LAPIN AMK
Lapland University of Applied Sciences

ANALYSING CONSIGNMENT STOCK'S RISKS AND BENEFITS FOR CASE COMPANY AS CONSIGNEE

Case company

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Bachelor's Thesis

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Abstract of Thesis

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The central theme of this thesis work can be described as the process of organizing a consignment stock on the commissioner's territory- the case company with supplier X. The main objective was to consider the benefits and risks of such an inventory model for the commissioner and explain why the company would need to make such changes. This work implementation was possible through cooperation with the commissioner, its provided materials, and the author's work experience in the case company.

The subjects directly related to the main concern of this thesis were chosen for the theoretical part, including a comprehensive overview of the inventory organization processes following the specification of purchasing functions and the concept of consignment stock. For a theoretical basis, domestic and international scientific sources were applied.

The empirical part, consisting of qualitative research and explanatory methods, was used by interviewing stakeholders of the case company, who have proximate professional knowledge and experience in business development, purchasing, and inventory management. No specific information about the case company or its supplier was revealed regarding the commissioner's will, including the companies' names and interviewers.

Keywords materials & inventory management, consignment stock, purchasing

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SYMBOLS AND ABBREVIATIONS USED

CC- Case Company-Consignee

CPFR-Collaborative Planning, Forecasting and Replenishment

CS- Consignment Stock

ETD- Electronic Data Interchange

EOQ- Economic Order Quantity

ERP- Enterprise Resource Planning

FIFO- First In, First Out

LIFO- Last In First Out

ROI- Return On Investment

ROL- Reorder Level

SKU - Stock Keeping Unit

SX- Supplier X-Consignor

1 INTRODUCTION

1.1 Background and the Commissioner

The idea for choosing the topic of this thesis came from the case company. It is a Finnish company that was established more than thirty years ago. This company specializes in the development and production of heavy machinery parts. The company's headquarter and the production sectors are in Rovaniemi-Finnish Lapland.

The idea of writing the thesis about cross-border consignment stock was received with enthusiasm, since the thesis author has deep interest in Logistics, Supply Chain, Procurement, and Cross-cultural Communication. The main advantage of choosing this topic and the entire research process was that the consignment stock model and inventory management development are relevant agendas in many manufacturing companies nowadays. A deeper understanding of its processes may become necessary for specialists from various company departments in the future, starting from material management and warehouse management and ending with the financial and budgeting departments and the production line.

On the contrary, Djalma Batista Oliveira Filho (2023) states that due to the fact that companies ignore the importance of a qualified approach to inventory management, often associated with a lack of competence, they are not able to organize control over purchases, thereby losing investments in the accumulation of goods. Also, the author, referring to the Department of Labor Statistics (USA, 2022), says that in the worst outcome of such a negligent inventory management approach, up to 50% of companies face serious troubles within 10 years (Oliveira Filho 2023).

The Thesis author's interest in consignment stock grew even more when she started to work as a delivery supervisor at the case company. In a short period, it was explicit that the efficiency of production, which means satisfaction or, on the contrary, the risk of losing customers, directly depends on the accurate and cohesive work of the inventory management team and the purchasing department.

Inventory management aims to reduce the cost of production and, consequently, increase profits. The bigger the stock balance is - the more space the warehouse occupies and the more expensive payments for maintenance becomes. Current economic conditions require suppliers and buyers of a non-trivial approach to supply chain management. Oliveira Filho (2023, 6) also mentions in his doctoral dissertation that the financial condition of the company and its competitiveness depend on the efficiency and method of inventory management, since any operations with inventory, from purchase to storage and transportation, imply costs for the company, thereby directly affecting working capital.

One of the tools to reduce costs in implementing procurement activities is the consignment stock. This type of inventory management is of great importance in economic activity in the presence of a mandatory condition for the uninterrupted supply of goods. Bányai (2023, 1006-1007) states that with the help of the consignment model, it is possible to optimize the supply chain and thereby achieve maximum profit for both parties of the consignment contract. Also, in the study, the author points out that the consignment model has a positive effect on reducing inventory investment and operating costs for both business partners, thereby making the inventory management strategy and supply system more flexible, which positively impacts the entire supply chain (Banyai, 2023).

Even so, the consignment stock might become an excellent solution for both parties; however, it requires proper preparation and constant collaboration between the consignee and consignor. Winata (2022, 110-111) also notes in her case study the criticality of choosing a business partner to introduce consignment operations. She argues that the main element of successful cooperation is determined by the stage of negotiations and the drafting of a contract, according to which both parties are obliged to follow the agreements Winata (2022,111).

This thesis is limited by describing the consignment stock organization processes and analysing the risks and opportunities for the case company as a consignee. However, the work excludes the actual consignment stock implementation time between the consignor and consignee because of the thesis work delivery time limitation. Moving inventory to the customer's (consignee) premises means building a trusted partnership that may take longer, including visiting the premises,

possibly making construction changes, agreeing on the details, and making proposals. Likewise, this thesis excludes the negotiation process, its results, and potentially legal, tax-related, and accounting issues in managing cross-border consignment trade. Also, the details of agreements and any other information beyond public accessibility have not been revealed in this work.

1.2 Research Problem and Objectives

The case company already has some issues in inventory management processes, including duplication of goods in different warehouses, which leads to the wrong number of stocks, resulting in the lack of necessary materials for production. Other problems arise when goods are delivered at the warehouse and the data has been incorrectly recorded in the system, which also negatively affects the reliability of information regarding the volume of the materials. Another problem is incorrect product naming, driving to inaccurate inventory. In general, based only on the above problems, one can conclude that it is expedient to consider the reorganization of inventory management.

Currently, one of the biggest problems in the case company is the inaccuracy in forecasting the number of sales. As many components are made from specific materials designed for concrete customer needs, inaccuracy in sales forecasting brings to a shortage of some components/materials or an oversupply of others. Material shortage brings work delays and failure to meet the agreed deadlines for delivering finished elements to customers. An overabundance drives inventory stagnation (low turnover) and, consequently, monetary losses.

This thesis aims to understand and describe the processes of organizing a consignment stock, its advantages, possible risks, and opportunities. The specific objective of this work is to determine all the stages of a consignment stock establishment with supplier X on the case company premises to reduce the tied-up capital possibly.

The essential questions for the thesis research were identified considering the existing problems of the case company and the objectives of the study:

- Why would the case company start reorganizing the inventory model with supplier X?
- How may the consignment stock influence the cash flow in the case company?
- What are the possible risks and benefits for the case company as a consignee?
- How may consignment stock affect the case company's purchasing operations and stock inventory?

1.3 Structure of the Thesis

This thesis contains six chapters. Starting with the Introduction, background information that describes the idea, the commissioner, the importance of the chosen subject, and the author's interest in the matter. The introduction part also contains information about the limitations of this research. Chapter Two presents the study and analysing methods, data collected, research ethics considering chosen research method, and a subchapter on the literature reviewed. Chapters Three and Four are devoted to the theoretical data, considering the information carefully selected according to the relevance of the main objectives of the thesis. Chapter Five addresses the assessment and analysis of the research results. Chapter Six proposes the outcome of this thesis work and suggestions for possible further development. An appendix containing the details of interviews is at the end of this work in Appendices part Appendix 1. An illustrated explanation of Logisticar (software) data analysing can be found in Appendices part Appendix 2. Appendix 3 contains an illustration of the operative purchasing process of the case company.

2 METHODOLOGY

2.1 Research and Analysing Methods

The purpose of this work is to identify the existence of potential risks and benefits in the process of establishing a consignment inventory between the commissioner and its supplier on the commissioner's territory. For that reason, qualitative research in collecting information was chosen for this study.

Qualitative research includes the necessary theoretical content based on which research is conducted regarding the chosen research method. Likewise, another essential element to achieving qualitative study results is empirical analysis, for which the choice of collecting information and their argumentation is significant. (Tuomi & Sarajärvi 2009, 19-21.) This statement is also supported by Burton (2021, 12), referring to the words of Buchanan et al. (2014) that for the best understanding of corporate governance, the method of qualitative research, utilizing further analysis of empirical data, is best suited, as it provides objective data and not assumptions. Also, Burton (2021, 3; 60) refers to Simpson et al.(2012) & Bluhm et al. (2011) that it is through empirical research that one can determine the effectiveness of a company's organizational operations, given the qualitative data obtained, based on the experience of the participants in the study.

An explanatory research approach of qualitative research was chosen to answer the thesis primary question, why would the case company begin reorganizing the supply chain model with supplier X? According to Yin (2015, 233), to build a good explanation, it is necessary to use the help of informed people who have an idea about the chosen topic for research.

Through the gathered empirical data, based on an in-depth study of a narrower sample of respondents and their interviews, this research aimed to investigate a study case, allowing for more accurate conclusions about the consignment stock phenomenon. To collect an empirical basis, three interviewees were chosen. The respondents were selected on the principle of possessing similar professional characteristics in terms of criteria essential for the analysis.

Likewise, through empirical research and in-depth interviews, the author was expected to get input from the company's stakeholders regarding the reasons for the reorganization of inventory and understand the issues. Moreover, it was expected to find out if there is a correlation between consignment stock and tied-up capital reduction by identifying the pros and cons of the consignment inventory model.

According to Brinkmann (2013, 1-4), interviewing can be called one of the central engaging elements of issues of human interest. It is through conversations over the years that mankind has acquired knowledge. In Brinkmann's opinion (2013, 1-4), despite some criticisms that the information of a qualitative interview is subjective, it is also the most objective with human experience. That is why the empirical in-depth interviews method of qualitative research was chosen for this thesis.

For this study, it was important to form an array of values based on the theoretical data already obtained, thereby giving primary significance to the empirical part or experience of the respondents. Although the respondents have similar professional characteristics, the range of their professional qualifications differs; thus, the semi-structured interview method was most appropriate for this study. Another reason for choosing this method was because the number of respondents was moderate, and the need for different opinions on the current situation and desired outcomes was high. The major advantage of the semi-structured interview method for this study was to delve more naturally into individual elements of the dialogue, allowing the respondents to reveal their experiences in their narrative.

Galletta (2013, 75) argues that one of the main aims of a semi-structured interview is the mutual benefit of both interview participants. The exchange of information and reflection begins during the interaction between the participant and the researcher. Thus, it tends to reveal the actual attitude of the interviewee on the research topic. (Galletta 2013, 77.)

2.2 Data Collected

Tuomi and Sarajärvi (2009, 157) argue that it is characteristic of a qualitative study to describe in a report all sequential actions, that is, an explanation of how the objects were selected, how the information was collected, and how the analysis was performed. Likewise, Tuomi and Sarajärvi refer to Hirvisjärvi et al. (1997) that any researcher's goal is to ensure the question is answered before making a report. The results can be combined with those already studied by the research, either starting a dialogue between what has been obtained before and new developments or continuing to investigate the results through additional references (Tuomi & Sarajärvi 2009, 157-158).

To continue the thesis research flow, the main objects for this study, such as material management and consignment stock, were formed. Based on these matters, questions for a more in-depth analysis were identified, such as the impact of the consignment stock on the tied-up capital and this model's positive and negative aspects. To find answers to the questions of interest in this work and to create analysis in the end, primary information sources, such as semi-structured in-depth interviews, and secondary information sources, such as scientific research and articles on a similar topic, were used for the study. The interviews were conducted in person, using a recording device. Questions for the discussion were compiled individually for each interviewer.

The research interview differs from the every day one in that it is planned and developed in advance, and after it is carried out, analysis and report follow. One of the main tasks of the interview is to get an answer to a topic of interest. Arguing that society was built through dialogues, interviewing is an appropriate method for studying certain aspects. Since interview results alone are insufficient to conduct research, other sources of information, such as observation or documents, should be used to reinforce the interview results. (Brinkmann 2013, 45-48.)

Yin (2015, 86) argues that the corroborated sources of information determine the credibility of the work; that is, the transparency of the selected materials affects the outcome of the level of trust in any study. Tuomi and Sarajärvi (2009, 143-144) state that triangulation is one option for assessing the validity of qualitative

research. This tool can be described as selecting at least three sources to verify information, as a result of which the study's credibility will increase (Yin 2015, 87).

It is possible to call a study of poor quality where, for example, there is an insufficient number of references and a discrepancy between the results or the methods used (Tuomi & Sarajärvi 2009, 133). According to Yin (2015, 85), only research strengthened by reliable data is credible. In addition, data collection still needs to be accurately interpreted.

For this thesis validity, sources of information with scientific background were collected, in some cases using the triangulation tool, to form a more trusting stance towards the work and the reliability of the results. All borrowed information in the thesis was marked according to the Lapland UAS required style of referencing.

2.3 Research Ethics

The question of ethics in research is not unambiguous. According to Tuomi and Sarajärvi (2009, 125), ethical issues can be addressed through research; on the other hand, ethical issues can influence research results. Also, ethics in research means quality and reliability; that is, the chosen subject for study is appropriate in the quality report attached to it. Therefore, ethical principles are essential for good research. (Tuomi & Sarajärvi 2009, 127.)

Since during research, there is an interaction between the researcher and the participant, the result of which is unpredictable, it is necessary to take into account the particular principles of protecting the rights of freedom of people participating in research, indicated in Section 16 of Finnish Constitution safeguards the freedom of science and arts. Such principles include participation on a voluntary basis, also excluding the fear of negative consequences in case of refusal to participate in the study. As well as the possibility of the participant to terminate participation and withdraw consent to participate at any time during the study. (TENK 2019, 8.)

Wiles (2012, 51) states that anonymity is one of the main criteria for research ethics. To protect the company's and its employees' privacy, pseudonyms were

used in this work, and no private information was published. The anonymity of the company, its employees, and the supplier was also necessary to keep preventing risks to well-being that could arise from an emotional reaction to the publication results (Wiles 2012, 59).

Also, according to Wiles (2012, 26), informing is a fundamental factor for ethical research. Therefore, the invited interviewees were chosen for interviews of their own free will; they were also notified in advance about the topic of the discussion, their anonymity in the reports, and the possible recording of the interview, with their consent.

2.4 Literature Review

Scientific materials, such as books, online books, and articles, were used to write this work. The thesis's objectives set the parameters for choosing the study material, firstly, the collection of theoretical data, based on which further preparation for the interview was carried out, and secondly, the collection of data on the topic of methodological research, data collection, analysis, and conclusion. To analyse the study, an article and studies related to the main issues of this work were used. Original materials belong to Finnish and international authors. All references are indicated in the text and by the specified criteria at the end.

3 MATERIALS AND INVENTORY MANAGEMENT

3.1 Materials Management

Any organization, in one way or another, is engaged in procurement and has a stock of materials, whether for its own consumption or transformation. According to Chunawalla (2008, 1), the material management function is essential in the manufacturing sector, as it directly affects the added value of finished products; material management is one of the main components of business management.

Bhat (2008, 2) claims that the total production costs associated with materials can be 50-85% of the enterprise's total costs. Therefore, the organization's success, efficiency, and competitiveness directly depend on competent inventory management.

Among other things, the main factor influencing the importance of materials management is the ratio of monetary investments in materials compared to other costs of the organization, considering that the finished product depends on the quality of materials. Efficient material management leads to lower costs and higher profits. (Bhat 2008, 2.)

3.2 Inventory Management

The primary purpose of inventory management control is to plan and predict the production volume, considering the number of raw materials and the time spent. Having the right stocks directly influence customer satisfaction and production need, minimizing the risk of demand fluctuations. On the contrary, disruptions in the supply chain affecting material availability, whether due to an unreliable supplier or logistical difficulties, may greatly harm entire business operations. To reduce possible risks, it is necessary to stipulate in advance and document in writing the terms of deliveries and possible sanctions for non-compliance with the agreements. (Muller 2011, 13.)

The cost of maintaining storage facilities varies from the company's activities. According to Sakki (2014, 71), in Finland, storage costs can be as high as 46%

of all logistics costs. Thus, in industrial production, due to the production of specific goods, the price of an inventory exceeds the average cost of stock of wholesale and retail stores.

According to Hokkanen, Karhunen, and Luukkainen (2004, 216-217), the logistics task is to increase the added value to the client by minimizing costs (inventory maintenance). Therefore, inventory minimization is one of the main tools to decrease the cost of the finished product.

When talking about added value for the customer, Hokkanen, Karhunen, and Luukkainen (2004, 216-217) say there are three essential factors to keep in mind: low costs, reliable delivery, and product quality (Figure 1). By adding value to the customer, the company gains a competitive advantage. All three of these factors are in the area of materials management.

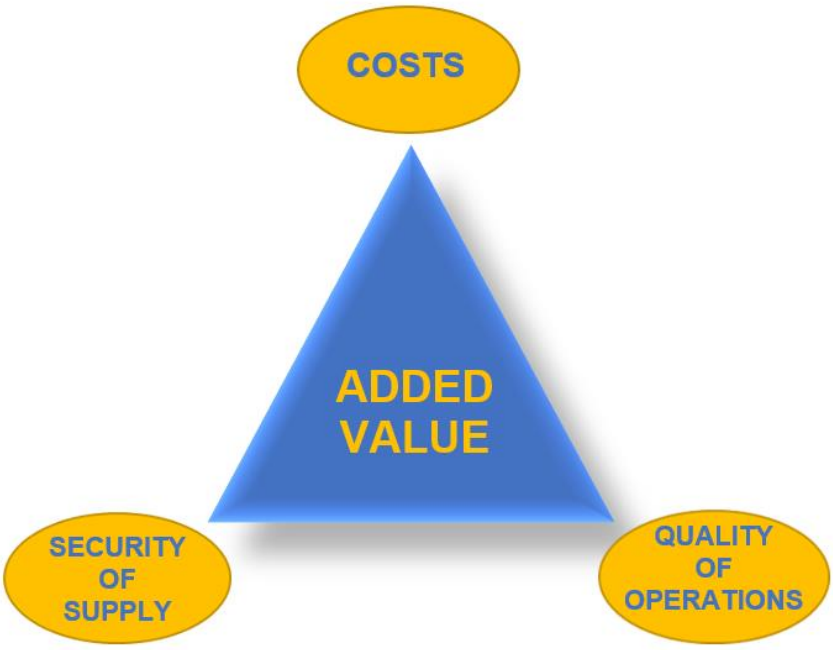

Figure 1. The structure of the added value brought by inventory control (adapted from Logistisen Ajattelun perusteet (Hokkanen, Karhunen & Luukkainen 2004, 217))

3.3 Accounting of Inventory

According to Muller (2011, 22), inventory is money. Therefore, in any business, it is necessary to have a fundamental dependence understanding of inventory use,

losses, and profits. It is essential to be aware of what products and their amounts are available - inventory accounting is used for this. In practice, it is required to record each unit of goods and their movement.

Since the case company is the manufacturer, it has its type of inventory, which is shown in Figure 2. This type includes ready-to-sell goods, ongoing production, raw materials, and consumables for other than direct production business operations.

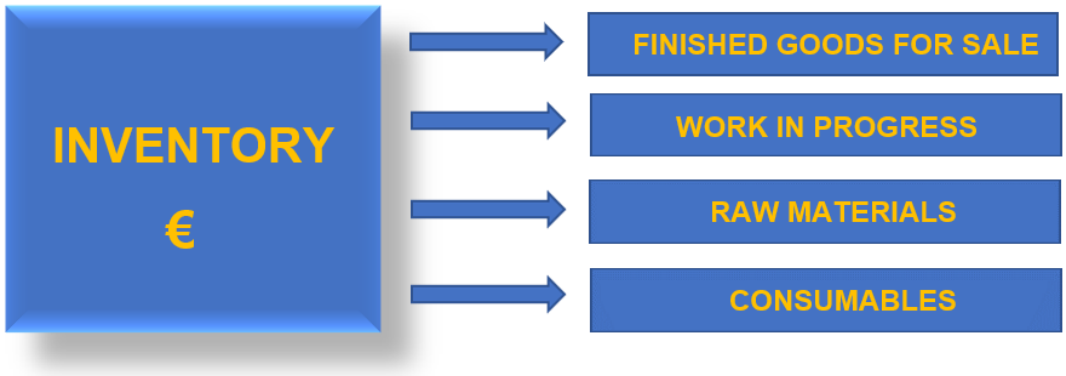

Figure 2. Types of inventory (adapted from Accounting Corner, 2023)

3.4 Inventory Turnover Ratio

Among other inventory management goals, continuity of supply plays an important role. Of great importance in the size of the tied-up capital is the speed of stock turnover and, as a consequence, money use efficiency in other areas of the organization (Bhat 2008, 4).

When determining the turnover ratio, the capital invested in inventory is defined. In this case, a certain period is taken as the calculation unit, for example, a year, in relation to the average cost of the entire inventory. The correlation shows that the higher the turnover ratio, the lower the capital tied to stocks. (Hokkainen, Karhunen & Luukkainen 2004, 221.)

By optimizing the number of orders, it is possible to reduce the cost of buying and holding inventory. Thus, the effective work of the purchasing department reduces the risks of shortages of materials and production stoppage; after all, the downtime of machines and labor affects the production costs, reducing the return on investment (ROI). (Bhat 2008, 5.)

Bhat (2008, 145) argues that inventories always represent a significant cost to a company. If the turnover of goods is low and stocks in the firm prevail in excess, the company will lose about 30% of the total inventory value on warehouse maintenance. Conversely, if a company experiences a constant shortage of goods, this can lead to a stop in production and loss of customers. Therefore, the amount of inventory must be kept at an optimal level.

3.5 Inventory Classification

Inventory analysis is an indispensable technique for purchasers who wants to competently carry out procurement planning and build a strategy (top level) for procurement management. Any planning begins with an initial analysis of the current situation. Inventory planning is carried out both at the initial stage of the formation of the logistics system in the company and when it changes under the influence of demand, changes in the cost of materials, labor, and redevelopment of space. (Ghiani, Laporte & Musmanno 2013, 122.) For example, the decision to redistribute inventory may be affected by a decrease in demand for a product, which the loss of a customer may cause.

Since the case company manufactures different types of products, there are over a thousand items in the stock assortment and more than a hundred suppliers. Each product must be broken down into components for more efficient inventory management. That will make it easier to control the timing of the manufacture of products for sale and the purchase of their parts (Sakki 2014, 61).

3.6 ABC Method

Classifying inventories makes visible which parts are most in demand in producing specific products, which are repeated in different products, and which are

critical for manufacturing a particular product (Sakki 2014, 63). Specialists often use the ABC method when studying the issue of controlling stock. This accounting method is based on the more well-known Pareto 20/80 principle, in which only 1/5 (20%) of the total number of objects under standard conditions gives approximately 80% of all results. Accordingly, the remaining 80% of the rest objects returned will be only 20%. (Sakki 2014, 62; Morana 2018, 93.)

A distinctive feature of this method is the selection of objects of first importance, which should be given the most attention, and less significant things, the contribution of assets to which is not very appropriate. That helps to simplify inventory management and therefore has a positive impact on cost-effectiveness. (Logistiikan maailma 2022 a; Bhat 2008, 160.)

The ABC technique refers to a method of rationing, control over the state of all stocks, which consists of the correct division into three uneven subsets determined based on a particular formal algorithm:

A - a small group of essential goods, the size of the stocks of which must be constantly monitored to determine the exact costs of purchases, deliveries, transhipment, and storage, as well as the size of the lot and the moment of order;

B - in terms of importance, the middle group of positions for which regular control is carried out with the prompt collection of information about the best opportunities for restocking;

C - a large mass of goods, which accounted for a significantly smaller part of all funds previously invested in stocks and for which lot size calculations with an order period are usually not carried out. In contrast, the replenishment of stocks is routinely recorded, but the stocks' level should not be tracked. (Logistiikan maailma 2022 b; Bhat 2008, 162.)

3.7 Warehouse

One of the critical components of logistics activities is warehousing. By its definition, a warehouse can be characterized as an object for storing, selling, and re-

ceiving goods (Ghiani, Laporte & Musmanno 2013, 212). Inventory in the warehouse can mitigate adverse effects on production, such as supply shortages, unscrupulous suppliers, external economic difficulties, strikes, or inaccurate forecasting.

For keeping stocks at all stages of the material flow movements, from the primary source of raw materials to the end consumer, the essential requirement is specifically appointed spots for inventory. According to Morana (2018, 80), the warehouse can be called a connecting link between production and consumer demand. That is why the importance of warehousing cannot be underestimated.

3.7.1 Warehouse Parameters

Considering the information on the raised issues, it can be concluded that the role of stock in logistics is ambiguous. On the one hand, the general tendency is the maximum stock reduction. On the other hand, it is impossible to avoid the creation of stocks in most cases due to the high risk of production materials shortage.

For more efficient warehouse functioning, the most favorable type of storage for a specific type of goods must be defined. It involves the choice of technological equipment for warehousing cargo and the form of its placement in the warehouse space. The choice is influenced by: the area and the height of the warehouse, the goods carrier used, the volumes of delivery lots, free access to goods, the conditions for storing goods, the breadth of the assortment, the definition of the location, including not only physical configurations but also the required conditions according to the agreements. (Morana 2018, 48-49.)

3.7.2 Main Processes in a Warehouse

There is no universal model of inventory processes since each warehouse has its own parameters, depending on the characteristics of the goods, the type of warehouse operations, the technologies used, and services with added value. However, there are fundamental processes of receiving goods proceeding in every warehouse. When conducting warehouse accounting on paper, in an Excel

table, or a special program, it records all operations related to storing and moving goods. These include:

- Receiving, checking on quality, and posting goods from suppliers
- Entering product data into the database or accounting documents
- Location and relocation (the ABC analysis can be used in this stage)
- Inventory
- Completion and transfer of goods to the dispatch office
- The actual outgoing goods checking- out
- The write-off due to damage
- Packing according to required transportation norms
- Sending out deliveries, including delivery notes with listed terms (a delivery note may be an electronic version). (Logistiikan maailma 2022c.)

3.8 FIFO and LIFO

The FIFO (First In, First Out) method provides inventory accounting on a first-in-first-out basis. That means that those units of goods, raw materials, or materials purchased earlier are written off first, and therefore the costs associated with them are written off. The use of this principle is widespread in warehouse logistics. According to Bragg (2005, 110), one of the most significant advantages of this method is the minimization of inventory cost layers in the database.

The LIFO (Last In First Out) method is used to write off for the production line or to sell in the first place those items which arrived in the last order. Unlike FIFO, this method is only suitable for goods with an expiration date or goods with a very high turnover. (Logistiikan maailma 2022d.)

Another specific aspect of LIFO is that it can have many cost records layers, which may result in overestimating production costs and incorrectly conceived valuation. That leads to balance misjudgement on the checking day, including

profit reduction and the company's productivity degradation. Because of that, some enterprises can use this method to reduce tax. (Bragg 2005, 112.) However, reducing tax this way is possible if it is allowed according to the country's law.

4 PURCHASING

4.1 Purchasing Functions and Responsibilities

Purchasing is essential in the logistic system because production flows must be continuous. The direct correlation between purchasing and the final product is the product price; the more efficient purchasing operations will be, the lower price for the final product may become. That is especially evident in industrial production when supply chain disruptions occur, for example, if the material is shipped from far distances. In such a situation, it might become difficult to calculate the exact arrival time. Consequently, buying missing material from local suppliers at a higher price is often necessary, affecting the finished product's cost. According to Bhat (2008, 35), by saving just one percent on purchases, a company increases sales turnover by almost 10%. With that, savings occur to a greater extent due to operational purchases.

Indeed, for buyers, the rule "at the right time, in the right quantity, at the right price" is relevant; it is also one of the main tasks to fulfil. As shown in Figure 3, buyers have a number of other professional responsibilities, such as controlling and forecasting inventory, keeping track of changes in price categories, and selecting new materials, which directly lead to further interaction with suppliers. (Bhat 2008, 34.) Purchasers must continuously share information about the current situation with other departments in the company, such as manufacturing, warehousing, and accounting (Chunawalla 2008, 11).

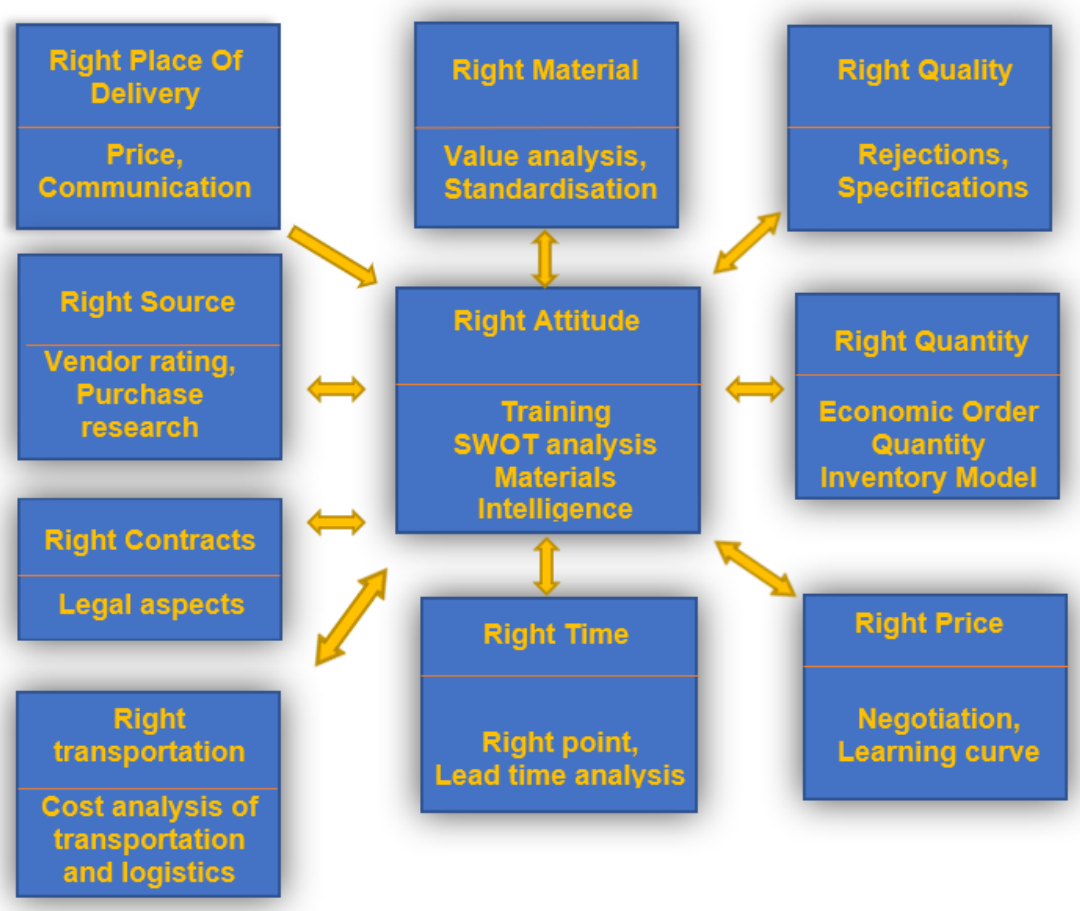

Figure 3. Purchasing Parameters (adapted from Materials Management (Bhat (2008, 37))

4.2 Economic Order Quantity (EOQ)

The Economic Order Quantity (EOQ) accounting method may be described as a smarter way of choosing the batch size according to inventory, set-up costs, and quantity sold annually (Callarman 2020). It may affect the maximum reduction of overall materials management costs, thereby positively influencing the company's competitiveness (Sakki 2008, 86).

For calculating EOQ, Harris Wilson's formula may be helpful.

$$EOQ = \sqrt{\frac{2(Annual\ Demand * Cost\ per\ Order)}{Annual\ holding\ cost\ per\ unit}} \quad (1)$$

Figure 4. Economic Order Quantity – EOQ Definition, Calculation and Formula. (Cin7 team)

To use this method, it is necessary to take the order size as the calculation unit to determine its low critical value. In this way, a whole batch can significantly decrease the costs associated with inventory management, such as reducing transport costs by ordering more material from one supplier. (Aswathappa & Shridharabhat 2008, 547-548; Sakki 2014, 87.)

It is important to remember that, like other methods, this one also has limitations. For example, it might be challenging to determine the storage and ordering costs due to its variability and volatility in demand. Therefore, to calculate this formula, it is necessary to consider the total costs. Difficulties in calculations may also arise when the order price changes due to possible discounts from suppliers. This calculation formula is a good starting point for the correlation between storage costs and the number of orders. (Bozarth & Handfield 2013, 355-357.)

4.3 Reorder Level (ROL)

One of the main purchasing management tools is setting a reorder level (ROL). This method calculates the correct time to place a new order. A particular value is set in the register to initiate a new order. When determining such a value, the EOQ calculation is usually used. (Chunawalla 2008, 230.) Getting on it or below the system reminds the purchaser about the need to replenish the inventory item.

The formula can determine the level of further order:

$$ROL = (\text{Lead time} \times \text{average daily consumption}) + \text{Safety stock.} \quad (2)$$

Figure 5. Materials and Purchasing Management (Chunawalla 2008, 230)

4.4 Min-max Method

In the "minimum-maximum" system, orders are made when stocks in the warehouse at the current moment become equal to or less than the established minimum. Therefore, the order will not be executed if the current stock level is in the middle of the set values. (Sakki 2014,85.)

The initial value is the minimum reorder quantity. An automatic restocking request appears if the system falls below a critical minimum. The maximum is calculated by adding the optimal lot size to the required minimum value. When a maximum and minimum are set, the purchaser receives notice of the need to replenish stocks while still having enough inventory before receiving a new batch. Therefore, paying attention initially to the appropriate amount and the corresponding minimum and maximum is necessary. (Aswathappa & Shridharabhat 2008, 551-552.)

Minimum stock calculation:

$$\text{Minimum stock level} = \text{Re-order level} - [\text{Normal usage} \times \text{Average delivery time}] \quad (3)$$

(sabet, stak)

Figure 6. Order point problem (Aswathappa & Shridharabhat 2008, 551)

Maximum stock calculation:

$$\text{Maximum stock level} = \text{Reorder-level} + \text{Reorder quantity} - (\text{Minimum usage} \times \text{Minimum delivery time}) \quad (4)$$

Figure 7. Order point problem (Aswathappa & Shridharabhat 2008, 551)

4.5 Consignment Stock (CS)

According to Morana (2018, 89), the consignment inventory method is determined by the location of the supplier's goods and, more precisely, the customer's

territory to store the supplier's inventory. At the same time, the customer can return the goods, for example, no longer used for sale or processing, without additional obligations if the contract does not contain a clause on this point.

According to the contract terms, the supplier's goods are stored permanently on the customer's territory. The supplier is the actual owner of the goods until the customer takes the goods from the warehouse for its needs, for example, sale or processing. That will be followed by payment of the invoice to the supplier only for the used material or product. (Van Weele 2005, 308.) Morana (2018, 89) also states that the supplier is responsible for the goods, for example, in case of theft or loss, until the customer takes the goods for their use. However, that is the negotiable aspect of the consignment agreement and insurance strategy.

4.5.1 Responsibilities/ Liability

According to Chunawalla (2008, 24-25), it is usually the supplier's responsibility to maintain the required inventory level. In turn, the customer must determine and group the necessary materials to be provided by this supplier and be included in the consignment contract. There is an option where the supplier and the client can only define a part of the goods from a particular supplier for such a model. The choice of goods is usually influenced by their purchase price, availability, and level of criticality of further use. Chunawalla (2008, 25) also notes that the buyer needs to provide the supplier, in addition to the description of the goods, with information on the use level of goods that have been transferred to the consignment stock. The supplier may also require the buyer to provide a guarantee to purchase a certain stock (Sollish 2011, 34).

4.5.2 Reception Inspection

As in the traditional procurement model, the consignment also receives the goods with the proper documentation. Upon receipt of the goods, it is necessary to check the condition of the goods and the compliance of the contents with the one indicated in the packing list. Also, a Good Received Note must always be attached to the cargo, containing a more detailed overview. It must be remembered that such a note is an important document on the actual transfer of the load from the carrier company to the customer (Chunawalla 2008, 219.)

As described earlier in this thesis, the supplier owns the goods with the consignment method of storing inventory until the customer uses them. Therefore, no bill of exchange is used when goods are received, which in the traditional purchasing model accounts "as the basis for paying the bill" (Cherunilam 2009, 439; Chunawalla 2008, 219). It is necessary to note the particular importance of reliable and trusting partnerships for maintaining the consignment stock.

4.6 Vendor Managed Inventory (VMI)

Vendor Managed Inventory (VMI) is another popular inventory management model. Its essence lies in the supplier being given the right to manage customer inventory, for example, replenishment, inventory, planning, and forecasting deliveries. It is the responsibility of the customer to forecast sales, based on which a stock plan will be drawn up, and this data will be transferred to the supplier. (Sakki 2014, 92.)

It is typical for a VMI organization at the initial level to define strict maximum and minimum levels of stock-keeping units (SKU) in the buyer's warehouse. Failure to hatch this condition may result in the allotted storage space being full. Conversely, by setting a precise inventory size, the vendor will not be able to replenish unnecessary, which will benefit the inventory size and improve the buying company's overall cash flow. (Payne, Dorn, & Podolak 2011, 161.)

It should be noted that the Vendor Managed Inventory model is often referred to as a consignment inventory, although this is not always the case. The main difference between these two models is that VMI can include both: the ownership transfer from the supplier to the customer after goods are received from the carrier with its subsequent payment through the invoice and the consignment inventory model when the rights to the goods remain with the supplier (consignor) until the moment of use goods by the customer (consignee), and invoicing according to the consumption. CS always implies keeping ownership right to the supplier until the customer uses the goods. Therefore, it is always worth clarifying which VMI model is in question to avoid misunderstandings.

4.7 Collaborative Planning, Forecasting, and Replenishment (CPFR)

Continuing the importance of developing partnerships between the customer and the supplier, consider the Collaborative Planning, Forecasting, and Replenishment (CPFR) concept. Thanks to advanced technologies, companies can move to a level of cooperation that allows both parties, based on the exchange of information, to jointly make decisions regarding the entire supply chain (Van Weele 2005, 312).

According to Van Weele (2005, 312), for the successful implementation of the CPRF, the collaborating companies need to agree on joint "goals and objectives, frequency of plan updates, exception criteria, and key measures" at an early stage. Based on such agreements, to avoid misconceptions in future collaboration, a jointly developed document must be created.

Van Weele (2005, 312) has stated in reference to McCarthy and Golicic (2002) that there are difficulties in implementing this concept associated with setting up the CPFR model, including significant time costs for personnel training and changes in corporate culture in both firms. Also, slowing down the process of implementing this cooperation model can be the search for appropriate software suitable for both parties. The right software will help prevent problems in the exchange of information, including in real-time, which is critical for this type of cooperation, which needs constant intensive and continuous maintenance of activities.

Speaking about the advantages of this concept, Van Weele cites McCarthy (2002), declaring an increase in revenues by optimizing the amount of stock. Van Weele also argues that this system will help increase inventory turnover while reducing stockouts. That indicates once again the correlation between higher profit margins and lower inventory maintenance costs.

4.8 Enterprise Resource Planning (ERP)

An enterprise resource planning (ERP) system is now a necessary management element in any advanced company. The largest provider of ERP is SAP, a program created for supply chain management. ERP's significant difference is that, with its help, it is possible to manage all primary business operations, such as accounting, finance, sales, purchases, and others (Figure 8). The activities associated with transactions are the main tasks of the day-to-day use of ERP. (Bozarth & Handfield 2013, 415.)

Figure 8. Information Integration Through ERP System (adapted from Production and operations management (Aswathappa & Shridharabhat 2008, 621))

According to Van Weele (2005,19, 254), the ERP program has greatly facilitated the work of the purchasing department. It helps buyers track information and respond faster to frequently changing customer requirements. Including the simultaneous use of this program by the supplier and the buyer, the delivery time and stock levels are reduced, and transaction costs are minimized.

The main benefits of ERP are a 60% lead time reduction, doubling business, up to 30% increase in inventory turnover, up to 80% reduction in cycle time, and up

to 70% reduction in work-in-progress inventory (Aswathappa & Shridharabhat 2008, 284).

4.9 Electronic Data Interchange (EDI)

Thanks to digitalization, transparency in the transfer of information prevails between business partners. The Electronic Data Interchange (EDI) program enables the transfer of information between the supplier and the buyer, such as sending an order, changing or confirming it, and sending an invoice (Van Weele 2005, 308; Aswathappa & Shridharabhat 2008, 283).

One of the main advantages of this program is the reduction of order processing time, the elimination of paperwork, the improvement of operational control, and the increase in the accuracy of the relationship between supply and demand. According to Aswathappa and Shridharabhat (2008, 606), EDI can be a significant factor in gaining a competitive advantage for the company by increasing logistics efficiency.

4.10 Bullwhip Effect

With many manufacturers looking to cut costs, collaborating with a supplier from a distance is standard practice. Sometimes companies are forced to take such measures simply because local suppliers do not have what they need. The bullwhip effect can explain the correlation: the farther the supplier, the higher the risks associated with information exchange and restocking (Morana 2018, 73).

Ghiani, Gianpaolo, and Musmanno (2013, 41) state that instability in the logistics system can also lead to a bullwhip effect. For example, slight fluctuations in demand, after a while, can lead to a substantial increase in orders along entire supply chain.

According to Bozarth and Handfield (2013, 365), the EOQ model can lead to a bullwhip effect in the supply chain since it is calculated considering only one company. Therefore, cost reduction in one link can increase total costs in the entire supply chain. To diminish the risk of the bullwhip effect, continuous cooperation

between suppliers is needed to eliminate volume discounts and therefore reduce the number of orders while reducing the order costs.

Sakki (2014, 77) also argues that occasional volume discounts or an attempt to save on shipping costs can lead to skewed information from customers about replenishment orders in a short period; as a result, the bullwhip effect appears. Since suppliers see only information about the replenishment of orders, they, in turn, react to market changes and change their orders. Sakki (2014, 77) states that this phenomenon can be eliminated through better collaboration in the supply chain.

4.11 Partnership

The significance of supplier selection cannot be underestimated. In many organizations, this process is preceded by a business strategy, where the main objectives are to achieve savings and improve operational processes. As shown in Figure 9, the strategic development of partnerships is the way to enhance features in the cooperation and add value to the customer, hence leading to economic value growth for both parties.

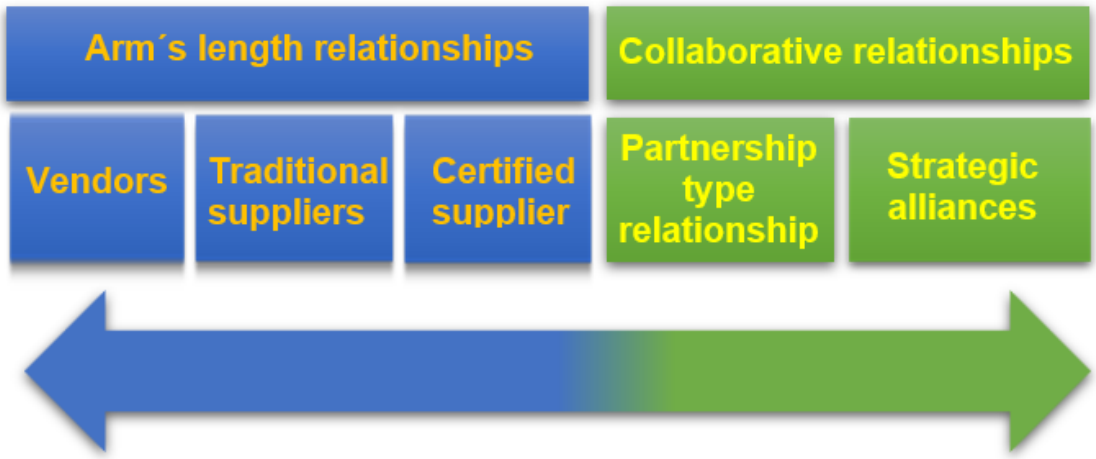

Figure 9. Continuum of Supply Relationship (adapted from Materials Management (Bhat 2008, 41))

The correlation between manufacturers and suppliers is obvious: the successful growth and development of one lead to the same outcome for the other. The

search for a supplier can take many years. During this time, to achieve positive results in a partnership, it is necessary to overcome conflicts of interest. Van Weele (2005, 163-167) says the sourcing program includes ongoing contract reviews, bidding, and continuous collaboration.

When checking contracts, the documentation is analysed. The functionality of the current relationship with the supplier is performed, including verification of price agreements, liability, the performance of the supplier, and satisfaction from cooperation, including consideration of possible risks. Van Weele (2005, 163) argues that only such an extensive analysis can lead to savings.

To find competitive bidding, an analysis of the international market is one of the main requirements of the search. For that, it is necessary to create a supplier profile based on the manufacturer's criteria. Those who have passed such qualifications are further considered potential suppliers and receive a request for proposals. (Van Weele 2005,163.)

After the supplier selection stage, specific cooperation objectives are built. Such goals include, for example, improving the quality of materials and pricing, reducing lead time, and providing customer service (Van Weele 2005, 163). Van Weele (2005,163) states that the relationship balance occurs at the point of superiority of the supplier's forces.

Figure 10 shows the supplier and customer relationship through two main logistical flows: information exchange and material transfer (Lambert- Stock 1992). With the development of society, an information flow appeared, which changed from a primitive fulfilment of demand and supply to a highly digitalized constant exchange of information in real-time. Material flow can mean the physical flow of materials and service provision. Through cash flow, a company can sustain its business operations. Most of the money comes from the client, but for more significant investments, companies often turn to banks or investors for financing.

Also, with the development of society and the availability of information on the negative impact of excessive resource extraction, the principles of sustainable development and the reuse of raw materials began to appear. That is how the recycling flow appeared in modern logistics. Finally, strategic alliances began to

emerge in logistics. Thanks to synergy, it became possible to make a profit that exceeded the sum of the costs of both parties (Hokkanen, Karhunen & Luukkainen 2004, 14-16.) Here, the correlation between transparent and intensive collaboration and sustainable development in the supplier chain must be noticed.

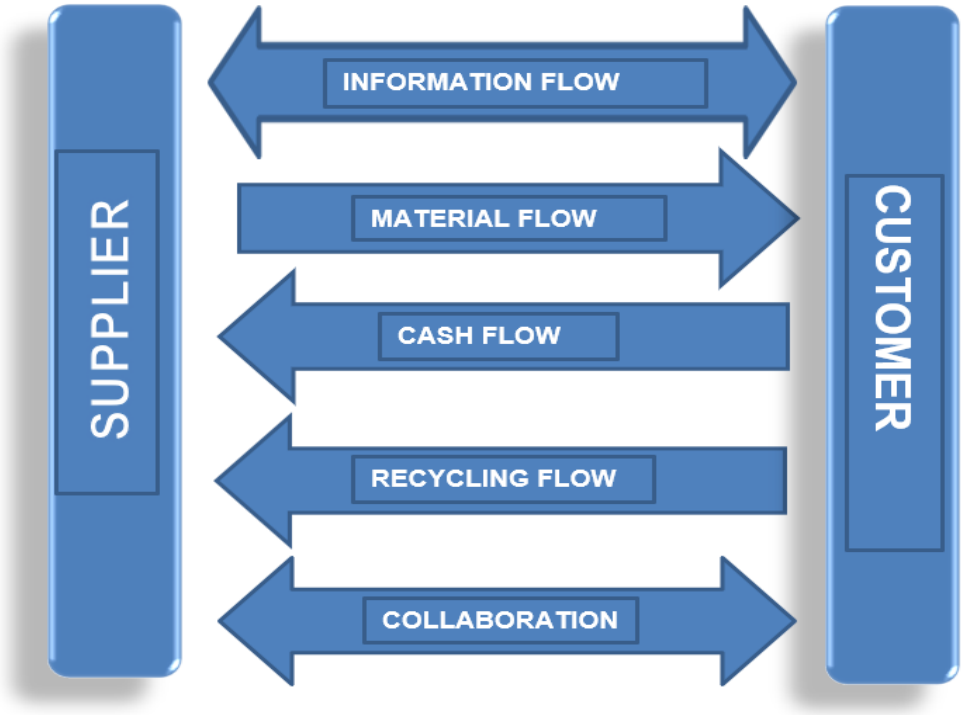

Figure 10. Logistics interaction between supplier and customer (adapted from Logistisen Ajattelun perusteet (Hokkanen, Karhunen & Luukkainen 2004, 16))

5 THE EMPIRICAL RESEARCH, GENERAL PURCHASING MODEL, AND CONSIGNMENT STOCK ASSESSMENTS

5.1 Prologue

The empirical part of this thesis contains information about the start situation between the case company and its supplier X, and their current partnership overview, including difficulties caused by the traditional inventory model. That gives a clearer understanding of the commissioners' choice for the thesis research, considering the improvement of the inventory model and business collaboration with supplier X. It was also essential to raise the existing issues in the purchasing department to show the necessity of finding new inventory management options.

All information in the empirical part, at the commissioner's request, remains anonymous to avoid possible contradictions about the disclosure of private information by supplier X. Also, since problematic issues were raised in this work, the case company remained anonymous to prevent possible negative consequences for the commissioner's reputation.

5.2 The Case Company's Current Situation

The case company has over a thousand items for production, some of which have a stock balance, and others are ordering according to the request only. The company has about 100 suppliers, 30 of which are active. Currently, the VMI model with several suppliers is being practiced in the case company, where the supplier has the right to manage inventory at the place allocated for it in the case company's warehouse. In such a VMI model, the ownership of the goods passes to the customer (case company) immediately after receiving them at the warehouse, with a payable invoice, according to the terms. The case company also has had the experience of consignment inventory in the past, but back then the number of goods included in it was not significant and did not have much impact on the company's cash flow.

5.3 Logisticar

The forecasting process takes place in the sales department. It is based on a 12-month cycle and includes about 500 types of finished products. Information about the required components is moved to the Logisticar program. All the functions of this program are presented in Figure 11.

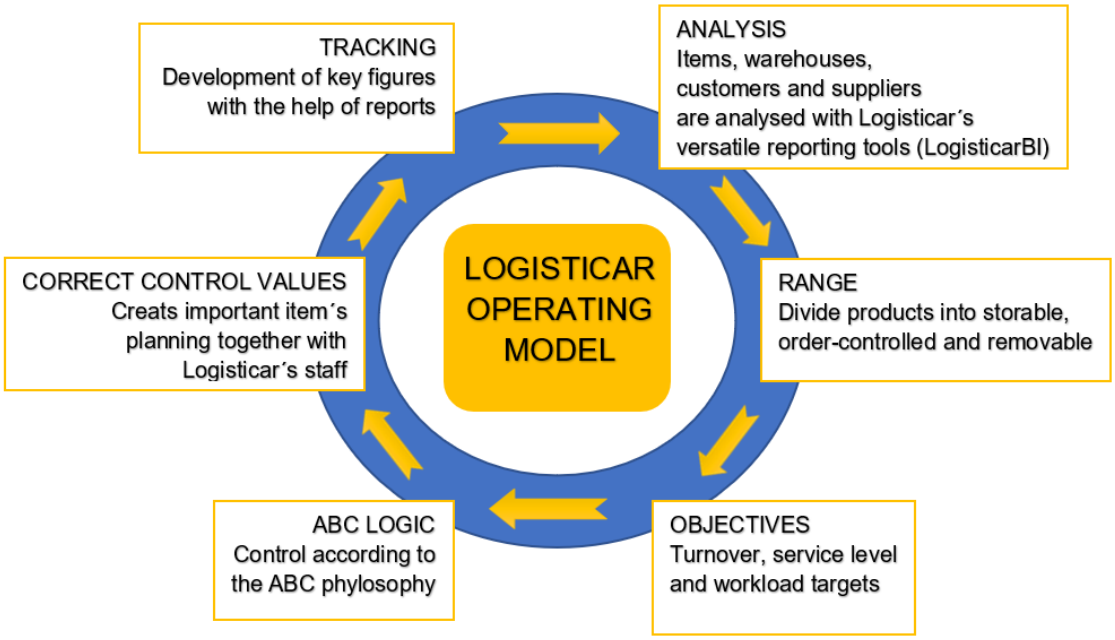

Figure 11.Logisticar -Operating Model (adapted from www.leanware.fi)

Logisticar is a program that tells a purchaser daily how often an item is used. The task of each buyer is to draw up their own weekly consumption requirements. The Logisticar program classifies materials according to the ABC principle, using a deeper classification, in a total of 9 classes. Based on this principle, in the Logisticar, a minimum and maximum stock is created for each item. Class A includes expensive materials with a high turnover, so it should have a small safety stock to maintain a high turnover. Class H includes goods/materials with a low annual cost. These items do not require weekly replenishment. Although, according to the third interviewee, even such an inexpensive component should not be stored for more than six months to avoid its obsolescence and possible damage, followed by write-off- every item needs to be under circulation. However, in Logisticar classification, there is also group I, which denotes a product that has not been used for 12 months or it may be a new item.

Thanks to the Logisticar program, the buyer sees the number of goods in stock and the speed of their turnover from the reports. Based on this information, a purchaser only decides which items to keep in stock and which items to order, considering a customer's need. Goods subject to storage are classified into categories, for each of which the levels of safety stock, target turnover indicators, and basic purchasing parameters are determined. The system monitors every day whether the buyer is within the set goals. For example, the target for class A, with a high turnover, could be 12%. On the graph, a purchaser sees how the stock balance develops. If the target is not achieved, the buyer must make changes, such as reducing the purchase quantity or safety stock.

An illustrated explanation of the processes described above can be found in Appendices part Appendix 2.

5.4 Collaboration with Supplier X

The business partnership between the case company and supplier X has been going on for more than ten years. Currently, it is the largest supplier of the case company, with about 18% of the total share of all deliveries. In addition to volume, this supplier delivers the most critical raw materials for production. It is important to notice that this supplier is a wholesaler, not a factory. The wholesaler's prices are higher than those of the factory. But the sales volumes of the case company do not yet allow cooperation directly with the factories because, as a rule, manufacturers provide large batch sizes for the year ahead. Although the case company has several factories as suppliers, they deliver only specific materials, and the volume of purchases from them is insignificant. Here, necessary to emphasize that it is not possible to purchase everything needed from one supplier, and it is also essential to take into account force majeure circumstances. Hence, companies need to have several suppliers in the database.

5.5 Purchasing Processes in the Case Company

Currently, most purchases, in the case company, are made according to the traditional way. An illustration of operative purchasing process may be found in Appendices part Appendix 3. As described earlier in this thesis, purchasing begins

with a sales forecast. It is crucial to notice that in this situation, the forecast is based on the number of sales per piece and not the amount from the previous year's order book. The company switched to this method due to global crises and worldwide economic instability in recent years, so the information from the order book is not sufficient anymore.

Based on a sales-per-piece forecast, a unit quantity of finished products is formed, which, in turn, is divided into its constituent components. Then this data is formed into a purchase forecast, which is sent to suppliers for further actions to replenish their stocks. These forecasts are made on an annual basis so that they may be inaccurate by up to 20% on a monthly basis. That is due to the fact that the clients of the case company do not give accurate forecasts for the acquisition estimation of finished products. Therefore, because of this, the number of purchases broken down into components can also have significant deviations from their actual utilization, leading to overstocking the warehouse or the lack of necessary materials.

A considerable advantage of wholesalers, in contrast to manufacturing factories, is that they can deliver suitable material reasonably quickly. Conversely, for factories, pre-orders can reach a one-time annual size; that is, the buyer needs to accept the yearly reserve of material from the supplier in accordance with the forecasts provided by the customer, even if the forecast changes significantly during the year.

According to the second interviewee, supplier X uses the case company's forecasts to create its own forecast and discuss annual volumes with the manufacturer to balance inventory. However, the wholesaler can sell the excess material left over due to customers' inaccurate forecasts to other companies; because of that, the inaccuracy in the customer's forecast is not harmful compared to the situation with the manufacturer.

5.5.1 General Invoice Creation

In the case company, when placing an order, always confirmation of purchase by the supplier is required, and only after the order confirmation takes place in the ERP system. More advanced companies use EDI for confirmation, others still

send confirmation letter via e-mail. The confirmation date is crucial because it is the only information from the supplier about the delivery of the goods, based on which the production of the case company draws up a production plan, taking into account the amount of material available. Based on the delivered order, the supplier invoices the customer. After receiving the invoice, the buyer checks that the goods received correspond to the order, including the price control. After reviewing the invoice by the purchaser, it is redirected to the head of operations for confirmation; that is, there is always a double check and verification of the invoice. (Interviewee second.)

5.5.2 Issues in Procurement and Inventory

According to the second interviewee, the main problem for the case company's purchasing department is the global availability of materials caused by all kinds of crises: starting with the global economic crisis of 2007-2013, the Covid pandemic 2019-2021, and the war in Ukraine 2022-. Price fluctuations during this time doubled and even tripled. But apart from prices, the availability of goods has declined. The one who has been paying more got the advantage.

Considering the specific problem of the case company, it lies to a greater extent in the inaccuracy of forecasts and the company's rapid growth. The number of purchases doubled, but the warehouse continued to have a shortage of some materials and an excess of others. Since the company's management actively monitored the index of raw materials every month before the pandemic and the war, the company could negotiate prices with suppliers. Lately, negotiations have become more complicated. There is an exceptional situation in the world right now.

In the opinion of the first interviewee, due to problems with the availability of materials, buyers placed too large orders at once and for an extended period in the future. Thus, buyers wanted to secure the availability of material for production. Over time, availability may be improved, and buyers have to revise their orders and cancel and reschedule them to avoid overstocking the warehouse and unnecessary material costs for the company, which creates a lot of extra work.

According to the first interviewee, many purchases are made with long delivery times in mind due to the specific nature of the materials and lower prices from distant suppliers. The wholesaler companies have the availability advantage of materials because of a vast volume and variety of products in their warehouses, which makes delivery time way shorter; nevertheless, even wholesalers occasionally lack a shortage of materials.

One of the problems with the case company is that the delivery time of their finished products is very short compared to specific materials acquisition. That is also superimposed by inaccuracies in forecasting sales volume, based on which a procurement plan is drawn up. For buyers, it is essential to know the approximate dynamics of needs because procurement always happens in advance. And production team should not place production plans on those dates when there are no stocks. However, this scenario may lead to the non-fulfilment of the plan for the manufacture of goods, considering too short delivery times of a product specified in the contract, and, as a result, a contradiction with the needs of the client.

A more profitable option for the company to confirm orders by considering the existing capacity. Another variant is to organize the capacity, including the availability and flexibility of staff (possible outsourcing) and sufficient material- both can greatly affect the formation of additional costs for the company. (First interviewee.) Therefore, a case company may need to reconsider the delivery time in agreement to decrease extra costs.

Another problem of the company is the large inventory in the warehouse and items' slow turnover. According to the second interviewee, only traded goods bring money. He also noticed that any product has its own life cycle; the goods are written off at certain stages, while the raw material remains in the warehouse. That may be due to the fact that sales stop, and the goods remain in stock. According to the principle of depreciation, after a certain period of non-use, the product becomes obsolete and is written off, which means that its value is also written off.

5.6 Consignment Stock Planning in the Case Company

In the consignment model, the process will begin with receiving the material agreed to the warehouse of the case company. According to the first interviewee, collecting goods from the consignment warehouse will be implemented according to the FIFO principle. It is important to add that since the supplier X delivers almost a quarter of all deliveries, not all its materials will be transferred to consignment, but only the one with the highest turnover ratio. Back to the theoretical part, it is necessary to remember that establishing consignment processes takes time and requires active interaction of both parties, so the implementation should be carried out carefully, starting with pilot testing of several items.

The first interviewee states that it is the responsibility of the customer-case company to provide forecasts, based on which the supplier X will draw up a replenishment plan. For its best implementation, the supplier X has access to real-time information about the case company's needs and the stock balance. The supplier's responsibility now includes monitoring the stock levels in the customer's warehouse so that the goods are always available, in quantity specified by the minimum and maximum levels, according to the contract.

According to Sari (2008, 578), in the traditional procurement model, there is a considerable probability that each participant in the supply chain does not consider other participants' strategies, concentrating only on their own procurement processes. Similarly, Sari (2008, 276) links improved supply chain communication to a reduction in the bullwhip effect, and those forms of partnerships such as VMI, CPFR, and the consignment model are primarily aimed at high real-time information sharing among trading partners.

The case company must determine the maximum and minimum levels for the consignment stock, and supplier X will plan the implementation of the replenishment. In case of minimum-maximum levels of non-compliance, the case company will give feedback. It will not be possible to return the surplus due to the high cost of transportation. Therefore, close cooperation is necessary at all stages of the consignment stock development.

The case company wants to retain the right to change the maximum and minimum levels; for example, this may be convenient during holidays when production stops. In this situation, the consignor supports only the minimum level. The case company also retains the right to use materials in the consignment stock at any time. A basic inventory should be carried out once every six months; executors are appointed by agreement.

When a case company's production department sends a signal to the warehouse about what material they need, it also indicates that the material has been transferred from consignment stock to production. This action means that the goods automatically become the property of the case company; that is, they can no longer be returned to the consignment stock, except for the quality issues.

At the beginning of CS implementation, information about the goods transaction will be sent to the supplier, for example, once a week or by another agreement. It is advisable to include in the weekly report information about when the last shipment was received, that will help the supplier to get a more precise picture of the volume consumption of the case company. The plan for further development is to create a Portal in the Cloud, which will be in use for real-time stock control and information exchange.

The actual consignment inventory balance is also attached to the information about the moved goods for the most accurate accounting of the balance. Based on this information, the supplier only sends an invoice for the goods transferred for the company's use. According to a third interviewee, it is essential for the case company that when the consumption data goes to the supplier, confirmation of replenishing the stock possibility would be received, for example, if the amount of consumption increased sharply.

5.6.1 Quality Claims

If there are claims about the quality of the goods, such materials are not returned to the consignment stock but transferred to a special block reserved for such goods; the balance of such a block must also be reported to the supplier in a weekly report (in the future Portal in Cloud). The details of such a transfer and

compensation for damages must be discussed separately in the agreement; details of the contracts are not included in this thesis work.

5.6.2 Consignment Stock Invoicing

Since, in the consignment model, the invoice is received as the goods are consumed, the processes for its verification differ from the general model. The contract's terms determine the billing timeframe; for example, the invoice arrives weekly, following by the purchaser´s inspection of the invoice and payment together with the financial department. However, a record of what is taken from the consignment stock on the case company's territory must be kept daily because goods become the customer's property. According to the second interviewee, even when the invoice is drawn up once a week, the terms of payment under the contract can be from 60 to 90 days from the moment of invoicing; that is, the cash effect will be seen only two to three months after the use of the goods.

5.6.3 CS Model Flow-Chart

This CS model (Figure 12) was created specifically for the commission agent, and the points described in that flow chart meet the needs of the case company as consignee, including the specific agreements of both parties. For example, the reporting interval for material consumed may vary depending on the agreement between a consignor and a consignee. Also, the Quality Blocked Stock locations in CS and Material warehouses at the time of writing this thesis were included in the plan for a consignment model realization but have not yet been approved for implementation. Therefore, this scheme can be considered as a general structure of the CS organization but cannot be applied to any other company without making the necessary adjustments due to the specification of its structure.

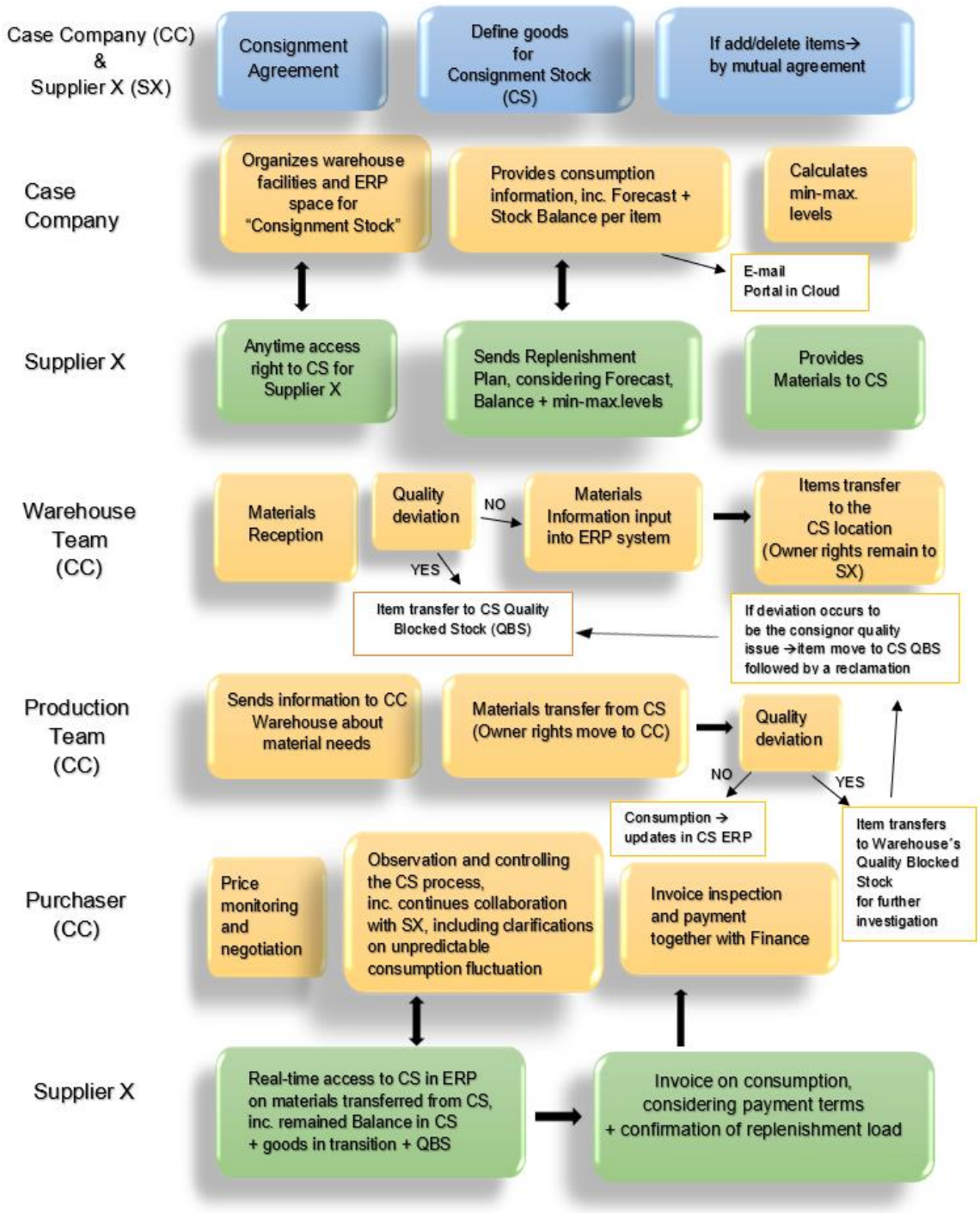

Figure 12. Consignment stock processes (Lehto 2023)

5.7 Risks of Consignment Stock

According to the first interviewee, in the consignment model, it is essential to follow the balance, reception, and collection of material, where the goods are

placed, and where they are moved. Therefore, the organization of physical (warehouse) and virtual (ERP) spaces should be appropriately established to avoid conflict between business partners. Constant monitoring is required.

The second interviewee also notes the possible emergence of digitalization problems. For consignment stock, access to real-time inventory information is essential. That is, when a material code is read off from the consignment stock for use, it must be immediately removed from the consignor's stock balance, and this information must be available to the supplier in real-time so that it can react in time. Inventory errors can cause balance fluctuations, leading to misunderstandings about where the goods have gone. In practice: when inventory shows a required balance, but in reality, the company does not have it, a conflict of interest arises, plus failure in production due to missing components and delay in replenishment. To avoid such problems, goods from the consignment stock must be kept separate from the case company's stock, and barcode readers must be used when collecting items.

The first interviewee also states that the risks include the responsibility for classifying goods and their replenishment transfers to the supplier. In this case, problems may arise due to inaccurate forecasts. There may be an oversupply or shortage of goods, even if the minimum and maximum levels are agreed upon.

Valentini and Zavanella (2003, 220), in their article, noted the importance of choosing a supplier for the implementation of the consignment model. One of the essential criteria is the activity of the supplier, and its critical view of the economic significance of the goods, qualifications for the reliability, and quality of supplies.

The second interviewee also points out possible problems due to inaccurate forecasts. The buyers need to respond quickly to such situations. And they must still monitor the supplier's reliability level. To avoid negative consequences, the case company needs to have other suppliers in any case.

The second interviewee believes that the problem may also arise with pricing since when the inventory belongs to the supplier, the interval between price checks is longer than before. The buyer still monitors the price index for raw ma-

terials and the supplier's competitiveness; therefore, when moving to a consignment inventory, it is necessary to define a price check cycle in the contract, for example, once a month.

5.8 Benefits of Consignment Stock

One of the main advantages of consignment stock is the reduction in inventory levels. This work has already raised the correlation between inventory size and return on investment (Sollish 2011, 4). According to the second interviewee, switching to consignment stock will primarily have a beneficial effect on the level of delivery reliability. In addition, the company expects to reduce tied-up capital since the consignment stock items, in monetary terms, belong to the supplier's investment and be paid by the case company on its use, which can decrease a significant part of the inventory cost in the case company's cash flow.

The first interviewee also noticed the vast advantage of consignment stock regarding the reduction in tied-up capital and, thus, greater opportunity for the case company to focus on other business activities. The goal of the case company in transition to the consignment inventory model is to meet the budget of planned inventory values for the whole year.

The interviewees' statements are also supported by Payne, Dorn, and Podolak (2011, 161) claim that the consignment stock model directly affects inventory shrinking, as safety stock is significantly reduced due to the timely delivery of materials. Also, Payne, Dorn, and Podolak (2011, 161) confirm the positive impact of the consignment stock on the tied-up capital, as this model improves the overall cash flow of the consignee due to the fact that the goods be paid only as they are used.

Another reason for switching to this model is the improvement in inventory turnover. As described earlier in this work, in the traditional model, replenishment of stocks, in the case company, occurs on the basis of sales forecasting, and forecasts can differ significantly from reality. This usually increases the remaining material in the warehouse, which affects the cash flow. It may happen that the stock balance bought at a low price has a positive effect on the stock cost, but this situation rarely occurs, so it should not be considered when planning stocks.

It is more critical to free up money from inventory for other operations in the company. According to the second interviewee, switching to consignment inventory will increase the stock turnover and reduce the value of the company's inventory and the capital invested in it. The second interviewee also states that a consignment stock may minimize material depreciation problems because there should not be goods stagnation in such a warehouse. Given a model's goal is to choose a material with a high turnover.

Braglia and Zavanella (2003, 3793) argue that the consignment model might become very beneficial in strategic and profitable ways, especially for businesses with uncertain environments, which means great variation in delivery time and market demand. And that is precisely one of the issues of the case company since it has many specific items in the stock, long-distance suppliers, and fluctuation in the sales-based forecast.

Ryu and Hwang (2018, 36) also refer to Zavanella (2003), Battini (2010), and other researchers claim that one of the essential advantages of consignment stock is that this model allows the buyer to reduce the capital associated with purchases and the supplier to increase sales stability.

The third interviewee also notes the positive impact of the consignment warehouse on the company's cash flow for the same reasons listed earlier in this work. The interviewee noticed the importance of monitoring the correctness of the minimum and maximum levels by the case company's purchasing department.

Valentini and Zavanella (2003, 221) state that the buyer and supplier's desired maximum and minimum stock levels will differ. Thereby the supplier wants to make the minimum level as low as possible because this is its invested money capital. For the buyer, on the contrary, the minimum level gives confidence in the availability of the material, so it seeks to increase the minimum level. It is convenient for the supplier to have the maximum stock level as high as possible, freeing up space in their warehouses, which can be used for other purposes. For the buyer, managing warehouses leads to certain costs; the larger the volume, the greater the costs; thus, the buyer will try to limit the maximum level. Therefore, these parameters must be analysed and set together.

Also, the first interviewee claims that this model will reduce the amount of work on purchases. The buyer's work turns more to observation, control, and negotiations. Given the commitment to one supplier, material price increases are risky. Still, advantages such as reliability, timely delivery, material quality, and additional services from the consignor negate the potential price increase. However, the price change dynamics still must be controlled by a purchaser.

The second interviewee also agrees that a significant benefit of consignment stock is the ease of use, which partly eliminates the work of the purchasing department, such as the ordering process for each line, delivery confirmation and order tracking, and double invoice handling.

In their article, Braglia and Zavanella (2003, 3796) also note the consignment model's positive effect on simplifying the purchaser's activities, consequently reducing administrative costs. Braglia's and Zavanella's (2003, 3796) statement also include the reduction of costs associated with tied-up capital and the presence of a guaranteed minimum level of stocks, which means an increase in the reliability of material availability, initially as part of the consignment stock policy.

According to the third interviewee, the considerable advantage of this model is the transparency and close cooperation of both parties," It requires a continuous exchange of information between the two parties" (Braglia & Zavanella 2003, 3795), including the exchange of information about changes in consumption in real-time, which will directly affect the entire supply chain. For example, if consumption values have increased, the buyer can immediately clarify whether this phenomenon was temporary or permanent. Due to this information, if this is a constant change, the supplier can quickly respond with an increase in their purchases, influencing other members in this supply chain. If the phenomenon is temporary, the supplier will not take any action, thereby preventing the effect of a bullwhip throughout the supply chain.

Holweg et al. (2005, 5) also confirmed in their article that visibility is one of the main goals of cooperation so that the demand structure is transparent throughout the whole supply chain. This claim is also supported by Braglia and Zanavalla's (2003, 3796) article about the correlation between the significant benefit of stra-

tegic partnership in the consignment stock model and the elimination of the bull-whip effect since the information of any changes drives through the whole supply chain. Holweg et al. (2005, 7) also state that the uncertainty and opacity caused by lack of collaboration often lead to an artificial increase in demand, or the so-called whiplash (bullwhip) effect, which can be a costly mistake throughout the supply chain.

6 CONCLUSION AND RECOMMENDATIONS

Thanks to this study, the goal of this work was achieved - to identify the pros and cons of the consignment stock model considering the case company as the consignee. In addition to this primary goal, another achieved goal for the work was the creation of a scheme for organizing a consignment inventory model for the commissioner. This diagram can become an introductory and easy-to-understand manual of the consignment model processes for the other company departments in addition to purchasing.

Thanks to the empirical part of the study, answers were found to the questions posed at the beginning of the work. The advantages of the consignment model and its beneficial effect on reducing tied-up capital were identified by comparing information from primary and secondary sources. In addition, considering the problems in the company's inventory management processes found during the study and the benefits of the CS model, it can be concluded that the company indeed should implement reorganizing partly inventory management, leaning towards the consignment model.

The analysis of this work made it possible to highlight the main problem regarding both the traditional and consignment replenishment models, which is an inaccuracy in forecasts. Since it is precisely because of sales fluctuation, there is an oversupply and stagnation of goods, leading to low turnover, material depreciation, a shortage, or a sharp increase in replenishment, driving the bullwhip effect. But the consignment model's advantage is that forecasting inaccuracies will not affect the tied-up capital of the case company, only when, due to the lack of goods, it will have to be compensated by another supplier. However, as time passes, experience and the availability of real-time inventory information will enable the consignor to better adapt to changes in consignment stock and fluctuations in forecasts.

Also, through the analysis of this work, another problem was revealed related to short delivery dates of ready-made products and unclear cancellation policy of pre-orders, not prescribed adequately in the contracts for the clients of the case company. For now, the consignment stock will not be able to solve this problem

since supplier X cannot provide all the materials. Due to saving on purchasing costs, many goods must be ordered from long distance suppliers. While the delivery time of those can be up to 12 weeks, plus the time for manufacturing components can reach up to 4 months. The production department of the case company schedules the start of work based on the arrival date of the required material. The delivery time of the finished product to the clients of the case company's contracts ranges from 4 to 8 weeks; these terms look quite pessimistic since anything can happen in 6 months (an estimated time of arrival from a distance), including changes in sales, needs, or even global crises and local strikes. The case company must reconsider timing and terms issues, including production planning, delivery time terms, contracting, cancellation policies, and forecasting problems.

The organization of a consignment stock with suppliers at a long distance could improve delivery reliability indicators, but this is not possible in the near future due to the lack of resources of such suppliers and even cultural differences. That might be a great topic for further research!

Thanks to this study, it was also possible to find an answer to the question of potential changes in the procurement processes. Consignment stock can positively impact purchasing operations by simplifying replenishment processes and buyer's actions, thus reducing administrative costs. However, to effectively manage the consignment stock, in addition to digital technologies, it is necessary to pay special attention to the training of warehouse personnel in order to avoid problems with the movement of materials from the consignment inventory to the production department, or a separate block, in case of damage or defective goods before determining the cause.

During the empirical research, another issue, which can be challenging to eliminate only through CS implementation due to its limited volume, was identified in the purchasing department. It is the continuous processing of information manually. At the same time, the buyer must have a clear idea of the number of orders while keeping the total cost of inventory low. This issue is also related to the problem of inaccurate forecasts and excessive cancellations. Even when a company checks predictions every month, customers may cancel their orders the

estimates were made on, resulting in non-conformity with purchases made for manufacturing. In this case, buyers have to make changes, move items' delivery dates, or cancel orders to avoid excess inventory. Essential to note that for all cancellations of the already made orders, currently, buyers must make them manually. Because of that, some cancellations do not occur, which leads to excess stock and slows down the turnover of goods. The purchasing department must constantly check its order book to make sure the purchase is up to date. That can be a very exhausting task, and a human factor must also be taken into account. Therefore, the company should consider introducing AI technologies for more efficient procurement management, primarily for more efficient information processing and subsequent logical decisions. That could be an excellent topic for further investigation.

In the case company, the purchasing department regularly monitors the activity and reliability of suppliers through the Logisticar digital program. With its help, buyers observe the changes in the supply chain both for the better and for the worse. However, without further analysis of the results, one cannot do without the help of specialists to assess the situation's criticality. After all, this program does not take into account external factors influencing supplies, for example, strikes in the field of transport services; in this case, even the most reliable supplier may appear to experience negative results in the program's statistics. Therefore, a high level of buyer professionalism and continuous development in the purchasing field is a mandatory condition to achieve efficiency in inventory management and reduce tied-up capital. It is also important to remember that the turnover of many materials will continue to depend on robust and accurate purchasing.

The consignment stock cannot solve all the problems with balancing the goods in the warehouse. However, this research showed more benefits of the consignment inventory model for the consignee than risks, especially considering the improvement of the cash flow of the case company. Moreover, the risks described in this work can be minimized through a competent planning process at the stage of negotiations with a potential consignor, including careful drafting of the contract, which will stipulate the aspects of safety stock levels, the period for transmitting data on the material used, sales forecasts, pricing check cycles, and insurances.

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APPENDICES

Appendix 1 1(1). Semi-structured interview

- 3 interviewees:

A. Materials Manager. 10.3.2023. 46 min.

B. Head of Operations. 20.3.2023. 1h 04 min.

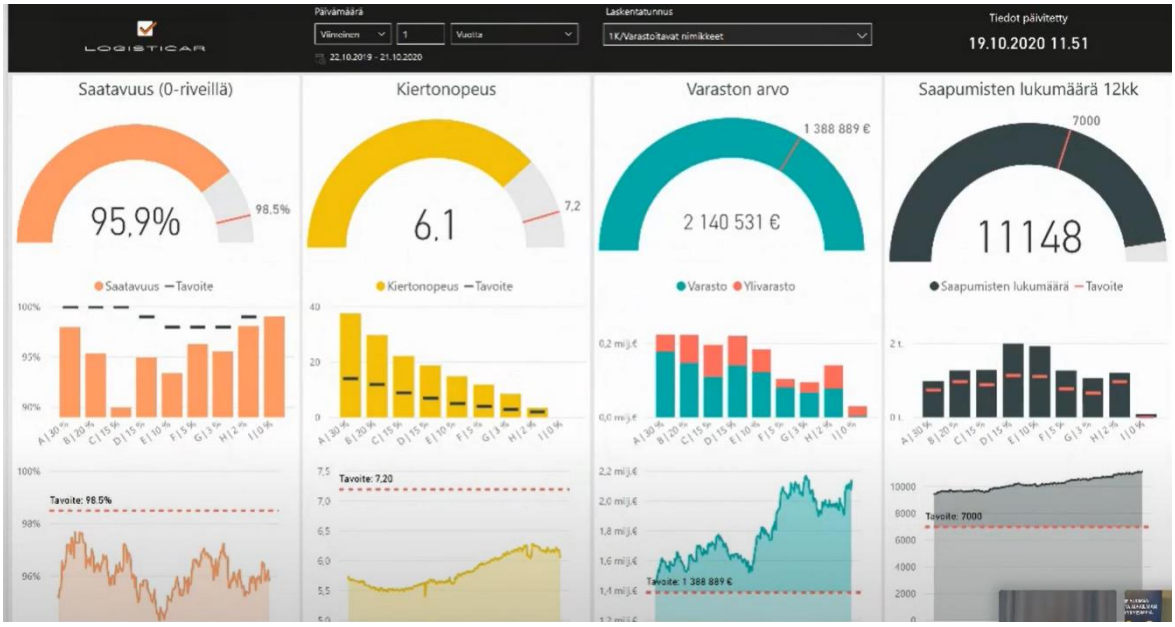
C. Supply Chain Analyst. 28.3. 2023. 58 min.

- Interviews conducted in Finnish
- Interviews conducted face-to-face
- Audio recorder was used
- Transcription and coding analyse were made afterwards

Conversation topics for semi-structured interviews:

- The case company background.
- Current situation and collaboration between the case company and supplier X.
- Consignment stock as a concept, processes, requirements, risks, benefits, and expectations.
- Comparison of traditional purchasing model with consignment stock model.
- The issues in inventory management and procurement.

Appendix 2 1(2). LOGISTICAR Program Report: observation and analysis



(Leanware Oy - Webinaari - Tavoitteellisen oston työkalu (Logisticar) 2020)

Saatavuus/ Availability:

- The main gauge, what to look at; measures the number of goods in the warehouse, defined in the category of stocking. This parameter can help identify problematic items, on the basis of which further inventory management adjustments will be made regarding each individual item.

Kiertonopeus/ Turnover:

- There are 9 categories of ABC sorting. Each item is allocated according to its consumption in euros, where A and B are half of the euros, and the first four categories (A; B; C; D) are 80% of total value in euro. Other items have insignificant euro value but might still be critical for production.

Varaston arvo/ Inventory value:

- For this indicator is relevant information to analyse the excess in stock (the red part). The observation of these results includes following continuous monitoring of the maximum stock and calculating on how each item's maximum stock should be.

Appendix 2 2(2). LOGISTICAR Program Report: observation and analysis

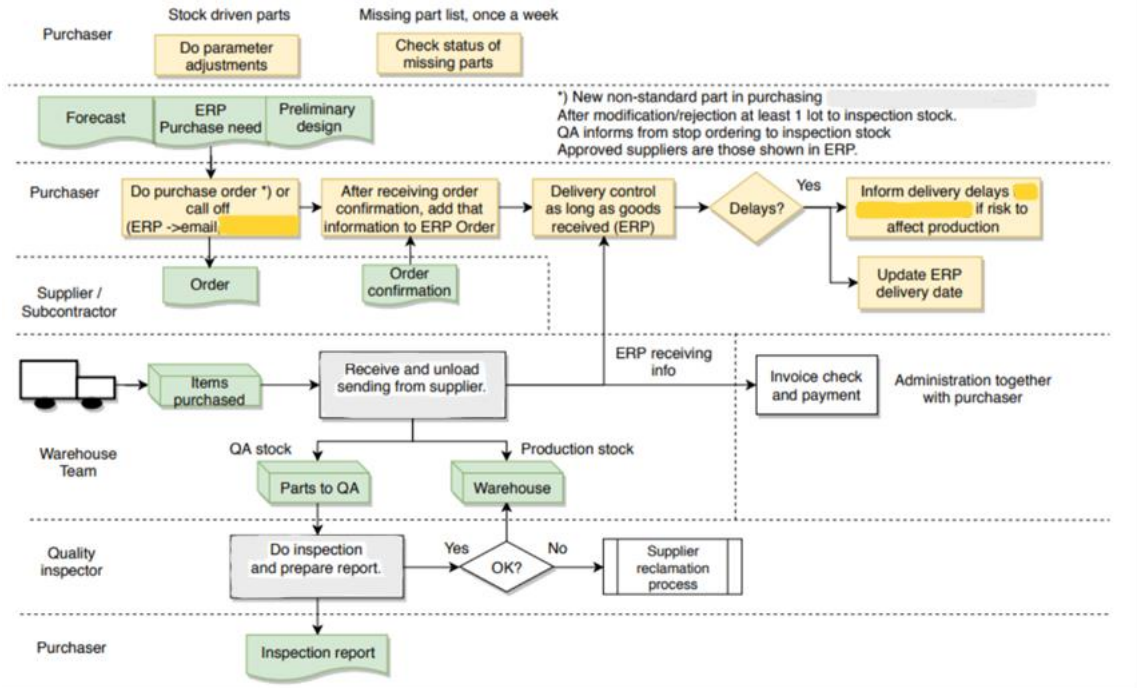
Saapumisten lukumäärä/ Number of arrivals:

- This parameter means the amount of work per item. The problem occurs when the lower category of items (E; F; G; H; I) form too much work, i.e., items themselves bring little euro value but require a lot of processing work.

Important to note that all the measurements from Logisticar report are relevant only in case, when the desired parameters are predetermined. (Leanware Oy - Webinaari - Tavoitteellisen oston työkalu (Logisticar).)

(picture: https://issuu.com/editorhelsinki/docs/logisticar)

Appendix 3 1(1). Operative purchasing process



(Adapted from Case Company Intranet 2023)