013

- Keying platforms

All the different types of products are sold to both commercial and residential customers within five main segments, which are: locksmiths, retail/trade, original equipment manufacturers (OEM), professional end users and electronic access control segments.

Focal sources both raw material and components, for the use in the local production, as well as finished goods. The sourced volumes have gradually increased over time as more and more of the high volume production has been outsourced, mainly to factories in China. A large transfer of products from in-house production took place in 2006 and 2007 when Focal closed down a manufacturing facility in Brisbane. Employees at Focal say that they expect sourced volumes to further increase the next coming years. The sourced finished goods, consisting of both purchase to stock, PTS, and purchase to order, PTO, items, currently make up 51 percent of sales. The remaining 49 percent of sales is from the local manufacturing of both make to stock, MTS, and make to order, MTO, items. Reasons for keeping the local manufacturing is that it creates a competitive advantage when it comes to winning public procurement projects, as well as it enables final assembly and customization of products closer to the end customer.

Inventory at Focal

Focal has a set limit of that a maximum value of ten percent of annual sales is allowed to be tied up in inventory at any given time. The company holds three different types of inventory: raw material and components before production, work-in-process (WIP) in production and finished goods inventory, see Table 3 for a breakdown of the inventory levels. The finished goods inventory consisting of both MTS and PTS items are kept in the central distribution center in Melbourne. While the raw material and components inventory is held before production at the manufacturing site in Melbourne.

Type of inventory	Percentage of total inventory
Components and raw material	33 %
Work-in-process	15 %
Finished goods	52 %

Table 3. Breakdown of inventory at Focal.

The inventory turnover rate was during 2012 14 percent below the targeted level. Hence, the inventory moved slower than the target. A contributing factor to this was that the amount of inventory tied up in slow moving and obsolete inventory, see definition on p.3, was 150 percent above the target level. The targets for lost sales and backlog were reached when an average calculation for 2012 is performed. The amount of lost sales were then on average 30 percent below target, and the backlog 19 percent below the target level. However, even though the targets for lost sales and backlog were met on average during the period, there were several months where the targets were not reached. January is an example of this where the amount of lost sales was 48 percent above target, at the same time that the amount of backlog was 23 percent above target. The inventory performance of Focal is therefore regarded as unsatisfactory by Focal employees.

The MTS inventory is replenished according to a kanban system where a buffer corresponding to eight days of demand should be kept in the finished goods inventory. The local manufacturing is planned on a two week horizon and the raw material and components inventory should have a 100 percent service level towards the factory.

4.1.2 Supplier X

Supplier X is Focal Group's largest export unit in Asia. 84 percent of Supplier X's sales are exported. Focal is one of the largest individual customers accounting for 15 percent of total sales. Supplier X has a mix of both high volume and low volume production, and supplies approximately 20,000 SKUs. Supplier X's factory consists of ten workshops, where one workshop is dedicated for products that are specific for the Australian, New Zealand and American markets.

Supplier X is Focal's largest supplier of both components and finished goods; constituting 24 percent of the total supplier spend. Supplier X is also the largest supplier of products within the Brand X. The items that Focal purchases from Supplier X are either specific for Focal or also supplied to other customers under different branding. During 2012 Supplier X had an in full on time, IFOT, performance of 71 percent. IFOT is by Focal defined as the percentage of delivered orders that contain the requested quantity at the requested time. The delivered quantity should at the same time also be of satisfying quality, which is why random quality checks are performed when the goods arrive at Focal. If quality defects are noticed during the inspections or at a later stage by Focal's customers, all shipments of that product are put in quarantine. Quarantine implies that all products are quality controlled and verified before the products are sold. The verification process of all next coming shipments continues until the supplier has corrected what is causing the defects, and is performed manually at Focal. During 2012 Supplier X caused 31 percent of the total amount of needed quality related actions at Focal.

The Guangdong province, where Supplier X is located, is a manufacturing intense area. Many of the factory workers have therefore moved from other parts of China in order to find a job. This causes capacity problems during the months around Chinese New Year as many of the workers leave the province and travel to see their families. Many of the workers do, however, not return after the holiday so the factories have to find and train new workers, which can be difficult to achieve on a short time frame. This does not only affect the capacity of the company, Supplier X's suppliers also suffer the same problems, which hence affect the overall delivery performance of Supplier X.

4.2 Lead Times

Focal is continuously working to streamline both their internal administrative functions as well as their internal production to become more efficient. By streamlining their processes Focal has managed to cut down costs as well as reduce lead times internally within their organization.

However, Focal has put little efforts on reducing external lead times, such as the supply lead time from Supplier X. Today, the lead time for Focal to source goods from Supplier X is set to three months. The lead time is the same for all finished goods and components that Focal is sourcing from Supplier X, regardless of volumes or product complexity. The three months consists of one month procurement and planning at Supplier X, one month production at Supplier X and one month transportation, see Figure 15 below. However, according to Supplier X's acting General Manager during 2012, the lead time "for 70-80 percent of the products

sourced by Focal can be drastically reduced”⁹. The different phases of the supply lead time will be presented in more detail below.

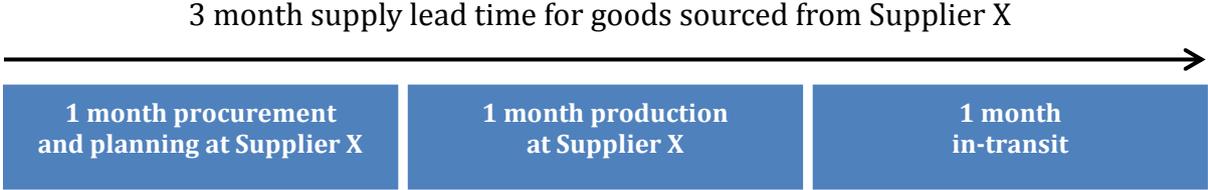


Figure 15. Breakdown of the supply lead time of goods sourced from Supplier X.

4.2.1 Procurement and Planning Lead Time at Supplier X

Supplier X starts their planning of production and procurement of materials after they receive firm purchase orders from Focal. Every month Focal makes two larger purchase orders; one at the beginning of the month and one at the middle of the month. This is done in order to facilitate capacity planning at Supplier X. In between the two larger orders Focal can make small additional orders.

Supplier X has a set planning and procurement lead time of one month as the time for Supplier X to procure materials from their suppliers can differ from a few days up to 35 days. In general, Supplier X holds very limited inventory of raw materials and components inventory and material need to be purchased prior to every production run. The start of the production is therefore dependent on when the component with the longest lead time are received. The supplier lead time for raw material and components depends on the product complexity, the suppliers’ ability to carry inventory as well as the suppliers’ capacity. Most of Supplier X’s suppliers are local as the region form a cluster of lock manufacturers. The purchasers at Supplier X have during the last three months been working to reduce the lead time from their own suppliers. By putting more pressure on their suppliers, Supplier X has managed to reduce the supply lead time by up to 14 days for certain suppliers. The ongoing process of supply lead time reduction is currently not transferred into a reduction of the delivery lead time to Supplier X’s customers.

4.2.2 Production Lead Time at Supplier X

Today Supplier X needs one month lead time for production to ensure that products can be produced for Focal. Supplier X produces in total about 20,000 SKUs, of which Focal sources about 400 items. Supplier X has both high and low volume production and Focal sources both types. The vast amount of SKUs make Supplier X’s production complex due to set up times. For certain low volumes the production time can be about 20 minutes while the set up time is 30 minutes.

The production is labor intensive and characterized by unstable processes. Supplier X is currently struggling with quality issues and some employees have estimated that scrap stands for about 15-20 percent of the total produced volume. The quality issues are partly explained by untrained staff as well as unclear process descriptions. At the moment quality issues tend to be covered by overproduction rather than identifying and resolve the root causes of the problem.

⁹ Operations Director – Architectural Hardware Group (Acting General Manager at Supplier X in 2012), Focal Asia Pacific Division, 22th of April 2013

Furthermore, production at the different production lines is not always performed according to the aggregated production plan, called the master production schedule, see Figure 16 below.

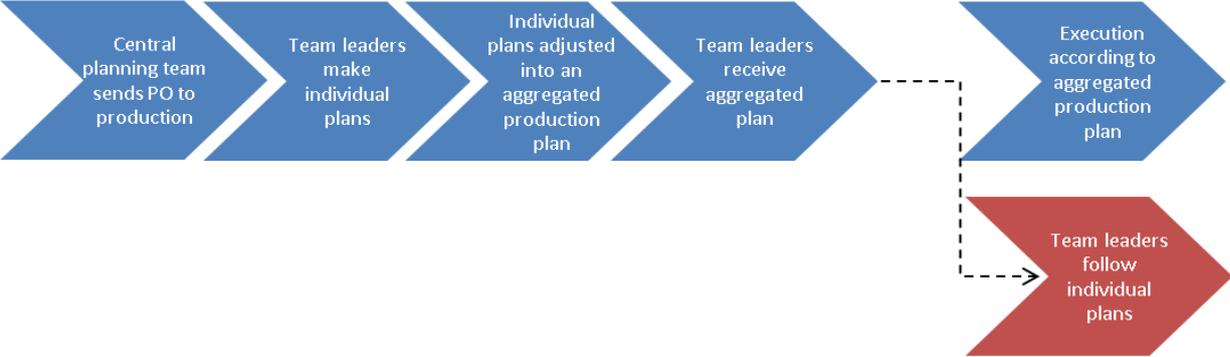


Figure 16. Planning and execution of production at Supplier X.

The central planning team at Supplier X sends the received purchase orders, PO, to the production team. Based on the purchase orders, team leaders of the different production lines make individual plans. These plans are then sent to the central planning team who adjusts the individual plans into an aggregated production plan in order to optimize the overall production. The team leaders should then execute the production of their line according to the aggregated plan. However, some team leaders do not follow the plan and instead follow their own individual plan to maximize batch sizes.

4.2.3 In-Transit Lead Time

The in-transit lead time is also set to one month and consists of domestic transport from Supplier X to the port in China, overseas transport by boat, queuing at the port in Australia, custom clearance, repacking by a third party logistics provider (3PL), and domestic transport to Focal’s warehouse in Melbourne.

Weekly shipments are made from Supplier X. The goods are at sea for about 13-14 days but the vessels might need to wait up to a week before they can enter the port in Australia due to queues or problems with customs. In Australia the domestic transport is carried out by a 3PL. The 3PL receives the goods at the port and repacks the containers on to semi-trailers before the goods are transported to Focal’s distribution center. The distribution center holds only finished goods and has a limited capacity for how much goods that can be received on a daily basis. The 3PL is therefore sometimes required to hold goods for Focal depending on when the goods arrive at the port. Finished goods as well as raw materials and components are transported to the new warehouse as these goods are mixed in the containers from Supplier X. The raw materials and components are then transported from the distribution center in Mentone to a raw materials and components inventory at the factory in Oakley.

4.3 Uncertainties

According to Focal’s employees, the company’s operations face challenges regarding both demand- and supply uncertainties.

4.3.1 Demand Uncertainties at Focal

Focal serves two major customer segments; commercial customers and residential customers. Commercial customers are both private and governmental construction firms that operate on a

project basis. The residential customers refer to the private market and sales are mainly done through retail channels. The customer segments have different purchasing behavior, but both segments purchase products within all product families. In general, all product families have a product life cycle of at least ten years. Furthermore, both customer segments have a volatile demand without following a specific seasonality. In general sales are better when Australia's economy is going well as more building projects will be initiated and when weather conditions permits building.

The commercial sales are project driven and often involve large volumes. If a building project is on schedule and running according to budget customers will be able to afford Focal's products. Due to that they are regarded as a premium brand and therefore more expensive than most competitors' products. However, if the project is not on schedule or exceeds the budget, the probability that the customer will buy Focal's products decreases. Installations of locks are usually made at a late stage during building projects. Focal will therefore not know what the chances are for doing businesses until quite late during the building project, and will hence only know on a short time horizon if they have managed to win the purchase order or not. Focal's inability to predict the demand of commercial customers results in lumpy demand orders.

The residential customer segment also has a volatile demand, where "70 percent of the retail sales are initiated by impulse buys"¹⁰. This impulsive buying behavior makes it difficult for Focal's retail customers to predict their customer demand and it is therefore difficult for the retail customers to achieve high forecast accuracy. Some retail customers, for example Focal's largest retail customer, are reluctant to share their forecasts with Focal. This is for example due to that customers do not want to be held accountable for any discrepancies between the forecast and actual demand.

In general, Focal has difficulties in changing the customers purchasing behavior and changing the customers' mindset to understand the implications of Focal's current LCC sourcing strategy. Customers require Focal to hold inventory for them as they expect to get deliveries after one day even though it takes Focal three months to source the products. For example Focal's largest retail customer will cancel their purchase order if Focal cannot supply the whole order after 24 hours. Focal will then register the canceled order as a lost sale.

4.3.2 Supply Uncertainties Related to Supplier X

Supplier X's IFOT performance of 71percent as well as Supplier X's responsibility of causing 31 percent of quality related actions results in that their performance is not regarded as satisfying by employees at Focal when compared to other suppliers. This unsatisfying performance is due to Supplier X having both capacity- and quality issues, which results in that they cannot deliver on time or deliver defect free goods.

From Supplier X's perspective some of the capacity and quality issues in their production can be explained by the closedown of the factory during Chinese New Year. Many employees do not return after the vacation and it is difficult to find new competent workers. The shortage of people causes problems in Supplier X's delivery performance, as the production is highly labor intensive. The same scenario applies to Supplier X's suppliers resulting in that it takes a longer time for Supplier X to receive components and raw material. Supplier X is currently not making a stock build to prepare for the factory being closed during Chinese New Year.

¹⁰ Purchasing and Planning Manager for finished goods, Focal, 8th of April 2013

Furthermore, from Supplier X's perspective the company's inability to find competent workers results in that part of its workforce is untrained. This contributes to the quality issues in production. Quality inspections are made at both Supplier X and Focal. If Focal detects quality defects there will be a 100 percent quality check of the particular product type until the quality issue is resolved with Supplier X. Focal has quality meetings with Supplier X fortnightly to discuss and ensure that quality issues are resolved. Some quality issues are resolved within weeks while some issues have been open and unresolved for more than one year.

4.4 Forecast

The forecast is used internally by Focal to take decisions regarding for example purchasing volumes, if products should be discontinued, and to make financial decisions. The forecast is also shared with Focal's suppliers in order to facilitate the suppliers' decision making regarding for example inventory levels and capacity planning. Focal hence shares their forecast with Supplier X. Supplier X in turn shares Focal's forecast with its own suppliers so that these suppliers can plan their inventory levels. Supplier X themselves does, however, not use Focal's forecast to plan their operations. One reason for this is the low forecast accuracy¹¹ of Focal's forecasts.

The forecast accuracy was during several of the interviews mentioned as a major driver of inventory at Focal. The forecast accuracy is used by Focal to see how much the forecast deviates from actual demand. The accuracy for PTS items was during 2012 on average 44 percent which by Focal is considered as a poor result.

4.4.1 The Forecasting Process at Focal

The forecast at Focal is made on a rolling twelve month horizon and is revised on a monthly basis. The input to the forecast is both quantitative and qualitative data. The quantitative data consists of historical data of both ordered and delivered quantities. The historical data is entered into a forecasting system containing 21 different formulas for estimating the future demand. The system compares the outcome of the different formulas in order to find the formula that would have provided the most accurate outcome for the last period. This formula is then used to create a system forecast for the next coming period. The system forecast is created on a SKU level. The different steps of the forecasting process at Focal can be seen in Figure 17 below.

¹¹ The forecast accuracy is calculated by Focal on a monthly basis by comparing the forecasted volume for each product with the actual sales of the product.

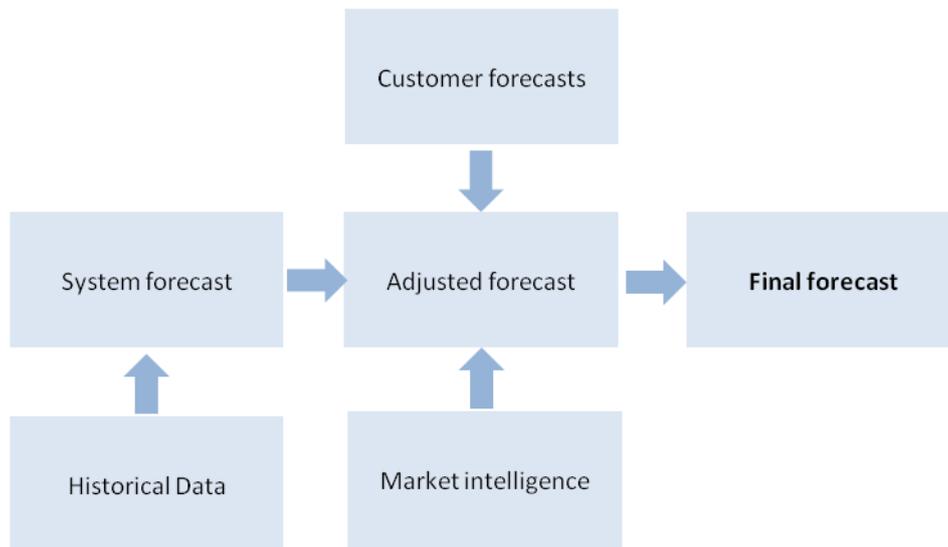


Figure 17. The forecasting process at Focal.

After the system forecast has been created the Product Managers are responsible for creating an adjusted forecast. Product Managers are responsible for the adjustments as they are in charge of the different product families and are therefore considered to have the best insight into the different products. The Product Managers work together with other departments to receive market intelligence in order to make adjustments and make a final forecast. The accuracy of the adjusted forecast is not higher than that of the forecast created by the system. The adjusted final forecast is however the forecast that is used within Focal to for example place purchase orders.

Each Product Manager adjusts the forecasts that are related to their product portfolio. The market intelligence they receive can for example be information about upcoming sales or projects, the economical situation within different markets etcetera. The Product Managers use information that they themselves receive from the customers, but they are also highly dependent on that the sales team provides market intelligence. This is, however, perceived as problematic by both the Product Managers as well as the sales team. A reason for this is that the sales personnel are unwilling to share information unless they have a certain degree of its certainty. The Product Managers must hence assess the information that they receive from the sales team and decide if it is sufficient to adjust the forecast with. The forecasts provided by Focal's customers, which is the other input used to adjust the system forecast, have a forecast accuracy of on average 25 percent and is therefore currently not regarded as reliable enough to be used to predict demand.

The Product Managers are allowed to make adjustments to the forecast until two months before the actual demand. They are, however, encouraged to make as many adjustments as possible three months before actual demand as the purchasers must place purchase orders three months in advance. Further adjustments to the final forecast can be made if there are for example very lumpy demand orders that will have a high impact on the forecast. These changes can be made up until one month before actual demand. All changes made closer than two months must be approved by the demand planner who then owns the forecast.

4.5 Lack of Coordination and Information Sharing

During the interviews at Focal, employees said that there is a lack of coordination and information sharing affecting decisions regarding inventory negatively, both internally within the different departments at Focal but also externally with Supplier X.

4.5.1 Lack of Internal Coordination and Information Sharing at Focal

At Focal the Supply Chain Business Manager is accountable for the overall inventory performance. Every department and individual person should then take responsibility for their inventory even though they are not all measured by this. As an example the Product Managers, who are responsible for finished goods, and the Manufacturing Manager, who is responsible for raw material and components, are the ones who ultimately decides when to phase out slow moving goods. Currently these departments are not measured by slow moving and obsolete inventory. This gap between who are accountable for inventory KPI's and who are responsible for taking actions has resulted in a situation where limited actions are taking place to improve inventory performance at Focal.¹²

Lack of coordination and information sharing exists between the supply chain team and the sales team. From the supply chain team's point of view the sales team can approve large customer orders, causing lumpy demand orders, without verifying with the supply chain team if there is inventory to cover for the sale or not. The reason for this is according to both the supply chain team and the interviewed National Sales Manager due to that the sales team is measured on sales growth and margin improvement, and not on lost sales or backlog.

Moreover, Product Managers perceive the sales team's role in the forecasting process as problematic. When the Product Managers are adjusting the forecast they are dependent on market intelligence from the sales team. However, as the sales team is not accountable and measured by forecast accuracy there is a low incentive for them to improve the process for gaining reliable information from customers. Currently there is no structured process for how the sales team should gather important customer data. According to employees at Focal this often leads to that the information is communicated too late or not at all.

4.5.2 Lack of External Coordination and Information Sharing with Supplier X

Focal communicates with Supplier X on a continuous basis. The communication is however, according to the purchasing team at Focal, of a transactional and reactive nature. Meetings are for example held when quality issues already have occurred.

The empirical study showed that employees at Focal are frustrated that Supplier X communicates delays of deliveries too close to the decided delivery date. Focal gives subjective feedback regarding delivery precision to Supplier X but there is no formal feedback process in place. Supplier X has, on the other hand, from March 2013 started to share a scorecard with their delivery performance to Focal. The definition of delivery performance that Supplier X uses does however differ from the definition that Focal uses.

The amount of information that Focal shares with Supplier X is according to employees at Supplier X also lacking. One example of this is that Focal does not communicate in time when Focal plans to make a stock build, i.e. when Focal will make a larger than normal order, for Supplier X to have time to plan for the extra capacity required.

¹² Supply Chain Business Manager, Focal, 25th of March 2013

4.6 Service Level

For Focal’s finished goods that are stocked, MTS and PTS, all items have a service level of 95 percent towards customers. The company has internally classified the finished goods into ABC-items depending on if they are fast or slow moving items. The ABC-classification is based on the volume value of the cost of goods sold, as can be seen in Table 4. C-items for example stand for five percent of cost of goods sold but constitute 16 percent of the total inventory for finished goods. According to Focal’s employees, a high service level for C-items causes unnecessary slow moving and obsolete stock, and the amount is 279 percent below the averaged target level.

Classification	Percentage of items	Percentage of COGS	Percentage of inventory (AUD)
A	6.5%	80%	66%
B	13.6%	15%	18%
C	79.9%	5%	16%

Table 4 Breakdown of the ABC-classification for finished goods.

The ABC-classification is used by the purchasers when they plan what amount at what time that needs to be purchased. Or by the Product Managers when they are reviewing the product portfolios to identify which items that could potentially be phased out, and which items that should be given extra attention. The service level is, however, not differentiated depending on if the stocked items are classified as an A, B or C-item. This is according to employees’ at Focal due to their competitive strategy where it has been decided to have a 95 percent service level for all products. The decision is based on what Focal perceive is required to satisfy customer demands.

No classification system is used for raw materials and components at Focal. This is, according to employees at Focal, due to that the same raw materials and components can be used to produce both slow moving and fast moving end products. All the raw materials and components that are kept for production in Melbourne have a 100 percent target service level. 23 percent of the raw material and components inventory consists of slow moving and obsolete goods.

4.7 Product Range

Focal has about 25,000 SKUs and this broad product range is by the company seen as one of their greatest competitive advantages. The broad product range is a result of offering many different products as well as providing one product in many different forms such as colors etcetera. The products are also divided into different price segments depending on their brand. For example, in Australia the brand Brand X is positioned as Focal’s premium brand and is relatively expensive, while products within the brand Brand Y are positioned as mid-range products with a lower price.

All products are divided into product families. The product families are then divided into different product portfolios that are managed the Product Managers. It is the Product Managers’ responsibility to look after the different products and to accomplish this they work together with several departments in the organization. They work with the sales team to understand what the customers want, with the R&D team to develop new products and to upgrade their portfolio, and with the supply chain team regarding forecasting and inventory levels. The Product Managers have targets to hold a portfolio of products where 25 percent should be new products that are less than three years old. Product Managers are also responsible for phasing out products that are slow moving. Product Managers perceive the phasing out process as

challenging as Focal uses package sales which means that certain slow moving products can be required to satisfy certain channels and customers.

According to one of Focal's National Sales Manager's "the large variety of products is Focal's biggest strength as well as their biggest weakness"¹³. Competitors cannot compete with having the same broad portfolio but they can instead focus on a certain segment and become very good within that segment. Focal's broad product portfolio consists of both different brands, within three different price segments, as well as a high number of different variants of each product. One product can for example come in ten to fifteen different colors.

One challenge for Focal is to position their brands as the brands may cannibalize on each other. Furthermore, many of the interviewees at Focal expressed that the large variety of products has drawbacks. One drawback is that the customers get confused by having too many different colors and variants to choose from and that for certain products it would be better to reduce the number of options.

Another drawback is that some products become slow moving or obsolete. Focal keep products within segments that they are not competitive within and products that were popular many years ago without reviewing if today's customers still demand these products. According to one of the National Sales Managers Focal "should be better at adjusting their product portfolio to market demands"¹⁴ by performing more reviews regarding customers preferences.

¹³ National Sales Manager, Focal, 10th of April 2013

¹⁴ *ibid*

5. Analysis

*In this chapter the empirical findings are analyzed based on the analytical framework presented in section 3.4. Both research questions will be assessed in this chapter; **What are the major drivers affecting Focal's inventory performance?** and **How can the inventory performance at Focal be improved?** In order to answer the research questions each driver of inventory; lead times, uncertainties, forecasting, lack of coordination and information sharing, service level and product range will first be treated separately. Secondly, an analysis of how the six drivers of inventory are intertwined and together amplifies the impact each driver has on inventory is presented. Suggestions for potential actions that can be undertaken to manage the negative impact these drivers have on inventory levels are also presented.*

5.1 Lead Times

Focal's supply lead time of three months in combination with a delivery time of one day towards customers leads to a large lead time gap between supply and demand. Focal needs to manage this lead time gap by keeping inventory; the combination of LCC sourcing and a competitive strategy with one-day-delivery hence inevitable results in a need for inventory. This inventory needs to be properly managed in order to reach an efficient inventory performance. However, this does not seem to be the case as the empirical findings reveals an inventory turnover rate 14 percent below target and a 150 percent larger amount of excess inventory than targeted.

The long supply lead time furthermore increases the supply uncertainty of the supply chain. The supply uncertainty is in this case study caused by the poor IFOT from Supplier X of only 71 percent and the consistent problem with poor quality. The supplier uncertainty that the lead time amplifies hence further pushes the need for inventory. Moreover, the three month lead time increases the planning horizon and Focal becomes reliant on forecasts when placing the purchase orders. The long planning horizon in turn increases the uncertainty of the forecast; contributing to Focal's forecast accuracy of 44 percent for PTS items. The low forecast accuracy together with the supply uncertainties hence impacts the inventory performance of Focal negatively. The impact of long lead times on inventory is illustrated in Figure 18.

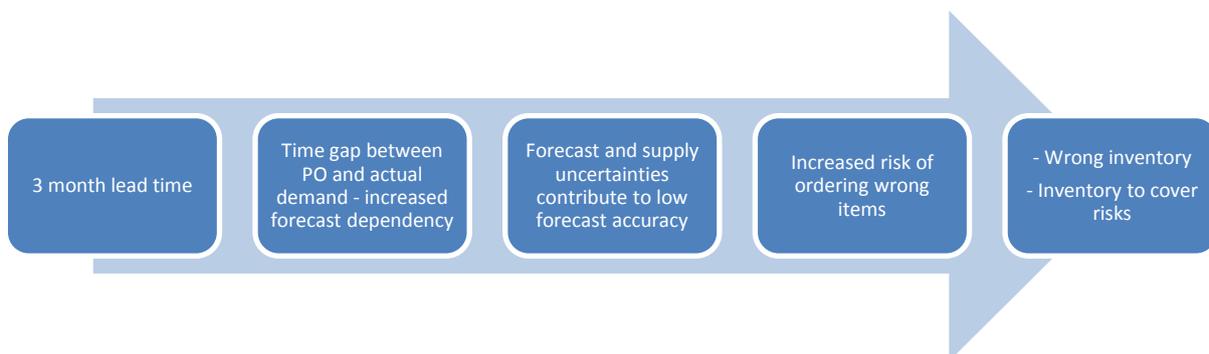


Figure 18. The impact of the supply lead time on Focal's inventory performance.

In order for Focal to close the lead time gap they can either try to increase the delivery time to the customers or work to reduce the supply lead time. Compared to the supply lead time of three months, the one-day-delivery time to customers is very short. To extend this time to make a significant impact on reducing the lead time gap is difficult since it would demand a relatively large time increase for the customers. As the customers are used to a short delivery lead time, a significant increase could damage customer satisfaction and result in loss of customers. One way

to try to prolong the delivery time without risking customers satisfaction is, however, to increase the visibility of the customers' future demand through for example using customer forecasts. This would enable Focal to plan on a longer horizon and hence more efficiently match supply and demand. Some of Focal's customers currently share their forecasts. However, the general forecast accuracy of only 25 percent makes it difficult for Focal to use these as any valuable input. Hence, currently it is difficult for Focal to increase the visibility and predict customers' true demand if the customers themselves do not improve their forecast accuracy. Therefore, Focal needs to put effort in communicating and creating a dialogue with its customers to make them understand the importance of creating and sharing forecasts. By helping the customers to realize the mutual benefits of forecasts, Focal should try to encourage its customers to develop their forecasting procedures.

The supply lead time of three months on the other hand holds a greater potential for closing the gap between supply and demand. This argument is supported by the acting General Manager at Supplier X in 2012 who claimed that the lead time for "70-80 percent of the products sourced by Focal can be reduced"¹⁵. There have been little efforts by Focal to reduce the lead time from Supplier X, as the lead time has been viewed as set. However, as showed in the empirical findings, it is evident that the supply lead time of two months does not properly reflect the value adding time needed at Supplier X. Since Focal has not made any efforts to reduce the supply lead time this has resulted in that Supplier X has become used to having a lead time of two months, and without any pressure from Focal to shorten lead times Supplier X has not had any incentives to reduce it. This fact is exemplified in the empirical study where Supplier X is negotiating with their own suppliers to reduce the lead time from them, but the lead time reduction has not been transferred into a reduction of the supply lead time to Focal.

5.1.1 Recommendations

As discussed above, the main efforts to reduce the lead time, and hence reduce the lead time gap, should be put on the supply lead time. The following recommendations are focused on how to reduce the two months set lead time at Supplier X; the planning and procurement lead time as well as the production lead time.

Planning and Procurement Lead Time at Supplier X

A potential solution to reduce the procurement lead time at Supplier X is for Supplier X to start holding raw material and components inventory for products that are intended for Focal. Initially Supplier X could focus on storing raw material and components with the longest supply lead time. The production can then be initiated at an earlier point in time as there is no need to wait for the material with the longest supply lead time. Alternatively, Supplier X could stock common components and materials that are used in Focal's high volume and standardized products. By focusing on common components that are used within many products Supplier X minimizes the risk of stored components becoming obsolete. From a supply chain perspective this solution is beneficial as it does not only shorten the lead time, but is also less costly as components are held in inventory instead of in a value added form i.e. as finished goods inventory at Focal. However, if Supplier X were to start holding inventory designated for Focal it needs to be supported by a contract regarding inventory ownership and volume commitment by Focal.

¹⁵ Operations Director – Architectural Hardware Group (Acting General Manager at Supplier X in 2012), Focal Asia Pacific Division, 22th of April 2013

Supplier X is, as recommended by Bragg (2011), currently working with putting demands on shorter lead times from their suppliers. When this process is stabilized and the lead times shortened, the time savings should be transferred to Focal, hence reducing the supply lead time to Focal.

Production Lead Time at Supplier X

Regarding potential actions for reducing the one month production lead time, Supplier X should focus on identifying the root causes of waste during the production process. Quality problems are a major contributor to waste as it currently causes 15-20 percent scrap during the production process. As a result of that Supplier X tends to use over production to cover up for the scrap, larger batches are produced. Hence longer lead times in production are required. In order to solve the quality problem Supplier X should focus on educating the staff and define clear task descriptions for the different production processes.

Furthermore, Supplier X could accomplish a reduction of the production lead time by preventing the suboptimization of the different production lines. The major cause of the suboptimization is the fact that the team leaders do not follow the aggregated production plan and instead optimize their individual production line without consideration to the flow of the total production. This can be achieved by implementing more discipline and educating the team leaders to follow and understand the importance of the aggregated production plan. In this way the total production lead time can be reduced as a more efficient flow within the production can be achieved through synchronizing the different production lines.

5.2 Uncertainties

Focal has to cope with both demand and supply uncertainties. In turn, the company uses inventory as a buffer to reduce the impact of these two types of uncertainty. How the two types of uncertainties drive inventory, together with recommended actions to prevent inventory are presented below.

5.2.1 Demand Uncertainties

The life cycle of Focal's products can be regarded as relatively long as it is at least ten years for all products. The life cycle can therefore be considered as stable and thus does not cause high demand uncertainty. Focal is, on the other hand, subject to volatile demand, which causes high demand uncertainties. The demand fluctuations in combination with an unstructured approach by Focal to collect important customer information hamper the company's ability to estimate customer demand. This uncertainty hence affects the ability to make accurate forecasts, which in turn makes it difficult for Focal to purchase the right inventory. Furthermore, the demand uncertainty also drives safety stock levels at Focal. This as the supply chain team is measured by the amount of backlog and lost sales, and in turn purchases larger volumes to cover for demand uncertainties and prevent potential stock outs. These two KPIs hence drive higher safety stock levels.

The volatility in demand is a great challenge for Focal as it is spread across all customer segments. Even though the two major segments, commercial and residential, have different purchasing behavior they both affect demand volatility. The volatility by commercial customers is mainly caused by lumpy demand orders while residential customers contribute to volatility by impulse buying. The complexity of the problem is further enhanced as the different segments purchase all types of products. If Focal could relate certain customers to certain products and

hence isolate the demand uncertainty to a smaller scale, it would be easier for Focal to find solutions to the problem. As this is not the case today Focal is limited in their actions and continues to cover demand uncertainties with inventory.

Focal's limited ability to gain valuable information from their customers increases the demand uncertainty and the need for inventory. In the empirical study this unwillingness of customers to share information was in one way exemplified by Focal's largest retail customer refusing to share their forecast. At the same time that the customer expects that it can place orders with one day delivery time. Therefore, from Focal's perspective the customers' unwillingness to share information or lack of understanding the importance of doing so hampers the company's ability to reduce demand uncertainty. How the lack of cooperation with customers drives inventory at Focal is illustrated in Figure 19.

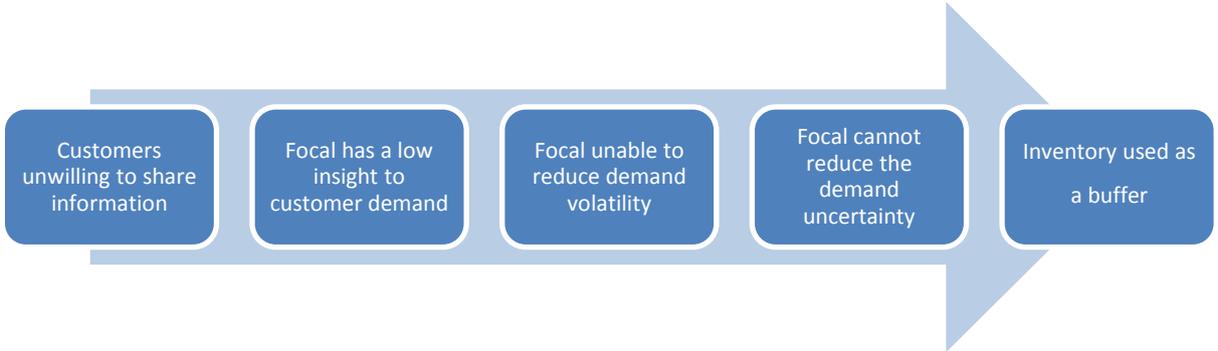


Figure 19. Focal's inability to reduce demand uncertainty drives inventory.

Recommendations

In order to reduce demand uncertainty Focal should work more closely with customers, create a better dialogue, and work to improve information sharing. Hence, through obtaining more reliable information from the customers the demand uncertainty can be reduced.

5.2.2 Supply Uncertainties

Supplier X causes supply uncertainties for Focal when their IFOT performance is 71 percent at the same time that 31 percent of the total amount quality related actions that Focal must undertake are caused by Supplier X. Since Focal does not want to give their own customers poor delivery performance Focal needs to hold a buffer inventory to cover for the capacity and quality issues at Supplier X.

Other factors increasing the supply uncertainty is the low visibility and limited information sharing between Focal and Supplier X. The fact that Focal does not have a standardized feedback process regarding Supplier X's supplier performance is one example where the communication between the two parties is lacking. Both parties are measuring the IFOT performance. However, as they are using different definitions and do neither discuss the measures or goals regarding future performance, Supplier X is not encouraged to improve. With no formal feedback process Supplier X has low incentives to improve, limiting the possibilities to reduce supply uncertainties.

The lack of visibility and information sharing has also resulted in that the parties do not trust each other. For example, employees at Focal feel that Supplier X tends to communicate delays too close to the actual delivery date. This tendency makes Focal less prone to trust that Supplier

X will fulfill their commitments. As Focal does not trust Supplier X to deliver defect free products on time, Focal uses inventory in order to create a buffer to cover for the supply uncertainties. Hence, the supplier uncertainties are directly driving increased inventory levels. The negative effect that supply uncertainties have on Focal's inventory levels is illustrated in Figure 20 below.

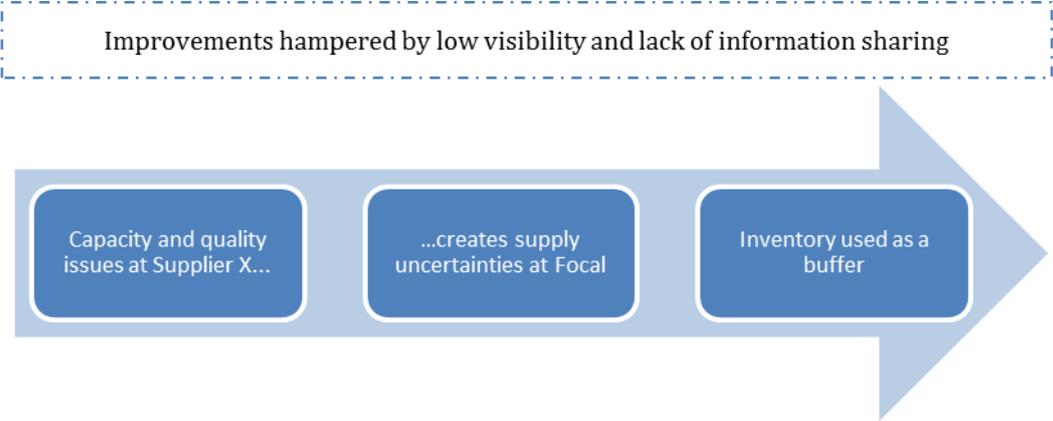


Figure 20. Supply uncertainties create a need for inventory at Focal.

Recommendations

Trust, communication and visibility in the supply chain are key in order to reduce supply uncertainties. By communicating and using transparent information sharing all members in the supply chain can at an earlier stage be notified about discrepancies and take preventive actions. Furthermore, the parties should aim to work more closely regarding measuring Supplier X's performance. It is essential that the parties have a shared definition of the measurements and that Focal establish a feedback process to create incentives for Supplier X to improve. It is also essential that Supplier X works to fulfill their commitments in terms of IFOT and quality performance so that trust between the parties can be developed.

5.3 Forecast

As Focal is dependent on forecasts when purchasing, the accuracy of the forecasts have a major impact on the inventory performance. The 44 percent forecast accuracy for PTS items, considered by Focal as poor performance, leads to both stock outs as well as excess inventory. This as Focal has a set limit that an inventory to a value of maximum ten percent of the annual sales volumes can be kept. The set level limits the size of the inventory but also complicates inventory management due to the inflexibility it entails. If the forecast is inaccurate, the possibilities to make up for earlier mistakes are hampered by the limitations on inventory levels. An example of implications caused by this inflexibility is the fact that Focal's amount of lost sales was 48 percent above target in January 2013, while slow moving and obsolete goods at the same time was 150 percent above the target level. Hence, slow moving and obsolete goods accounted for a substantial part of the inventory which could be used more efficiently by storing goods that were needed during that time period. Hence, low forecast accuracy does not only lead to purchasing difficulties, in combination with Focal's restrictions regarding inventory levels it can also result in wrong inventory at the wrong time.

During the empirical study several factors contributing to the unsatisfying forecast accuracy were identified. One factor is that the three month supply lead time demands that Focal forecasts on a SKU level far ahead of actual demand. The time gap makes it difficult to create a forecast on a detailed level, as discussed by Christopher (2010).

Other contributing factors that were discovered during the interviews are that there is a lack of clear responsibilities and standardized processes for how and what market intelligence that should be collected in order to adjust the system forecast. This results in that information from many customers is never collected or that the appropriate adjustments are not made. The information that is collected by the sales personnel is filtered by the Product Managers before adjustments are made, and there is thus a risk that information is lost on the way. The process is hence highly people dependent and the accuracy of the forecast will depend on the persons involved in collecting the data and making appropriate adjustments. A negative effect of this is that the accuracy of the adjusted final forecast currently is not better than the accuracy of the system forecast.

5.3.1 Recommendations

The forecasting process must become more standardized in order to reduce the people dependency that the current process has. Furthermore, the division of responsibilities must thus become clearly defined.

It is also important to improve the quality of the input since the forecast accuracy is highly dependent on the input data. The quality of the quantitative data is high, but the qualitative data, the market intelligence, does however have more variability. To improve the quality of the market intelligence Focal firstly need to start communicate more and in a more standardized form with its customers. By increasing and standardizing this communication information about for example future sales or projects can be noted earlier. The standardized process for meeting with customers should consist of guidelines regarding what information to collect on a regular basis and how to document and communicate this information to the persons responsible for adjusting the forecast. Through working in a more standardized way Focal can ensure that information does not get lost on the way. Another way for Focal to attain more reliable input is to encourage customers to improve the forecast accuracy of their forecasts and to share these forecasts with Focal on a continuous basis.

Another way to work to facilitate the forecasting process is to try to reduce the supply lead time. Purchase orders can then be placed closer to the actual demand, which enables Focal to collect more accurate market intelligence before making the forecast. Ways in which this can be achieved is discussed in section 5.1.1.

5.4 Lack of Coordination and Information Sharing

Focal struggles with lack of coordination and information sharing internally, within its organization, but also externally in the supply chain with Supplier X. The result of this is that some functions have to base decisions on inaccurate or insufficient information. These inaccurate decisions lead to purchasers replenishing the wrong inventory. Focal's current behavior hence requires the company to hold unnecessary inventory to cover for uncertainties and inefficiencies due to the risk of faulty decisions. Hence the lack of coordination and information sharing hampers Focal's ability to improve the inventory management.

5.4.1 Lack of Internal Coordination and Information Sharing at Focal

A gap between accountability and responsibility for inventory management undermines Focal's ability to improve the efficiency of inventory processes. As described in the empirical section, the supply chain department is responsible for KPI's regarding inventory performance. However, some functions and people who are responsible for critical decisions regarding

inventory management, which directly affect inventory levels, are working in other departments and are measured by other KPI's. It is therefore a risk that inventory management issues will not be prioritized and that departments actually work against each other since they work towards different goals. Lack of coordination and conflicting KPI's hence leads to suboptimization within Focal which drives inventory levels.

Product Managers, for example, have the authority to decide which products that should be retained and which to phase out, as they continuously review their product portfolio. Since the Product Managers currently are not accountable for slow moving and obsolete inventory they have low incentives to focus on inventory reduction. Instead there is a risk that they will prioritize to keep the product range in order to keep their customers satisfied. The result of this can be seen in that the amount of slow moving and obsolete inventory is 150 percent above the target level; hence slow moving products that should be phased out are still retained. At the same time the Product Managers focus their efforts on their core activity which is new product development. By focusing on their own KPI's and not prioritizing SKU reduction there is a risk that the number of products actually keeps increasing, adding to the complexity of managing the inventory by increasing the product range. Hence, the lack of connection between responsibility and accountability, and the partly conflicting KPI's, affects the inventory levels.

Another example of the gap between accountability and responsibility is the sales departments lacking incentives to continuously provide valid information to the forecasting process. This can be explained by the fact that the sales team is driven and measured by sales and margin growth and not forecast accuracy. Therefore, their incentives to put effort into gathering market intelligence are relatively low since they are not measured on the outcome of the information gathering. The sales team are neither directly affected by the consequences of a poor forecast. As they are not measured on what can actually be delivered, i.e. they are not accountable for backlogs and lost sales.

The negative effects of lack of coordination and conflicting KPI's is also evident as the sales team approves large customer orders which are not accounted for in the forecast, i.e. lumpy demand, without verifying with the purchasing department that inventory is available. If the inventory is withdrawn for the lumpy demand order this will become problematic for Focal as it leads to stock outs for other customer orders, with backlogs and lost sales as a result. The sales department has yet again low incentives to prevent this problem and change their behavior since they are not accountable for these KPI's. However, this is causing large problems for the supply chain team since this behavior increases the backlogs and lost sales, which are KPI's that the supply chain team are measured by. The behavior requires the company to hold a certain safety stock to cover for uncertainties and inefficiencies due to the risk of faulty decisions. This example shows again how the different objectives within the organization and lack of transparent information sharing and coordination lead to decisions causing poor inventory performance.

Recommendations

Firstly, Focal needs to implement processes that encourage coordination and information sharing across all departments to hinder the need of making decisions based on lacking information.

Secondly, Focal needs to review what functions and/or departments to be accountable for KPI's respectively responsible for actions to manage the inventory. By defining clear roles and responsibilities, incentives to start working more proactively to manage inventory can be achieved. Furthermore, Focal needs to set and implement aligned goals within the organization in order to ensure that KPI's are not conflicting and causing suboptimization within individual departments. All departments need to understand their own role in relation to each other and how their decisions affect the performance of other departments. They also need to understand how their decisions are affecting the overall inventory performance of Focal. By working more proactively and foreseeing potential issues, inaccurate decisions regarding inventory can be prevented.

5.4.2 Lack of External Coordination and Information Sharing with Supplier X

Focal's lack of coordination and information sharing is not only an internal issue. This is also a current problem that exists externally in their relationship with Supplier X. As a result of lacking communication with Supplier X, Focal needs to carry more inventories to cover for inefficiencies and uncertainties within the supply chain. Lack of coordination and information sharing with Supplier X is hence considered to be a major driver of inventory at Focal. Figure 21 below summarizes how the current situation with a lack of coordination and information sharing with Supplier X drives inventory at Focal.

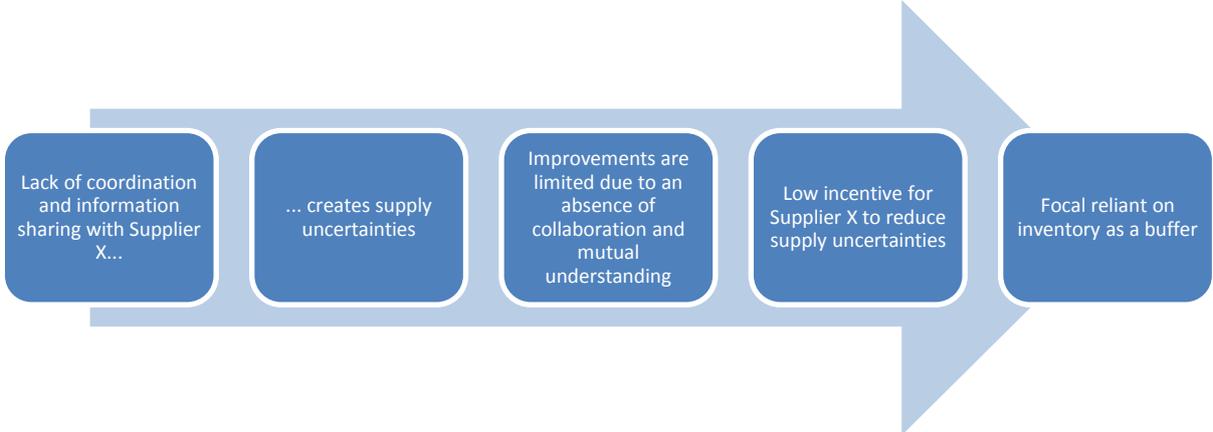


Figure 21. Lack of coordination and information sharing with Supplier X drives inventory at Focal.

One example of the lack of coordination and communication in the supply chain is that Focal does not communicate any expectations for, or results of, Supplier X's performance. The IFOT of 71 percent is regarded as low by the employees at Focal. However, due to the lack of feedback from Focal, Supplier X is unaware of this and therefore has low incentives to improve their performance. The same applies for Supplier X's quality performance, where the supplier stands for 31 percent of all quality related actions that Focal has to undertake, which is relatively high considering that Supplier X only stands for 24 percent of the spend.

Furthermore, Supplier X tends to communicate problems regarding delivery, such as delays, very late close to the planned delivery date. This problem, which Focal's employees perceive as recurrent, affects Focal's trust in Supplier X. If Focal does not believe that they can rely on Supplier X to deliver as agreed, there is a possibility that Focal tends to purchase extra large shipments to cover the risk of any problems. Poor communication may hence trigger higher inventory.

Focal does currently not treat Supplier X as an important supplier. This limits Focal's ability to improve the external coordination and information sharing in order to develop the inventory performance. Due to that Supplier X is not treated as an important supplier the company has low incentives to improve their behavior; causing uncertainties in the supply chain.

Recommendations

In order to improve the inventory performance of Focal's supply chain with Supplier X both parties need to set aligned goals that contributes to inventory performance improvements. Creating more visibility in the supply chain by sharing more information with Supplier X is also important in order for Focal to accomplish improvements. However, transparent information flows between Focal and Supplier X requires a collaborative environment between the two parties. In order for Focal to facilitate a collaborative and open relationship with Supplier X the company needs to, in alignment with Christopher (2010), treat Supplier X as a strategic supplier and build a relationship based on trust and cooperation. In order to build a strategic relationship both parties have to invest required resources and commit to the relationship on a long term basis. If Focal can establish a closer relationship towards Supplier X, Focal will be in a better position to reduce supply uncertainties and hence reduce inventory.

5.5 Service Level

When analyzing inventory at Focal there are two service levels that are of importance; the 95 percent service level for all finished goods and the 100 percent service level for raw material and components inventory. These two service levels become a large driver of inventory at Focal as the service level is high and generalized for all products.

To be able to ensure a 95 percent service level for all stocked products, Focal needs to store fast moving as well as slow moving goods. In combination with the set limit of a maximum of ten percent of annual sales tied up in inventory, the high generalized service level contributes to limit the wiggle room of managing the inventory.

To exemplify, by keeping a high service level of 95 percent on slow moving stock, the risk of holding too high as well as the wrong inventory increases. 16 percent of the finished goods inventory barely moves and have an inventory turn-over rate of 279 percent below averaged target level for total inventory turnover. Even though these slow moving items only make up five percent of sales they make up 16 percent of the finished goods inventory, hence increasing inventory levels. This inventory furthermore occupies part of the maximum permitted inventory value, and since it barely moves it limits the flexibility of the inventory. This may lead to a vicious spiral with backlogs and lost sales of other more fast moving goods which volumes cannot be increased due to the value limit of allowed inventory on hand. Besides the fact that the slow moving inventory hinders the flexibility of the inventory, it also adds to the total cost of holding inventory.

The 100 percent service level for raw material and components creates a large complexity in managing the inventory. Every time the factory needs material it should be available directly in the warehouse. Whereas the major part of the material sourced has a lead time of three months. This vast lead time gap forces Focal to depend upon the forecast when ordering material, which in turn increases uncertainties. The situation forces Focal to use high safety stock levels to cover for the lead time gap and enable the company to meet the 100 percent service level to the factory. The high service level combined with the lead time gap are major contributors to the

raw material and components inventory constituting 38 percent of the total inventory. Finished goods inventory, with refined goods, constitutes 52 percent of total inventory value. If this distribution is reasonable or not is questionable as raw materials and components takes up a relatively large proportion of the inventory volume value even though it is not refined goods. The generalized high service level for raw material and components is hence a contributing factor to high inventory levels. Besides driving inventory levels, due to the inflexibility of wiggle room regarding inventory levels described above, this high service level also entails a risk of Focal holding the wrong inventory at the wrong time.

5.5.1 Recommendations

By differentiating the service level for finished goods, with a higher service level for fast moving goods than slower moving items, Focal could be able to reduce the capital tied up in inventory. By differentiating the service level the percentage of inventory held in slow moving goods could be reduced, and capital could hence be freed up and used to purchase inventory that the customers demand, thus ensuring more of the “right” inventory. The ABC-classification that is currently being used within the company can be used to decide for which items that the service level should be reduced. The classification must also be reviewed continuously to ensure that the items are correctly classified to see if the service level should be adjusted again.

Focal’s customers are used to the current service level so the company must however evaluate how a reduction in the service level would affect customer satisfaction. The trade-off between the cost reduction that can be achieved and the effect on customer satisfaction need to be considered.

The 100 percent service level for the raw material and components inventory could also in theory be differentiated. However, the lead time of three months combined with the fluctuating customer demand makes it very complex to differentiate service level without risking to disrupt production. If the material is not in place the production will be hindered. It is thus important that a potential differentiation of the service level is carefully planned so that the production is not delayed. As 23 percent of the raw materials and components inventory is slow moving, this inventory provides a good starting point for differentiating the service level.

5.6 Product Range

The broad product range is a large competitive advantage for Focal as no competitors are able to offer the same amount of product options. The interviews did however indicate that the width of the product range is also one of the company’s largest weaknesses. This as it demands that the company holds a large number of different products in inventory. It also makes the forecasting more complex, as discussed in section 5.3, and therefore makes it harder for Focal to ensure that the right inventory is kept. The large number of product options also makes the total production time longer as it takes time to set up the machines; a difficulty that both the local factory at Focal and the factory in Supplier X are struggling with. The broad product range will hence lead to increased inventory levels. But it will also affect the ability to hold the right inventory by driving longer lead times and complicating the forecasting process. The strengths and weaknesses of Focal’s broad product range are summarized in Figure 22 below.

Strengths	Weaknesses
<ul style="list-style-type: none"> ▪ Superior customer offer ▪ Competitive barrier 	<ul style="list-style-type: none"> ▪ Creates forecast complexity ▪ Increases total production lead time ▪ Brand confusion ▪ Product cannibalization ▪ Increases inventory complexity

Figure 22. Strengths and weaknesses of Focal's broad product range.

The need for the broad product range to satisfy customer demands can however be questioned. Since the company offers a broad product range including many brands there is a risk that these brands cannibalize on each other. Hence, the same amount of sales could be achieved with a smaller number of product options, which would in turn imply a decreased need for inventory in stock.

A problem identified in the empirical study is that the targets for new product innovations are met, while the targets for SKU reduction are not. One reason for this is that the Product Managers are more focused on new product development than on phasing out products. The result of this is that the product portfolio keeps increasing, and thus drives higher inventory. This lack of focus on SKU reduction is a contributing factor to the high amount of slow moving and obsolete inventory that Focal has today, i.e. 150 percent above target.

5.6.1 Recommendations

The high rate of innovation is an important part of Focal's strategy, but the rate of innovation must be matched by a reduction of the number of SKUs to ensure that the costs for inventory does not become too high. The importance of SKU reduction must therefore be stressed among the Product Managers to ensure that the task receives higher priority. A review of the SKU reduction process should also be performed to see where improvements can be made to make the task easier for the Product Managers.

In order to reduce the needed inventory Focal should review the need for the high number of SKUs that they offer their customers. The interviews performed at Focal indicated that the customers sometimes feel more confused when they have many different colors to choose from. Therefore, one place to start is by reviewing the necessity of all different color options. This is strengthened by the fact that the company still offers colors that were popular 15 years ago but now are slow moving. Hence, it is important to review what the customers actually demands in order to make informed decisions and avoid continuing with the broad product range just due to old habits.

5.7 Interdependence Between the Drivers of Inventory

In the previous sections of this chapter, the factors driving inventory within Focal's supply chain have been analyzed individually. But in alignment with the analytical framework used within this study, described in chapter 3.4, all factors are interdependent. Therefore, the factors affect inventory both directly, by individually driving inventory levels, but also indirectly by affecting other factors. Hence, the factors will amplify the effect of each other and thus further drive

inventory. This dependence amongst the factors also implies that actions to reduce the effect of each individual driver will have an impact on other factors as well.

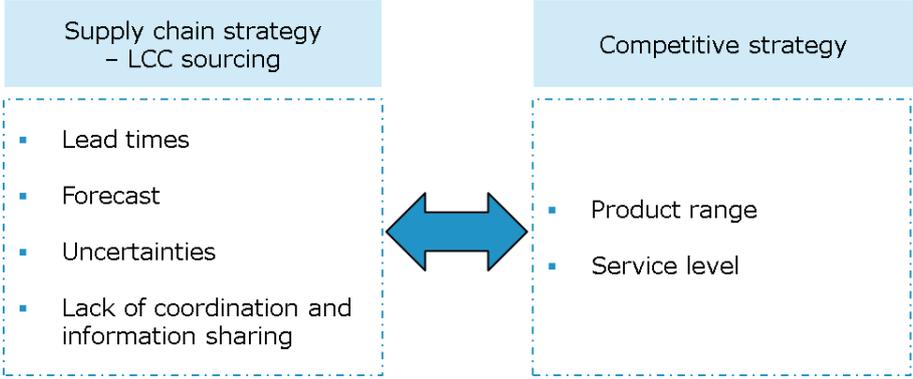


Figure 23. The two clusters of factors driving inventory.

The factors driving inventory within Focal’s supply chain can be divided into two clusters; one group of factors which are influenced by the supply chain strategy of Focal, and one group of factors which are correlated to the firm’s competitive strategy, see Figure 23 above. Focal’s supply chain strategy of LCC sourcing is directly affecting the four factors; lead times, forecast, uncertainties and lack of coordination and information sharing. The competitive strategy of the firm includes the broad product range together with high service levels towards customers, factors that in combination amplifies the effect on inventory levels. Within these two clusters, the factors are strongly interrelated, but the two clusters also have a considerable influence on one another. These sets of factors and their correlation will be analyzed in the two following sections.

5.7.1 Effects of the Supply Chain Strategy

When the drivers of inventory have been analyzed individually, a connection between four of the drivers (lead times, forecast, uncertainties, and lack of coordination and information sharing) and the use of LCC sourcing has been identified. Firstly, Focal’s use of a LCC sourcing strategy entails longer supply lead time partly due to the geographical distance, but also due to the suppliers working procedures. Secondly, LCC sourcing affects, partly due to the increase in lead time, the uncertainties of the supply chain. Furthermore, Focal’s dependency on the accuracy of the forecast has increased together with difficulties in coordinating operations within the supply chain. The use of a LCC sourcing strategy and the effect that it has on these four drivers of inventory has locked Focal into a pattern of events that trigger each other, and the company is hence stuck in a vicious circle, see Figure 24.

The three month supply lead time can be viewed as the starting point of the vicious cycle. The circle keeps continuing due to the limited collaboration and a lack of coordination within the supply chain, see Figure 24 below. The lead time of three months for goods sourced from Supplier X forces Focal to place orders at least three months ahead of actual demand. When making purchase orders this early in time, the order is made based on the forecast, and the purchasing department is dependent upon the forecast. However, at this point in time, the forecast accuracy is at an unsatisfying level since it is compiled several months ahead of actual demand and the uncertainties regarding future demand are high. These uncertainties in combination with the low forecast accuracy leads to that Focal does not dare to commit to any volumes ahead in time, and therefore only make firm purchase orders.

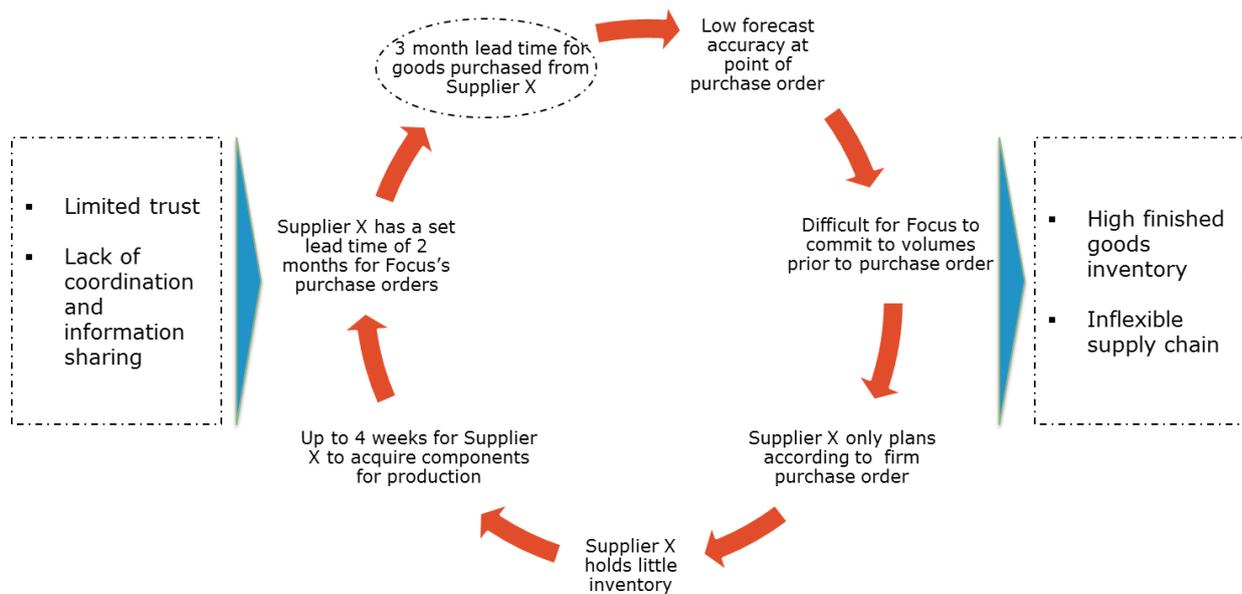


Figure 24. The vicious circle.

Due to the low forecast accuracy, the lack of commitment of volumes from Focal prior to a firm purchase order, and as a result of the corporate culture in China, Supplier X does not initiate their procurement and production before they receive a firm purchase order from Focal. Supplier X furthermore holds very limited amounts of raw material and components inventory. The effect of this is that it takes on average one month to purchase materials, and the production can hence not start until one month after the firm purchase order is made. The short term planning at Supplier X leads to that the lead time for production of goods is set at two months, then another month for transportation. Hence, the vicious circle continues. Due to the lack of cooperation and coordination Focal and Supplier X are trapped in this vicious circle which will continue unless actions are undertaken.

5.7.2 Effects of the Competitive Strategy

The broad product range and high service level are both parts of Focal's competitive strategy. Having a broad product range requires Focal to hold a large number of products in inventory. In addition to this the high service level for all products further enhances the required inventory. The two factors hence jointly amplifies the necessary inventory levels, see Figure 25 below.

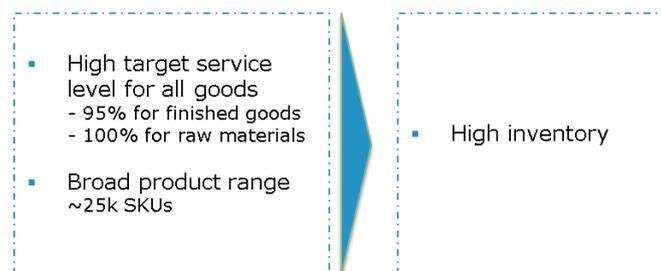


Figure 25. The service level and product range jointly affect inventory levels.

5.7.3 The Impact of the Combined Strategies

The above analysis shows that both the chosen supply chain strategy and the chosen competitive strategy drives inventory individually. However, the combination of the two strategies also

further drives inventory. Focal’s supply chain strategy and competitive strategy should in accordance with Chopra and Meindl (2013) be aligned in order to support the supply chain performance and ensure its efficiency. However, as they are constructed today, these both strategies are not fully aligned and incompatible with keeping low inventory levels.

The competitive strategy of a broad product range and high service level increases the complexity of Focal’s supply chain and affects several other factors driving inventory. As an example, the broad product range leads to that it becomes more difficult to forecast demand. The vast number of products, variants, and colors implies a need of forecasting on a detailed level, which is more difficult than forecasting on a more aggregated level. Furthermore, the broad product range increases the demand uncertainties as customers can choose between many different product variants, hence increasing the variation in demand. When sourcing the goods, the broad product range also increases the lead time at Supplier X. The mix of producing different variants, large and small volumes, and different colors entails long set up times whereby the total lead time increases. To summarize, the product range affects several other drivers of inventory, such as the forecast, uncertainty and lead time, which enhances the effects of the driver's impact on inventory levels. The interconnection between the two clusters of drivers is illustrated in Figure 26 below.

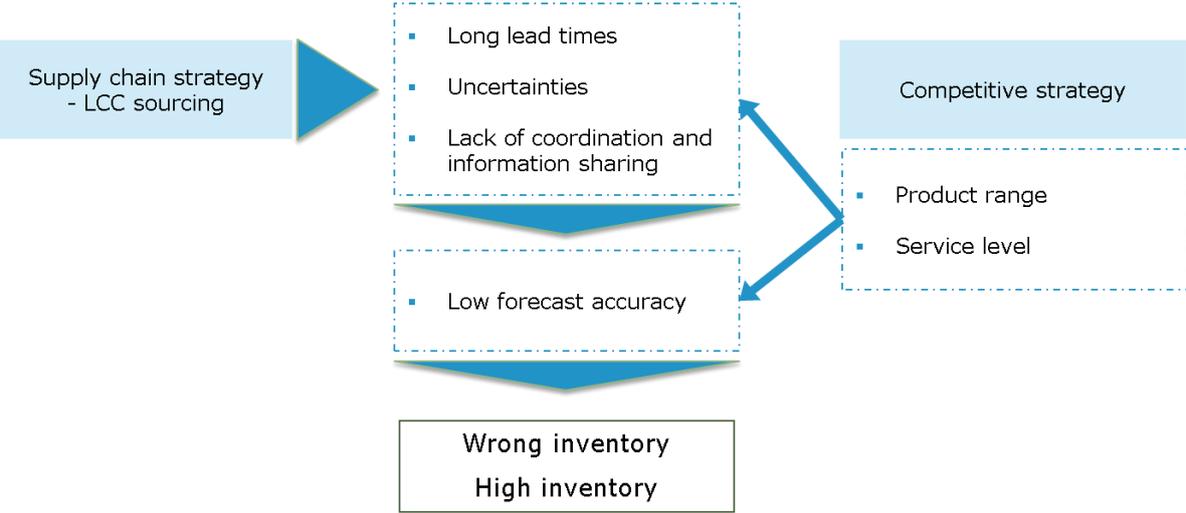


Figure 26. The joint effect of the two clusters on inventory performance.

5.7.4 Actions to Reduce Inventory are Interconnected

Although the factors can be targeted separately, actions to reduce the impact of the factors will influence other factors as an effect of their interdependency. Therefore, when planning how to reduce the impact of the drivers it is important to consider what factor to focus on in order to achieve the highest positive impact on inventory performance. The understanding of how the drivers and actions to resolve their impact are interdependent is hence essential in order to determine where to focus actions for improvement.

6 Discussion

In this chapter, the purpose of the thesis to evaluate how Focal's LCC sourcing strategy in combination with its competitive strategy affects its inventory performance, in order to provide suggestions of how to improve the performance will be discussed. It is followed by a discussion regarding the feasibility and prioritization of the recommended actions that Focal initially should undertake. Thereafter, a discussion of the analytical framework follows, as well as two sections describing the study's contribution to the academia and topics for further research.

6.1 Purpose

Aiming to reduce costs, Focal has, as many other companies, followed the trend of increasing LCC sourcing. However, as mentioned by among others Fredriksson and Jonsson (2009), LCC sourcing does not only imply cost reductions but instead a redistribution of costs. This research shows that Focal is no exception from the crowd, and that the company is experiencing an increase in tied up capital affecting both the cost and complexity of managing the inventory. By changing the supply chain strategy but retaining the competitive strategy (of a broad product range, with a high service level and short delivery time), new challenges have arisen as a result. As mentioned by Chopra and Meindl (2013), it is important that the strategies support each other to obtain what they call a strategic fit. This research has however shown that there is not a strategic fit between Focal's supply chain and competitive strategy. This causes a lead time gap, which needs to be covered with inventory, hampering efficient inventory management. It can therefore be concluded that Focal's reality coheres with what has been seen in theory and discussed by Christopher (2010).

As the combination of two strategies trigger the use of inventory, Focal has to, as suggested by Chopra and Meindl (2013), align the strategies better in order to facilitate inventory performance improvements. According to the authors a strategic fit can be accomplished by adapting the supply chain strategy, in this case Focal's LCC sourcing strategy, to its competitive strategy. However, in Focal's case this is a major challenge as the decision to use a LCC sourcing strategy has been taken on a corporate level and is considered as fixed.

To reach a strategic fit Focal could instead focus on changing the competitive strategy. The new lead times of sourced goods would not be a large issue if customers could accept a longer delivery lead time so that for example sourced products could be purchased based on customer orders. Such a change of the customer offer would imply that the two strategies are more aligned, and the complexity regarding holding right inventory would decrease. However the reality is that it is not easy for Focal to make such a major change in their competitive strategy without harming the customer satisfaction. There is hence a trade-off between the costs of holding inventory and the risk of losing customers. It can therefore be questioned if changing the competitive strategy to reach a better strategic fit will give the sought benefits. For Focal to justify a change in the competitive strategy the sought benefits have to have a larger pay-off than keeping the strategies as they are today. We therefore want to highlight the importance for Focal to balance their goals of supply chain efficiency and responsiveness to customers, and strive to make changes that have a positive impact on the supply chain as well as on customer satisfaction. The changes that the company can make to its competitive strategy therefore have to be of a more incremental nature.

As mentioned earlier, the two strategies are more or less fixed, as the supply chain strategy is decided on a corporate level and changing the competitive strategy will be met with resistance

from Focal. However, it is in this research important to point out that even if the literature advocates changing strategies to become fully aligned, this may not be possible for Focal. With the strategy combination Focal has today the company is able to be very profitable in spite of the lacking strategic fit. The strategies they have today results in lower production costs while remaining responsive to customers, which in turn enables them to be very profitable. However, as Focal works on a mature market, the company cannot keep on performing business as usual, and rely on sales to keep its profitability. In order for Focal to stay competitive the company therefore may need to shift their focus towards, in alignment with van Weele (2010) and Bengtsson et al. (2005), cost savings within the whole supply chain. An essential part in this cost reduction is hence to learn how to efficiently manage the inevitable inventory. Therefore it may in Focal's case be better to accept the lack of strategic fit and instead of changing the direction of the strategies, focus on making them more efficient. In this way measures to improve the inventory performance can still be accomplished.

Another important reflection Focal should consider is that their main focus should be to ensure that they have the right inventory on hand when it is needed rather than focusing on only reducing inventory levels. In the initial stage of the project Focal wanted to find ways to reduce inventory levels. However, as this project progressed it became clear that ensuring the right inventory should be the main goal, as the company struggles with excess inventory, backlogs and lost sales at the same time.

6.2 Recommended Actions

Focal must find and solve the root causes of inventory in order to improve the inventory performance on a long term basis. The analysis contains a number of recommended actions that Focal can undertake in order to reduce the effect of the six identified drivers of inventory. However, it is not efficient to approach all factors individually as this will require too many actions to be implemented at the same time and demand a large amount of resources. Instead, Focal needs to prioritize and choose a number of feasible actions to focus on.

Since the factors have appeared to be interdependent, actions to improve one factor will also affect other factors. Therefore, it is important to carefully consider what factor to prioritize in order to achieve the best result. As discussed in the previous chapter, the factors can be divided into two clusters affected by the LCC sourcing strategy and the competitive strategy respectively. These two clusters of factors need to be approached in order to affect the overall inventory performance of Focal. How to affect the factors within these two areas will be discussed below.

6.2.1 Breaking the Vicious Circle

To reduce the impact that LCC sourcing has on inventory levels, the vicious circle, described and illustrated in Chapter 5.7.1, Figure 25, needs to be broken. This circle of activities that do not favor the development of the supply chain's efficiency is continuing since the parties, Focal and Supplier X, are not engaging in trying to break the pattern. Instead, both Focal and Supplier X are currently suboptimizing their own operations without looking at what would benefit the whole supply chain. However, since both companies are a part of the Focal Group it should be in their interest to increase the cooperation and improve the overall supply chain performance. Furthermore, since the parties are important actors for one another, both parties have good incentives to deepen the relationship with each other. Therefore, by developing a strategic relationship the incentives for breaking the vicious circle are increased.

By building trust and mutual understanding for one another, Focal and Supplier X can develop their relationship and start cooperating to improve the efficiency of their shared supply chain. Both parties need to create an understanding of the importance of addressing the drivers of inventory, and how this can result in benefits for both parties. In this way incentives to jointly break the vicious circle can be created. Therefore, the first step in breaking the vicious circle is to develop a strategic relationship in order to create incentives for Focal and Supplier X to perform joint actions to improve the supply chain performance. This recommended development of the relationship is in line with the trend of partnership alliances that Christopher and Lee (2004) advocates.

We believe the second step to break the vicious circle should be to jointly start approaching the drivers of inventory. The shared actions can be initiated in several ways. Based on the previous analysis of each factor, lead times is identified as a driver with high impact on inventory levels as well as on other factors, but also as a factor with high potential for improvement. Hence, to break the vicious circle, we suggest a focus on reducing the supply lead time as illustrated in Figure 27.

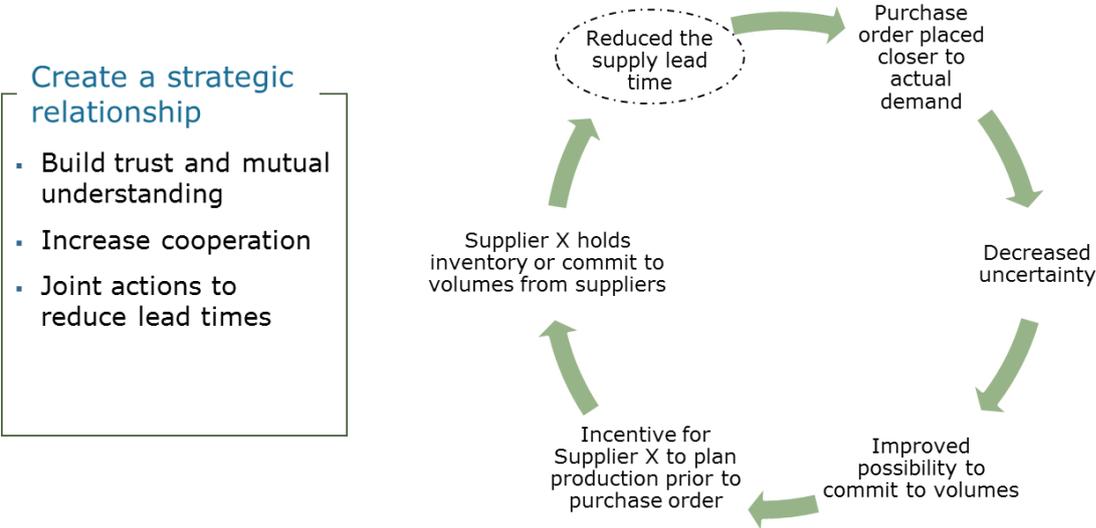


Figure 27. Breaking the vicious circle.

By reducing the supply lead time, Focal can place orders closer to actual demand. Hence, demand uncertainties decreases as well as the dependency on the forecast. The potential for increased forecast accuracy is also increasing since the time horizon is shortened. With a more accurate forecast and reduced uncertainties, the possibility for Focal to commit to volumes increases. Supplier X hence gets larger incentives for planning purchasing and production before firm purchase orders are made. This will in turn further enable reduction of the supply lead time, and the parties will instead be in a circle of beneficial events. For concrete suggestions on how the supply lead time can be shortened, see section 5.1.1 Recommendations.

Regarding the supply lead time reduction most of the responsibility is put on Supplier X. It is Supplier X that must implement most measures, like for example start holding raw material and components inventory as well as start planning on a more long term basis. However, since Supplier X, in alignment with Lang’s (1998) description of Chinese businesses, is working on a more short term horizon, the firm may be reluctant to perform the needed changes. Since there is no existing long term planning at Supplier X it can be difficult to convince them to start

keeping raw material and components inventory as it would increase their costs. The Focal Asia Pacific headquarters may therefore have to stress the benefits of holding raw material and components inventory at Supplier X, instead of a large finished goods inventory at Focal, in order for Supplier X to start holding inventory for Focal. Hence, in order to achieve action, and increase the efficiency of the supply chain between Focal and Supplier X, the headquarters involvement may be required.

6.2.2 Reduce the Complexity Caused by the Competitive Strategy

Focal cannot only depend upon Supplier X to reduce lead times in order to improve Focal's overall inventory performance. The firm also needs to put some efforts in cleaning up their own yard before they are entitled to make demands on Supplier X. Therefore, Focal needs to work to reduce the impact the competitive strategy has on inventory levels.

However, the second cluster of factors driving inventory, related to Focal's competitive strategy, are maybe more difficult to approach. This since the broad product range and high service level are both core features in Focal's competitive strategy. Suggestions to change a successful customer offer that is currently profitable will probably meet resistance among top management at Focal, who are scared of what a change may entail. However, since these factors contributes to increased inventory levels, not least by complicating the execution of the supply chain strategy, it is essential to at least review them. Therefore, we recommend Focal to review the necessity of the broad product range as well as the necessity of the generalized high service level. By reviewing these factors Focal can attain a deeper knowledge about what customers actually value as important. Moreover, at an initial stage it may, as earlier discussed, be difficult to change the product offer and the generalized service level at the same time. As it has been shown that the broad product range offered today contributes to brand confusion and product cannibalization, this factor may therefore be more appropriate to start with.

Furthermore, Focal should also review their internal KPIs and goals so that actions of different departments are not conflicting. It is also important to clarify roles and responsibilities regarding inventory management. These actions will demand resources, which might be met with resistance within the organization. The suggested change is however probably easier to implement than changing the competitive strategy as it is in alignment with existing strategies and helps to uphold the customer satisfaction by improving the internal processes at Focal.

6.3 Analytical Framework

The presented analytical framework consists of six factors that drives inventory individually but also together, as they are interdependent, see Figure 28 below. This framework was created during an iterative process where theory was compared with the findings from the case study; an approach that has helped to ensure that the framework is usable in practice.

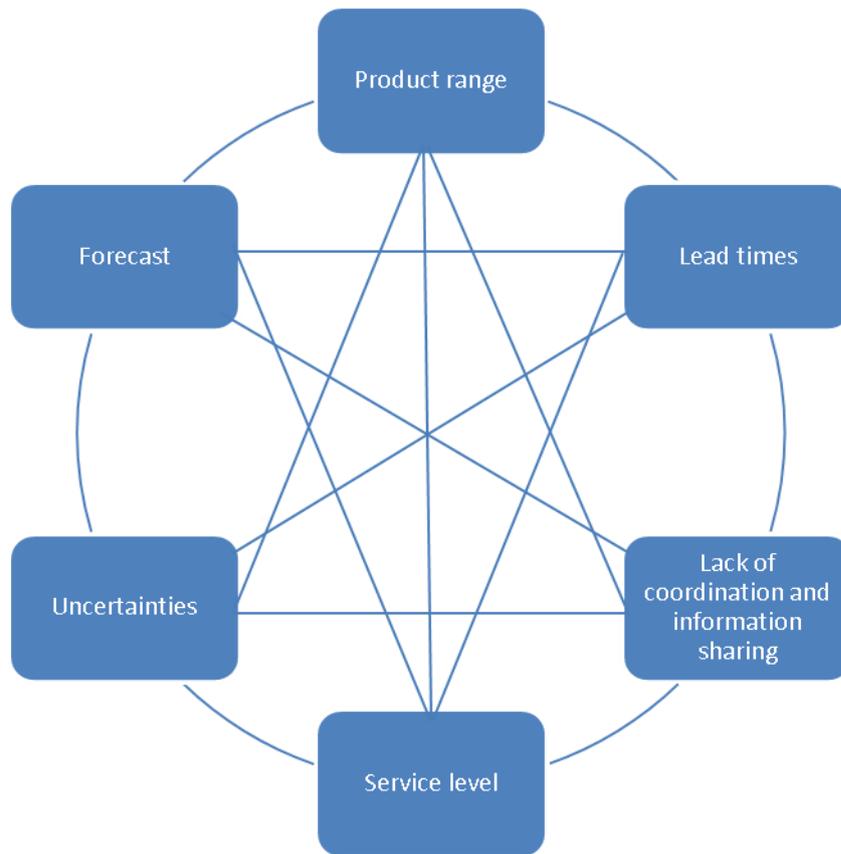


Figure 28. The six interdependent drivers of inventory.

Within the academia, different authors focus on different factors as main drivers of inventory. Christopher and Lee (2004) do for example discuss how uncertainties in the supply chain create a need to build buffers of inventory, and Kahn (2003) covers how poor forecasting leads to excess inventory. However, during our research, we noticed that whatever factor that was defined as the main driver, that factor would in turn affect several other factors. Hence, the drivers appeared to be interrelated. This finding made us chose to broaden our perspective, and create a tool without a predetermined direction enabling us to approach the case study with an open mind. This approach resulted in the analytical framework emphasizing not only individual factors driving inventory, but also the interdependence between these factors. As we were unable to find literature that emphasized the interrelation between all the identified drivers of inventory, we chose to create a more holistic framework. The framework hence takes the interdependency of the factors into account, see Figure 29 above.

The model is thus a combination of what is mentioned in theory and findings from the case study. Therefore, the analytical framework is adapted to our specific case study which reduces its generalizability. However, we believe that what is most valuable with this framework is its simplicity to use, its broad perspective, and its concept of emphasizing the interrelation between different factors driving inventory. These features of the framework are generalizable.

However, to use the framework, it is important to adapt the individual factors to the situation which is intended to be explored since these factors are somewhat unique for each specific case. The factors are, as revealed in the analysis, strongly linked to the supply chain strategy and the competitive strategy of a company. Therefore, the appearance of the framework is also influenced by the strategy used by the organization that is to be investigated.

6.4 Contribution to the Academia and Supply Chain Practitioners

This study has been conducted focusing on the case study of Focal's supply chain. However, this research is investigating a problem area which is common among firms sourcing from low cost countries. The analytical framework created in this study is therefore believed to be useful on a more general level, to be applied when investigating other sourcing companies. The analytical framework is created to be a simple tool to use to structure data collection, and is in this study consisting of six interdependent factors driving inventory. The tool can as mentioned earlier be adjusted, and factors can be changed, withdrawn or added to suit the situation under investigation. Due to the flexibility of the framework and the generalizability of the investigated phenomenon, the tool is hence believed to be usable for other firms or the academia when investigating inventory performance.

This study also contributes to increasing the understanding of the implications on inventory levels when a firm sources goods from China, and that some costs actually are increased when a LCC sourcing strategy is applied. This is probably a good lesson to learn for many companies that seek to source goods from low cost countries only to reduce costs, and do not properly consider the implications that the sourcing strategy entails. Furthermore, this study reveals the importance of not only seek to minimize inventory but to manage inventory as efficient as possible. An important lesson to learn from this study is that the goal should be to maintain the right inventory at the right time to the right cost. To solely focus on cost reduction will not always lead to an improved profitability.

6.5 Further Research

This study has attained a broad perspective, investigating a larger area but not on a detailed level. The reason for choosing this approach was that Focal did not have a clear picture or understanding of how operations within their organization and in their supply chain fits together, i.e. they do not have a holistic view of the organization and the supply chain. By having a broad perspective during the study, we have been able to create a holistic picture of the supply chain and create an understanding of how inventory is created by different factors simultaneously.

The broad approach of this study has definitely contributed to strengthen the result of this study. However, due to the broad character of the research, the possibility to probe deeper within specific areas, and investigating each factor more thorough, were limited.

An interesting topic for future research would therefore be to perform more focused investigations of each factor. A study like that would have the possibility to create a more thorough understanding of how the factor in focus drives inventory and create more detailed suggestions on how to reduce the impact of that factor. A research of this character would certainly benefit the firm in this case study, but also give insightful information about how LCC sourcing and choice of competitive strategy will affect inventory performance on a deeper level, which can be useful within the academia.

7. Conclusions and Recommendations

In this chapter a brief summary of the findings from this research will be presented by answering the research questions stated in the first chapter. Lastly the chapter contains a summary of the recommended actions that Focal is recommended to undertake in order to improve their inventory performance.

This study aimed to *evaluate how Focal's LCC sourcing strategy in combination with its competitive strategy affects its inventory performance in order to provide suggestions of how to improve the performance.* To accomplish this purpose an extensive literature study combined with a case study of Focal's sourcing from Supplier X has been performed. In order to facilitate the investigation, two research questions have been created and assessed. Based on these questions, empirical data has been collected and analyzed by using an analytical framework, developed during the theoretical study of this research. These research questions will be answered below.

RQ1: What are the major drivers affecting Focal's inventory performance?

Six factors have been identified as drivers of inventory at Focal. These factors are; lead times, uncertainties, forecast, lack of coordination and information sharing, service level, and product range. These factors have been identified through an extensive literature research and the case study of Focal and Supplier X. The factors affect inventory both directly and indirectly since they are interdependent and therefore amplify the effect of each other.

The factors affect inventory levels in two major ways. Firstly, the factors drive unnecessarily high levels of inventory, which leads to more tied up capital. Secondly the drivers cause Focal to end up with the wrong stock on hand, which in turn is not only costly for the company but it may also negatively affect the customer satisfaction. This, as carrying the wrong stock increases the risk that Focal cannot deliver the right products to the right customer at the right time. Hence, the six drivers of inventory places Focal in a situation where the company struggles with both excess stock, backlogs and lost sales at the same time.

RQ2: How can the inventory performance at Focal be improved?

To improve the inventory performance of Focal the root causes affecting inventory need to be solved, i.e. the six factors driving inventory. The impact of the six factors can be treated individually. However, their interdependency leads to that actions focused on one factor also will affect other ones. This interdependency should be leveraged when focusing resources on improving inventory performance, since it enables Focal to accomplish a larger impact using fewer resources. The prioritization of which factor that Focal is suggested to address is based on to what extent the factor in question drives inventory. But it also depends on what impact actions focused on that particular factor will have on other factors as well.

The factors driving inventory at Focal can be divided into two clusters related to the supply chain strategy and the competitive strategy respectively. The first cluster includes four factors: lead times, uncertainties, forecast, and lack of coordination and information sharing. These factors are interdependent and all affected by the fact that Focal uses LCC sourcing. To reduce the impact of these four factors on Focal's inventory, actions should be focused on lead time

reduction. By shortening the supply lead time, the uncertainty as well as the dependency of the forecast will be reduced, and the ability to improve the forecast will increase as the time horizon decreases. To accomplish this supply lead time reduction, actions need to be taken by Supplier X. An enabler to shorten the supply lead time is for Focal to create a strategic relationship with Supplier X. This will in turn create incentives for Supplier X to take action and initiate the work with decreasing lead times during their planning and procurement phase as well as during the production phase.

The second cluster consisting of service level and product range are part of Focal's competitive strategy. These factors are together amplifying the effect of one another; driving the inventory levels at Focal. These factors are also affecting the factors in the other cluster, and hence further contribute to the complexity of handling the inventory. In order to decrease the inventory levels, Focal is recommended to review the possibility to differentiate service levels and decrease the product range.

Initially, Focal is recommended to focus on the suggestions to reduce the impact of the factors in the first cluster; to create a strategic relationship with Supplier X and work to reduce supply lead times. These measures are probably more feasible in the short term since they do not seem to entail the same risk as changing the competitive strategy. To change the competitive strategy of a profitable company will meet resistance among top management, and hence be more difficult to perform, at least in a near future. However, we believe it is important to approach the complexity that the combination of the current supply chain strategy and competitive strategy implies in a near future. This since the LCC sourcing strategy and the competitive strategy are not fully aligned and contributes to the risk of unnecessary high or the wrong inventory levels.

To summarize, LCC sourcing and the current competitive strategy affects the inventory performance negatively. Focal's change towards increased LCC sourcing in combination with their retained competitive strategy makes it difficult to manage inventory.

A summary of all recommended improvements for each individual factor are presented below. Actions need to be taken by both Focal and Supplier X in order to improve the inventory performance at Focal.

Lead times

Activities to reduce lead time are dependent on that Supplier X takes action. An enabler in order to shorten lead time is hence that Focus works to create a strategic relationship with Supplier X in order to create incentives for Supplier X to reduce the lead time. The following actions need to be taken by Supplier X:

Planning and procurement lead time at Supplier X

- Supplier X should set demands of shorter lead times from suppliers
- Supplier X can start holding raw material and components inventory for products intended for Focus

Production lead time at Supplier X

- Supplier X should identify and resolve quality issues within production
- Supplier X's production team leaders should produce according to aggregated production plan instead of according to individual production plans

Uncertainties

Demand uncertainty

- Focus should increase customer collaboration and improve information sharing

Supply uncertainty

- Focus should encourage information transparency with Supplier X
- Supplier X should focus on fulfilling commitments regarding delivery precision and quality

Forecast

- Focus should improve the forecast process by using a clear division of tasks and responsibilities between the involved departments
- Focus should develop and implement a standardized approach for collecting customer data, which should be documented and reported to concerned departments
- Focus should encourage customers to share forecasts and improve their forecast accuracy
- Focus should work to encourage Supplier X to reduce the lead time

Lack of coordination and information sharing

Lack of coordination and information sharing at Focus

- Focus should set and implement aligned goals within the organization in order to encourage coordination and information sharing across the board
- Focus should review what functions and/or departments to be accountable for KPI's respectively responsible for actions to manage the inventory

Lack of coordination and information sharing with Supplier X

- Focus and Supplier X should increase the visibility of the supply chain
- Focus should encourage collaboration and treat Supplier X as a strategic supplier

Service level

- Focus should review the impact of a potential service level change on customer satisfaction
- Differentiate the service level for finished goods depending on item classifications
- Review the service level and item classification continuously
- Review the potential to start classifying raw material and components in order to start differentiating service levels within this inventory as well

Product range

- Focus should review customer needs and start to reduce the number of product options (different colors etcetera)
- Focus should review the process for SKU reduction and work to meet targets

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