



**SAVONIA**

# **Vendor Managed Inventory**

Pilot for Fiskars Home Sourcing Unit

**Minna Kervinen**

Bachelor's Thesis

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**Bachelor's degree (UAS)**



**SAVONIA UNIVERSITY OF APPLIED SCIENCES**  
**THESIS**

**Abstract**

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Abstract <p>Just in time principles and vendor managed inventory model are part of today's supply chain management. These models are utilized in order to have successful and effective supply chain. This thesis concentrates on inbound logistics operations of supply chain. It describes the general theory of inbound supply chain logistics operations and dives into vendor managed inventory model and how this model can be utilized in a company where the suppliers are located far, lead times are long and demand is uneven.</p> <p>Vendor managed inventory model is designed to streamline the flow of goods within the supply chain. It is built on supply chain relationships to quickly replenish inventory on the basis of joint planning or actual sales experience. Basic idea is to remove the order-delivery process between the supplier and the customer. Supplier takes the responsibility to maintain inventory level directly to customer's inventory. Therefore it requires extensive co-operation and information sharing between supply chain partners.</p> <p>In this thesis it was not possible to utilize vendor managed inventory model in the company as such due to long lead times, unstable demand and IT-challenges. But it was used as a basis when creating its own Fiskars vendor managed inventory model. The research included defining the requirements, creating the new process and agreeing on the follow up system for the new model. It also included a pilot where the new Fiskars vendor managed inventory model was tested with two selected suppliers.</p> <p>The Fiskars vendor managed inventory model pilot showed clear improvement in the inbound supply chain metrics. Supplier performance figures had clearly improved. Pilot also showed challenges which need to be taken into consideration when actual Fiskars vendor managed inventory implementation will take place.</p>			
Keywords vendor managed inventory, sourcing, supply chain, score card, sales forecast			

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## DEFINITIONS

Bullwhip effect	Phenomenon where the swings in inventory are larger the longer you go forward in supply chain from the point of changes in demand
Cross-docking	Material handling and distribution concept where goods move directly from receiving to shipping
Delivery accuracy	Measure of how well supplier is able to keep agreed delivery time
EDI	Electronic data interchange
EMEA	Europe, Middle East and Asia
ERP	Enterprise Resource Planning
IT	Information Technology
JIT	Just In Time
Lead time	Measure of the elapsed time between release of a purchase order to the supplier, to the ready-to-ship product status
Order cycle time	Time between order placement to order delivery
PO	Purchase Order
SCIS	Supply Chain Information Systems
SKU	Stock Keeping Unit
SMI	Supplier Managed Inventory
S&OP	Sales & Operations Planning
VMI	Vendor Managed Inventory

## 1 INTRODUCTION

This thesis is made in co-operation with Fiskars Group. The researcher is working as a supply chain manager in the Fiskars Home sourcing unit. The topic of the thesis developed while the researcher was facing daily challenges in the outsourcing supply chain. Continuous need to develop supply chain in the company and future requirements in the business field realized the topic to be suitable and needed. This thesis is limited to Fiskars Home sourcing unit thus it concerns only the inbound area of supply chain management. Part of the material, direct business figures of Fiskars Home sourcing unit, in this thesis is seen as confidential. All confidential material is located in the appendices and therefore appendices are not available in public format of this thesis.

Outsourcing in Fiskars Home does not have a long history. The outsourcing of finished goods started in Fiskars Home when the cutlery factory was closed down in Finland during year 2001. The cutleries stayed in selection thus company needed a new outside source for them and outsourcing business started. Throughout the years the outsourcing has increased together with growing business of Fiskars Home, previously known as Iittala Oy Ab. Nowadays the outsourcing does not consist only cutleries but other items and material areas too, such as porcelain, glass, cookware and plastics, to guarantee an interesting, versatile and competitive product range for consumers. (Iittala www page.)

In Fiskars Home sourcing unit the effectiveness of the supply chain is a challenge. The outsourcing business does not have a long history and company has grown rapidly though company mergers. Now there is a clear need to improve supply chain in outsourcing. Especially supplier lead times, delivery accuracy, inventory level and inventory turnover need improvement. Vendor managed inventory (VMI) has given promising results in this business field in general and other business areas in Fiskars Group. Therefore Fiskars Home wants to get to know vendor managed inventory model more and find out how it could be utilized in Fiskars Home sourcing unit. In this Thesis one will get familiar to vendor managed inventory model. One will find out what does vendor managed inventory mean, how does it work and when it can be utilized? What are the strengths and weaknesses of this inventory model? The main target of this thesis is to develop suitable vendor managed inventory model for Fiskars Home sourcing unit. Part of the thesis is to develop the practices and tools for Fiskars vendor managed inventory and make a pilot with selected suppliers to realize the new model.

## 1.1 Structure and research methods of the thesis

The thesis includes a theoretical framework, a description of current home sourcing supply chain state and requirements for future. Thesis will also include the construction of Fiskars vendor managed inventory model and the pilot of the new model with two selected suppliers. The theoretical framework will start from general information of supply chain management, storages and inventories and it will continue into details of vendor managed inventory. It will also give information of how supply chain can be controlled; how it is classified and measured. The theory is gathered from both primary and secondary sources.

After the theory part, the current status of Home sourcing supply chain and requirements for future will be described. The description will be the background for the new Fiskars vendor managed inventory model. In the last part the new Fiskars vendor managed inventory model will be created and piloted with two selected suppliers.

The research was carried out as both qualitative and quantitative research. Qualitative research is holistic acquisition of information and the material is gathered from natural, real life situations. Therefore the starting point is not testing the theory and hypothesis but examining the materials from multiple perspectives. The research methods used in qualitative research are for example theme interviews, participating observation, group interviews and different document analysis. Also the target group is selected intentionally, not randomly. (Hirsjärvi, Remes & Sajavaara 1997, 164.) All these qualitative research methods mentioned above were used when setting the targets for Fiskars vendor managed inventory model. Quantitative research method was used when studying the current status of Fiskars outsourcing supply chain and in analyzing the outcome of Fiskars vendor managed inventory pilot. In quantitative research the material is in statistical form and the material is based on numerical measurement (Hirsjärvi et al. 1997, 140).

In this thesis action research was used as a research strategy. The purpose of action research is to produce practical knowledge that is useful to people in the everyday conduct of their lives. Action research is about working towards practical outcomes and about creating new forms of understanding. Therefore action research is also participative research and it starts with everyday experiences and is concerning development of living knowledge. (Reason & Bradbury 2006, 2.) In this study the researcher has worked in the company as Supply chain manager already before starting the research. The researcher is dealing with supply chain development issues in her



current position and therefore was the project leader in defining and implementing vendor managed inventory model for Fiskars.

One part of this research was interviews. Interview is a unique method to gather information because there the researcher has a direct, linguistic interaction with the examinee. Flexibility of interviews is seen as the biggest advantage. The interviews were realized as theme interviews, where the subject of the interview was known but no exact questions were available. (Hirsjärvi et al. 1997, 204-210.) The interviews were made as a group interview. Also internal and outside benchmarking was used when defining Fiskars vendor managed inventory model.

## 1.2 Fiskars Group

### *Fiskars group in short*

Fiskars is the oldest company in Finland. It has over 360 years heritage when all begun from Fiskars village in 1649. In 1883 Fiskars become a joint stock company and expanded into a number of new businesses. Company was listed on the Helsinki stock exchange in 1915. 1967 the famous orange handled scissors came to selection together with wide range of other plastic consumer products. The garden tools production started in year 1985. During the years Fiskars has grown by acquiring several innovative companies to enlarge its offering in consumer products. One of these acquisitions was Iittala group, now known as Fiskars Home, in 2007. (Rajala 2012.)

In 2011 the net sales of Fiskars was 742,5 million euros. It has 3400 employees around the world and Fiskars products are sold over 60 countries (figure 1). Fiskars Company is divided into Fiskars Americas and Fiskars EMEA (Europe, Middle East and Asia) areas. The net sales of Fiskars Americas in 2011 were 233 million euros and it employs 565 people. The net sales of Fiskars EMEA in 2011 were 517 million euros and it employs 2609 people. (Rajala 2012.)

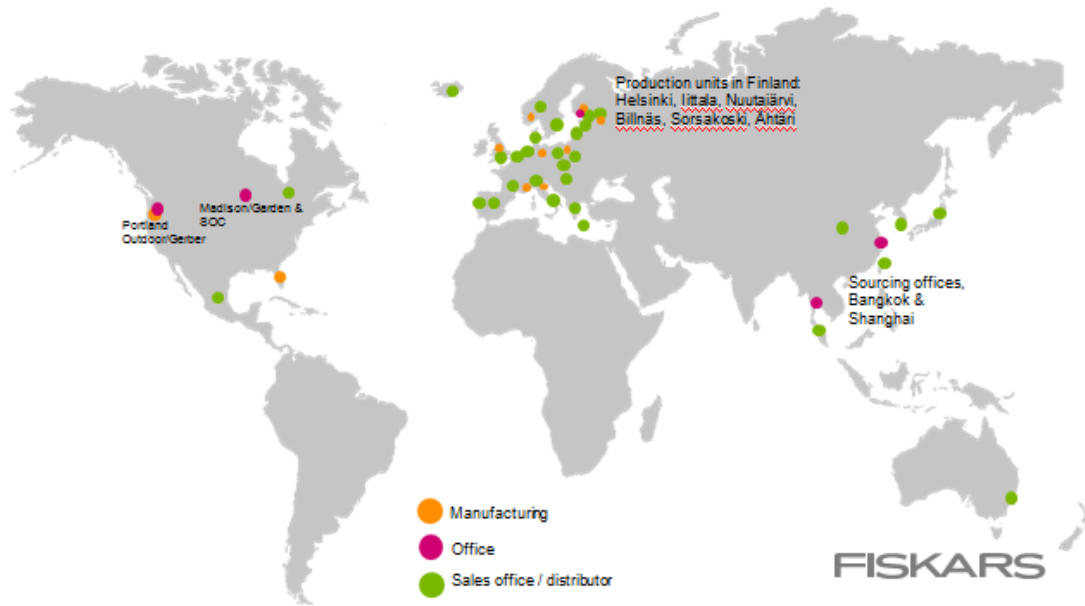


Figure 1: Fiskars company locations around the world (Rajala 2012)

Fiskars group structure can be seen in figure 2. Fiskars group is divided into EMEA, Americas, real estate and corporate functions and associated company Wärtsilä. The EMEA and Americas business has three business areas: Home, Garden and Outdoor. Fiskars Home business area offers modern Scandinavian design products for the kitchen, table, living room and school, office and craft. Its turnover in 2011 was 306 million euros and it had the share of 41 percent of total sales. The famous brands in Home business area are for example Iittala, Fiskars, Hackman, Arabia, Kaimano and Rörstrand. The Garden business area offers ergonomically designed tools for gardening and construction. The net sales of 2011 were 294 million euros and it has the share of 40 percent of total sales. Garden business area brands are Fiskars, Leborgne, Zinck Lysbro and Ebertsankey. The Outdoor business area with net sales of 138 million euros (19% of total sales) offers innovative, essential products for an active lifestyle and durable leisure boats. It has brands Gerber, Buster and Drive. (Rajala 2012.)

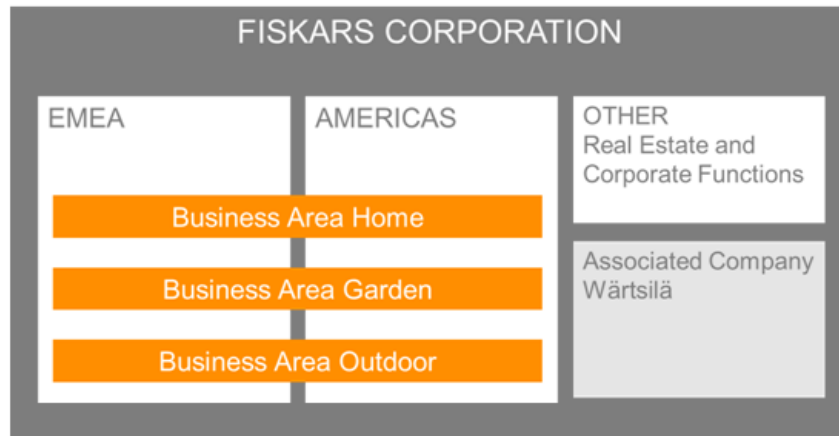


Figure 2: Fiskars Group structure (Rajala 2012)

The corporate values are presented in figure 3. Fiskars values are based on Fiskars code of conduct. The values are innovation, teamwork, accountability and integrity. (Rajala 2012.) Fiskars defines values with following way: innovations should have consumer and customer insight and commercial thinking. Teamwork is important since together Fiskars is stronger. Each of Fiskars employees has accountability of their actions; each one of Fiskars people can make a difference. Also Fiskars people are good corporate citizens and integrity is highly valued. (Fiskars www page.) All these Fiskars values work as a pillar for common Fiskars culture in the company. The business of the Fiskars group is founded on responsible operations that follow the company's values. The respect for nature and the environment play a central role for Fiskars. Fiskars also requires all of its suppliers to follow national laws and reach towards continuous efforts to reduce their environmental impact. (Iittala www page.) The strategy of Fiskars is to get their unique products into the homes and gardens of consumers around the world. (Rajala 2012.)

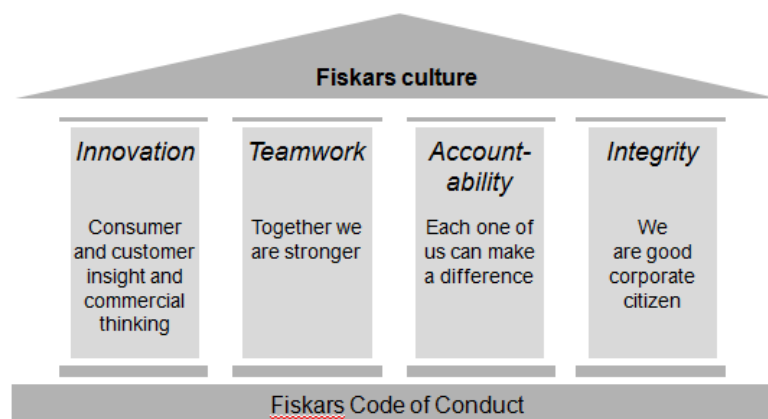


Figure 3: Fiskars values (Rajala 2012)

*Fiskars Home sourcing unit*

Fiskars uses contracted manufacturers in order to guarantee an interesting, versatile and competitive range for the consumer, even when Fiskars does not have sufficient capacity or technical facilities to manufacture a particular product. Fiskars is committed to ensure that working conditions in its supply chain are safe, workers are treated with respect and dignity, and business operations are environmentally sustainable. Fiskars external suppliers are seen as long-term partners and are selected on the basis of their capability to support Fiskars' quality, supply chain, cost, and technical targets with flexibility. Fiskars requires its partners to commit to principles covering labor and human rights, health and safety, environmental impact and business ethics. (littala www page.)

Fiskars home sourcing unit is the unit handling the outsourcing in Home business area: from vendor management to operational purchasing. Fiskars Home is divided into four material areas: metal, porcelain, mechanics and glass. Metal is divided into subcategories of cutlery / cutting tools and cookware. Mechanics area consists of plastic, wood, textiles and other materials. The turnover share of material areas in year 2011 is presented in appendix 1. Fiskars home sourcing unit is located in several countries: Finland, Sweden, Thailand and China. Ready goods are purchased from suppliers and the goods are delivered into Fiskars own warehouses for further distribution. (Kervinen 2010).

## 2 INBOUND SUPPLY CHAIN LOGISTICS OPERATIONS

Supply chain management consists of different companies co-operating in order to have influence on strategic positioning and to improve operating efficiency. For each company involved, the supply chain relationship reflects a strategic choice. A supply chain strategy is a channel and business organizational arrangement based on co-operation and understood dependency. Supply chain operations require managerial processes which extends functional areas within individual companies and link suppliers, trading partners and customers across organizational boundaries. (Bowersox, Closs & Cooper 2010, 4-6.) This chapter will study different supply chain logistics operations sections. The material has been limited to concern only outsourcing sections according to the thesis limitations: inbound logistics.

### 2.1 Warehousing

Because demand can't be exactly predicted, production can't react instantly, delivery times exist and transportation is not perfectly reliable, companies need storages. Storages are used to improve supply-demand coordination and lower overall costs. Storages are needed also to assist in the production process and in marketing process. The cost of warehousing and materials handling can be traded off with transportation and production-purchasing cost. A company can lower production costs through economical production batch size and sequence. It also can lower transportation costs through larger, more economical shipment quantities. The object is to use just enough warehousing in order to find economical balance between warehousing, production and transportation costs. (Ballou 1992, 236-237.)

The storage system can be divided into two important functions: storage and material handling. In figure 4 these functions can be seen by tracing product flow through a typical distribution warehouse. Materials handling refers to activities of loading and unloading, moving the product to and from various locations within the warehouse and order picking. Storage is the accumulation of inventory for a period of time. The objectives of warehousing is to efficiently receive inventory, store it as required, assemble it into complete orders and make customer shipment (Bowersox et al. 2010, 253). The storages may take place under several financial and legal arrangements. The basic four alternatives are owning, renting, leasing and storing in transit. Through combinations of these four alternatives one can create an almost infinite variety of storages. (Ballou 1992, 239-245.)

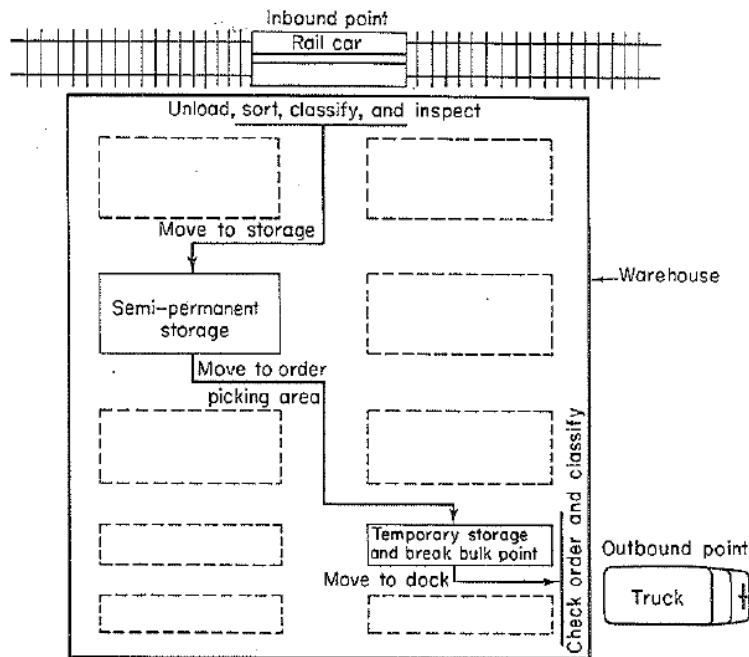


Figure 4: Typical distribution warehouse (Ballou 1992, 239)

Most manufacturing companies and service organizations have **space ownership** in some form. In this form the company or organization has a capital investment in the space and in the materials handling equipment in the facility. In this form the company expects following advantages: better control, lower costs and greater flexibility as compared with rented warehouse space. (Ballou 1992, 245.)

**Rented space** provides warehousing services to other business firms on a short-term basis and they perform many of the same services that are carried out under a private warehousing arrangement: receiving, storage, shipping and related activities. The public warehouses are more standardized and use multi-purpose equipment. The advantages of public warehousing are: no fixed investments, lower costs when utilization of inventory space is relatively low and high location flexibility by changing warehouses according to markets. (Ballou 1992, 246.)

**Leased space** for many companies represents a choice in between short-term space rental in public warehouse and long-term commitment of a private warehouse. The advantage of leasing storage space is that a lower cost may be obtained from the space owner. But space user must guarantee through a lease contract that space rental for a specified time will be paid. Therefore some location flexibility is lost. (Ballou 1992, 252.)

**Storage in transit** refers to the time that goods stay in the transportation equipment during delivery. It is a special form of warehousing and it requires coordination with the

choice of a mode of transportation or transportation service. Because different transportation choices mean different transit times, it is possible to select a transportation service that can reduce or even eliminate the need for conventional warehousing. This alternative is especially attractive to companies dealing with seasonal inventories and shipment over long distances. (Ballou 1992, 252.)

## 2.2 Inventories

Inventories are stockpiles of raw materials, supplies, components, work in process and finished goods that appear in many points throughout a company's production and logistics channel (figure 5). Inventories can be found in warehouses, yards, shop floors, transportation equipment and on retail store shelves. (Ballou 1992, 403.) The inventories may locate close to the customers or manufacturers. They can be centralized or spread in several locations. (Mustonen, Pouri 1994, 5.) These inventories can cost between 20 to 40 percent of their value per year. Often the disadvantage of the inventories is bigger than the advantages (Koskinen, Lankinen, Sakki, Kivistö & Vepsäläinen 1995, 108). Therefore careful management of inventory levels is important. (Ballou 1992, 403.)

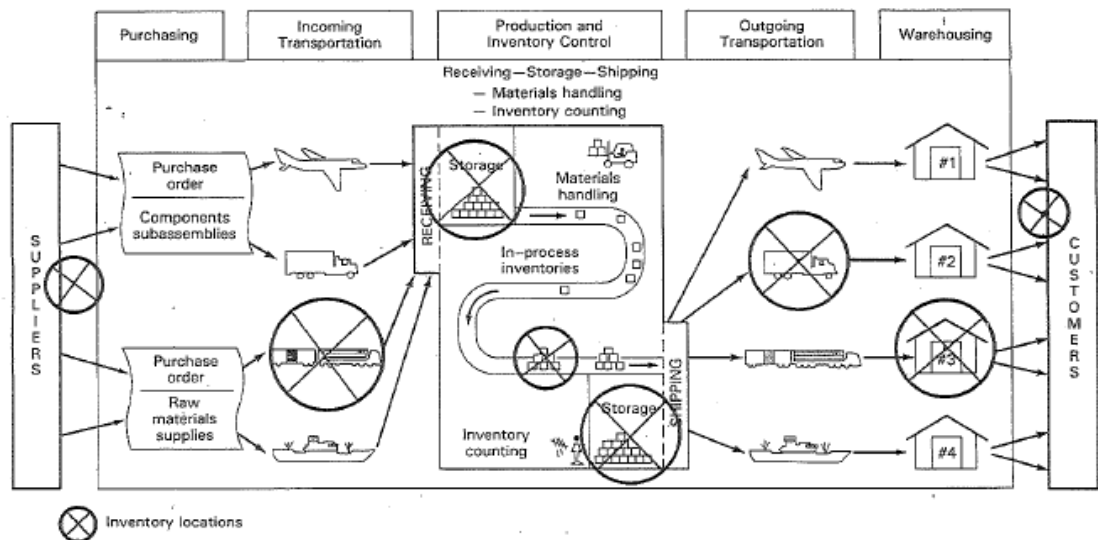


Figure 5: Locations of inventories in production and logistics channel (Ballou 1992, 404)

Inventories are kept due to customer service or cost factors. Inventories provide a level of service or product availability, which can meet a high customer service requirement. The presence of these inventories to the customer may not only maintain sales but increase them. Also even though holding inventories has a cost, it can indirectly reduce operating costs in other activities and can more than offset the carrying cost. Holding inventories enable more economical production by allowing larger, longer and more even production runs. In this case inventories act as a buffer between the two. Holding

inventories decrease costs in purchasing and transportation by utilizing cost efficient quantities. Price reduction can be reached when purchasing bigger volumes and transportation costs reduces when handling per unit decreases with bigger volumes. Forward buying, what increases inventory level, reduces costs, if purchase prices are expected to rise in the future. The variation in time that it takes to produce and transport goods throughout the operating channel can cause uncertainties that impact on operating costs and customer service levels. Inventories are frequently used at many points in the channel to buffer the effects of this variability and therefore they help to smooth operations. Unplanned and unanticipated shocks, such as labour strikes, natural disasters and supplier delays, can happen. Having some inventory in key points throughout the logistics channel allows the system to operate for a period of time while the effect of the shock can be diminished. (Ballou 1992, 405-406.)

There are also reasons against inventories. Inventories are considered as wasteful because they absorb capital that might otherwise be put to better use, such as to improve productivity or competitiveness. Inventories do not contribute any direct value to the products of the company. Inventories can also mask quality problems. When quality problems appear the tendency is to work off existing inventories to protect the capital investment. Therefore the correcting the problems may be slow. Also using inventories promotes negative attitude about the management of the logistics channel as a whole. With inventories it is often possible to isolate one stage of the channel from another. Without inventories the planning and coordinating across several levels of the channels could be made at one time. (Ballou 1992, 406.)

Inventories can be categorized in five forms: in the pipeline inventory, for speculation inventory, regular inventory, safety stock and obsolete stock. **In the pipeline inventories** are in transit between stocking or production points because movement is not immediate. Some **stock** may be held **for speculation** due to purchase price changes, seasonality or forward buying. **Regular stocks** are inventories what are necessary to meet the average demand during the time between successive replenishments. The amount of regular stock is highly dependent on production lot sizes, economical shipment quantities, storage space limitations, replenishment lead times, price-quantity discount schedules and inventory carrying costs. **Safety stock** is in addition to the regular stock. Safety stock is needed due to variability in demand for the inventory and in replenishment lead time. Safety stock is determined by statistical procedures. Accurate forecasting is essential to minimize the safety stock levels. If lead time and demand could be predicted with 100 percent accuracy, safety stock is not



needed. **Obsolete stock** is stock what diminishes, becomes out of date, is lost or stolen when held for a period of time. (Ballou 1992, 407.)

Due to reasons mentioned in this section there will always be a need for inventories. But it is possible to reduce the need of inventories and the level of inventories with the help of different operating models, co-operation contracts and supply planning methods. (Mustonen & Pouri 1994, 5.)

### 2.3 Just-in-time (JIT)

Just in time (JIT) approach is nowadays perhaps most widely discussed in supply chain management. In today's business people often refer to a JIT manufacturing process, JIT inventories or JIT delivery system. JIT systems are designed to manage lead times and eliminate waste. (Coyle, Bardi & Langley 2003, 246.) The goal of JIT is to time-phase activities so that purchased materials and components arrive at the manufacturing or assembly point just at the time of need in the process. The product should arrive exactly when a firm needs it, with no tolerance for late or early deliveries (Coyle et al. 2003, 246). As a result of reducing or eliminating reserve stocks, raw-materials and work-in-process inventories are minimized. The key to just in time operations is that demand for components and materials depends on the finalized production schedule. Requirements can be defined by focusing on it. When the production schedule is established, just in time arrival of components and materials can be planned to meet the requirements. This results as reduced handling and minimized inventories. (Bowersox et al. 2010, 91.)

JIT has numerous implications. Four major elements can be raised up in just in time concept: zero inventories, short lead times, small and frequent replenishment quantities and zero defects (Coyle et al. 2003, 247). It is necessary to have suppliers with high and consistent quality level, since their components will go directly into the process. The logistical performance needs to be absolutely reliable in order to eliminate or reduce the need for buffer stocks of materials. JIT generally requires more frequent deliveries of smaller quantities of purchased inputs. This may require modification of inbound transportation. JIT system also typically involves short production runs and requires production and manufacturing activities to change frequently from one product to the next (Coyle et al. 2003, 248). Also to make JIT work, the co-operation and communication between the buyers purchasing organization and suppliers must be very close. Both buyer and the seller must have strong, mutual commitment in JIT operations (Coyle et al. 2003, 249). In just in time operations companies attempt to gain the benefits of backward vertical integration but avoid the formal tie of ownership. Companies achieve many of the same ends through coordination and process

integration with suppliers. (Bowersox et al. 2010, 91.) Successful JIT requires a concern for minimizing inventory throughout the supply channel. It will not work if companies only push inventory back to another channel member. (Coyle et al. 2003, 249).

#### 2.4 Vendor managed inventory

There have been many industry initiatives to create efficiency and effectiveness through integration of supply chain activities and processes. The 1990s was the decade when many logistics-related strategies and tactics were developed largely in response to the customer and consumer revolution. (Coyle et al. 2003, 83-109.) Vendor Managed Inventory (VMI), also known as Co-Managed Inventory (CMI), Supplier Managed Inventory (SMI) (Blonqvist, Jalovaara & Laiho 2011) and consignment inventory (Dong & Xu 2002, 75) is one of the specific techniques for collaborative inventory replenishment. It is an effective supply chain strategy that can realize many of the benefits obtainable only in a fully integrated supply chain (Dong & Xu 2002, 75). Replenishment program is designed to streamline the flow of goods within the supply chain. Vendor Managed Inventory is build on supply chain relationships to quickly replenish inventory on the basis of joint planning or actual sales experience. And the intent is to reduce reliance on forecasting when and where inventory will need to be positioned to demand on a just in time basis. These kind of effective collaborative replenishment programs require extensive co-operation and information sharing among supply chain partners. (Bowersox et al. 2010, 187.)

Vendor managed inventory model has just in time basis (Coyle et al. 2003, 187). The basic idea of Vendor Managed Inventory is to remove the order-delivery process between the supplier and the customer and supplier has the responsibility to maintain inventory level directly to customer's inventory. Vendor managed inventory model eliminates therefore the need for replenishment orders. (Bowersox et al. 2010, 187.) It is an arrangement whereby the consignor (owner) of the goods delivers its goods to another party (consignee) for use or for sale purposes with the proceeds of the sale being remitted to the owner only after the actual use or sale. VMI model involves a supplier which monitors inventory levels at its customer's warehouses and assumes responsibility for replenishing that inventory to achieve specified targets trough the use of highly automated electronic messaging systems. (Dong & Xu 2002, 76). The goal of VMI is therefore to establish so flexible and efficient supply chain arrangement that retail inventory is continuously replenished, instead of operating on a 15- to 30-day order cycle. In Vendor managed inventory the supplier takes more responsibility and actually manages a category of inventory for the customer. (Bowersox et al. 2010, 187.) Supplier

makes the replenishment decision instead of waits for the customer to reorder the product (Dong & Xu 2002, 76).

The basis for co-operation is a purchasing contract where there are mutually agreed how to make automatic replenishment orders. The minimum and maximum limits of inventory levels need to be agreed as well as the way how supplier will receive information on consumption and demand. (Blonqvist et al. 2011.) The general vendor managed inventory process is described in figure 6. In VMI the supplier will receive daily transmission of retail sales, warehouse shipments, open purchase orders and sales orders. Based on this information supplier needs to be proactive and assume responsibility for replenishing retail inventory in the required quantities, colors, sizes and styles. Supplier checks the general VMI replenishment plan and makes possible updates to the system. In VMI the supplier commits to keep the customers stock on correct level and maintain inventory velocity. If there is a need for VMI production, supplier confirms the VMI order and feeds production quantity and time schedule to the system. This generates the open purchase order for VMI. VMI production run is made based on agreed inventory steering parameters and delivery status. After VMI production the order is picked up from the suppliers stock and delivered to the customer. Customer receipts the goods against the open purchase order and the invoice is created in the system. (Tuomikangas 2011.) Sometimes the replenishment involves cross docking or direct store delivery in order to eliminate the need for warehousing between the supplier and the customer (Bowersox et al. 2010, 187). Cross docking is a concept of material handling and distribution, where goods move directly from receiving to shipment (Rohrer 1995, 846). In case of small articles the VMI model can be totally manual method, where supplier will go and check the stock status on the spot (Blonqvist et al. 2011).

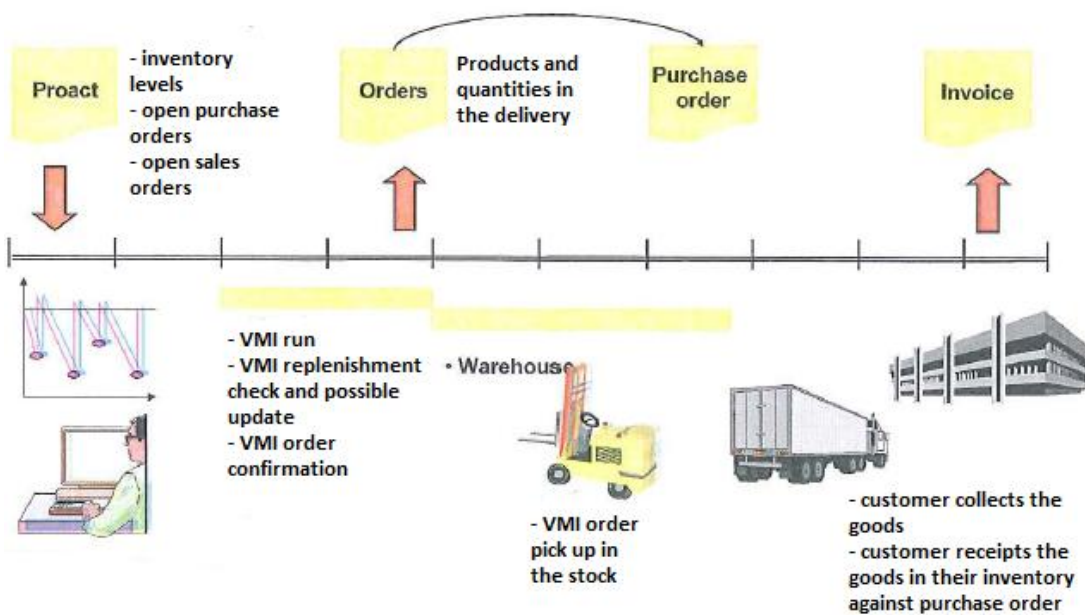


Figure 6: Vendor managed inventory process (Tuomikangas 2011)

### *Requirements for the vendor managed inventory*

Vendor managed inventory is a collaborative commercial co-operation initiative; it integrates operations between suppliers and buyers through information sharing and business process techniques (Yao, Evers & Dresner 2007, 663). In order to have working vendor managed inventory it requires best possible information of the real demand to the supplier. It also requires that the product numbering are the same and information technology boundaries match. (Blonqvist et al. 2011.) The information can be shared on a real time basis by using correct information technologies, such as electronic data interchange (EDI) or internet based XML protocols. EDI is the electronic system where companies are able to exchange intercompany business documents and information from a computer to another (Swatman & Swatman 1991, 1). With these tools supplier is able to use this information to plan production runs, schedule deliveries and manage order volumes and inventory levels at the buyer's facilities. (Yao et al 2007, 663).

Vendor Managed Inventory is also difficult to execute if the business is too small. This would only mean more work for the supplier with keeping the stock levels, if the buyer does not place purchase orders anymore. Vendor Managed Inventory can only be used with goods where the material stream is relatively steady. Vendor Managed Inventory can't be used with goods with one time orders. (Blonqvist et al. 2011.) To have a working VMI, internal supply chain processes must work in the company. Also the supplier must be suitable. In order to secure a working vendor managed inventory

process, piloting must be made. Piloting does not require IT functions right in the beginning. (Tuomikangas 2011).

### *Benefits of vendor managed inventory*

It has been noticed that vendor managed inventory can improve supply chain performance by decreasing inventory levels and improving customer service levels, such as reduced order cycle times and higher fill rates (Yao et al. 2007, 663). Order cycle time describes the duration of order placement time to order delivery time (Hult, Ketchen & Nichols 2002, 577) and order fill rate defines the share of complete orders that can be filled directly from the inventory (Larsen & Thorstenson 2006, 2). Both the buyer and supplier can benefit from the vendor managed inventory. VMI always leads to a higher buyer's profit but suppliers profit can vary. In the short term VMI will reduce total costs of the supply chain but under certain cost conditions it could decrease the purchasing price and supplier's profit. In the long run VMI could more likely increase also supplier's profit, so it may take longer period of adjustment and reconfiguration before the benefits of VMI can be realized for the supplier. (Dong & Xu, 2002, 75-76.)

From the buyers point of view the VMI will eliminate the whole process of making the purchase orders. This means savings in transaction costs and reduces the complexity in supply chain. However it is good to remember that some order costs, such as information processing costs and bookkeeping costs may still incur (Yao et al. 667). In fully implemented VMI the buyer does not manage its inventory system thus its inventory costs are no longer in the profit function (Dong & Xu 2002, 79). Vendor managed inventory also means that the responsibility of the availability transfers from the buyer to the supplier. Working VMI also allows the supplier optimize its operations what may lead to cost savings for the buyer. Vendor managed inventory also improves visibility in the supply chain. This allows both buyer and the seller to reduce inventory levels through the whole supply chain. (Blonqvist et al. 2011.) The buyer's inventory levels may drop by 25-75 percent. The delivery accuracy will also improve with the help of VMI. It is possible to reach delivery accuracy level of 99 percent. (Tuomikangas 2011.) Some evidence have suggested that a consignee can enjoy reductions in holding costs and operational costs with cash flow benefits, but consignor bears the burden of inventory carrying and demand forecasting with chance to improve production and marketing efficiency (Dong & Xu 2002, 76).

For the supplier, on top of advantages mentioned above, Vendor Managed Inventory means also better visibility to the demand. In a supply chain without VMI the supplier

receives information on consumer demand only indirectly through the buyer's ordering policy. In vendor managed inventory model supplier receives directly the consumer demand data. (Yao et al. 2007, 665.) This enables supplier to optimize its own operation by balancing its production planning and improving availability. Supplier can concentrate on finding optimal production quantities and replenishment frequency to minimize the costs of the VMI model (Yao et al. 2007, 666). Thus the co-operation of the buyer and supplier will improve significantly. (Blonqvist et al. 2011.)

The direct, short term effects of vendor managed inventory implementation come from immediate changes in both buyer's and supplier's inventory management. In the beginning of VMI, sales and purchase quantities are relatively stable due to the market constraints and other contractual or public agreements with other parties. The purchase price can be adjusted however relatively quickly after new VMI contract is negotiated and determined. If supplier is able to reduce its inventory related costs with the help of VMI, the purchase price can even be reduced, but quite often in the beginning the new VMI creates higher purchase price, since supplier has taken the responsibility of buyers inventory cost. Long term effects of VMI model can be seen in annual sales volume and purchase quantity increase. Because the inventory costs decrease the buyer is able to sell more products with lower final market price. This means more profit for the supplier who is receiving bigger purchase quantities with even higher purchase price. (Dong & Xu 2002, 81-83).

The bullwhip effect is the phenomenon where the size of the inventory overages and shortages increases the further a company is from final consumer demand in a supply chain. The bullwhip effect can be minimized with the help of information sharing in the supply chain. The decrease of bullwhip effect is a clear improvement in supply chain performance. VMI enables to decrease bullwhip effect by reducing the inventory levels and lead times with the help of increased information sharing in the supply chain. (Yao et al. 2007, 664).

#### *Risks of vendor managed inventory*

When buyer and the supplier decide to use Vendor Managed Inventory model it means that the stage of commitment with these parties is high (Tuomikangas 2011). It can be seen as a risk in today's business world where co-operation and business is all the time changing. Vendor Managed Inventory goods need to have high purchase volume in order to work (Blonqvist et al. 2011). Also collaborative replenishment inventory model often means that the inventory is only relocated from the buyer to the vendor since it is

almost impossible to operate the entire supply chain completely on a demand pull approach to inventory. (Coyle et al. 2003, 83-109.) Sometimes suppliers tend to accept VMI as a necessity due to intense global competition, since potential benefits are not certain for supplier. Vendor managed inventory ties up more suppliers' working capital when buyer targets to zero inventory. This increases the total administration and processing costs for the supplier. (Dong & Xu 2002, 76.)

When VMI model is adopted it means that buyer no longer manages its inventory system but leaves the management to the supplier. Supplier is determining inventory levels, order quantities, lead times and so on. (Dong & Xu 2002, 78.) This can be seen as a risk from availability point of view. What if the supplier does not deliver goods in time to the inventory? Implementing VMI also leads to higher replenishment frequencies with smaller replenishment quantities. This minimizes the average inventory levels, but it is important to follow the transportation cost development. The aim of the VMI is not to optimize only one part of the supply chain and increase costs in other. (Yao et al. 2007, 668.)

One major challenge with vendor managed inventory is the operation in case of exception (Tuomikangas 2011). Possible major changes in the purchase volume, such as high extra sales or sudden sales drop, can be a risk since VMI is not planned for products which do not have steady material stream (Blonqvist et al. 2011). If the demand variance increases in VMI, the possibility to reduce the inventory levels decreases due to continuous need of replenishments (Yao et al. 2007, 664). Also the parameter updates for novelties, seasonal products, campaign products and products at the end of life status are a challenge in VMI-model (Tuomikangas 2011). These products do not have stable demand.

## 2.5 Transportation

Transportation is a very visible part of logistics. A wide range of transportation alternatives are available to support supply chain logistics. Five basic transportation methods are rail, highway, water, pipeline and air (Bowersox et al. 2010, 203). Technology has enabled real time visibility of the location of freight throughout the supply chain and advanced information concerning the delivery. This reduces inventory, storage and materials handling thus the value of transportation has become greater than simply moving product from one location to another. (Bowersox et al. 2010, 192-193.)

The two major services the transportation enterprises provide are product movement and product storage. **Product movement** means the movement of inventory (material,

components, work-in-process or finished goods) to specified destinations. The performance of transportation is vital to procurement and manufacturing. Without a reliable transportation, most commercial activity could not function. Transportation consumes time and financial- and environmental resources. During the transportation process the inventory is inaccessible and it is called as in-transit storage. **Product storage** is a less visible aspect of transportation. When product is in a transportation vehicle, it is being stored. Transport vehicles can also be used for product storage at shipment origin or destination, but they are relatively expensive. (Bowersox et al. 2010, 193.)

## 2.6 Controlling supply chain

The supply chain provides the framework where logistical strategies are developed and executed (Bowersox et al. 2010, 1). The old saying “if you don’t measure it, you can’t manage it” is true for logistical activities both internally and outside own company (Bowersox et al. 2010, 389). In this chapter one will understand the importance of information technology in supply chain, how inventories can be classified and why and how supply chain performance should be measured.

### 2.6.1 Information technology applications

Supply chain technology systems initiate activities and track information concerning processes. They facilitate information sharing in the company and in between supply chain partners. They also assist in management decision making. Timely and accurate information is critical in logistics system design and operations for following reasons: Customers require real time information regarding order status, product availability, delivery tracking and invoices. Information can be used to reduce inventory, minimizing demand uncertainty and human resource requirements thus reducing total supply chain assets. Information increases flexibility to achieve competitive advantage. The improved internet information transfer and exchange is facilitating collaboration and redefining supply chain relationships. (Bowersox et al. 2010, 96.)

Supply chain information systems (SCIS) are linking logistics activities into an integrated process. The integration builds on four levels of functionality: transaction systems, management control, decision analysis and strategic planning. (Bowersox et al. 2010, 96.) Management control, decision analysis and strategic planning amendments require a strong transaction system foundation. **Transaction systems** characteristics are formalized rules, procedures and standardized communications, large volume of transactions and an operational day-to-day focus. The transaction systems record



initiate and individual logistics activities and their outcomes. Typical transaction functionalities are order entry, inventory assignment, order selection, shipping, pricing, invoicing and customer inquiry. **Management control** focuses on performance measurement and reporting. Performance measurement is necessary to provide information regarding supply chain performance and resource utilization. Common performance dimensions are cost, customer service, productivity, quality and asset management measures. **Decision analysis** focuses on software tools to assist managers in identifying, evaluating and comparing strategic and tactical alternatives to improve effectiveness. Typical analyses are supply chain design, inventory management, resource allocation, transportation routing and segmental profitability. Decision analysis is also used to manage customer relationships. The final SCIS level, **strategic planning**, organizes and combines transaction data into a database that assists in strategy evaluation. Strategic planning focuses on information to evaluate and develop supply chain and logistics strategy. Strategic planning includes for example desirability of strategic alliances, development and refinement of manufacturing capabilities and opportunities related to customer responsiveness. (Bowersox et al. 2010, 96-97.)

The major supply chain information system modules are enterprise resource planning (ERP), communication systems, execution systems and planning systems. The ERP systems are the backbone of most companies' logistics information system. This system maintains current and historical data and processes to initiate and monitor performance. Often the company's ERP database includes information storage capability for both operations and financial transactions. (Bowersox et al. 2010, 98.)

### 2.6.2 Classifying inventory

Companies may have thousands of different items in their selection. It is not possible to concentrate operations to all items with same emphasis. It is enough to concentrate on most important items to have more sophisticated and effective inventory management (Coyle et al. 2003, 207). One way to categorize items is with ABC-analysis. (Sakki 2001, 100.) In ABC-analysis the items are categorized based on their sales or consumption into different categories. With the help of ABC-analysis one understands how materials handling should be developed and where the recourses should be placed. It is important that items themselves are categorized, not for example product groups. The basis for categorizing could be for example following (Sakki 2001, 101.):

A items = first 80% of sales/consumption

B items = next 15% of sales/consumption

C items = next 5% of sales/consumption

ABC-analysis is based on Pareto's law which separates the most important few items from rest of the products. This means that a relatively small number of items or stock-keeping units (SKU) may account for a considerable impact or value. In figure 7 is shown ABC analysis in inventory management. Picture shows that 20 percent of the items in the product line, account for 80 percent of total sales. These items are referred as A items. The B category items account for around 50 percent of the items in the product line and only 15 percent of total sales. C items are the remaining 30 percent of the items and they account for only 5 percent of sales. (Coyle et al. 2003, 208.)

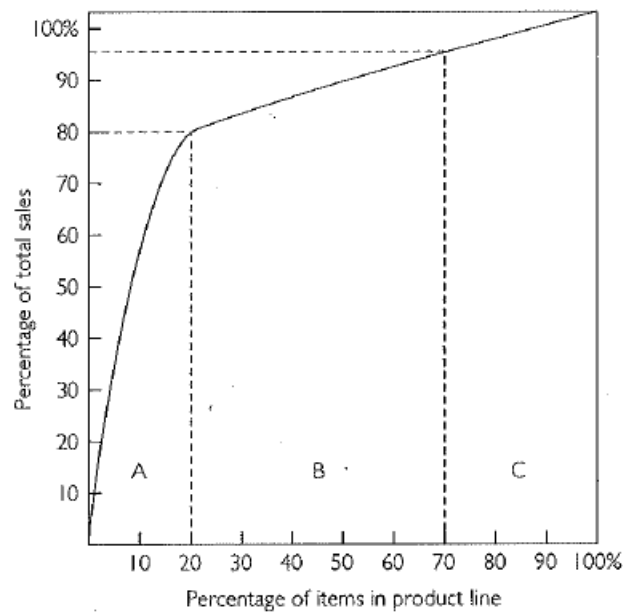


Figure 7: ABC-analysis in inventory management (Coyle et al. 2003, 209)

It is important to understand that the value does not always mean the same as the necessity. The value of the item may be small, but it can be necessary for customers and therefore it will be kept in product assortment. (Sakki 2001, 101.) Therefore all items in different category are important to some extent and each item deserves its own strategy to assure availability at an appropriate level of cost. For example one could assure availability for A items either immediately or through the use of express logistics services and the rest items could be available in a timely manner when needed. (Coyle et al. 2003, 209.) Also one needs to remember that ABC-analysis is made from sales or consumption history. Future may differ from this. The decrease of inventories and the handling of material are much based on ABC-analysis and therefore one should be able to read correctly the results of the analysis. (Sakki 2001, 101.)

The ABC-analysis enables companies to focus attention on few but important products that account for majority of company's volume. Analysis also enables to create different stocking and service policies for each class in order to reach target inventory turnover.

(Armstrong 1985, 8.) The aim of ABC-analysis is to create steady flow and working inventory control for the fast moving A and B class products. These products are goods which should hardly have any inventory. The ideal situation would be, when A products would reach total pull steering according to JIT principle. This means that A products should have most tight inventory control. This is enabled with the help of IT applications, continuous follow up, correct purchasing contracts and conditions and precise anticipation. The slow moving B and C products should have a higher safety stock. The replenishment costs should be minimized and the follow up is not so frequent compared to fast moving A and B products. Companies should also aim to remove the slowest moving C goods from their selection to maintain the inventory on a healthy base. (Karrus 2005, 182-183.)

### 2.6.3 Measuring performance

All organizations need performance measurements to manage their operations. Performance measurements need to be set correctly since “what you measure is what you get”. If the measurement is set in wrong way it can give inappropriate outcome. (Coyle et al. 2003, 482-487.) Effective measurement system must accomplish following three objectives: monitoring, controlling and directing logistical operations. **Monitoring** is accomplished by establishing appropriate metrics to track system performance for reporting to management. **Controlling** is accomplished by having appropriate standards of performance to indicate when the logistics system requires modification or attention. **Directing** is related to employee motivation and reward for performance. (Bowersox et al. 2010, 382.) Also performance measurements need to change over time. To know what metrics to use is important for performance measurement. A good measurement is quantitative and easy to understand. It encourages appropriate behaviour, is visible and is clearly defined and mutually understood. Good measurement contains both outputs and inputs and it measures only what is important. It should be multidimensional and more economic than the cost of collection and analysis. A good measurement should facilitate trust. (Coyle et al. 2003, 482-487.)

Following guidelines are seen useful for logistics and supply chain performance area: The metrics should be consistent with overall corporate strategy and they should focus on customer needs and expectations. Metrics should be prioritized and they should focus on processes, not functions. Both internal and external measures should be used when selecting and developing metrics. Also precise cost measurement is important for defining improvement. Technology should also be used to have efficient performance measurement. (Coyle et al. 2003, 487.) Common methods for measuring critical

performance issues include establishing balanced scorecards, key performance indicators (KPIs) and supply chain metrics (Dilger 2001, 39-41).

### 3 FISKARS HOME SOURCING SUPPLY CHAIN

This chapter looks into Fiskars Home sourcing unit's current supply chain status and its targets for future. In this section the supply chain status is referring to the Fiskars Home outsourcing business. The outsourcing business is growing in the company and thus the number of the countries and suppliers Fiskars is working with is growing. It is vital to keep the supply chain working and develop it even further to make it more effective. Outsourcing has a key status in the co-operation between the supplier and the end customer. The strategic status of outsourcing in companies' success and profitability has been understood only recently. (Haapanen, Vepsäläinen & Lindeman 2005, 221.)

Fiskars Home outsourcing business is divided into vendor management and supply chain management. Vendor management includes the management of Fiskars vendor field from finding the suppliers to managing the co-operation: contracts and operating models, product development, quality and pricing. Supply chain management includes managing the daily operations in the supply chain from order placement until delivery of goods from own warehouse.

#### 3.1 Fiskars Home procurement process

The current procurement process in Fiskars Home is shown in the process chart in figure 8. The database and information needed for procurement is available for supply chain managers in Fiskars ERP system. Based on the information visible from the ERP, supply chain manager places the purchase order (PO) to ERP system if needed. Supply chain manager sends the order to the supplier via electronic mail, receives and checks the order confirmation from the supplier and signs back the confirmation if everything is suitable for Fiskars. The PO and logistics follow up is made by the supply chain managers together with Fiskars sourcing offices in Asia. The ready goods at the supplier are inspected to match the PO and to secure the quality. After passed inspection the goods are shipped to Fiskars warehouse by suitable transportation method. The customs clearance is made in the harbor, before the delivery of goods to Fiskars warehouse. After arrival to warehouse, arrival inspection is made at goods receipt, possible claim handling and corrective actions are made and items are invoiced according to agreed payment term. The current average length of Fiskars Home sourcing procurement process is presented in appendix 2.

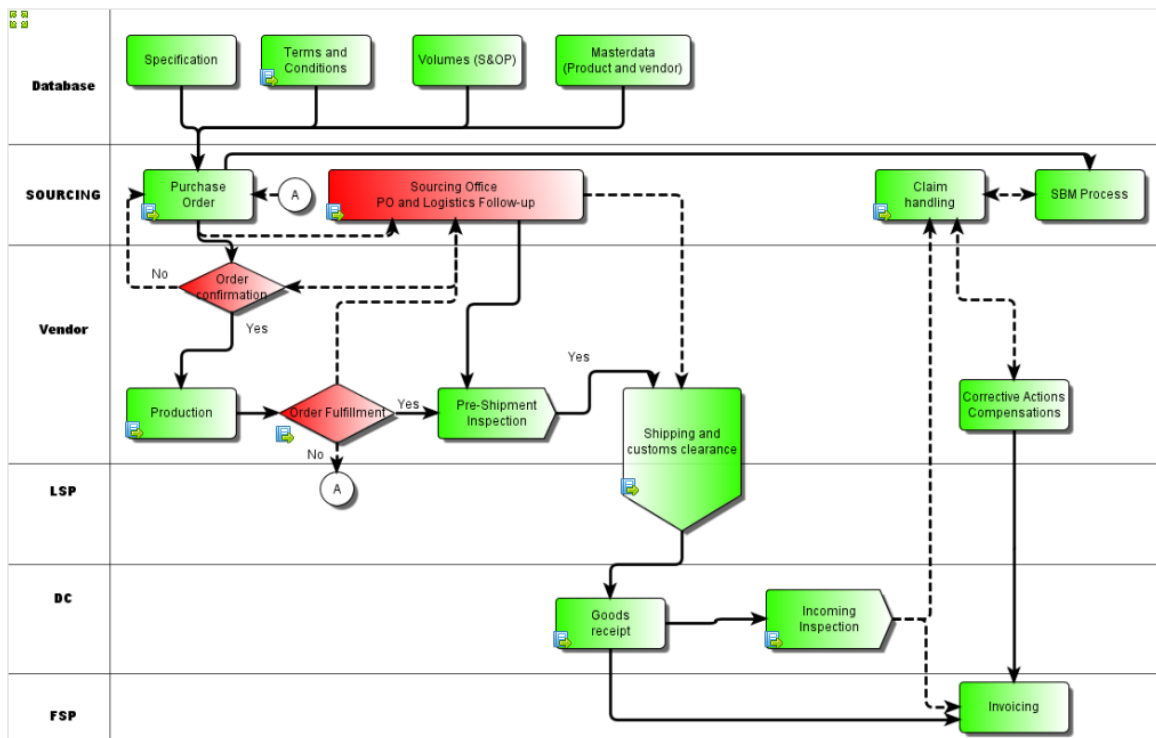


Figure 8: Fiskars home procurement process chart (Fiskars 2013)

The supply planning and procurement starts with regular update of steering parameters in ABC calculation. When steering parameters are set according to company targets, demand volumes are compared to these with the help of demand visibility report. Supply chain managers make continuous follow up and actions against the changes in demand by running the demand visibility regularly. The demand is updated mainly on a monthly level but big special sales (campaigns, business to business sales) are continuously updated into system. Prioritization of the purchased products can be made with the help of ABC calculation results. The demand visibility report is run from the company ERP system and the report is checked on SKU level. Report shows the inventory development for each SKU. Supply chain manager places the purchase order for the supplier according to target inventory levels and agreed lead time with the supplier. Follow up is relatively manual work, since the report does not indicate automatically which products are the items that need replenishment. The inventory follow up is entirely on supply chain manager's responsibility.

If replenishment need exists, supply chain manager makes purchase order to the ERP system and sends it for the supplier by electronic mail. Supplier confirms the sent PO with a written order confirmation. If the confirmation is suitable for Fiskars, supply chain manager signs the order confirmation back to supplier. If the confirmation is not suitable for Fiskars, supply chain manager and supplier continues negotiations until a mutual agreement is found. The order confirmation is based on Fiskars purchase agreement

conditions. The agreed delivery information is updated in Fiskars ERP system by supply chain manager and the open orders are followed up by supply chain manager and Sourcing offices. Possible changes in the delivery (quantity, delivery time, quality) are mutually agreed with Fiskars and the supplier and the updates are made in the ERP system. After goods are ready at the supplier, Fiskars makes quality inspection. When goods have passed the quality inspection supplier books the freight with Fiskars freight partners and delivers the goods to selected transportation provider. The final update on delivery is made to ERP system from the transportation documents. When goods arrive to destination country, the items go to customs control. After customs the items are delivered to the warehouse: Fiskars distribution center. Distribution center makes arrival inspection and feeds in the order receipt to ERP system. In case of any defects, the claim process is handled by the vendor managers.

#### *Fiskars warehousing and inventories*

Fiskars has own warehouses which work as a distribution centers. The distribution centers are located in several locations and in several countries. Fiskars home sourcing unit has one main distribution center in Hämeenlinna, Finland, from where the goods are delivered to customers or satellite warehouses against customer orders. Fiskars also uses rented storages to secure availability in peak seasons. The Fiskars outsourcing inventories in beginning of this research are located in storages in transit, own distribution centers or in rented storages. Suppliers can have also some raw materials and components stored in their premises to secure agreed lead times for Fiskars, but Fiskars does not have liability towards raw material and semi finished inventories.

#### *Fiskars transportation*

Fiskars home outsourcing suppliers are located in several locations and continents. This means that the main transportation used in Fiskars home sourcing unit are sea freight and road transportation (trucks). In some exceptions also air freight can be used to secure availability with shorter transportation time for A class products (defined by ABC calculation). The average transportation times are presented in appendix 2 (PO ocean transport). The main Fiskars sourcing supply areas can be seen in appendix 3.

#### *Fiskars information technology applications*

Fiskars home business area has own ERP system and it is used all over the company from factory floors to white collars. It has been observed that big part of Fiskars home

purchasing is done still by relatively manual way. This is partly due to IT-possibilities in the Fiskars and at the suppliers. In the current ERP system the purchase planning is done manually in the demand visibility report. The report does not give automatic suggestions for purchase quantities or it does not give any automatic signal if some items are out of the planning limits. Supply chain manager needs to be active and continuously check all SKU's to maintain target inventory levels and availability and manually feed in purchase plan in order to check the inventory development.

The purchase planning and procurement is made with Fiskars home ERP system by the supply chain managers. In supply chain management following key programs are available for procurement: ABC-calculation, demand visibility report and supplier performance report. The **ABC calculation** is used in Fiskars to classify and calculate product planning parameters (appendix 4). The ABC calculation program exists in Fiskars home ERP system. The ABC calculation defines each active SKU in own class based on sales forecast. For each class and SKU the system calculates the steering parameters for the inventory at the Fiskars' warehouse and at the supplier's warehouse. The steering parameters are minimum and maximum inventory (days) and order point (pieces). The calculation also defines the inventory turnover, average stock and days at hand (how many days the existing stock is predicted to last) for each SKU. The ABC calculation update is made always when the steering parameters are updated or new items are added to the system. With the help of ABC calculation the supply chain planner is able to make prioritization among the purchased goods. (Mikkola 2008, 10-11.)

Volumes for the purchase order comes from Fiskars home ERP system: **demand visibility report** (appendix 5). This is the main tool for supply chain managers. From this report the supply chain manager is able to see the current supply chain status on item level. The report can be run either based on values (euros) or quantities (pieces) and for period of 12 weeks or 12 months. The report shows following information on SKU level: batch size, current minimum and maximum stock level in home inventory, minimum and maximum stock level in home inventory after the lead time of the item, order point, cumulative lead time, actual stock quantity in Fiskars home inventory, sales history, rolling actual sales, rolling sales forecast, existing purchase orders, purchase plan and rolling stock plan. (Kervinen 2011, 1-3.) Based on this information supply chain planner realizes the procurement according to planning parameters and agreed lead time with the supplier.



**Supplier performance report** (appendix 6) is a tool for both vendor managers and supply chain managers. This report is used to see the overall delivery status of each supplier. Report informs the purchase volume (euros and pieces), number of orders and order rows, delivery accuracy, quality and lead time. It also informs on SKU level the open order rows and late order lines. This information can be used in supplier strategy, price negotiations and supply chain management. The report can be run for certain supplier, supplier groups, material areas or whole sourcing. Also the time period can be defined according to own need when running the report. (Kervola 2006, 2-4.)

### 3.2 Current Fiskars Home supply chain status

Fiskars home sourcing supply chain is measured with help of sourcing scorecard. Sourcing scorecard 2010 is shown in appendix 7. The scorecard table consists of three colors: green, yellow and red. The target values are illustrated with green color. When crossing an alarm value the color of the metric is red. Yellow color presents the values between the targeted values and alarm values. The black circle in the metric system describes the current situation. Scorecard includes several metrics but according to the researcher following metrics relates most to this research: inventory turnover, inventory turnover finished goods, inventory value, availability %, supplier delivery accuracy % (requested date and confirmed date), total lead time (days) and lead time to harbour (days). (Kervola 2008, 49.)

As it can be seen from the sourcing scorecard (appendix 7), there is need for improvement. The current result is either in yellow or red area in the scorecard. Based on this information, it can be summarized that current key challenges in sourcing unit are too long lead time, low supplier delivery accuracy and too high inventory level. The supply chain is therefore too unreliable. Unreliable supply chain can be seen as too high safety stock levels and too long lead times.

Supply chain managers have observed that the lead times are long due to two main reasons at the supplier; supplier only starts the production planning after they have received the official purchase order (PO) and supplier does not keep the confirmed delivery dates. Fiskars has tried to tackle these problems earlier by sending the demand visibility report to supplier each month. With help of this report the supplier would be able to plan their production and reserve capacity for Fiskars already before the official PO is send. It was observed earlier that suppliers are mainly using demand visibility reports for raw material purchases but not for actual production planning purposes. Supplier have given feedback that in order to make production planning based on forecast report, Fiskars should commit on taking the production what has been made

according to demand visibility report. Fiskars has not made this commitment. Forecast report is sent only for information to suppliers in order to plan their production better.

Because suppliers do not use the demand visibility report for production planning purposes already before an actual PO, suppliers are not able to keep their confirmed delivery dates. This is shown as low delivery accuracy (appendix 7). The agreed lead times are so tight that in case of exceptions in production the delivery becomes often late. It has been also observed that because often Fiskars is only a small customer for its suppliers, supplier does not prioritize Fiskars orders in production.

## 4 FISKARS VENDOR MANAGED INVENTORY MODEL

The vendor managed inventory process is presented in chapter 2.4 and the current supply chain status of Fiskars home sourcing unit in chapter 3. Based on this material it can be observed that the general vendor managed inventory model is not directly suitable for Fiskars home sourcing unit. The major conflicts against general vendor managed inventory model requirements in Fiskars procurement process are following: Yearly sales volume levels are not high and stable enough because of seasonality in products. Christmas is the peak season in Fiskars Home. Also the sales forecast level is too inaccurate for VMI. Like it can be seen from Fiskars scorecard (appendix 7) the production time at the supplier is long. Also Fiskars suppliers are located far from Fiskars Home warehouse. This means the transportation time is long. The average Fiskars transportation time is presented in appendix 2. Sea freight is used for deliveries outside Europe and truck transportation is used for deliveries from Europe. This means also that the transportation can't be said to be 100% reliable. Few days delays may exist. Fiskars also does not share common ERP system / IT system with any of Fiskars suppliers currently. It is not seen as a possibility in near future either. This means that communication is currently done in relatively manual way: electronic mails, word- and excel documents are sent between Fiskars and its suppliers. In order to work, VMI requires stable demand, high sales forecast accuracy level, short lead time and high supplier accuracy. Also real, on-time data should be available for VMI partners.

However vendor managed inventory is seen as a good alternative to improve supply chain process. Therefore the general vendor managed inventory model can be used as a basis for the new model in Fiskars, but there is a clear need to develop own Fiskars vendor managed inventory model. In this section we will go through what will be the Fiskars vendor managed inventory and how the Fiskars vendor managed inventory will be implemented in the company.

### 4.1 Requirements for Fiskars vendor managed inventory

#### 4.1.1 Preliminary company requirements

The input of the Fiskars vendor managed inventory model came from Fiskars Home logistics director. The preliminary material was based on Fiskars' subsidiary: Fiskars Americas, where the vendor managed inventory model was already taken into use. The material set following requirements for Fiskars Home vendor managed inventory model; the key of Fiskars vendor managed inventory model is to increase general Fiskars flexibility in supply chain. The flexibility is increased by reducing the lead time,

decreasing the minimum order quantity, locating the inventories where the product has the lowest value and changing mode for order-delivery chain from push to pull. The preliminary requirements also stated that the Fiskars vendor managed inventory can be on finished goods, unpacked goods or component level. This needs to be defined in the vendor managed inventory agreement between Fiskars and the supplier. The potential lead time reduction with the help of Fiskars vendor managed inventory model is up to 40%. The benefits Fiskars is looking from vendor managed inventory for the supplier, for Fiskars and for the customer are presented in figure 9. Fiskars vendor managed inventory should improve and create more stable cash flow for the supplier, it should help to balance their production and improve supplier's quality by giving supplier time to plan systematic and balanced production without hurry. Fiskars vendor managed inventory also enables suppliers to offer more steady labor force by stabilizing the production. Also all this shared information in Fiskars vendor managed inventory model will improve the visibility throughout the supply chain. For Fiskars the vendor managed inventory model means reduced inventory levels and reduced minimum order quantities (MOQ) since supplier is able to produce optimal production batches to the inventory at their site and Fiskars is able to call products home according to their real need. Improved supplier quality is also improved quality for Fiskars. The cash flow will improve with more stable call off's and the general supplier performance will improve as a result of well managed vendor managed inventory. (Fiskars 2010.)

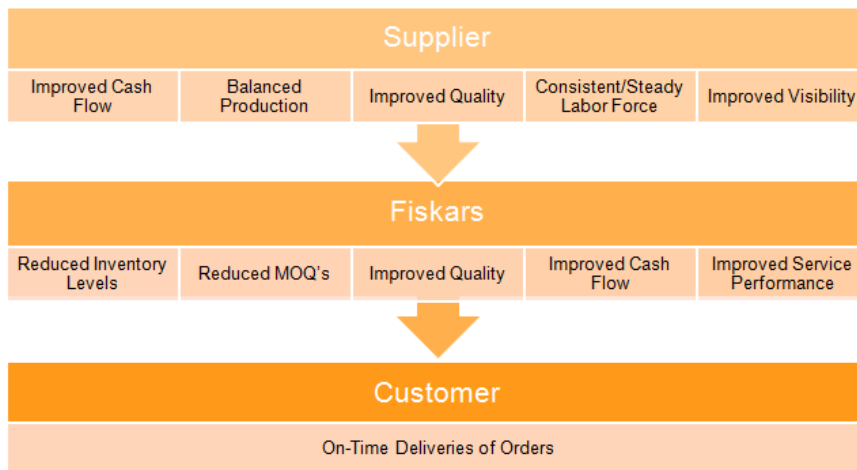


Figure 9: Target benefits of Fiskars vendor managed inventory model (Fiskars 2010)

The main roles and responsibilities of Fiskars in the vendor managed inventory model are that Fiskars shall define the supplier inventory levels (minimum and maximum levels) based on forecast and agreed steering parameters. Fiskars shall provide supplier the monthly update of demand for rolling 12 months (demand visibility report) and Fiskars shall commit to purchase agreed inventory from supplier within certain time

period. The supplier will also have following roles and responsibilities: Supplier shall reserve capacity based on Fiskars demand plan. Supplier shall inform Fiskars about possible challenges in the supply. Supplier shall purchase raw material based on demand information (demand visibility report). Supplier shall initiate production orders when needed in order to keep the inventory between the minimum and maximum levels. And supplier shall reduce the lead time and minimum order quantity. (Fiskars 2010.)

#### 4.1.2 Theme interview

The interview was arranged with sourcing director, sourcing vendor managers and sourcing supply chain managers as a group interview. There were totally 9 people attending the interview: 1 sourcing director, 4 vendor managers and 4 supply chain managers. The researcher was one of the sourcing supply chain managers. The meeting was arranged in March 2010 in Helsinki head office. The preliminary company material (Fiskars 2010) was used as a background material for the theme interview. This material was send to each participant before the theme interview. Researcher also made an agenda for the interview in order to have fluent conversation in the meeting. The agenda of the theme interview meeting is presented in appendix 8: The team interview agenda.

First in the interview researcher presented the preliminary company VMI material which was sent before hand for all participants. Information on the material seemed clear; no comments related to preliminary material appeared. Researcher continued the discussion according to agenda. Firstly the researcher presented the preliminary vendor managed inventory amendment to Fiskars supply agreement. The content of the preliminary agreement seemed suitable for all. A question concerning the amendment in general appeared: should there be two versions of the VMI contract? One version which is an amendment to general supply agreement and a version what could be used as a direct contract with the suppliers with whom Fiskars does not yet have signed supply agreement. Sourcing director commented that VMI should not be taken into use with suppliers unless there is the general Fiskars supply agreement valid.

Next the discussion went to roles and responsibilities of Fiskars vendor managed inventory model. The researcher had made preliminary list to the background material. The list was confirmed to be clear and comprehensive. The roles and responsibilities are defined in details in chapter 4.2.1.

Next issue in the agenda was the action plan for VMI model. It was commented that each sourcing material area should gather the information themselves in co-operation

with vendor manager and supply chain manager. It was also commented that the researcher should create a common template where information of the VMI suppliers and items are gathered. It should also include time schedules for the VMI implementation. The suppliers and products should be chosen according to each material area's best knowledge, keeping following points in mind: start up should be with main suppliers, only items with big volumes (pieces) and values (euros) should be selected, suitability of key products and bottle neck products should be checked, no novelties or products which will be discontinued soon should be selected due to their unexpected demand behaviour.

It was discussed that each material area should also create information of the status of each supplier selected for vendor managed inventory model. This status information should include supplier performance figures (purchase volume, lead time, on time delivery %) in order to understand the current situation with the supplier before the VMI implementation. It was agreed that each material area manager should return the material to researcher within a week from the meeting. Discussion about how to get the supplier committed was active. It was clearly commented that it might be a difficult task to make VMI model to be positive issue for the supplier, since supplier has to make investments for the inventory already before an actual purchase order. The benefits of VMI for the supplier (figure 9) were presented in the preliminary material (Fiskars 2010). It was commonly agreed that the key is to highlight the positive effects for the supplier. Supplier shall have more stable cash flow, their production is balanced and production quality can improve with more balanced production. Supplier is able to plan their production to be produced when it is more suitable time for them and not push the production at the peak seasons. With VMI the supplier is able to have more steady labor force due to more balanced production. Especially in Asia area, to offer a steady labor to employees is a big advantage, since the workers attend to change companies relatively often due to unstable need of workers. Also the visibility in the demand is a clear improvement for the supplier in VMI model. All in all, Fiskars values long term relationships in their business; VMI is a clear indication towards this. People also commented in the interview that it is clear that the help of Fiskars offices in Asia are needed in this project implementation. They need to support in continuous follow up and arrange face to face meetings with the suppliers to have common understanding and a good start up of Fiskars vendor managed inventory.

About vendor managed inventory model follow up all theme interview participants confirmed that it is important to have systematic follow up. The follow up should be made more frequently in beginning and the help of Fiskars sourcing offices are needed.

It is vital that sourcing will have a general follow up template, which can be used throughout Fiskars and suppliers. All should use the same template in order to avoid misunderstandings and to keep the VMI follow up process effective and systematic. It was agreed that the researcher will create a common follow up table for sourcing. Also the researcher should check the correct contact persons in Fiskars sourcing offices in order to ensure correct information flow in VMI process.

The further requirements and development ideas for the Fiskars vendor managed inventory were created based on this interview. The definition of Fiskars vendor managed inventory model is presented in chapter 4.2.

#### 4.2 Defining Fiskars vendor managed inventory model

In order to shorten the lead time with supplier a ready inventory of goods is needed in supplier's premises. If supplier produces the goods ready to their own inventory before an actual purchase order from Fiskars, it would mean a clear decrease in lead time. The normal production time at the factory could be left out. In order supplier to produce inventory ready for Fiskars, supplier will need instructions and parameters for the inventory. The needed parameters are: minimum and maximum inventory levels. The minimum and maximum inventory levels should be defined by Fiskars based on their inventory targets (inventory turnover, inventory level), minimum production batch size and supplier lead time for replenishment batches on a monthly level. If the inventory levels have too low gap, supplier is not able to produce the minimum production batch size and avoid overstock. Also if the inventory levels are on too low level, supplier might not have enough time to maintain the inventory on correct level due to lead time for replenishment. The minimum and maximum levels can be defined in Fiskars ERP systems ABC calculation program (days of forecast). The VMI items should be grouped into one steering group in order to control parameters. When the minimum and maximum levels are defined in the ABC calculation, the levels are automatically calculated to the demand visibility report on SKU level and manual update is not needed.

Supplier also needs to know the future development of their inventory. How the inventory will be called off from the suppliers premises is defined by the sales forecast, actual sales and suppliers minimum order quantity (demand visibility report). The report should be run so, that the sales forecast takes the existing stock in Fiskars distribution center into consideration in order to avoid over forecasting for the supplier. Sales forecast and actual sales figures should be provided by Fiskars for the supplier at least once a month. The time schedule should be selected suitable for Fiskars sales and

operations planning process (S&OP), since new updated sales forecast figures are outcome of this process. Fiskars has also possibility to send updated demand visibility report to suppliers in mid month, if there are major changes in forecast figures. If the real need of item exceeded the forecast need, it was agreed that for those quantities the lead time will be the normal production time, since supplier has not been able to produce these quantities to the inventory in advance. The minimum order quantity information should be provided by the supplier for Fiskars. The minimum order quantity should be based on master carton sizes, so always full cartons are ordered to the Fiskars distribution center. The minimum order quantity can be maintained in Fiskars ERP system and it is visible in the demand visibility report on SKU level.

Supplier is responsible for making replenishment production for the inventory in order to keep the inventory level in between the minimum and maximum level. The replenishment quantity and time schedule should be informed to and approved by Fiskars. This way Fiskars is able to follow that the supplier inventory stays in between the agreed levels and the replenishments are made on correct time to avoid lack of stock and overstock situations. The monthly follow up responsibility is with supply chain manager and the weekly follow up of VMI replenishment is with Sourcing offices. Fiskars should also have obligation towards the defined minimum and maximum inventory levels to support supplier cooperation. Therefore Fiskars should have obligation to purchase the items in the supplier's inventory up to agreed maximum inventory level. Fiskars should not have any obligation to purchase semi-finished goods or raw materials that supplier has in their premises. After a call off order is made for the VMI item, the rest of the procurement process will continue as it is defined currently (see section 3.1).

The vendor managed inventory model should be taken into use only with key suppliers where Fiskars wants to build up long term relationship. The supplier should be selected based on their purchase value and SKU's they are supplying. The VMI suppliers should have the highest purchase values in each sourcing material area. The suitable SKU's are items which have high sales value (Euros) and high sales volume (pieces). Each material area should make definition for suitable SKU's based on ABC calculation. The VMI items should be A- or high B-category products and the sales volume should be big enough to have need for several replenishment shipments per year (at least 6 replenishments). Also the suitability of bottle neck products should be checked for VMI. Novelties and items which will be discontinued soon are also not suitable for VMI because of their unexpected demand behavior. The items not suitable for Fiskars VMI will continue to be produced against the purchase orders.



Education inside the organization also needs to be organized. The project manager shall arrange education for each material area and Sourcing offices in order to secure common understanding of the Fiskars vendor managed inventory model and usage of the material and tools.

#### 4.2.1 Roles and responsibilities

The roles and responsibilities of Fiskars vendor managed inventory model needs to define clearly in order to secure the operation. Following parties can be separated in the Fiskars vendor managed inventory model in the company: Fiskars vendor manager, Fiskars supply chain manager and Fiskars sourcing office. The roles and responsibilities of Fiskars in VMI are defined in table 1. The table 1 also includes the frequency, how often informed task needs to be executed. VMI contract and contract negotiations are vendor manager's responsibility. In these negotiations time schedules and general VMI process should be defined and VMI product list and minimum and maximum level agreed. Product lists and minimum and maximum levels should be decided by vendor manager and supply chain manager together. After these are agreed supply chain manager shall make parameter updates to the system. Demand visibility report from the system should be send once a month to the supplier. If any major changes in the demand, the demand visibility report can be send to the supplier again. The VMI development should be reviews monthly in beginning and after process is working, on a quarterly basis. In these reviews vendor manager and supply chain manager should also check if the VMI product list is suitable and valid. Also VMI targets should be adjusted for future. The general follow up of the VMI process should be made monthly by supply chain managers and weekly by Fiskars sourcing offices. The call-off orders are made by supply chain managers.

Table 1: Roles and responsibilities of Fiskars in VMI

Task	Owner	Frequency
VMI contract, contract negotiations (agree on timelines, review meetings and follow ups)	Vendor Manager	Yearly
Define VMI product list and min - max levels	Vendor Manager & Supply Chain Manager	Yearly
Pluto parameter updates according to agreement and parameter reviews	Supply Chain Manager	Quarterly
VMI contract reviews	Vendor Manager	Yearly
VMI product list update	Supply Chain Manager & Vendor Manager	Quarterly
Business review: on time delivery, inventory status, capacity review	Vendor Manager & Supply Chain Manager	Monthly (in beginning), Quarterly
VMI target adjustments (min - max levels)	Supply Chain Manager	Monthly
Follow up of supplier inventories, on time deliveries, capacity	Supply Chain Manager Fiskars Sourcing Offices	Monthly Weekly
Send demand visibility report for vendor	Supply Chain Manager	Monthly / twice a month
Call-off orders	Supply Chain Manager	Daily / according to need

The roles and responsibilities of the vendor in VMI model are presented in table 2. Vendor should confirm the VMI product lists. They should reserve capacity for Fiskars based on demand plan presented in demand visibility report. Supplier shall inform Fiskars about supply challenges. Supplier should purchase raw material based on Fiskars demand plan and make replenishment according to agreed parameters in VMI. To maintain inventory between minimum and maximum levels is at suppliers responsibility. If any call-off orders are made, supplier should confirm the orders according to agreed lead times.

Table 2: Roles and responsibilities of vendor in VMI

Task	Frequency
Confirm VMI product list	Yearly
Reserve capacity for Fiskars based on demand plan	Continuous
Inform Fiskars about supply challenges	Continuous
Purchase raw material based on demand plan	Continuous
Maintain inventory between min - max level	Continuous
Make replenishment to secure inventory levels	Continuous
Confirm call-off orders	Daily / according to need

#### 4.2.2 Fiskars vendor managed inventory agreement

Fiskars vendor managed inventory model is a mutual agreement between Fiskars and its supplier. Therefore a written amendment concerning Fiskars vendor managed inventory is needed to existing Fiskars Supply Agreement. Based on the defined Fiskars vendor managed inventory model, requirements were given to sourcing vendor manager, who is responsible of creating actual contracts with Fiskars vendors. Requirements were following:

- Amendment should include heading
- Amendment should include short explanation on Fiskars vendor managed inventory model.
- Amendment should include requirements and responsibilities (obligations) of Fiskars and vendor.
- Amendment should include place for signatures.
- Appendix what includes the VMI product list code and name.

After the amendment was made, it needed confirmation from the company's legal department. The final Fiskars vendor managed inventory amendment is presented in appendix 9.

#### 4.2.3 Fiskars vendor managed inventory model follow up

##### *The general VMI follow up tool*

Fiskars vendor managed inventory is continuous process between Fiskars and its supplier. Therefore this process needs a follow up tool in order to understand what is the Fiskars vendor managed inventory status and how the status will develop in future. A common follow up tool is also needed in order to shear same information to several parties related to the process: Fiskars supply chain manager, Fiskars sourcing office personnel and the supplier. The monthly follow up table should include following issues:

- Item number
- Item name
- Minimum inventory level
- Maximum inventory level
- Sales forecast quantities, rolling 12 months
- Open purchase orders
- Current VMI stock at the supplier
- Supplier replenishment quantity
- Supplier replenishment time schedule
- Free stock (current stock – open orders)
- Quantity below minimum inventory level
- Quantity above maximum inventory level
- Comment fields for quality and logistical issues
- Comment field for counter measurements
- Purchase price
- VMI stock value

This information is needed in order to identify the VMI item, see the current VMI status (pieces and value) and see how the VMI inventory will develop. Since all Fiskars shipments are quality checked, the quality status can be checked also with the help of this table. This table shall work as a weekly tool for Sourcing offices to follow up inventory development and as a monthly tool for supply chain managers. The table is maintained in excel (appendix 10).

##### *The material area follow up*

Each sourcing material area should follow up their VMI implementation development and supplier development after VMI implementation. The VMI implementation development is checked commonly on a quarterly VMI review, organized by the VMI project leader. The template for the material area follow up is presented in table 3. The

table includes the selected suppliers, the start up of the VMI model implementation, time when the VMI agreement is signed, who is the vendor manager, supplier chain manager and what is the status of the implementation. Material area manager has the responsibility to update this material for the quarterly VMI review meetings.

Table 3: Common material area VMI implementation follow up table

<b>Supplier</b>	<b>VMI model start up (m/year)</b>	<b>Agreement signed (m/year)</b>	<b>Vendor Mgr</b>	<b>Supply Chain Mgr</b>	<b>Comments</b>
Supplier 1	M / YEAR	M / YEAR	Name	Name	Material area comments.
Supplier 2	M / YEAR	M / YEAR	Name	Name	Material area comments.
Supplier 3	M / YEAR	M / YEAR	Name	Name	Material area comments.
Supplier 4	M / YEAR	M / YEAR	Name	Name	Material area comments.

After the VMI model has been implemented and agreement signed, the material area follow up should be made on monthly level in management meetings with the help of VMI implementation tool. This tool should include supplier SKU information: all items produced at the supplier and selected VMI items. The table should be updated by vendor managers and supply chain managers. It was agreed with the company that this table will be restricted out from the thesis and the follow up table shall be created by Fiskars sourcing controller separately.

### *Supplier performance follow up*

In order to control and follow Fiskars vendor performance, a systematic follow up process is needed. Each material area should make continuous follow up of the suppliers with Fiskars VMI model. As per result of the theme interview following issues needs to be followed on a supplier level: purchase volume, production time and on time delivery %. Follow up is made on monthly basis. This means that the above mentioned figures will be taken from the Fiskars ERP report: Supplier performance report. The figures are monthly average of the arrived goods. The follow up material is presented in appendices 11 and 12. These appendices include the results from the Fiskars VMI pilot, introduced in chapter 4.3. This follow up material should be reviewed on monthly level inside own material area and with supplier. The table is updated by the supply chain managers in excel. The status of key suppliers can be presented also in monthly management meeting.

#### 4.3 Fiskars vendor managed inventory model pilot

In order to realize the Fiskars vendor managed inventory model, a pilot was organized. The vendor managed inventory pilot was decided to make in the biggest material area: metal. Metal material area manager and the researcher selected two main cutting tools suppliers for the pilot. The suppliers were selected based on following reasons: the suppliers are key suppliers in this material area - it is important to develop supply chain with these suppliers. The sales volumes (value & quantity) of the purchased goods are big enough for the Fiskars vendor managed inventory and the co-operation with these suppliers is on a good level. Therefore it is easier to develop new operation model. supplier 1 has had good supplier performance in general and supplier 2 has had clear challenges in their performance. If VMI can be implemented for both suppliers, it can mean major improvements for supplier 2.

After supplier selection the researcher and vendor manager selected the suitable items for vendor managed inventory. The selected suppliers and products are presented in appendices 13 and 14. The selected items belong to A or B category in ABC-calculation and they have yearly sales volume of minimum 10 000 pcs. Next step was to define the time schedule for building up the vendor managed inventory. The dead line for VMI creation was placed four months ahead (December). During this time schedule suppliers should produce the inventories for the VMI products. After the VMI inventory was created, it was decided that the production time shall be in the beginning 30 days. In this research the production time means the time from order placement date to shipment

date. Therefore it includes suppliers' production time + delivery to harbor + loading the goods to the vessel. Production time can be tightened after a working VMI model has been created with the suppliers. After supplier and item selection, planned time schedule and agreed production time, the Fiskars vendor managed inventory agreement was updated and it was sent for the suppliers. After contract negotiations and signed contract the VMI implementation could start. VMI implementation education was arranged with the suppliers by help of Sourcing offices. Also the regular meeting and follow up process was agreed according to defined process description (chapter 4.2).

### *The results*

Both suppliers react positively to the VMI model in general and signed the contract. The time schedule seemed suitable for the suppliers to build up the inventory. But as it can be seen from the appendices 11 and 12 (VMI pilot development) either of the suppliers did not manage to create the inventory in time. The main reason for this was that the VMI inventory was supposed to be built up during the high season: Christmas. Christmas is a clear peak season for home ware manufacturers and they selected suppliers suffered from the lack of capacity and workers. They were only able to produce the normal, ordered production but not any extra for the VMI inventory. The result was that the Supplier 1 was able to create the VMI inventory four months late (April) and Supplier 2 one month (January) late from the target schedule.

After the VMI inventory was created, first VMI orders were placed for the suppliers. With supplier 1 the first VMI orders placed in April arrived to Fiskars warehouse in June (due to freight time of average 40 days with these suppliers). The results are shown in appendix 11. This follow up is made for VMI products and does not include products that are not taken to the VMI. When looking at the on time delivery % there is a clear improvement. Starting from June, the supplier lead time is 99% in average. If the delivery was 3 days late from the requested shipment date, it was still considered as on time shipment. Average on time delivery % during previous year was for VMI products 92%. This is a clear improvement. With on time delivery % of 99% Fiskars is able to rely on supplier's confirmations. When looking at the production time (appendix 11), it shows that supplier still suffered from overbooked capacity situation. Starting from June, supplier managed only to reach the target production time (or lower) three times. Supplier still suffered from tight capacity and the VMI production times were not kept. But still the production time was reduced by 43 %. It was also seen during the pilot, that the supplier did not start to make VMI replenishment in time. The VMI inventory did not stay all the time between the defined minimum and maximum levels. Supplier 1 started the replenishment mainly only after the inventory levels went below the minimum stock

level. When the order value is studied, it can be clearly seen from order value development (appendix 11) that the order values per each month are much more stable. The average order value starting from June was reduced by 43 % compared to previous year figure. Bullwhip effect has been reduced with the help of VMI. These were positive results but development needs to continue in order to reduce the production time to target level.

When looking the results of the supplier 2 following observations and development was made. Supplier finished the VMI inventory in January. The effects are visible starting from March due to the freight time of average 40 days with these suppliers. Results are shown in appendix 12. Supplier 2 improved it's on time delivery % with 47 %. The production time was reduced by 35 % and average order value was dropped by 44 %. A major challenge could be seen in June, when the VMI inventory was consumed for the first time with the call off orders. Supplier 2, who previously had manufactured only against purchase order, did not rely on the VMI inventory levels and therefore did not plan the replenishment production for the VMI inventory automatically, according to agreed process. This led into a situation that VMI inventory did not stay in between the minimum and maximum inventory levels, but instead they dropped below the minimum inventory levels or they were totally consumed. In June the on time delivery % was dropped to level of 18% and production time reached a peak of 123 days. This led into new massive meeting- and education round between Fiskars and supplier 2. After new meeting- and education round the VMI model was working again. Also a systematic phone meeting with the supplier 2, sourcing office and supply chain managers were agreed.

During the pilot, following problems were noticed. One key problem with VMI model was the unstable forecast accuracy. A well working VMI model would require relatively correct sales forecast. This is a challenge in Fiskars. Due to unreliable sales forecast some goods were purchased from VMI inventory sooner than planned and some items stayed at the inventory. Another major challenge was to handle the reality of big unforecasted sales, for example Business to Business gift sales. This could mean that one sales deal can be for example three times bigger than items normal sales in one month. And quite often these sales could only come true, if Fiskars was able to agree fast delivery. This meant in practices that the VMI was consumed for the unforecasted sales in order to secure the big sales deal and normal sales VMI was lost and the lead time grew up again, since supplier needed to make new batch for the normal purchase orders. But this can be seen as normal task for the supply chain manager; make decision on which sales should be secured and which sales will receive lower availability

in case of lack of stock. Also even though education and follow up meetings were arranged, still it was visible that the suppliers are not very pro active when planning the replenishment for the VMI inventory. It requires continuous and careful follow up from Fiskars side to maintain the inventory levels correct at the suppliers end. Therefore it would be good for Fiskars to develop the VMI process further concerning the planning of replenishments. If supplier is able to keep the inventory levels always in between the defined inventory levels by Fiskars, the results would improve even further. According to Tuomikangas (2011) there is a possibility to reach delivery accuracy of 99% in the long run. Fiskars could also lower the safety stock levels in own warehouses, which would mean even lower inventory levels. Supplier feedback was positive concerning the possibility to make better production batch sizes instead of the smaller order quantities. The demand has stabilized more and the difficult major peak purchase months have disappeared.

The major risks in this model are currently the unreliable sales forecasts and the unforecasted sales. If the sales forecasts are on too high level compared to actual sales, it means that Fiskars has the liability to purchase the vendor managed inventory at the supplier within six months from the production into their own premises. This means Fiskars has to purchase goods they do not have actual need and it means overstocks and obsolete stock for Fiskars in future, if new sales is not created. If the sales forecast is on too low level compared to actual sales, the defined vendor managed inventory is on too low level and the inventory will be consumed away sooner than the supplier is able to make replenishment. This means availability problems and lack of stock situations. Same situation is with the big sales which are not forecasted. For these challenges of unreliable forecast level, vendor managed inventory can react by selecting correct inventory levels; higher inventory levels for VMI, if the item is often sold more than forecasted and lower inventory levels for VMI, if the item is often sold less than forecasted. Also regular view of the VMI inventory development is important to be able to select correct items to stay in the VMI item list. It was also noticed from the pilot, that more careful planning for the implementation time schedule of the projects should be made. If the project will be implemented during peak seasons with the suppliers, they should have enough time in order to produce the inventory ready.

Pilot also showed the challenge with information technology. With current ERP system Fiskars and supplier was not able to share real time information with each other. All information was shared via e-mails, telephone calls or teleconferences. This causes a challenge to have valid information available all the time for all parties. In order to share information with each other it always meant manual work from the participants. This is



not effective work. This extra work would be possible to avoid only with common IT solution, where both parties could upload on time information.

After VMI implementation, Fiskars outsourcing inventories were not only located in storages in transit, own distribution centers or in rented storages but now also in vendors' premises. This inventory will be invoiced only according to call off quantities shipped.

## 5 CONCLUSION

To manage supply chain is a key in today's business world. Just in time principles and vendor managed inventory model are implemented in many companies. These or similar business models are needed in order to be successful and effective. Vendor managed inventory in general has many requirements in order to work. It is not suitable for all companies, but it can be used as basis for own inventory model. In this research the vendor managed inventory was used as the background to find suitable vendor inventory model for Fiskars. Many basic ideas could be taken into use.

It is interesting to create new co-operation model. To create new co-operation model, means good background check. It means better understanding of the current state, what are the key issues that needs improvement, what are the key risks and disadvantages in the current and future way of working? One needs to understand what needs to be improved and how those improvements can be achieved?

In this research a new Fiskars vendor managed inventory model was created and pilot was arranged. The pilot showed that the outcome of this project was improved co-operation and high commitment of both the buyer and the supplier. The pilot showed that working vendor managed inventory model will take time thus it is not suitable for a short term business relationships. Working VMI will enable short reaction time in the whole supply chain by giving shorter lead times and improved on time delivery status of the supplier. But the pilot also showed that there are risks in this model. Unreliable sales forecast and unforecasted sales will cause problems on managing the inventory levels both at the supplier's end and in the company itself. Clear communication and material is needed when implementing new operating models. Also good planning and clear follow up of the project is needed in order to secure the wanted result. When implementing new operating model one should always make sure that the time of implementation is suitable for both parties. In this case the implementation of the vendor managed inventory was planned just when the peak season was at the supplier. This led into VMI implementation delay.

The key challenges in sourcing unit were too long lead time, low supplier delivery accuracy and too high inventory level. The pilot clearly stated that all these key challenges were improved by the Fiskars vendor managed inventory model. The production time with selected products was reduced by 43 % with supplier 1 and by 35 % with supplier 2. Fiskars vendor managed inventory reduced directly the suppliers' production time from the general lead time. The on time delivery % was improved by 7

% with supplier 1 and it reached the high level of 99 %. On time delivery % increased by 47 % with supplier 2, who earlier had major challenges to keep their delivery confirmations. VMI model also improved the demand communication between Fiskars and the supplier, which had even further positive effect on the lead time development. After current Fiskars vendor managed inventory model is well implemented, there is possibility to reduce the agreed time from order placement date to shipment date even further. Supplier delivery accuracy was improved because supplier manufactured the goods ready to stock already before Fiskars call off order. This way the goods were ready at the inventory and majority of the unreliable factors which can delay the supplier production do not affect to the supplier accuracy. Also the call off order quantities was more stabilized after the Fiskars VMI implementation. The flow of goods was more stable and the high purchase peaks were reduced. The bullwhip effect was therefore reduced. All in all, the reliability of the supply chain improved significantly. In future this means that Fiskars inventory levels can be reduced by reducing safety stock levels. Fiskars should still think about improving the VMI process concerning the supplier replenishment. Could there be simpler operating model for suppliers in order to understand when to start the VMI replenishment? As a summary, Fiskars vendor managed inventory model is a good way to improve supply chain performance and it should be implemented with all main suppliers in the company.

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