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1 Introduction

The first chapter gives an introduction of the background of this study. Furthermore it gives an explanation of company's problems. Then the research questions and purpose of this thesis are presented. The chapter ends with the delimitation of this study and the outline of following chapters.

1.1 Background

The American Production and Inventory Control Society (APICS) define inventory management as the branch of business management concerned with planning and controlling inventories (Toomey, 2000). Inventory management is a critical management issue for most companies – large companies, medium-sized companies, and small companies.

Logistics is all about managing inventory, whether the inventory is moving or staying, whether it is in a raw state, in manufacturing, or finished goods (Goldsby & Martichenko, 2005). Logistics and inventory management are embedded in each other and tied up closely. The "Bill of 'Rights"' that logistics professionals often repeat is to deliver the *right* product to the *right* place, at the *right* time, in the *right* quantity and condition, and at the *right* cost (Goldsby et al., 2005). To make it happen, effective inventory management is a cornerstone.

Inventory management also becomes a fundamental part of supply chain management (SCM) now. A lot of research in SCM over the last two decades can be characterized as so-called "multi-echelon inventory theory" (Quayle, 2003). SCM has in recent years become an important way to enhance the company's competitive strength and therefore an important issue for most companies. According to Lam and Postle (2006), a summary definition of the supply chain can be stated as:

> *All the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer and the information systems necessary to monitor all of these activities.*

Supply chain management coordinates and integrates all of these activities into a seamless process. During the process, inventory holding and warehousing play an important role in modern supply chains. A survey of logistics costs in Europe identified the cost of inventory as being 13 per cent of total logistics costs, whilst warehousing accounted for a further 24 per cent (European Logistics Association/AT Kearney, 2004). As well as being significant in cost terms, they are important in terms of customer service, with product availability being a key service metric and warehousing being critical to the success or failure of many supply chains (Frazelle, 2002).

At Present the growth of small businesses and their impact on the entire economy is becoming clear (Chapman, Ettkin & Helms, 2000). Based on *The European Observatory for SMEs-Fifth Annual Report* (ENSR, 2004), more than 99% of the total number of enterprises in all EU countries is small and medium-sized enterprise (SME). In Sweden, for example, SMEs contribute 99.79% of all enterprises and they provide 96 percent of all employment. The average employment size for these SMEs is around 7 people. And SMEs account for approximately 50% to the UK gross domestic product and nearly 70% of employment (CBI, 2000; cited in Quayle, 2003). SMEs obviously become a vital part of national economy.

Many large companies have saved millions of dollars in costs and decreased inventories while improving efficiency and customer satisfaction through various SCM techniques (Chapman et al., 2000). But Welsh and White (1981) argue that the very size of small businesses generates a special condition-referred to as resource poverty-that distinguishes them from the big businesses and requires some very different management approaches. This statement deviates from the traditional assumption that small businesses should use similar management principles as big businesses, only on a smaller scale (Welsh et al., 1981). Many SCM techniques and systems are too complex and expensive to implement for small business. Then one question comes up. Can SCM work for small businesses, with attention focused on inventory management?

1.2 Problem Discussion

Effective inventory flow management in supply chains is one of the key factors for success. The challenge in managing inventory is to balance the supply of inventory with demand. A company would ideally want to have enough inventories to satisfy the demands of its customers-no lost sales due to inventory stock-outs. On the other hand, the company does not want to have too much inventory staying on hand because of the cost of carrying inventory. Enough but not too much is the ultimate objective (Coyle, Bardi & Langley, 2003).

The inventory investment for a small business takes up a big percentage of the total budget, yet inventory control is one of the most neglected management areas in small firms. Many small firms have an excessive amount of cash tied up to accumulation of inventory sitting for a long period because of the slack inventory management or inability to control the inventory efficiently. Poor inventory management translates directly into strains on a company's cash flow.

The studied company, HEL-SOL FORSALJNINGS AB (named briefly as HEM-SOL in text below) works in a niche market distributing the sports equipments to its customers. The company has difficulty in matching its supply with the customer demand efficiently, which means both stock-out of inventory and excess inventory occur in the business. The management problem has affected negatively their profitability mainly due to the existence of excess stock. It is considered that the problem results from insufficient control over inventory and volatile demand for each product on a monthly base. To get a reliable forecast of the demand is not easy task in the wholesaling industry because of being unable to estimate the right quantity of demand during a specific period for each product. Another reason is that the lead-time of most products is long, about three months at the longest.

1.3 Research Questions

The research question for this thesis project is listed below:

- How can inventory management concepts, principles and techniques be applied, or further adapted to improve the inventory management in HEM-SOL?

1.4 Purpose

The purpose of this thesis project is to investigate and identify the reasons behind the inefficient inventory management in HEM-SOL. Then the authors try to propose feasible managerial suggestions to improve the company's inventory management through our own

analysis, after examining the relevant theories and understanding the business operational practice of HEM-SOL.

1.5 Delimitation

Due to the limitation of time, it is impossible for the authors to make a longitudinal study, in which the implementation result of the proposed inventory control system can be observed and verified. And this harms the credibility of the study to some extent.

The case study scope is limited to the internal inventory management of HEM-SOL, not reaching out into the other actors in the supply chain network. In other words, the interaction among the actors in the network in terms of inventory management is excluded. And from the SCM perspective, the contribution of the study is reduced.

1.6 Disposition

Chapter 1 The first chapter gives an introduction of the background of this study. Furthermore it gives an explanation of company's problems. Then the research questions and purpose of this thesis are presented. The chapter ends with the delimitation of this study and the outline of following chapters.

Chapter 2 This chapter will explore the different theories and models that are related to the subject of this thesis and can be used for the analysis.

Chapter 3 In this chapter, the authors will examine different research methods and present what methods are applied to this thesis.

Chapter 4 The authors will present their empirical findings about business practice of the studied company and the major issues that needs to be addressed in their inventory management.

Chapter 5 The authors will conduct the analysis guided by theoretical framework. The analysis part is based on our empirical findings. Furthermore, the authors will present their suggestions upon the problems identified.

Chapter 6 In this chapter, the authors will present the conclusion about the whole thesis and summarize the implications of the research.

2 Theoretical Framework

This chapter will explore the different theories and models that are related to the subject of this thesis and can be used for the analysis.

2.1 Supply Chain Management (SCM)

The term "supply chain management" has become a popular buzzword, probably first used by consultants in the late 1980s and then analyzed by the academic community in the 1990s (Burt, Dobler & Starling, 2003).

Supply chain management is a set of approaches utilized to effectively integrate suppliers, manufacturers, logistics, and customers for improving the long-term performance of the individual companies and the supply chain as a whole (Chopra and Meindl, 2001). Supply chain management includes the link between upstream (such as supply and manufacturing), and downstream (such as logistics and distribution) value chain entities. Successful supply chain management requires the integration of these value chain entities to create cooperative and collaborative environments that facilitate information exchanges, materials and cash flows (Kukalis, 1989).

2.1.1 Inventory Management

Effective inventory management is essential in the operation of any business (Bassin, 1990). Hakansson and Persson (2004) identifies three different trends in the development of logistics solutions within industry, one trend is concerned with the increased integration of logistics activities beyond organization boundaries with an aim to reduce cost items such as capital costs for inventory and handling costs of flows.

Inventory as an asset on the balance sheet of companies has taken on increased importance because many companies are applying the strategy of reducing their investment in fixed assets, like plants, warehouses, equipment and machinery, and so on, which even highlights the significance of reducing inventory (Coyle et al., 2003).

Changes in inventory levels affect return on assets (ROA), which is an important financial parameter from an internal and external perspective. Reducing inventory usually improves ROA, and vice versa if inventory goes up without offsetting increases in revenue (Coyle et al., 2003).

2.1.1.1 Challenge of Inventory Management

The wholesalers and retailers that are major actors involved in downstream distribution channels face a special challenge in keeping inventory at reasonable levels due to the difficulty of forecasting demand and expectations of customers about product availability (Coyle et al., 2003). The challenge grows even bigger when we think about the diversity of products in terms of their color/design, package type, size and so on. To further explain the problem, we assume there is an accurate demand forecast; however, the aggregate demand needs to be broken down by various specifications of the product into sub-total demand forecast to guide the stock keeping units (SKUs) in the company in order to fulfill the final customer's order. But the sub-total demand forecasts could be diverse, reaching dozens, hundreds, or even thousands of categories; in that case, they become truly difficult, complex and time-consuming.

The difficulty of forecasting demands accurately naturally results in two problems, which are in opposite extreme, overstock and stock-out of inventory. As companies strive to avoid lost sales from stock-out of inventory, there is a tendency to overstock. Nevertheless, because keeping inventory is costly which definitely reduces the profit margin, companies try to reduce the inventory level, so appears the tendency to stock-out of inventory. We can get an overview of inventory management dilemma, where two opposing powers keep pulling the inventory towards their own direction. It is hard to balance the two powers all the time and station the inventory at the right level constantly.

2.1.1.2 Demand Management

Demand management may be thought of as "focused efforts to estimate and manage customers' demand, with the intention of using this information to shape operating decision." (Blackwell & Blackwell, 1999; cited in Coyle et al., 2003)

Independent and Dependent Demand

Independent demand is what whose usage is based on external market requirements rather than related to other items' demand. The market demand for consumer goods is a typical example of independent demand. Dependent demand is determined by the requirements of other items in the manufacturing process. The requirement of components or parts is based on the demand for the finished products (Toomey, 2000).

The inventory corresponds to independent demand is called distribution inventory/ finished product inventory, while dependent demand inventory is known as manufacturing inventory/raw material inventory and work-in-process (WIP) inventory (Simchi-Levi, Kaminsky & Simchi-Levi, 2004; Toomey, 2000).

Inventory is kept to meet demand, in light of dependent demand and independent demand, different approaches to managing inventory should be applied to align inventory supply with demand. Just-in-Time (JIT) approach and Materials Requirements Planning (MRP) system are typically associated with managing manufacturing inventory to serve dependent demand. Cross-docking is a typical approach for managing distribution inventory efficiently. Nevertheless, Vendor-managed-inventory (VMI) approach is applicable both for manufacturing inventory and distribution inventory.

Demand Forecast

Sufficient data result in more effective forecasts. The traditional way to forecast demand is to refer to the historical record of demand. All forecasting techniques are characterized by the fact that the more data are observed, the more we modify the estimates of the average demand and demand variability, and the more accurate these predictions can be (Simchi-Levi et al., 2004).

Of course, forecasts are never completely accurate. Indeed, the following rules of forecasting hold (Nahmias, 1997; cited in Simchi-Levi et al., 2004):

1. *The forecast is always wrong.* It is very unlikely that actual demand will exactly equal forecast demand.

2. *The longer the forecast horizon, the worse is the forecast.* A forecast of demand far in the future is likely to be less accurate than a forecast of near-future demand.

3. *Aggregate forecasts are more accurate.*

Stock-out

If stock-out occurs, different scenarios will happen. Subject to distribution inventory stock-out or manufacturing inventory stock-out, the impact on the supplier and the customer is different in terms of extent and scale, i.e. the impact is greater and more serious for one party than the other one. So the attitude toward stock-out varies accordingly. For instance, if there is a manufacturing inventory stock-out in the manufacturing companies like Ford and Toyota, the result is critical. The production line will be shut down and startup costs are very high. Hence such stock-out is prohibited. In case of distribution inventory stock-out, the impact on the customer is usually not big and serious, e.g. it is not a big deal when consumers encounter such a stock-out, therefore their counterparts-the suppliers, such as wholesalers and retailers, tolerate stock-outs.

When a supplier is unable to satisfy demand with available inventory, one of four events may occur: (1) the customer waits until the new replenishment arrives; (2) the customer back orders the product; (3) the sale is lost; (4) the customer is lost (Coyle et al., 2003). For most companies, the four results are listed from best to worst in terms of the impact.

Safety Stock

According to Toomey (2000), safety stock is one kind of inventory which can protect against fluctuations in demand or supply. And he also indicated that *'the quantity of safety stock is built into the reordering system's calculation in a manner that the inventory is not planned for consumption under normal (perfect) circumstances.'* (Toomey, 2000, p.47) Because of the situation of uncertainty in demand or delays in lead time or inadequate delivery, the company needs a small amount of safety stock on hand. In other words, the basic function of safety stock is to avoid stock-outs.

Another reason for setting safety stock is it could affect customer service level. When the actual order quantity from the customer is more than prediction, the safety stock needs to be held to avoid customer service problems (Krajewski & Ritzman, 2002). But Bloomberg et al. (2002) argued that the customer service levels vary by industries which mean the customer acceptance for stock-out is different.

The setting of safety stock will base on the trade off between service level and inventory investment. The quantity of safety stock should cover more than normal demand during the replenishment lead time. There are some parameters that should be considered when calculating the suitable quantity of safety stock, such as recent demand needs, lead time and the target service level (Krajewski et al., 2002).

2.1.1.3 Inventory Turns

Inventory turns indicates the number of times per year the companies such as retailers and manufacturers are able to sell off or use up their complete inventory of raw materials or finished goods (Coyle et al., 2003).

To maximize sales with the least amount of inventory, the company should try to meet demands by ordering smaller quantities more frequently from the suppliers, thus achieving more inventory turns, which refer to the annual number of times that average inventory sells (Goldsby et al., 2005). The inventory turns can be expressed mathematically as:

Inventory turns = Sales volume at cost/Value of average inventory

Increasing inventory turns means the company is holding fewer inventories on average, at the same time being able to fulfill the customer demand. The company's finance desires to reduce inventory, increase inventory turnover, and yield high capital return on assets (Coyle et al., 2003). But the company should note that there is no such a conclusion that the more inventory turns, the better the inventory policy. Again, individual company should recognize an appropriate number in their best interest.

Figure 2.1 gives an example to demonstrate the relationship between inventory carrying cost and inventory turns. As inventory turns increase, inventory carrying cost will reduce.

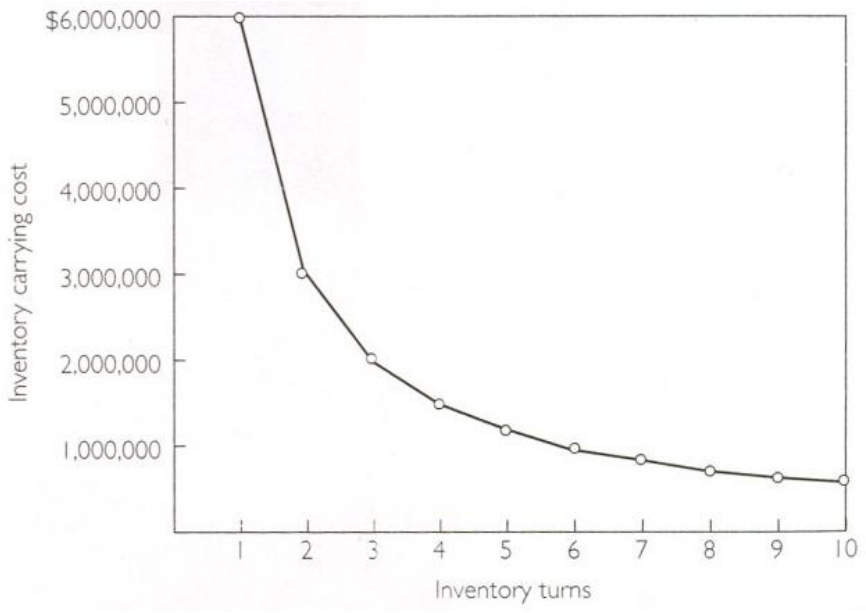

Figure 2. 1 Saving inventory dollars by inventory turns

Source: Coyle et al., 2003

2.1.1.4 Tradeoffs of Inventory

As to the performance measurement of a supply chain there are various parameters that should be taken into consideration from different perspectives. However, some of them are tradeoffs, which mean there are conflicting goals in SCM. Simchi-Levi et al. (2004) identified three tradeoffs concerning inventory: (1) The product variety-inventory tradeoff; (2) The lot size-inventory tradeoff; (3) The transportation cost-inventory tradeoff.

(1) The product variety-inventory tradeoff

Obviously, product variety dramatically increases the complexity of SCM. Since it is usually difficult to accurately forecast the demand for each type of product, higher aggregate inventory levels must be maintained to ensure the same customer service level. For a firm that is supplying a variety of products the major challenge needs to be addressed is how to match supply and demand effectively for each product (Simchi-Levi et al., 2004). The suppliers always pursue lower inventory levels because of financial concerns. And they are under temptation to increase the product variety in order to increase total sales volume. But when the product variety increases, inventory levels increase as well, so the effect on sales is offset to some extent by the increase in inventory levels.

(2) The lot size-inventory tradeoff

Manufacturers would like to have large lot sizes to reduce setup costs per unit, however, typical demand does not come in large lot sizes, so large lot sizes lead to high inventory, i.e. the larger is the lot size, and the higher is the inventory level (Simchi-Levi et al., 2004).

(3) The transportation cost-inventory tradeoff

Full loads minimize transportation costs because they can be spread among the largest possible volume of products. In many cases, however, demand is in small quantity of far less than a single full-load. Thus, when products are delivered in full loads, they have to wait for longer periods of time before they are used, leading to higher inventory costs (Simchi-Levi et al., 2004).

2.1.1.5 Inventory Carrying Costs

There are costs associated with holding all inventories, and the costs go beyond the expenditure of the inventory investment, inventory carrying costs form an interesting concept, representing both accounting costs and economic costs (Goldsby et al., 2005). Accounting costs are explicit and call for a cash payment. Economic costs are implicit, not necessarily involving an outlay but rather an opportunity cost. The components of inventory carrying costs are illustrated in Figure 2.2.

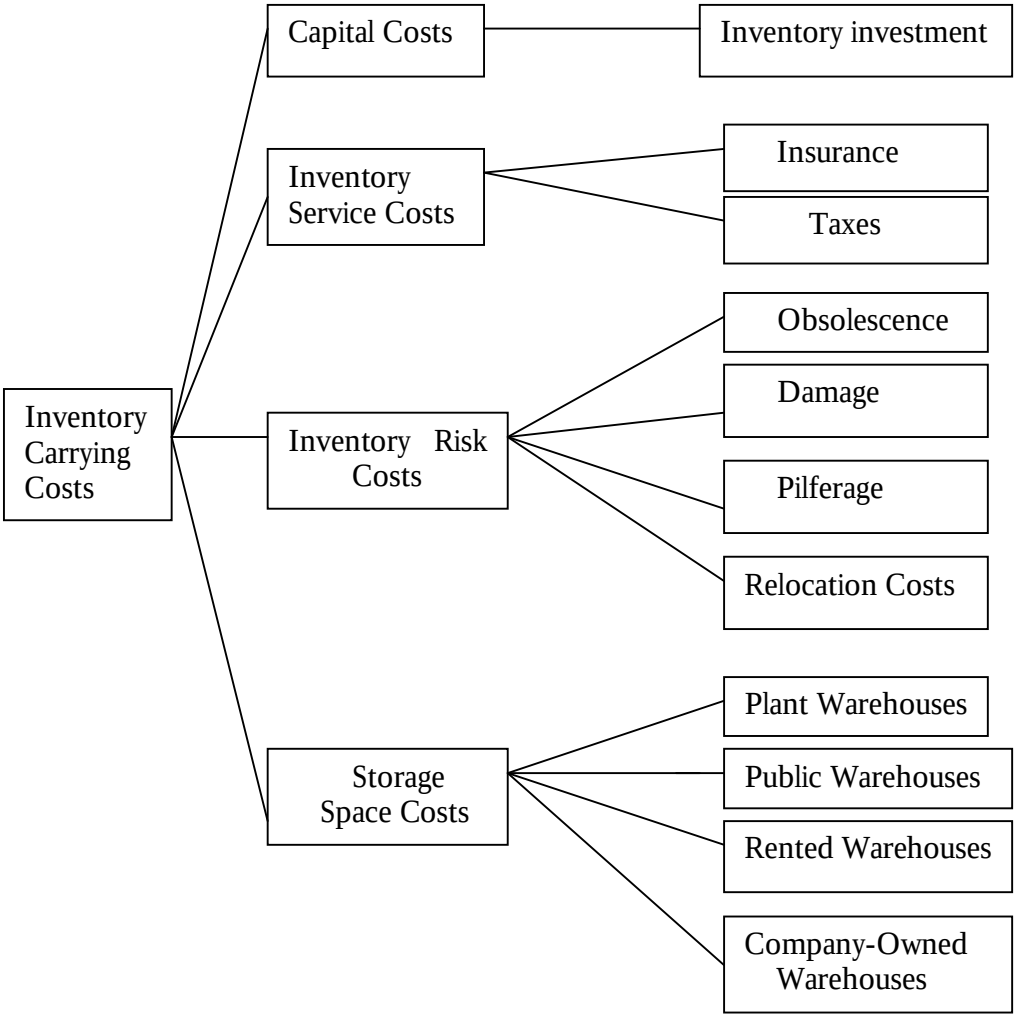

Figure 2. 2 What costs go into inventory carrying costs?

Source: Goldsby et al., 2005

Goldsby et al. (2005) explains the cost components in Figure 2.2 comprehensively as following. The capital cost is the single biggest factor of inventory carrying cost. It is opportunity cost; to clarify its sense, just think about what else could be done with the amount of capital if it were not tied up in inventory? Inventory is viewed as an asset on the balance sheet; hence, many state governments impose property tax rates on inventory. Insurance premiums are paid to provide coverage against loss or damage to inventory. Obsolescence reflects the real possibility that inventory value may decline in the course of being kept. Storage costs in this figure just refer to variable costs of storage. Fixed warehousing costs, which do not change with the volume of inventory maintained, are not included in inventory carrying costs but are calculated as warehousing costs in a total logistics cost.

2.1.1.6 Classification of Inventory

Minner (2000) introduces three types of motives of inventory control, and based on which classifies inventories into five categories. The three motives are transaction, safety, and speculation motives. The transaction motive is a result from the fact that ordering and manufacturing decisions are made at certain points of time instead of being performed continuously. The safety motive emerges in uncertainty where lead-time, demand and production yield are unknown at the time when decisions are made. The speculation motive generally refers to the special uncertainty in prices, if there is an anticipation of price increase for purchased goods, order are made in advance.

In light of three motives, inventories are divided into five groups (Minner, 2000):

- Cycle stocks. The cycle stock induced by batching alternates between an upper level when a batch has just arrived and a lower level just before the arrival of the next batch. Cycle stocks mostly attribute to economies of scale of purchasing and transportation, and technological restrictions in production (Minner, 2000).

- Pipeline stocks. Order processing times, production, and transportation rates contribute to pipeline stocks, also called process inventories. Materials that are in process, in transport, and in transit to another processing unit belong to pipeline stocks (Minner, 2000).

- Safety stocks. The safety stock is interpreted as the expected inventory just before the next replenishment arrives. It is caused by the uncertainty of demand, processing time, yield and other factors. And its major function is to protect business performance from forecasting errors (Minner, 2000).

- Speculative stocks. Expected price increase may result in earlier supply than would have been experienced under constant price, meaning there are more inventories on hand than actual demand at certain period of time, the redundant inventory is speculative inventory. And additionally, stimulated by the possible higher selling price, speculative stock may also appears (Minner, 2000).

- Anticipation stocks. Some products are characterized with seasonal demand, this fact, rather than expectations, generate anticipation stocks. A time varying demand pattern asks for balancing of overtime and inventory carrying cost in order to deal with the demand peak (Minner, 2000). Companies with significant seasonality find it more efficient to use smaller plants and produce prior to demand, which obviously means accumulation of inventory (Coyle et al., 2003).

Despite the above seemingly clear classification, it is difficult to determine to which of the categories a certain item belong. This problem rises from the fact that stocks may originate from more than a single inventory control motive and that there exists a certain degree of substitution (Minner, 2000).

2.1.1.7 Inventory Control Systems

Inventory control usually becomes one of the problems that bother small business managers. There are many inventory control systems and control techniques discussed in books and journal articles. Most of them deal with some complicated mathematical models which already beyond the reach of the small business (Lin, 1980). In the following content, some inventory control systems will be introduced.

ABC Analysis

According to Bloomberg et al. (2002), inventory classification systems help allocate time and money in inventory management and allow firms to deal with multiple product lines and multitude of stock-keeping units (SKU). The most widely used classification model is ABC analysis.

ABC analysis is an inventory classification technique in which the items in inventory are classified according to the dollar volume (value) generated in annual sales (Fuerst, 1981).

According to Onwubolu and Dube (2006), when ABC analysis is applied to an inventory situation, it determines the importance of items and the level of control placed on the items. The result of importance ranking is determined by two factors, the usage rate for an item and its unit value. These two factors can be multiplied to give the annual usage value (AUV), which is the total value of the annual usage. The bigger each factor, the more top ranking is the item. Therefore, close control is more important for fast moving items with a high unit value. To the contrary, for slow moving, low unit value items the cost of the stock control system may exceed the benefits to be gained and simple methods of control should be substituted.

By dividing a company's inventory into different classifications-A, B, or C, Onwubolu et al. (2006) indicates that managers can focus on the items that account for the majority of the inventory. Fuerst (1981) describes, generally, the A items include approximately 10 percent of the items in inventory, while accounting for roughly 50 percent of the dollar volume generated. The next classification, B items, includes roughly 40 percent of the items with 40 percent of the dollar volume. The remaining items, the C items, account for only 10 percent of the dollar volume, yet include approximately 50 percent of the items. Figure 2.3 illustrates the concept of ABC analysis.

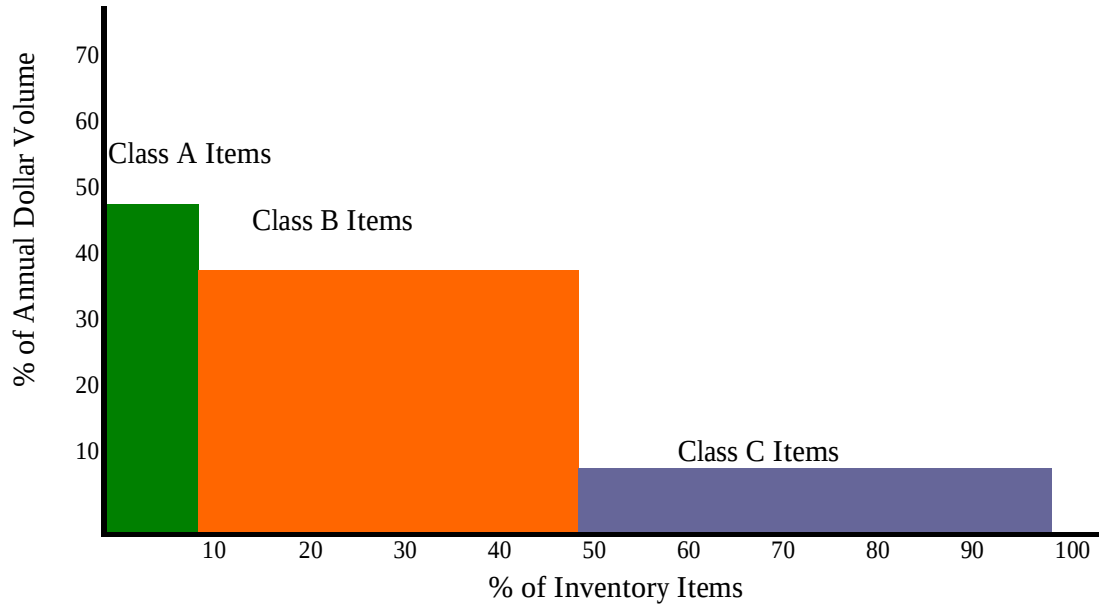

Figure 2. 3 Typical representation of ABC analysis

Source: modified from Onwubolu et al., 2006

Onwubolu et al. (2006) also mentioned, when we are doing an ABC classification, different types of inventory should be analyzed separately, such as, finished goods analysis is done separately from raw materials.

Benefits and Pitfalls of ABC Analysis:

Onwubolu et al. (2006) further stated that the advantage of dividing inventory items into classes allows policies and controls to be established for each class. Policies that may be based on ABC analysis include the following:

(a) The purchasing resources expended on supplier development should be much higher for individual A items than C items.

(b) A items should have tighter physical inventory control; perhaps they belong in a more secure area, and perhaps the accuracy of inventory records for A items should be verified more frequently.

(c) Forecasting A items may warrant more care than forecasting other items.

Better forecasting, physical control, supplier reliability, and an ultimate reduction in safety stock can all result from inventory management techniques such as ABC analysis.

But Fuerst (1981) argued that there are also some pitfalls of ABC analysis:

1. Although an item is classified as a C item, this does not necessarily mean that this item can (or should) be eliminated from the product mix. For example, a retail establishment may not be able to eliminate a particular item even though it is a C item because customers expect to be able to purchase that item in that store.

2. In manufacturing endeavors, a stock-out of a C item may cause serious delays in the completion for a finished product.

3. Some inventory situations do not lend themselves to classification. If the inventory situation does not reasonably reflect the underlying basis of the ABC technique-the "important few" and the "trivial many"-then such a technique should not be employed.

As Onwubolu et al. (2006) indicates, inventory management techniques should address two important questions: (i) when to order, and (ii) how much to order.

When to Order?

Continuous review and periodic review are two main types of models for companies to decide when to order. According to Simchi-Levi et al. (2004), in continuous review model inventory should be reviewed every day. Then management makes the decision whether the company needs to order more. And different from the continuous review policy, the periodic review is the policy in which the inventory is reviewed at regular intervals, and an appropriate quantity is ordered after each review.

Simchi-Levi et al. (2004) also mention that both of the above two models have a common basis, which is the concept of inventory position. The inventory position in real time is the actual inventory at the facility plus items ordered by the company but not yet arrived minus items that are back ordered.

- Continuous review model

This inventory review model is characterized by two parameters-the reorder point (ROP) "s" and the order-up-to level "S". Whenever the inventory position is at or below the reorder point "s", an order should be placed to increase the inventory level to the order-up-to level "S" (Simchi-Levi et al., 2004). Figure 2.4 shows the inventory level in a continuous review model.

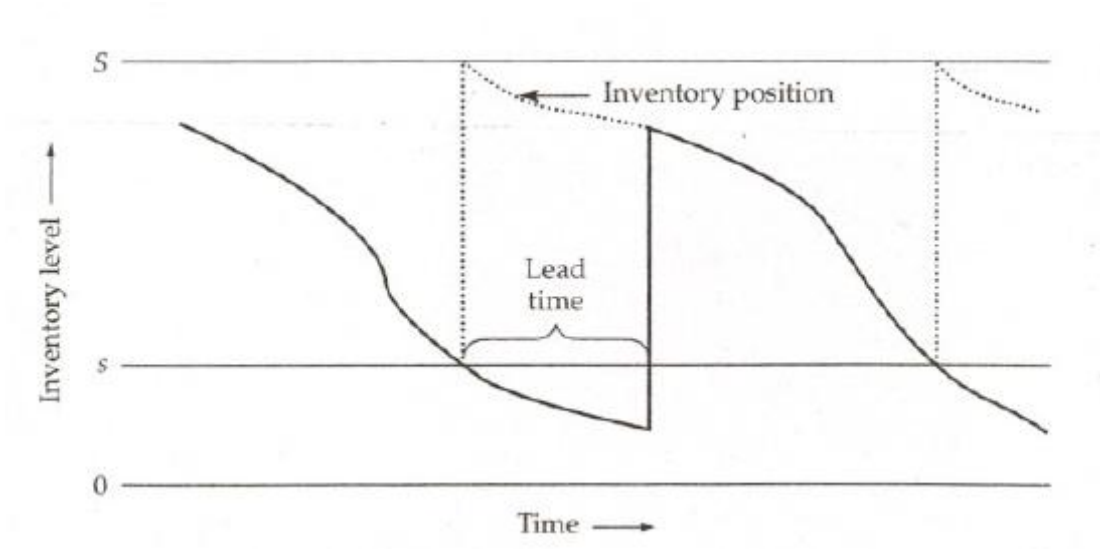

Figure 2. 4 Inventory level in a continuous review model

Simchi-Levi et al., 2004

Reorder Point (ROP) System

Davis et al. (1983) pointed out the reorder point (ROP) system determines when to place orders based on the number of component units on hand. The reorder point consists of

two components. The first is the average demand during lead time, and the second is the safety stock. The safety stock is the amount of inventory that the company needs to keep at the warehouse and in the pipeline to protect against deviations from average demand during lead time (Simchi-Levi et al., 2004). ROP is calculated using lead time, average demand, and safety stock. Lin (1980) suggested if demand has no seasonal fluctuation, and the supplier's lead time is reliable, the reorder point is just the demand during lead time (DDLT) plus a small amount of safety stock. Following above mentioned, the formula can be described as:

$$ROP = AD \times MLLT + SS \quad (2.1)$$

where AD = the average demand of the coming season

MLLT = the most likely lead time

and SS = the safety stock

Figure 2.5 shows the ROP with the safety stock.

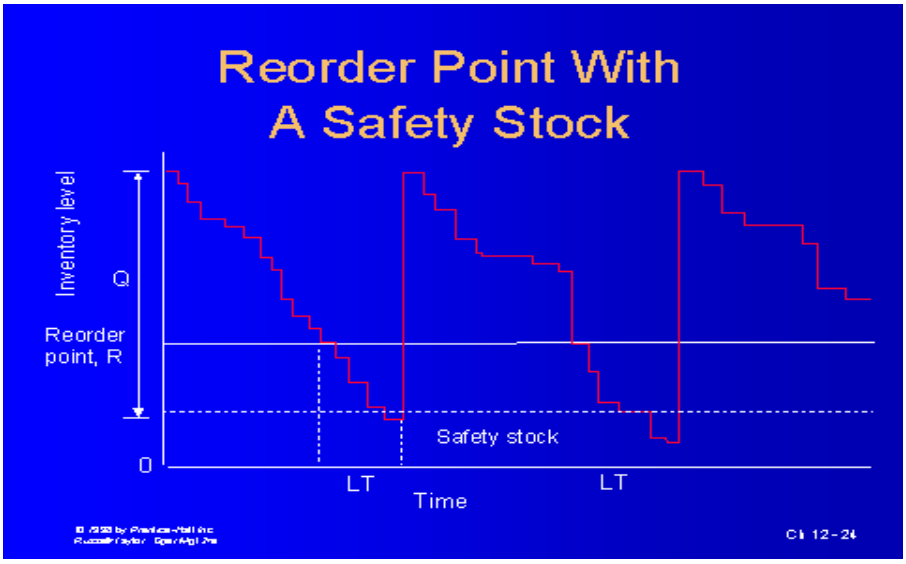

Figure 2. 5 ROP with safety stock

Source: http://www.usfca.edu/~villegas/classes/984-307/307ch12/sld024.htm

- Periodic review model

In many real situations, the continuous review is generally not practical. The more popular way is that the inventory is reviewed periodically, at regular interval. For example, the inventory level may be reviewed at the end of each month and an order may be placed at the same time. The review period can be set according to the company's actual situation. Since the inventory levels are reviewed at a periodic interval, the fixed cost of placing an order is a sunk cost and hence can be ignored (Simchi-Levi et al., 2004).

Since fixed cost does not play a role in this review model, one parameter for inventory is the base-stock level. The company determines a target inventory level, the base-stock level, and each review interval point the inventory position is reviewed, and the replenishment order is placed for an amount large enough to bring the inventory level back to the base-

stock level (Blackstone, Jr & Cox, 1985). Figure 2.6 illustrates the inventory level in a periodic review model.

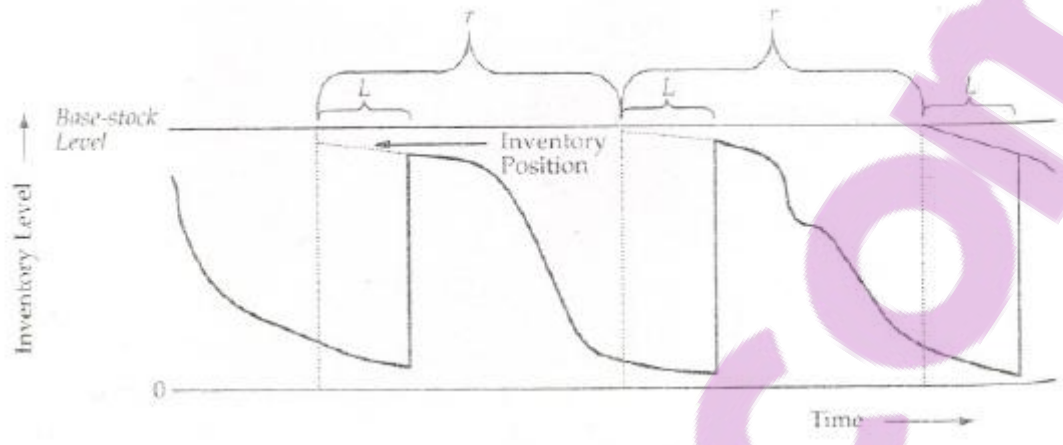

Figure 2. 6 Inventory level in a periodic review model

Source: Simchi-Levi et al., 2004

The base-stock level consists of two components: (1) average demand during an interval of time equal to the review period plus the lead time and (2) safety stock, which is the amount of inventory that the company needs to cover deviations from average demand during the same period (Simchi-Levi et al., 2004).

Simchi-Levi et al. (2004) remind us that it is difficult to determine the appropriate safety stock level, as it is affected by a variety of characteristics, like the service level. The service level is a critical factor in relation to safety stock determination. If a higher service level is desired, more safety stock will be required. Also, if demand is highly variable (frequently much higher or lower than average), it is also important to hold more safety stock. Similarly, if lead time is long, more safety stock is needed to guard against possible stock-outs during lead time.

How much to order?

There are some techniques will be introduced for managers to determine how much should be ordered for replenishment orders.

EOQ Model

According to Onwubolu et al. (2006), EOQ technique is based on several assumptions: (1) demand is known and constant; (2) lead-time is known and constant; (3) receipt of inventory is instantaneous, that is, inventory from an order arrives in one batch, at one time; (4) quantity discounts are not possible; (5) the only variable costs are cost of placing an order and the cost of holding inventory; and (6) stock-outs can be completely avoided if orders are placed at the right time. With these assumptions, the graph of inventory usage over time has a saw tooth characteristic.

Minimizing acquisition cost

The significant variable costs constituting acquisition cost are (i) ordering cost, and (ii) holding cost.

Variation of ordering cost versus holding cost

The more the quantity of materials that is ordered at a time, the less the ordering or replenishment cost, and the more holding cost; and vice-versa. The combination of above objective functions should be optimized as follows:

Min $\sum$ {ordering costs + holding costs}

This optimization leads to the following deductions: (1) minimum acquisition cost is a compromise of cost of ordering versus cost of storage, and (2) minimum total costs (acquisition cost) will be achieved by the economic order quantity.

The classical EOQ model is given as

$$\text{EOQ} = \sqrt{\frac{2DC_0}{C_h}} \tag{2.2}$$

where D=annual demand (units per year), C_0 = cost/order, and C_h = variable holding cost (cost/unit/year). The simplified classical EOQ model assumes that stock is replenished just at the point when inventory is zero. This zero inventory before replenishment is known as stock-out (Onwubolu et al., 2006).

Alternative Order Quantity Approach

For small business, the inventory control systems should be inexpensive, easy to understand, easy to use, and not too time-consuming. From the managers' aspects, the ideal systems are those that allow them to set policies, rules, and procedures easily, and have them implemented by the subordinate without any difficulty (Lin, 1980).

The application of the EOQ formula for a small business is much more difficult than that for a large corporation. Some estimating parameters, like order cost and inventory carrying cost for EOQ are not easy when records of various costs are inadequate or nonexistent. EOQ might have to be re-calculated each time there is a change in interest rate, price, or demand. This will increase the order cost, and is not suitable for a small business (Lin, 1980).

Lin (1980) suggests the following two methods can be easily adapted for small business use. The first method is called maximum inventory. The manager sets the maximum stock level for each item based upon his/her experiences or analysis of company's financial situation and desirable return on inventory investment. The formula is:

OQ=Maximum Inventory level – Reorder Point+ DDLT (2.3)

OQ: order quantity

DDLT: demand during lead time

The second method that he proposed is called *desired covering period*. Based on sales forecast, the manager can set the order quantity that will cover the period he/she likes. The outcome number might have to be modified to meet business requirements. For instance, the supplier probably sells certain products at the multiple of batch quantity or sets a minimum order quantity for a product.

2.1.1.8 Warehousing

'The warehouse is a point in the logistics system where a firm stores or holds raw materials, semi-finished goods, or finished goods for varying periods of time.' (Coyle et al., 2003, p.285).

Three Basic Functions of Warehouse

According to Lambert & Stock (1993), there are three basic functions of warehouse:

- *Movement* is necessary to store a product properly. It can be divided into three activities:
  i. Receiving inbound goods from transportation carriers and performing quality and quantity checks.
  ii. Transferring goods from the receiving docks and moving them to specific storage locations throughout the warehouse.
  iii. Shipping the goods outbound to customers by some forms of transportation.
- *Storage* is the second function of warehousing. It can be performed in two different ways:
  i. *Temporary storage* means that storing a product, which is necessary for inventory replenishment.
  ii. *Semi-permanent storage* is used for inventory in excess of immediate needs. It is the safety or buffer stock
- The last function of warehouse is the *information transfer*. When the product is moved and stored, this function occurs at the same time. It is important for the management to have timely and accurate information in order to administer the warehouse activity. The information can cover a lot of things like inventory levels, throughput levels, and data of the customer, facility space utilization and also about the personnel (Lambert, et al., 1993).

Types of Warehouse

One of the warehouse decisions is choosing the type or combination of types to use. There are three basic types of warehousing: private, public and contract (Bloomberg et al., 2002).

Private warehouse: The firm producing or owning the goods owns private warehouses. This type of warehouse is main focus on storing the firm's own goods until they are delivered or sold (Bloomberg et al., 2002). Coyle et al. (2003) also stated that stability of warehouse demand must be examined over multiple products and another advantage of using a private warehouse is the ability to maintain the physical control over the facility.

Public Warehouse: If a company without large inventory accumulations or a very seasonal need for warehousing space that they could not utilize a private warehouse consistently and efficiently, they would find a public warehouse. Or if a company shipping in small quantities for long distances would also usually find a public warehouse. The reasons for using public warehousing which are: (1) avoid the capital investment and financial risks; (2) flexibility of public warehousing (Coyle et al., 2003).

Contract Warehouse: *'Contract warehousing is one specialized form of public warehousing. Some reasons for the growth of contract warehouses are: (1) product seasonality; (2) geographic coverage requirements; (3) flexibility in testing new marketing; (4) management expertise and dedicated resources; (5) off-balance sheet financing; (6) reductions in transportation costs.'* (Bloomberg et al., 2002, p.76)

Warehouse Layout

According to Bloomberg et al. (2002), the objectives of warehouse layout and design should be as following:

i. warehouse capacity utilization must be optimized

ii. whatever is stored must be protected

iii. the layout should consider space utilization and stock placement

iv. the warehouse should be as mechanized and automated as possible

v. the warehouse layout should lead to high productivity in receiving, storing, picking, and shipping

vi. the warehouse design should be flexible and allow for improvement

From above mentioned, the rational utilization of warehouse space is the most important issue in warehouse layout management. The good utilization of space should begin with good warehouse visibility.

Baudin (2004) indicated that warehouse visibility includes: labels on the grid of columns which are supporting the ceiling, dock numbers that remain visible when docks are open, three-sided overhead zone identification signs, aisle/column/level labels on each slot in a pallet rack.

Warehouse Management System (WMS)

The computer-based warehouse management system (WMS) has been implemented widely in many companies. It could assist the warehouse manager to control the various operations, like receiving, put-away, picking, packing, shipping, storage location, work planning, warehousing layout, and analysis activities (Coyle et al., 2003). The system could help managers with workload reductions in terms of data collection, achieving higher accuracy, faster retrieval, and could support for cycle counting and data mining (Baudin, 2004).

Barcode scanning is used in many warehouses. Its function is to match serial numbers to customer purchase orders (PO), and the hardware and communication infrastructure to support a WMS is in place. Figure 2.7 shows one example of the materials handler scans barcodes for both location and item number when loading a pallet.

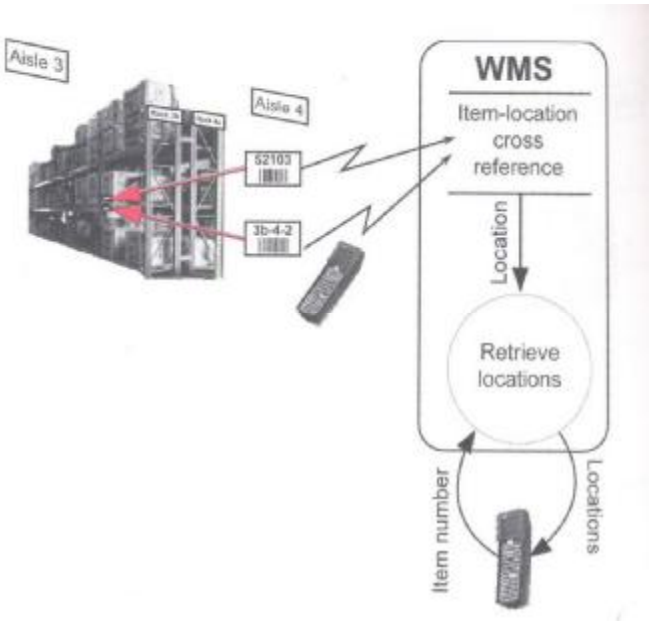

Figure 2. 7 The example of material's barcode scans.

Source: Baudin, 2004

2.1.2 Purchasing Management

Purchasing has two main objectives, one is to purchase for resale, and the other one is to purchase for consumption or for transformation (Dobler, Burt & Lee, 1990; cited in Quayle & Quayle, 2000).

Purchasing function starts as subordinate to the more important functions of marketing, finance and operations (Bloomberg et al., 2002). Firms give more attention to purchasing when the costs of purchased items increase. Reengineering the supply chain strategy concerns not only coordination of the various activities in the supply chain but also deciding what to produce in-house and what to outsource (Simchi-Levi et al., 2004). With the strong trend towards more outsourcing over the last decade, presently purchasing has evolved as an important strategic area of management.

Grittner (1996) suggests a 4C purchasing strategy which is to choose a competitive supplier, establish a commitment to the supplier, and analyze the complete production process with a cost-analysis mind-set, and co-ordinate with the supplier early and frequently to maximize cost efficiency (cited in Quayle, 2000).

2.1.2.1 The major purchasing decision processes

There are six major purchasing decision processes: (1) 'make or buy', (2) supplier selection, (3) contract negotiation, (4) design collaboration, (5) procurement, and (6) sourcing analysis (Aissaoui, Haouari & Hassini, 2007).

In the 'make or buy' decision process, based on the part/service is a finished/semi-finished goods or not, a company will decide the part/service should be produced internally or outsourced; In the supplier selection process, a number of supplier are chosen for purchasing according to a predefined set of criteria; the purchasing contract could be either short-term or long-term; as to design collaboration, the buyer and the supplier cooperate closely to de-

sign part/service that meet the customer's specific requirements; the procurement decision process is related to ensuring delivery of the part/service in time from the supplier and with minimum costs; finally, in the sourcing analysis phase, a company should examine the effectiveness and efficiency of its procurement process (Aissaoui et al., 2007).

2.1.2.2 Supplier relationship management

The most important purchasing activity is to select and keep close relationships with several reliable and high-quality suppliers, in order to reduce product costs, maintain good product quality and customer services (Aissaoui et al., 2007). Relations between suppliers and buyers in industrial markets have been found to be long term and characterized by stability (Gadde & Mattsson, 1987). Partnership should be established because if the buyer is to be best served, then the parties to a deal must work together for the win-win situation and both parties have an interest in each other's success (Quayle, 2000).

Figure 2.8 shows that a company is better off remaining in transactional relationships if it is not ready to develop relationships properly. Poor partnership is, instead, more costly than staying in a transactional relationship with suppliers (Goldsby et al., 2005). But it also shows in case of trust existence, good partnership is less costly than a transactional relationship.

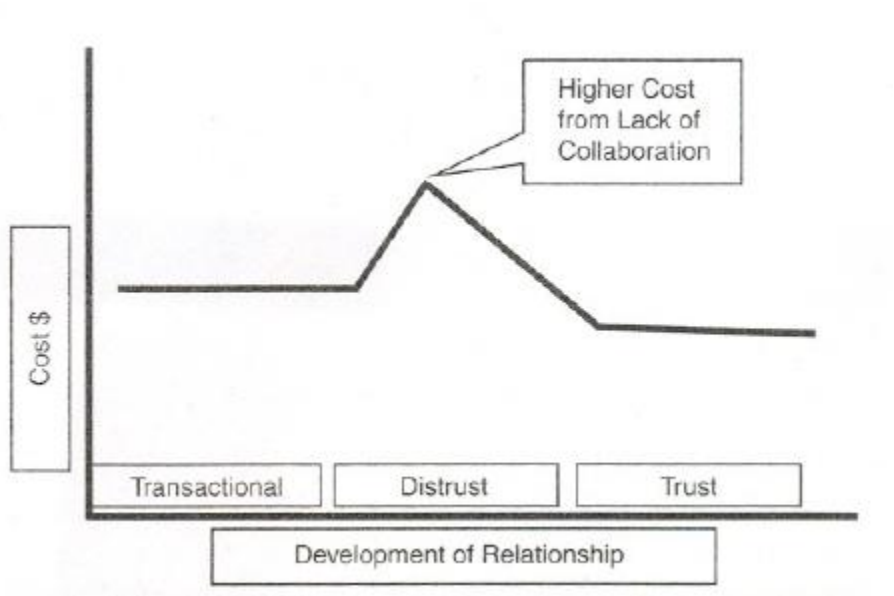

Figure 2. 8 The cost of unsuccessful supplier relationships

Source: Goldsby et al., 2005

2.1.3 IT Application in SCM

2.1.3.1 The Role of IT in SCM

Many practitioners perceive the SCM concept primarily as a phenomenon driven by the developments in the information and communication technology area (Hakansson et al., 2004). Information technology is a crucial enabler of effective and efficient SCM (Simchi-Levi et al., 2004). These statements indicate that IT evolution has been and will keep on acting as the major driving force for SCM development.

The revolution change that has occurred in technology, both hardware and software, has forced many companies worldwide to change the way they "do business." Technology can be viewed legitimately as a facilitator of change process since it enables companies to implement many of the strategies (Coyle et al., 2003).

IT application is extremely broad and deep in SCM through various approaches, for instance, in-house information systems and their integration, inter-organizational information transmission and sharing (in real-time or not), collaborative inter-organizational information systems, tracking technologies in which barcode, RFID and GPS are paradigms, internet, intranet, extranet. All in all, IT can be found everywhere when there is a need or a possibility.

2.1.3.2 IT goals in SCM

Simchi-Levi et al. (2004) classify IT goals for SCM into four groups:

- Collect information. The information availability in regard to the status of material is the foundation on which intelligent supply chain decisions can be made. In addition, it is not sufficient just to track the status of material across the supply chain; there is also a need to alert diverse systems to the implications of this movement. This goal calls for standardization of product identification, e.g. bar coding, across companies (Simchi-Levi et al., 2004).

- Access data. The single-point-of-contact concept is important for effective IT. The aim is that all the available information can be accessed in one stop regardless of the mode used or who is making the inquiry. In many companies, information systems are isolated, standing alone in light of their functions within the company. It will be ideal that everyone who needs certain data actually has access to the same real-time data through any interface device (Simchi-Levi et al., 2004).

- Analyze based on supply chain data. The information system should be used to find the best way of operating the whole supply chain. This entails various levels of decision making, from operational decisions to tactical decisions, lastly to strategic decisions. To facilitate this, information systems should be flexible enough to adapt to supply chain strategic changes. And the flexibility requires the information systems to be highly configurable and have new standards (Simchi-Levi et al., 2004).

- Collaborate with supply chain partners. Depending on its position in the supply chain, a company may be asked to either integrate with its customer's procurement system or require its own suppliers to link into its own procurement systems or collaborative platforms or both. In recent years, collaboration has become a new focus of supply chain system development. Two types of systems have been developed-supplier relationship management (SRM) applications and customer relationship management (CRM) applications (Simchi-Levi et al., 2004).

2.1.3.3 Integrating Supply Chain IT

Supply chain management is extremely complicated, different companies have their own concerns about introducing the IT innovation, they may worry about the magnitude of return on investment, or too detailed information making no sense for the customer, or certain IT investment is too big (Simchi-Levi et al., 2004).

How can all the components of IT join together? The key is to analyze each component contribution to the company and make investment plan according to the particular needs of the company (Simchi-Levi et al., 2004). Because of the lack of standards, it is much likely that in the near future middleware will be developed to mediate between different systems and different standards, eventually, the concept of supply chain standards can be established into the basic systems that constitute the infrastructure (Simchi-Levi et al., 2004).

2.1.3.4 ERP Information System in Organizations

Enterprise Resource Planning (ERP) is a system that attempts to do planning according to supply and demand information taken across the entire network (Toomey, 2000).

ERP traditionally covers manufacturing, human resources, and financials but now has become the backbone of most IT infrastructures (Simchi-Levi et al., 2004). Originally, ERP information system is for integrating internal operations like billing, payroll, cost analysis, sales analysis, and etc. ERP can produce great benefits, mostly in the form of more efficient business processes (Davenport, 2000). With the new development of ERP II, such information system is expanding to include new functionality, is providing Web-based access and services and becoming more open to external integration (Simchi-Levi et al., 2004). Due to the integration, inventory control system becomes better and inventory management also gets improved.

2.2 Small Business and SCM

2.2.1 Definitions

It is hard to give one simple or single definition of a small and medium-sized enterprise. Bolton Report (1971) conducted one of the earliest attempts to give a definition and proposed two definitions for the small and medium-sized enterprise (cited in Carter & Evans, 2006). First, it suggested a qualitative or economic approach that tried to capture the range and diversity of the smaller enterprise relative to the large enterprise. This definition suggested that a small enterprise was so if it met three criteria:

- independent (not part of a larger enterprise);
- managed in a personalized manner (simple management structure);
- relatively small share of the market (the enterprise is a price ‘taker’ rather than price ‘maker’).

It also proposed a more quantitative definition of the smaller enterprise. Again, the concern was to capture the heterogeneity of smaller enterprises. This is because no single measure such as assets, turnover, profitability or employment is likely to fully account for the size of an enterprise.

There is a more uniform definition that has been adopted by EU. From Table 2.1 you can see that smaller enterprise is classified into three types by EU: medium-sized, small and micro. Each of these has different employee number, turnover and asset thresholds.

Enterprise category	Head count	Turnover or	Balance sheet
Medium-sized	<250	⩽€ 50 million	⩽€ 43 million
Small	<50	⩽€ 10 million	⩽€ 10 million
Micro	<10	⩽€ 2 million	⩽€ 2 million

Table 2. 1 EU definition of SME

Source: European Union, 2005

Internationally, there are a wide variety of definitions. Countries such as the US or Canada define an SME as a company that employs fewer than 500 employees. Hong Kong has an alternative definition: SMEs are manufacturing enterprises with fewer than 100 employees or non-manufacturing with fewer than 50 employees (Carter & Evans, 2006).

2.2.2 Characteristics, Strengths and Weaknesses of SMEs

Form the definition problem of SME, we can know the most important characteristic of such enterprises is diversity. In spite of the diversity of SME, three core elements can be identified (Gils, 2000):

(1) Small scale: it is a characteristic of the firm.

(2) Personality: it indicates a pervasive intertwining of private and business affairs- in house, income, labor, management, internal and external contacts, motives.

(3) Independence: it indicates relative freedom from the discipline of capital markets, allowing for more distinct goals and conduct.

As Table 2.2 shows, each of these characteristics is the cause of some strong or weak aspects of the SMEs. The identified strengths and weaknesses suggest appropriate core strategies (Gils, 2000).

Characteristics		*Strengths*
Intertwined ownership and management	→	Motivated management/Commitment
Integration of tasks in worker, variation and improvisation	→	Motivated labor
Few hierarchical levels, short communication lines	→	No bureaucracy, internal flexibility, little filtering of proposals
Few and simple procedures, personal, direct, oral internal communication	→	Low costs and little distortion of internal communication
Personal and close relations with customers	→	Capacity for customization
Craftsmanship	→	Unique or scarce competencies
Tacitness of knowledge	→	Appropriability
Idiosyncratic perception	→	Originality of initiative
↑		↓
Core Characteristics		***Core Strategies***
Small Scale		Innovation or 'niche' strategies
Personality		New and/or customised producs
Independence		External networks
↓		↑
Characteristics		*Weaknesses*
Idiosyncratic perception	→	Unopposed misapprehensions
Tacit knowledge	→	Limited capacity for absorption of new knowledge/technology
Craftsmanship	→	Technological myopia
Few products and markets	→	Little spread of risk, limited synergy
Small volume of production	→	Diseconomies of small scale
No staff functionaries	→	Lack of functional expertise
Lack of managerial time	→	Ad hoc management, short term perspective
Great authority and many functions in one hand	→	Vulnerability to discontinuity of management and staff
Few layers of hierarchy	→	Limited career opportunities
Low level of abstraction	→	Lack of information
Product-or technique orientation	→	Errors in marketing and strategy
Possible lack in finance	→	Lack of means for growth

Table 2. 2 Characteristics, strengths and weaknesses of SMEs

Source: Gils, 2000

2.2.3 Small Business Embracing SCM：Pros and Cons

We all know that some famous large companies are reaping big benefits through the integration of supply chain management techniques (Chapman et al., 2000).

How about small business? Can supply chain management work for small business as well as these large companies?

Chapman et al. (2000) listed five reasons why small business also should take part in the practice of SCM:

1. If one company is a part of the flow of goods or services to a group of final customers, it belongs to a supply chain. Many small businesses are critical supply chain links as suppliers of parts, manufacturers of products, or distributors to consumers. The business decisions they make affect the supply chain that they belong to. This is why the SCM theory is highly relevant to them.

2. It is easy for small businesses to build SCM into their business strategy as it develops. Small businesses do not need to go through the difficult transform process, which large companies will face when they attempt to re-engineer their existing business network.

3. A small business can take advantage of flexibility and specific expertise it owns to sell them to other supply chain links. By using the advantage of their size, small companies can develop their business and become a vital link in their supply chain.

4. Another reason why SCM is relevant to small business is that support from information systems is now available.

5. SCM provides small business a method of addressing the competitive challenges facing the entire business world today.

But Heide and Heide (2007) argued that it is still evident that SCM implementation has its costs, hazards and challenges, especially for small and medium-sized enterprises (SMEs). SMEs are less able to harness the benefits of SCM or encounter greater obstacles when trying to introduce SCM practices.

The reasons for lack of SCM implementation can also be related to structures in the supply chain. This includes resource structures and how various assets are linked and shared between collaborating actors (Heide et al., 2007).

Compared with large companies, SMEs difference in performance after the introduction of SCM is negatively correlated with SME implementation (Heide et al., 2007). Another study of SCM practice in UK SMEs by Quayle (2003) attributed the difference to lack of effective adoption of SCM techniques, such as new technology, Research and Development (R&D) and e-commerce, which are normally associated with innovations in a supply chain context, which were regarded as low priority items by SMEs in their business practice.

A recent group of studies focus attentions on how processes and structures are combined with the management components of the supply chain (Lambert, Cooper & Pagh, 1998). One management component, which is related to the behavioral aspect of management, includes the power and risk and reward structures among networking companies. For example, if a key partner forces a less powerful SME supplier to implement SCM, the performance of the supply chain will increase (Arend & Wisner, 2005). Arend et al. (2005) also indicates that SMEs in general are not able to implement SCM to its full extent, mainly because they are managed at arm's length by larger customers and have to follow the norms stipulated by the buyer. It implies SMEs do not appear to implement SCM as deeply as large companies, and consequently receive fewer advantages from other actors in the supply chain.

3 Methodology

In this chapter, the authors will examine different research methods and present what methods are applied to this thesis.

Saunders, Lewis and Thornhill (2003) define business and management research as undertaking systematic research to find out things about business and management. Business and management research not only should provide findings that advance knowledge and understanding, it also should address business issues and practical managerial problems (Saunders et al., 2003).

The research process usually includes formulating and clarifying a topic, reviewing the literature, choosing a strategy, collecting data, analyzing data and writing up (Saunders et al., 2003). The research process is not strictly sequential in reality; the researcher often needs to revisit each stage many times in order to refine the ideas.

3.1 Generating the Research Topic

The authors decided to make the thesis a research project based on practical work, and a specific company needed to be accessed to collect empirical data for the research project. Somehow the authors managed to find a company that showed their initial interest in supporting the business management research project. However, the authors did not come up with any particular topic when we made the first visit to HEM-SOL Corporation in mid-September, 2007. It is during the interview with the general manager, also the owner of the company that he gave out an inventory problem – overstock, which has recently emerged and become a management bottleneck for the company. After the authors got an overview of the company business activities, we thought the inventory control in a SME management context would be a good topic to do our thesis project. On the other hand, the research project, given this topic, is particularly of practical relevance for the company.

3.2 Deciding the Research Approach

According to Saunders et al. (2003) there exist two types of research approach: one is the deductive approach, in which the researcher develops certain theories and/or hypotheses and design a research strategy to verify the hypotheses; the other is inductive approach, in which the researcher collects data and develops theories as a result of the data analysis.

Saunders et al. (2003) present some major differences between deductive and inductive approaches to research. Deduction approach emphasizes the following aspects:

- Scientific principles
- Moving from theory to data
- The need to explain causal relationships between variables
- The collection of quantitative data
- The application of controls to ensure validity of data
- The operationalisation of concepts to ensure clarity of definition
- A highly structured approach

- Researcher independence of what is being researched
- The necessity to select samples of sufficient size in order to generalize conclusions

While induction approach emphasizes the following aspects:

- Gaining an understanding of the meanings humans attach to events
- A close understanding of the research context
- The collection of qualitative data
- A more flexible structure to permit changes of research emphasis as the research progresses
- A realization that the researcher is part of the research process
- Less concern with the need to generalize

Considering the research questions and purpose of the thesis the authors chose the deductive approach as the legitimate approach to be used. The authors conducted a range of relevant theories review, proposed some hypotheses, such as the implications gained from the relevant theories would help to improve the management of the researched company and how to improve, and tested the hypotheses by concluding that they really worked.

3.3 Choosing the Appropriate Research Strategies

Saunders et al. (2003) present that eight strategies can be used in the research work: experiment; survey; case study; grounded theory; ethnography; action research; cross-sectional and longitudinal studies; exploratory, descriptive and explanatory studies.

3.3.1 Case Study Strategy

Robson (2002:178) defines *case study* as 'a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence' (cited in Saunders et al., 2003).

The researcher must be alert to the need for *multiple sources of evidence*. '*All evidence is of some use to the case study researcher: nothing is turned away.'* (Gillham, 2000, p.20) But this does not mean that you should talk to a lot of different people, but that you need to look for different kinds of evidence: what people say, what they are doing, what they are making or producing, what documents and records show.

Gillham (2000) gave us the following list of six main evidences.

1. Documents. These can be letters, policy statements, regulations and guidelines. They provide a formal framework to which a researcher may relate the informal reality.
2. Records. These are the evidences that go back in time but may provide a useful longitudinal fix on the present situation. These may well be stored in computer files.
3. Interviews. This is an inadequate term for the range of ways in which people can give you information.

4. Direct observation. It is used mainly when a researcher needs to be more systematic in how he or she observes.

5. Participant observation. This is the more usual sort in a case study-where a researcher is 'in' the setting in some active sense-perhaps even working there but keeping the ears and eyes open, noticing things that they might normally overlook.

6. Physical artifacts. These are things made or produced. Sometimes this kind of evidence is most important when a researcher is doing a multiple case study.

As to our research project, we investigated the current situation of inventory management in HEM-SOL by using multiple sources of evidence, for instance, the interviews with the top manager and other related staff at HEM-SOL, and annual sales records for twenty sample items. When we were visiting at HEM-SOL, we conducted direct observation on warehousing operation and the information system- 'Navision' operation.

There are two major types of case study, single-case study and multiple-case study.

Yin (2003, p.40) indicates that *'the single-case study is analogous to a single experiment, and many of the same conditions that justify a single experiment also justify a single-case study*.' Compared with single-case study, multiple cases' evidence is often considered more compelling and the overall study is regarded as being more robust. The distinct disadvantage of multiple-case study is that it requires extensive resources and time and cannot be taken lightly (Yin, 2003).

We used the single-case study approach to conduct the research project at HEM-SOL. Employing the single-case study strategy enabled us to fully understand the research context and acquire considerably deep understanding about specific management issues by constraining the research scope.

3.3.2 Cross-Sectional Studies

Cross-sectional research can be interpreted as the study of a particular phenomenon at a particular time (Saunders et al., 2003). In this sense our thesis project is a cross-sectional research as the case study conducted in HEM-SOL Corporation was based on interviews and observations over a short period of time – less than three months.

3.3.3 Exploratory, Descriptive and Explanatory Studies

(1) Exploratory studies

An exploratory study is conducted when not much is known about the current situation, or no information is available on how similar problems or research issues have been solved in the past (Sekaran, 2003). Saunders et al. (2003) argue that exploratory studies are particularly useful if the researcher seeks to clarify his understanding of a problem. There are three major ways of conducting exploratory research (Saunders et al., 2003):

- A search of the literature;
- Talking to experts in the subject;
- Conducting focus group interviews.

Our thesis research is obviously not an exploratory study according to the above explanation of exploratory studies.

(2) Descriptive studies

A descriptive study is undertaken in order to ascertain and be able to describe the characteristics of the variables in certain situation, and to understand the characteristics of organizations that follow certain routine practice (Sekaran, 2003). The aim of a descriptive study, therefore, is to provide the researcher with a profile or to describe the relevant aspects of the phenomenon from an individual, organizational, industry-oriented, or other perspective (Sekaran, 2003).

The descriptive study strategy was used in the chapter of empirical findings to clarify and elaborate the case study context, which included the company organizational structure, the functions performed in-house, the outsourcing functions, the business operational process, and the physical facilities.

(3) Explanatory studies

According to Saunders et al. (2003) a study that establishes causal relationships between variables may be termed explanatory study; the key issue here is to study a situation or a problem in order to explain the relationships between variables.

Sekaran (2003) further divides explanatory studies into causal study and correlational study, in which she discovered, very often, it is not just one or more variables that cause a problem in organizations. She further explains that, given the fact that most of the time there are a number of factors that influence one another and the problem in a chainlike fashion, the researcher might be asked to identify the crucial factors associated with the problem, rather than explore a simple cause-and-effect relationship.

As the authors recognized there are a number of issues associated with the inventory control problem in HEM-SOL Corporation that are actually affecting each other, we did not pursue a simple cause-and-effect approach to the problem discussion and the suggested solutions to the problem.

3.4 Qualitative or Quantitative Research

Quantitative research, known as 'number-crunching', uses techniques that apply more to numerical data, where researchers develop variables or concepts which can be measured, and transform them into specific data-collection techniques (Grix, 2004). Neuman (2000:157-8) believes that the techniques can produce precise numerical information that can be regarded as the empirical representation of the abstract concepts (cited in Grix, 2004).

Qualitative research is characterized by the use of methods that try to investigate inherent traits of the objects of inquiry and that tend to be more interpretative in nature (Grix, 2004). The strengths of qualitative research are rooted primarily in its inductive approach, its focus on specific phenomena or people, and its emphasis on words rather than numbers (Maxwell, 1996).

- Understanding the meaning, for participants in the study, of the events, situations, and actions they are involved with.
- Understanding the particular context within which the participants behave, and the impact that it has on their behavior.

- Identifying unexpected phenomena and influences, and establishing new grounded theories about the latter.
- Understanding the process by which events and actions take place.
- Developing causal explanations.

Sekaran (2003) states that case studies usually provide qualitative rather than quantitative data for analysis and explanation, however, the application of case study analysis to some of the organizational issues is relatively easy. Based on the research questions, the purpose of this thesis work and the data collection methods that have been used, the authors asserts that this thesis project is a typical qualitative research.

3.5 Data Collection Methods

The authors collected primary data mainly through in-depth interviews with the general manager of the company and through non-participant observations in the fieldwork, such as looking into the information system, visiting the warehouses, and observing the operational process of warehouse activities. E-mails also were used to send out questions and get responses and other data from the same interviewees. We prepared the interview questions in advance and also raised unprepared questions of relevance when interacting with the interviewees during the conversations. We used semi-structured and unstructured interviews approach to all the interviews that were conducted. Using unstructured interview approach gave the authors greatest flexibility in picking up as many clues as we could to draw a clear picture of the facts. While semi-structured interview approach was applied to the later stage of data collection actions, which assisted us in keeping focus on identified questions and digging deeper into the questions, however, concurrently, allowed a certain degree of flexibility during the interview.

The authors also gathered the product catalogue of the company as the secondary data for the thesis project. But we decided not to collect the historical commercial documents, for instance, the invoices that are most frequently used in the company's business activity, since we considered these documents as small pieces of a puzzle and they were too many to collect and form the whole picture for outside researchers. Instead we acquired the relevant information from the manager through in-depth interviews.

Purposive sampling is very useful for researchers. We collected 2007 sales report for twenty sample items, which were selected through purposive sampling. The sales report also is the secondary data and was retrieved from the company's information system. We set the criteria for sampling as listed: they should be "alive" which means they are ordered frequently, and they should have different unit price- low, medium, and high.

All the primary and secondary data collection in the company was under the permission of the manager and without any offence in ethical rules during the whole research process.

3.6 Analyzing Qualitative Data

Saunders et al. (2003) provide an overview of qualitative analysis process. The analysis process should start by classifying non-standardized qualitative data that have been collected into certain categories. It is a prerequisite that the data can be meaningfully analyzed later. The researcher is likely to conduct the analysis through the creation of a conceptual framework from either deductive or inductive perspective.

Embracing the above presentation as the guideline, the authors developed several categories in accordance with different theories that were reviewed, selected the corresponding data, and attached them to the appropriate categories till all the data were finished. As a result, the data were rearranged into a more manageable form. Then we examined what we have accomplished, refined the category building and data sorting. We developed hypotheses from comparing the theories and the data, then tested the hypotheses in further analysis and drew the final conclusion for our research questions.

3.7 Credibility/ Reliability

We built the theoretical framework from credited articles and books ensuring the credibility of the theories that were used in this thesis paper. When it comes to data collection, first both of us were collecting the same data all the time and verified the data with each other in order to reach agreement or identify the controversial data. After the mutual verification we made a check list about the collected data, either agreed or not, and examined them again with the original respondents in the next interview. Therefore all the empirical data were collected twice by both authors, and greater credibility of data collection was achieved in this way. Second as the studied company is a SME with very few employees it is easy to find the most appropriate respondents to answer our questions. We interviewed only two persons in the company, one is the owner who also as general manager, the other is the assistant in logistics and purchasing. They are proficient in the company's business activities and routine operations; we collected empirical data from them so the data is credible.

However the study is not longitudinal and the managerial suggestions we presented finally need to be tested over time by the company's business practice, hence the credibility of this section is limited.

4 Empirical findings

The authors will present their empirical findings about business practice of the studied company and the major issues that needs to be addressed in their inventory management.

4.1 Company Profile

HEM-SOL FORSALJNINGS AB (it will further in this thesis be named HEM-SOL) was established 15 years ago, the company started the business with sun-tanning products. Five years later it switched the business to gym sports equipment wholesale, both domestic sale and overseas sale are included. To date the company has engaged in this business for 10 years. With a lot of experience and expertise gained through 10 year's business practice, now HEM-SOL is listed as a major Scandinavian wholesaler of gym sports equipment. And the company has become a leading exporter for gym sports equipment in Scandinavia, the export goods has valued 10 million SEK till November current year.

HEM-SOL is located in Jönköping, Sweden. The company offers a broad range of quality gym equipments and sports machines as well as related accessories mainly for commercial gym use, but also for household exercise use, about 90% and 10% respectively in terms of sales turnover.

There are only eight employees totally, including the owner himself in HEM-SOL. It has an annual turnover of approximately 25 million SEK. May to July every year is the low season for the sales. With development over time, now the product variety is enormous, reaching approximately two thousand products. All the customers of HEM-SOL are located in Europe and Africa.

4.2 Organizational structure

The management structure in HEM-SOL is of two-layer, as Figure 4.1 shows. On top is the owner, who also acts as top manager of the company, while all the other employees lie in the low layer.

The owner/top manager is engaged in purchasing, collaborating with the suppliers to design new products, and making principal decisions regarding the inventory level for each product item. He often makes business trips to the supplier's plant to negotiate and communicate with the supplier in respect of product design, product quality, delivery time, and so on. He is responsible for the overall business management and supervises all the other employees.

There is only one man in sales department, whose main task is to exploit the market. However, he does not make sales forecast at all. Two men are involved in the warehouse operations, they operate the forklifts to load and unload the goods. Two men are serving the customers after-sale service, e.g. repair and installation. One female staff is working as the accountant. The last female staff is dealing with the logistics issues, which consist of in-house inventory management, order processing, transportation arrangements for inbound and outbound logistics, the logistics provider selection and documents preparation. She also provides assistance to the owner/top manager regarding purchase issues.

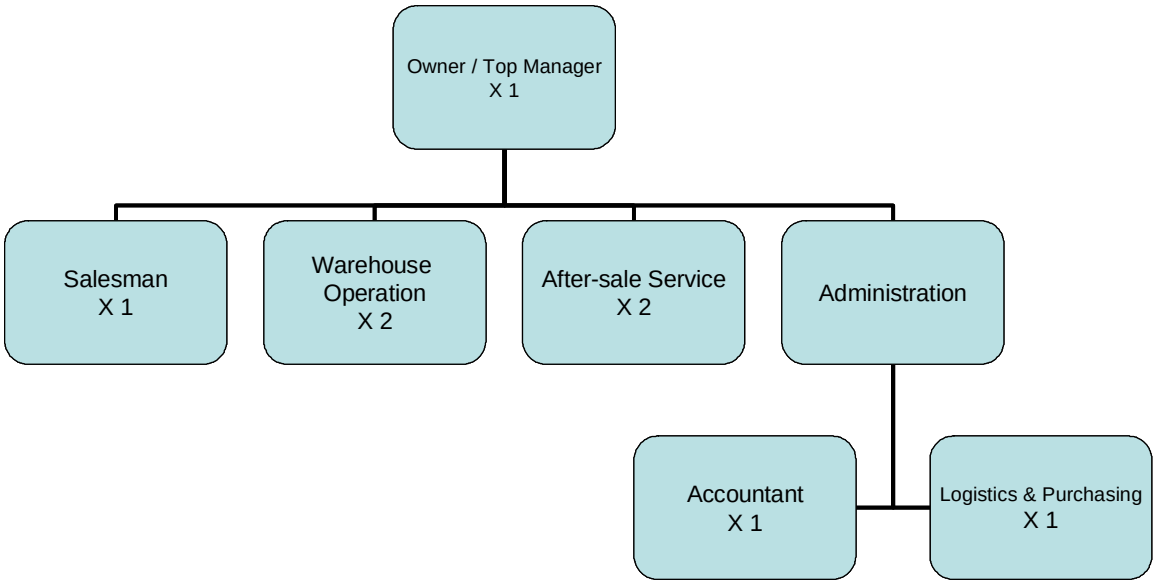

Figure 4. 1 Organizational Structure of HEM-SOL

Source: Own prepared

4.3 Supplier

Seven years ago, HEM-SOL left the domestic suppliers of gym sports equipment as a result of the distribution channel change by the manufacturers, where they decided to change their marketing strategy and start to sell the products directly in the consuming market, leaving no market space for HEM-SOL any longer. Hence the relationship between domestic manufacturers and HEM-SOL broke up. The owner/top manager turned to China and established new supplier relationships there.

Currently HEM-SOL has seventeen suppliers in total, twelve of which are in China (ten in mainland and two in Taiwan), two of which are in Germany, two of which are in Poland, and the last one is in Pakistan.

Germany and Poland suppliers provide windows and lockers for gym use and the lead-time is one to two weeks. As it is rather short, HEM-SOL does not keep such inventories in their warehouse, i.e. the purchase order is not issued until there is a real demand from the customer. HEM-SOL pays the bill within 30 days after the goods are sent out.

Pakistan supplier offers leather gloves to HEM-SOL. Since the product is light and the annual purchase quantity is not large, the leather gloves are purchased in advance and transported by air three times per year.

All the other gym sports equipments are bought from the suppliers in China. The lead-time is two months to two and a half months, of which one month is on transportation, and the rest time is for production and necessary preparation before shipment. As the relationship between the supplier and HEM-SOL is long term, HEM-SOL uses T/T payment term and pays the suppliers in China when the copy of shipping documents is received.

4.4 Business Operation Process

Usually the business routine is to transport the products from suppliers to the warehouse of HEM-SOL in Jönköping, then redistribute the products to its customers. But there is exception. In case of big order from the customers in Africa, the products are shipped directly from China to Africa in Full Container Load (FCL). Two to three containers are shipped directly to Africa every recent year.

4.4.1 In-house business operations

The owner/top manager previously issued the purchase order at random, when the purchase assistant found there was little buffer inventory left in the inventory management system or the drivers of the forklift observed the similar situation during their operation. But now the owner/top manager together with the purchase assistant are trying to utilize the inventory management system to give them an alert when the inventory level of certain items falls below the pre-set safety stock level. They have applied this approach to about 500 items and will get more items involved. They intend to collect the information once a week as a reference to issuing the purchase order.

HEM-SOL manages the warehouse by itself. It has two warehouses, which are leased. The warehouse function is to store the inventory, consolidate items according to customer orders. Into-warehouse and out-of-warehouse inventory are handled manually, the logistics/purchase assistant keys in the information system the volume of each item. Since manual error is inevitable, the company executes in-warehouse inventory examination for all items twice a year to rectify the actual inventory figure in the system.

4.4.2 Outsourced business functions

4.4.2.1 Inbound Logistics

HEM-SOL has been outsourcing to Third Party Logistics (TPL) service provider for transportation. As to the products bought from suppliers in China, in most cases FCL containers are shipped by sea and by truck to HEM-SOL warehouse in Jönköping. However, Less Container Load (LCL) is also used in case of small quantity and volume. Now HEM-SOL is using DHL as the TPL service provider in the two cases. 50-75 containers are transported from China to HEM-SOL per year.

The windows and lockers provided by suppliers in Germany and Poland are transported by lorry and by a different transportation company.

4.4.2.2 Out-bound logistics

When the products are sold and distributed from the warehouse of HEM-SOL in Jönköping, half of the customers choose to arrange the transportation by themselves. The other half of the customers wants HEM-SOL to take care of the transportation, then the logistics assistant will deal with this issue, find the appropriate transportation company, and get everything ready for the delivery of goods.

4.5 Information System

The information system that HEM-SOL has installed and been using is called “Navision”. Developed by Microsoft, it is a kind of ERP system for small business. The information

system integrates financial management, inventory management, and sales management in HEM-SOL. The investment in "Navision" system is about 30,000-40,000 SEK, plus the additional maintenance fee, 1,000 SEK per month, to get the information system upgraded.

4.6 Perceived Problems

- There is excess stock for certain items. Now the inventory value has reached about 12 million SEK, the company has an aim to decrease this number to about 10 million SEK in next year, and later to 8 million SEK, at the same time to maintain the customer service level.
- Inventory stock-out often occurs despite the heavy investment in inventory.
- The lead-time of some suppliers in China has been further extended from previous two months to two and a half months due to the production delay. HEM-SOL requires the lead-time to be 60 days, or 70 days at most.

As we mentioned in methodology part, we have twenty sample items selected through purposive sampling approach. The 2007 sales report for these twenty items is extracted from HEM-SOL information system. The data is shown in Appendix I, and the following analysis will focus on these twenty items.

5 Analysis

The authors will conduct the analysis guided by theoretical framework. The analysis part is based on our empirical findings. Furthermore, the authors will present their suggestions upon the problems identified.

5.1 Inventory Turnover

" We have an ambition to reduce the average inventory value finally to 8 million SEK. "

-Top manager of HEM-SOL

And as mentioned in empirical data, the annual sales turnover is 25 million SEK. We calculated the target inventory turns through the following formula:

Target inventory turns = Sales volume at cost/Value of average inventory

= 25,000,000 / 8,000,000

=3.1

The current average inventory value is about 12 million SEK, applied to the inventory turns formula:

current inventory turns=25,000,000/12,000,000=2.1

As inventory turns can be understood as how many times the products are sold off per year, and from the data shown in appendix I, the inventory turns of A items-700004, 8001-b, 512363, 312020-are about 2 for 2007, which match the above formula calculation result. The target inventory turns-3.1 is important for the following analysis and it serves as the guideline for improving inventory management in HEM-SOL. Raising the inventory turns to the target number 3.1, there is a big gap to bridge. And the situation is quite similar regarding the majority of B, C items.

5.2 Inventory Trade-offs

The product variety that HEM-SOL is offering to its customers is a lot, approximately two thousand types currently. It has big negative effect on inventory reduction efforts. In order to decrease the average inventory value to the target-8 million, the top manager has decided to reduce the product variety dramatically. For instance, some items are exactly the same except for various colors. Eliminating alternative colors will contribute to inventory reduction. And the best-selling color will be retained to satisfy customer demand.

The lot size plays a minor role in high inventory level in HEM-SOL, because there are few constraints on minimum lot size imposed by the suppliers in China, which enable the company to order the desired quantity for single replenishment.

The transportation cost is another major trade-off to inventory reduction for HEM-SOL. This largely attributes to the long distance between China and Sweden and consequential high transportation cost. The company must use full-container-load (FCL) to minimize the transportation cost, it means when placing an order the desired order quantity may be less than that for FCL and should be replaced by the latter one, leading to the possible inventory increase.

5.3 Inventory Control Systems

After several interviews with the manager and staff in HEM-SOL, the authors realized that there was not a formalized inventory control system. Normally, the manager placed new orders from his intuition and experience, or when inventory happened to be found few left in the information system or as the result of visual check by the staff working in the warehouse. Such practice has two opposite results. The first one is stock-out, where the customers have to wait for a period of time, shorter or longer, if they do not cancel the order. The second one is overstock, where unnecessary inventory accumulates and sits in the warehouse, costly but useless. Therefore, a formalized and standardized inventory control system should be established to solve the problems.

5.3.1 ABC Analysis

At present, there have been a lot of different gym products in HEM-SOL's two warehouses. If the manager and staffs allocate same time and effort on inventory control for each item, it would take them extra time and effort that would have been used otherwise, hence increasing labor costs. Based on the content in the theoretical framework, if we classify all the inventory items into several different level groups, then the different inventory groups can be treated differently. We believe this classification can save much time, effort and cost on the daily inventory operation. And it is a cost-efficient solution for the company, with improved management under limited resources.

According to Onwubolu et al. (2006), classifying inventory items into A, B, C categories should follow several steps:

1. Determine annual quantity usage of each item.
2. Multiply the annual quantity usage of each item by the cost of the item to obtain the total annual dollar usage of each item.
3. Add the total dollar usage of all items to get the aggregate annual dollar inventory expenditure.
4. Divide the total annual dollar usage of each item by the aggregate annual inventory expenditure to obtain the percentage of total usage for each item.
5. List the items in rank order by percentage of aggregate usage.
6. Review annual usage distribution and classify items as A, B, or C.

In Appendix I, we have the annual sales report of HEM-SOL' for twenty items in year 2007. Following the procedures of ABC analysis, Table 5.1 presents each item's annual quantity usage and annual dollar usage.

Item	Item No.	Number Sold	Unit Cost (USD)	Dollar Value (USD)
1	512831	68	65.00	4420.00
2	8001-b	1716	6.05	10381.80
3	700506	198	3.10	613.80
4	512003	550	2.52	1386.00
5	512152	1026	0.84	861.84
6	512363	595	13.50	8032.50
7	312020	26	676.50	17589.00
8	312005	56	89.10	4989.60
9	512858	290	8.47	2456.30
10	312017	13	492.80	6406.40
11	512068	1190	2.25	2677.50
12	512114	169	21.40	3616.60
13	ASA059B	668	4.35	2905.80
14	312050	4	464.20	1856.80
15	313001	13	420.00	5460.00
16	700004	979	24.90	24377.10
17	700008A	198	21.20	4197.60
18	312051	9	726.40	6537.60
19	312229	22	118.80	2613.60
20	312224	12	83.60	1003.20
Total:		**7802**		**112383.04**

Table 5. 1 Determination of dollar value

Source: Own prepared

According to Table 5.1, we can get the list of these items in rank order by percentage of dollar usage and classify them into A, B or C. As what has been mentioned in theoretical framework, the classification is using a model of 10-40-50 percentages of the items. This percentage is the approximate number and will vary from company to company. In accordance with the real situation of the sampled twenty items in HEM-SOL, we established 20-40-40 as the appropriate percentage of the items for the classification as shown in Table 5.2.

Item	Item No.	Number Sold	Dollar Value (USD)	Percent of Dollar Value	Cumulative Percent		Classification Category
					Dollar Value	Items	
16	700004	979	24377.10	21.69%	21.69%	5.00%	A
7	312020	26	17589.00	15.65%	37.34%	10.00%	A
2	8001-b	1716	10381.80	9.24%	46.58%	15.00%	A
6	512363	595	8032.50	7.15%	53.73%	20.00%	A
18	312051	9	6537.60	5.82%	59.54%	25.00%	B
10	312017	13	6406.40	5.70%	65.24%	30.00%	B
15	313001	13	5460.00	4.86%	70.10%	35.00%	B
8	312005	56	4989.60	4.44%	74.54%	40.00%	B
1	512831	68	4420.00	3.93%	78.48%	45.00%	B
17	700008A	198	4197.60	3.74%	82.21%	50.00%	B
12	512114	169	3616.60	3.22%	85.43%	55.00%	B
13	ASA059B	668	2905.80	2.59%	88.01%	60.00%	B
11	512068	1190	2677.50	2.38%	90.40%	65.00%	C
19	312229	22	2613.60	2.33%	92.72%	70.00%	C
9	512858	290	2456.30	2.19%	94.91%	75.00%	C
14	312050	4	1856.80	1.65%	96.56%	80.00%	C
4	512003	550	1386.00	1.23%	97.79%	85.00%	C
20	312224	12	1003.20	0.89%	98.69%	90.00%	C
5	512152	1026	861.84	0.77%	99.45%	95.00%	C
3	700506	198	613.80	0.55%	100.00%	100.00%	C
Total:		**7802**	**112383.04**	**100.00%**			

Table 5. 2 Ranking of items, using a 20-40-40% ABC classification

Source: Own prepared

ABC analysis is a kind of technique, which provides the means for identifying those items that make the largest impact on a company's overall inventory cost performance. Following the ranking from the analysis, we can place different controls on items A, B and C to improve the total inventory performance.

From Table 5.2, we can conclude that the first four items (Item No. 700004, 312020, 8001-b and 512363) are the high priority A items. They should be controlled more closely on inventory records, and they need more frequent reviews in terms of forecasting, demand inquiry and order quantity determination. The next eight items (Item No. 312051, 312017, 313001, 312005, 512831, 700008A, 512114 and ASA059B) are the medium priority B items. They should have less control compared to A items and be reviewed less frequently. The last eight items (Item No. 512068, 312229, 512858, 312050, 512003, 312224, 512152 and 7000506) belong to the lowest priority C items. They should have the least control and be reviewed over a long time, at the same time C items can be ordered in large quantities and have more safety stocks.

5.3.2 When to order?

When interviewing with HEM-SOL's top manager, Mr. Östman, we found out two distinctive phenomena of the business practice.

The first one is that May to July period of each year is the slack season for the company normally. After analyzing the twenty items' monthly demand situation, as the Table 5.3 shows, and according to Appendix II, we can clearly observe that seasonal fluctuation of demand occurs for the majority of these twenty items. Undoubtedly, the slack season-May to July contributes to the uneven demand pattern greatly. Take the second item (Item No. 312020) for example, there is no demand from June to September, but the demand in November accounts for more than 50% of its annual demand. This phenomenon happens not only to A items, but also is found obvious to B items and C items, such as Item No. 312051, 313001, 512858 and Item No. 312050.

The other one is that the lead time regarding the main suppliers in China is very long, ranging from two months to two and a half months. As the geographic distance between China and Sweden is very far and cannot be changed, the transportation time is constant, now is one month. The suppliers in China start manufacturing when they receive the purchasing order from HEM-SOL with the specific quantity for each product. And the production period takes one month to one and a half month. Therefore little can be done to shorten the total lead time.

Item No.	Monthly Demand in Volume & Ratio												Annual Sales	Clasification Category
	January	February	March	April	May	June	July	August	September	October	November	December		
700004	95	42	101	18	68	14	18	137	240	241	0	5	979	A
	9.7%	4.3%	10.3%	1.8%	6.9%	1.4%	1.8%	14.0%	24.5%	24.6%	0.0%	0.5%		
312020	0	1	4	8	-3	0	0	0	0	2	14	0	26	A
	0.0%	3.8%	15.4%	30.8%	-11.5%	0.0%	0.0%	0.0%	0.0%	7.7%	53.8%	0.0%		
8001-b	134	261	240	140	72	4	33	220	208	208	196	0	1716	A
	7.8%	15.2%	14.0%	8.2%	4.2%	0.2%	1.9%	12.8%	12.1%	12.1%	11.4%	0.0%		
512363	100	12	58	26	44	20	38	14	201	18	30	34	595	A
	16.8%	2.0%	9.7%	4.4%	7.4%	3.4%	6.4%	2.4%	33.8%	3.0%	5.0%	5.7%		
312051	0	0	1	1	0	0	0	2	1	1	3	0	9	B
	0.0%	0.0%	11.1%	11.1%	0.0%	0.0%	0.0%	22.2%	11.1%	11.1%	33.3%	0.0%		
312017	3	0	1	2	1	-1	0	1	0	0	6	0	13	B
	23.1%	0.0%	7.7%	15.4%	7.7%	-7.7%	0.0%	7.7%	0.0%	0.0%	46.2%	0.0%		
313001	0	2	0	0	0	0	0	7	2	0	2	0	13	B
	0.0%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	53.8%	15.4%	0.0%	15.4%	0.0%		
312005	15	7	12	6	4	5	0	0	0	0	7	0	56	B
	26.8%	12.5%	21.4%	10.7%	7.1%	8.9%	0.0%	0.0%	0.0%	0.0%	12.5%	0.0%		
512831	0	0	23	12	1	2	1	4	6	11	8	0	68	B
	0.0%	0.0%	33.8%	17.6%	1.5%	2.9%	1.5%	5.9%	8.8%	16.2%	11.8%	0.0%		
700008A	20	0	32	41	15	1	8	63	9	3	6	0	198	B
	10.1%	0.0%	16.2%	20.7%	7.6%	0.5%	4.0%	31.8%	4.5%	1.5%	3.0%	0.0%		
512114	9	2	1	18	41	-9	28	21	20	17	21	0	169	B
	5.3%	1.2%	0.6%	10.7%	24.3%	-5.3%	16.6%	12.4%	11.8%	10.1%	12.4%	0.0%		
512068	298	67	208	86	60	20	87	134	124	20	86	0	1190	B
	25.0%	5.6%	17.5%	7.2%	5.0%	1.7%	7.3%	11.3%	10.4%	1.7%	7.2%	0.0%		
ASA059B	81	49	74	77	24	62	27	102	66	36	60	10	668	C
	12.1%	7.3%	11.1%	11.5%	3.6%	9.3%	4.0%	15.3%	9.9%	5.4%	9.0%	1.5%		
312229	0	4	2	11	0	0	0	0	0	3	2	0	22	C
	0.0%	18.2%	9.1%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.6%	9.1%	0.0%		
512858	0	60	20	0	50	0	6	0	4	60	90	0	290	C
	0.0%	20.7%	6.9%	0.0%	17.2%	0.0%	2.1%	0.0%	1.4%	20.7%	31.0%	0.0%		
312050	0	0	0	0	0	0	0	0	0	0	4	0	4	C
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%		
512003	63	46	26	180	15	0	32	100	30	58	0	0	550	C
	11.5%	8.4%	4.7%	32.7%	2.7%	0.0%	5.8%	18.2%	5.5%	10.5%	0.0%	0.0%		
512152	250	154	80	2	36	0	30	52	14	0	268	140	1026	C
	24.4%	15.0%	7.8%	0.2%	3.5%	0.0%	2.9%	5.1%	1.4%	0.0%	26.1%	13.6%		
700506	0	0	55	22	21	6	9	18	32	8	27	0	198	C
	0.0%	0.0%	27.8%	11.1%	10.6%	3.0%	4.5%	9.1%	16.2%	4.0%	13.6%	0.0%		
312224	0	2	0	6	0	2	0	0	0	0	2	0	12	C
	0.0%	16.7%	0.0%	50.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%		

Table 5. 3 Twenty items monthly demand in volume and ratio for 2007

Source: Own prepared

As mentioned in the theoretical framework, continuous review and periodic review are two models, which can help small business management to determine when they need to place an order to replenish the inventory. With the above two features in mind, we tried applying each approach to fix the 'when-to-order' problem and got different results. Then we compared the two results and selected the more appropriate model as our solution.

5.3.2.1 Continuous Review

According to formula 2.1, ROP is the average demand during the lead time plus a small amount of safety stock. So we need to calculate the average demand and decide the safety stock level. If demand has little variability and the supplier's lead time is reliable, safety stock is easy to determine, hence ROP is easy to calculate and the result will be credible.

At present HEM-SOL has realized that there are problems in inventory management, which is not formalized and standardized, and the problems are growing faster and bigger. As response, they are starting to build the ROP systems for approximately 500 items, aiming at achieving efficient inventory management. But when asked, "How did the company determine the most suitable ROP level for each item", the top manager's personal experience coupled with help from historical sales data is the reply.

Table 5.4 shows us the ROP level of twenty items. HEM-SOL uses the term "safety stock quantity" in the Table 5.4. But they explained that if the inventory level reaches at or below this quantity, new orders would be released. This means "safety stock quantity" is the substitute of ROP and they are actually the same.

Art no	Purchase price/USD	In stock	Safety stock quantity	Purchase quantity
512831	65	50	60	50
8001-b	6,05	44	400	600
700506	EUR 2,20	44	100	200
512003	2,52	286	400	400
512152	0,84	680	400	400
512363	13,5	173	200	200
312020	676,5	0	10	20
312005	89,1	3	25	25
512858	8,47	149	200	200
312017	492,8	0	3	5
512068	2,25	288	500	500
512114	21,4	41	40	25
asa059b	4,35	269	200	200
312050	464,2	0	5	6
313001	420	3	4	8
700004	24,9	0	200	600
700008a	21,2	200	100	100
312051	726,4	1	4	6
312229	118,8	5	5	10
312224	83,6	0	5	5

Table 5. 4 ROP level & order quantity of 20 items

Source: HEM-SOL AB

However, obviously, the demand fluctuation is great for the majority of these twenty items as shown in Table 5.3 and Appendix II. What will ROP be like in this case? We think there is great difficulty for the top manager to determine an appropriate ROP.

From the data in Table 5.3 and Table 5.4, we found out some problems with HEM-SOL's current ROP level. For some items, ROP is set much lower than the largest possible demand during the three-month lead time. On the other hand, for some items ROP is set even higher than the largest possible demand during the same lead time. Below we will exemplify the situation and analyze the disadvantages.

Since A items are the top priority of inventory control, we decided to analyze all the four items in A group. We calculated the ROP percentage to the annual sale in 2007 and got the results- 21%, 39%, 23% and 34% (following the ranking list in Table 5.3). Then we calculated the corresponding percentage for largest possible demand during three months and got the results- 63%, 61.5%, 37% and 42.6%. Compare the two groups of numbers we know that all the A items' ROP have been set lower, which will lead to possible stock-outs. To avoid stock-outs, we can raise their ROP. But we also calculated the smallest possible demand during three month and got the results- 10.1%, 0, 6.3% and 12.2%. Then we realize there will be a lot of excess stock if we push the ROP even higher.

For item 512831 (B items) and 512858 (C items), the situation is opposite to A items. But the analysis logic and the result are the same. HEM-SOL'S ROP are set even higher than the largest possible demand during three months. Thus excess stock is really many. To re-

set ROP at a much lower level, e.g. lower than the largest possible demand, stock-outs may occur.

Additionally, in practice, a few items require customer service level to be 100%, which means stock-out is not tolerant by the customers concerned. This requirement pushes ROP even higher, consequently leads to more overstocks.

Among these twenty items, the majority of them (more than 80%) have distinct demand fluctuation, in which all the four items of class A are included. We concluded that the appropriate ROP is non-existent because it cannot solve overstock and stock-out at the same time; hence ROP system is not suitable for them. We know that appropriate control over A items is very important for the overall performance of inventory control system from previous ABC analysis. This statement further supports our conclusion.

5.3.2.2 Periodic Review

The periodic review, just as its name implies, means the inventory should be reviewed in a regular interval. Usually, the review period "r" can be set arbitrarily. According to Blackstone et al. (1985), common practice is to set "r" at once per month for A items, once per quarter for B items, and once per year for C items.

From the previous analysis about inventory turns, HEM-SOL's target inventory turns is about three. On the other hand, we determine the lead time for items A, B and C is three months because of the average lead time for products from the supplier out of Europe is around two and half months. The buffer half-month is due to the postponement of actual purchase order in order to use full-container-load (FCL) and save transportation costs.

Based on these two conditions, we propose that the review period for A items is once per quarter, which is the same as the lead time-three months; once every four months for B items and once per half year for C items. Then the review frequency over one year is four times, three times and two times for A, B, C items respectively. Finally the average annual review frequency should be a little more than three times. As each review generates single replenishment after the constant lead time, i.e. replenishments correspond to reviews and they have the same frequency. Suppose the aggregate order quantity during one year is matching actual annual demand of each item, we can reach the conclusion that average inventory turns is also three times, which is exactly HEM-SOL's inventory turnover target.

Figure 5.1, 5.2 and 5.3 below separately present the assumed periodic review system for items A, B and C.

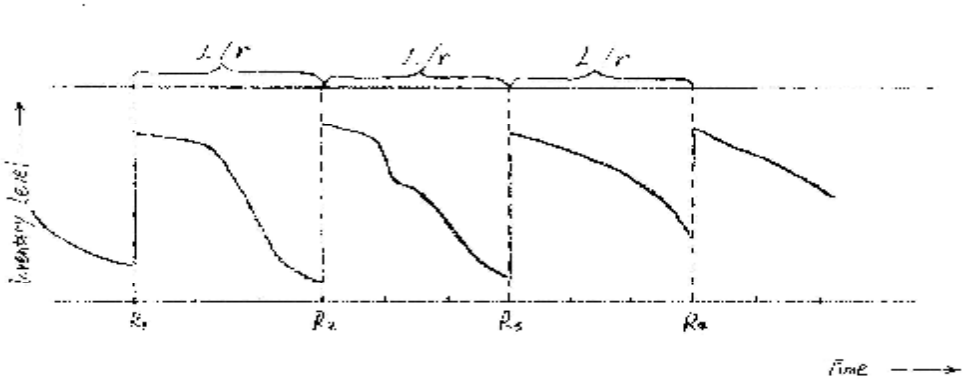

Figure 5. 1 Periodic review system for items A

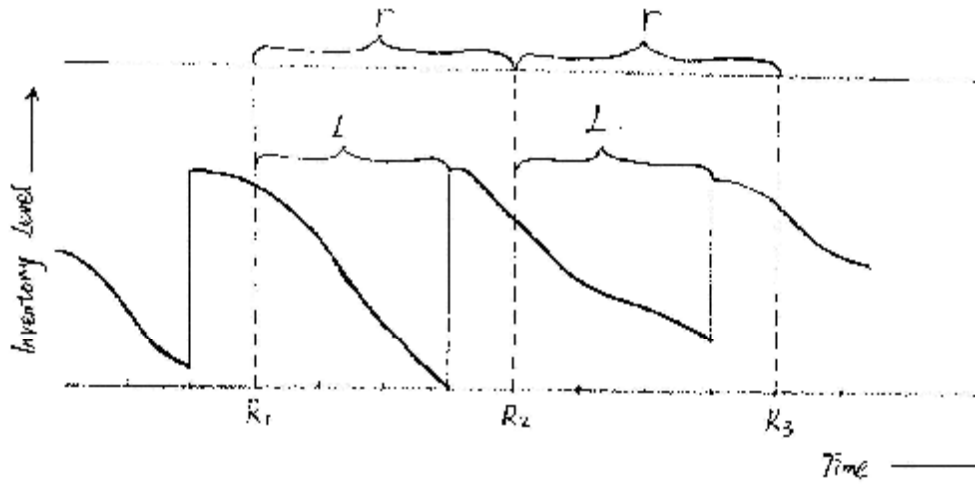

Figure 5. 2 Periodic review system for items B

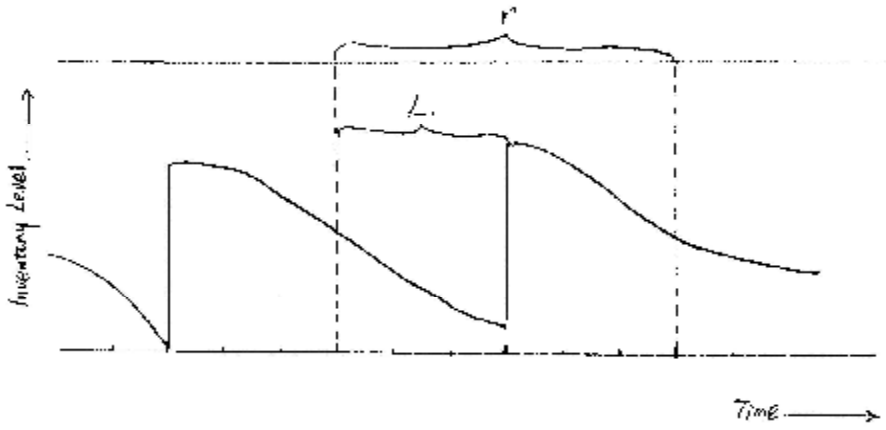

Figure 5. 3 Periodic review for items C

We can observe from the Figure5.1, the inventory level for items A is checked periodically at R1, R2…because of the review period is same as the lead time, when we checked inventory level at R1, an order should be placed at the same time to replenish the inventory level at R2, and inventory level at R1 was replenished at the same time by the order which was placed at R4 last year.

The reorder time can be set in HEM-SOL's ERP system, "Navision", in light of fixed review period for each items group. And setup should be done for A, B, C items respectively.

For A items: new order should be released three months later than the last order.

For B items: new order should be placed four months later than the last order.

For C items: new order should be released six months later than the last order.

When we anatomize Table 5.3, one special characteristic of C items can be found that demand for the first half-year is similar to the second half-year. This gave us a special solution for C items. We can set the order release time at the beginning of April, and the replenishment will arrive just before July to meet the demand for second half-year. Then another order release time will be the start of October, and replenishment will arrive just before January to cover the demand for the first half-year.

5.3.3 How much to order?

We suggest that periodic review is the appropriate policy for HEM-SOL to solve "when to reorder?" Following the logic of periodic review policy, we continued to analyze the data and identify the most suitable order quantity model for replenishment.

5.3.3.1 EOQ

When we tried applying the EOQ formula, formula 2.2, we found HEM-SOL cannot provide the necessary input data like order cost and holding cost. Therefore we cannot use EOQ formula to calculate order quantity.

5.3.3.2 Alternative Order Quantity approach

According to the formula 2.3, OQ=Max Inventory – ROP + DDLT. As we don't use ROP system, this approach is useless. Another reason why we don't use this approach is that it makes no sense to set a max inventory level for HEM-SOL's periodic review system.

How much should be ordered? Based on the theory, we decided to choose what is called "desired covering period" approach. And we propose desired covering period should be the same as review period when considering aligning order quantity with periodic review system. Order quantity is allowed to be different for single replenishment, and should be set according to the historical sales volume of the same period recent years. Of course, last year's data is more reliable than earlier years. The critical assumption of the approach is the demand during desired covering period may vary, but will not deviate too much from historical data, for instance, the last year's sales data over the same period.

Aggregate forecast is more accurate, which implies the estimated order quantity that covers three months, four months, and six months in relation to A, B, C items respectively, is comparatively credible and more accurate than what would have been if desired covering period is shorter, e.g. one month or two months in this case.

Because of the uncertainty of demand, different customer service levels, and inaccurate forecast, safety stock should be set subjectively by experienced personnel, in this case the top manager. If stock-out of certain items is not tolerant by certain customers, the safety stock level should be set higher. Since such items are just a few, the impact on the whole inventory management is little and can be ignored. If the safety stock is set higher than actual demand increase, there is excess stock. In order to improve the accuracy of safety stock determination, the top manager needs to practise and conduct review and analysis of demand change.

When there is a stock-out, from the practice of HEM-SOL, normally their customer will wait. Back orders also happen. Lost sale occurs rarely. And lost customer due to stock-out is almost none. If demand increases significantly, stock-out may occur. Or safety stock is set too low where demand increase is not so big, stock-out also may occur. For the former situation, the occurrence rate is not high and it is the unavoidable risk in HEM-SOL busi-

ness practice. For the latter situation, the safety stock level should be raised after careful analysis.

If demand decreases dramatically, excess stock may exist. To solve the problem, HEM-SOL needs to keep the updates of demand, analyze the demand change over a longer period, not a short period, in order to get the right trend, and then make adjustments based on right judgment, e.g. the company may reduce the next order quantity to offset the excess stock.

5.4 Inventory Carrying Cost

For HEM-SOL, there are no inventory carrying costs concerned with inventory taxes, damage, pilferage and relocation. Even though the two warehouses are rented, the rent is not calculated in inventory carrying cost as storage space costs because it is fixed costs per year, which do not change with the volume of inventory maintained.

Then what are left in inventory carrying costs are capital costs, insurance premiums, and obsolescence costs. The insurance premium is 36,000-48,000 SEK per year. The obsolescence costs are small probably because the products are not fashion merchandise. The capital cost forms the single weight factor that affects inventory carrying costs for HEM-SOL. If average inventory value decreases to the target-8 million SEK, the insurance premium and obsolescence costs may decrease as well, but not much. The biggest decrease will come from capital cost.

5.5 Warehouse

Form the empirical findings, we got to know that HEM-SOL uses two warehouses for their inventory storage, and both of them are contract warehouses. As HEM-SOL belongs to small business, the company is unable to build their own warehouse; it would take too much investment and have high risk. From the above analysis, demand is of big seasonal fluctuation, contract warehouse must be the better choice to decrease related spending on finance.

5.5.1 Warehouse Layout

As what has been mentioned in theory part, warehouse visibility is very important to improve the efficiency on warehousing operations.

There are several ways to strengthen the visibility inside the warehouse:

5.5.1.1 Location labeling on the warehouse floor

Distinct floor mark in warehouse can help forklift drivers to find the correct zones, regions or aisles easily. Usually, the bright yellow will be used for the floor mark color. At the same time, the grid of columns is one popular way for workers to identify the areas. The grid location labels can be affixed on all sides of columns. Figure 5.4 shows the example of column grid labeling. Compare with this example, we can observe from Figure 5.5 that HEM-SOL's warehouses are lack of this kind of identification labels.

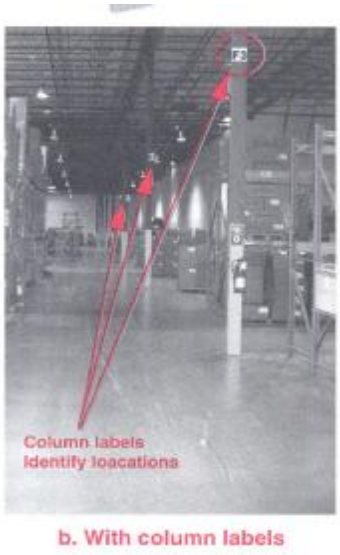

Figure 5. 4 The example of column grid label.

Source: Baudin, 2004

Figure 5. 5 HEM-SOL's warehouse

5.5.1.2 Zone identification

According to authors' experience, one common solution for zone identification is to hang a "name card" above every specific zone. Maybe the flat "name card" can not be seen from every direction, especially in the large rooms. Then we can use the triangular signs above the racks. This kind of shingle is visible from all directions. Figure 5.6 gives us an example of "name card" for zones. Unfortunately, we did not find this zone identification signs in two warehouses of HEM-SOL.

Figure 5. 6 The example of shingle of zone

Source: Baudin, 2004

5.5.1.3 Rack identification

Rack identification is the most useful and effective method for identify locations in pallet racks by three coordinates for aisle, column within the aisle, and level within the column. When authors worked in HEM-SOL's warehouse, we encounter some problems about the rack identification.

- There is no item location guide. Some items' number was shown on the label, like Figure 5.7 on the side of rack, but some items can not be found in the appointed rack. Figure 5.8 shows us one suitable item location guide board on the side of racks.

Figure 5. 7 Unclear item location guide

Figure 5. 8 The example of item location guide

Source: Baudin, 2004

- Location addressing is inconsistent or not adequately displayed. From the Figure 5.9 we can see the label on the rack shows item number is 512005, but after checking the goods on the pallet, it is not Item 512005. Figure 5.10 shows that most racks still did not have any kind of location addressing.

Figure 5. 9 Incorrect rack label

Figure 5. 10 There is no rack label for item location.

5.5.2 Warehouse Management System (WMS)

Base on the practical situation of HEL-SOL's warehouses, which store approximate two thousand different kinds of items, authors surprising why they did not use the barcode scanning system which can make the inventory control operation efficiently and accurately. The general manager, Mr. Östman told us that the supplier usually put different items into one wooden box when it was shipped. It is hard for them to consolidate them into one barcode label. Even the same item in one wooden box but they are in different colors. Figure 5.11 shows the same size of rubber plates in one big wooden box, but usually they are in different colors. If every independent small box has one barcode label, it takes time for workers to scan all of them. Nowadays, they input these data according to the packing list from suppliers with the shipment.

Figure 5. 11 Rubber plates in HEM-SOL's warehouse

5.6 Purchasing

HEM-SOL is a wholesaling company, not engaged in production. To exploit the market, low price and good quality of products are crucial. In this case purchasing can be considered as a core business with strategic importance. And it is the top manager who is completely involved in purchasing business further justifies its importance to HEM-SOL.

The top priority for the manager to manage purchasing is to maintain and develop relationships with suppliers. The stable long-term relationship may ensure consistent delivery including consistent lead time and sufficient delivery, good product quality and good price. It also contributes to transaction costs reduction.

Desirability of long-term relationship is different for suppliers and HEM-SOL. Due to the severe competition internationally suppliers are under great pressure to keep their customers, placing HEM-SOL in a position with more bargaining power. The suppliers need to try their best to fulfill the requirements from HEM-SOL and keep their promises. The manager also engages in design collaboration with the supplier to develop new products.

There is trust between HEM-SOL and the suppliers in China. The distinct evidence can be found on the payment term choice. They have been using the term Telegraphic Transfer (T/T). After the ship leaves the port, shipping documents are faxed to HEM-SOL, and then HEM-SOL will arrange the payment through T/T far earlier than the goods finally arrive in the company's warehouse in Jönköping, Sweden.

5.7 Information System

To evaluate the information system-'Navision', we will focus attention on its performance in inventory management for HEM-SOL.

The biggest aid 'Navision' is providing to the management is to update the inventory records for all the items every day so that they can capture the right data to support their decisions regarding inventory. Without the support from 'Navision', the management will face great difficulty in managing inventory effectively and efficiently.

However, 'Navision' cannot make right decisions about inventory for the management. Data are kept in the information system. But how to use and analyze data to establish an

effective and efficient inventory control system is still placed on the management. If they are unable to do it in the right way, the information system will reap fewer benefits.

'Navision' now has a disadvantage. The historical inventory record is replaced by new updates and cannot be retrieved any longer. We suggest these historical inventory records of each day should be kept in the database, which will be used to draw a graph for each item over the course of a whole year. The graph becomes a vivid measurement to demonstrate the inventory management performance. The management can easily identify whether there are overstock and stock-out for specific item, the occurrence frequency and degree. Through the reviews the management will get more experience about the inventory control system, hence further improve inventory management for the near future.

6 Conclusion

In this chapter, the authors will present the conclusion about the whole thesis and summarize the implications of the research.

Inventory management is critical for most companies, but is especially crucial for small businesses because when compared with large companies, they usually have limited resources and bargaining power, which have negative effects on the way inventory can be managed.

Many small businesses face great challenges in managing inventory when they seek developments. This thesis is trying to connect theories with a real case and propose managerial solutions that the small business firm, HEM-SOL, can implement to improve its inventory management.

6.1 Theoretical Conclusions

The theories about SCM, inventory management, purchasing, IT and small business included in theoretical framework are interrelated implicitly when they are applied to the case study in this thesis. In other words, the option of an efficient inventory control system is affected by all of them, in different perspectives, and to different extent.

We also find that even though inventory management is critical for small businesses, the related theory on small business managing inventory facing rapidly fluctuating demands is sparse. And most studies about various inventory control techniques did not provide prerequisites and constraints in terms of their application. However, we do get inspiration from previous research and construct the suitable theoretical framework for this case study as following:

1. In order to allocate time and money on inventory in rationalization, ABC analysis model has been used to classify various items that are for sale.

2. Periodic review policy is selected to help management to determine when they should place new orders for inventory replenishment.

3. The 'desired covering period' approach is chosen to determine the order quantity.

The logic why specific theories have been selected and the way in which they were applied to this case study may be seen as a little contribution to the theory evolution.

This research has also presented a brief review of other commonly discussed inventory control techniques, such as EOQ and continuous review policy. We have elaborated the reasons in the analysis section why they are not appropriate for this case.

6.2 Practical Conclusions

The data in 2007 sales report of twenty items reveal that demand variability is big in fact. After ABC classification, treatments become different for different category items. For instance, more attention needs to be paid to A items and less review on C items. It is an efficient approach to saving costs, time and efforts for management.

Following ABC classification, different review periods could be set in accordance with each category's specific characteristic. A items have the first priority to be reviewed as they ac-

count for 20% of total amount of items, but with more than 50% of total dollar value. More frequent review can help management to better control these items to minimize stock-out or excess stock occurrence. Based on the analysis of twenty items' demand monthly distribution pattern in 2007 and three-month lead time, review period for A, B and C items is three-month, four-month and six-month respectively.

It is concluded the EOQ model is not applicable to this case because the necessary inputs are not available. Instead, the desired covering period approach is applied regarding order quantity determination. We suggest that order quantity can vary for single replenishment based on the historical demand records, and the desired covering period is exactly the same as each item's review period.

6.3 Criticism to the Study

This research is built on comparison between existing activities and estimated activities. Due to the assumptions connected with estimations, the results could be questionable in terms of its credibility. However, our viewpoint is that the estimations are based on a solid investigation therefore the study is relatively convictive.

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Appendix 1 - Annual sales report for twenty items in 2007

Art no

Artikel 512831

Period Purchased amount Sold items

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	1	1 356,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	0	0,00	0	0,00
07-02-01	Februari	0	0,00	0	0,00
07-03-01	Mars	50	21 139,37	23	23 575,51
07-04-01	April	0	0,00	12	10 751,19
07-05-01	Maj	8	3 241,72	1	784,16
07-06-01	Juni	0	0,00	2	2 816,83
07-07-01	Juli	32	13 255,92	1	805,16
07-08-01	Augusti	0	0,00	4	4 970,10
07-09-01	September	19	7 664,73	6	5 533,57
07-10-01	Oktober	16	6 234,35	11	9 048,41
07-11-01	November	0	0,00	8	8 458,78
07-12-01	December	0	0,00	0	0,00

Art no 8001-b

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	68	7 979,88
06-07-01	Juli	0	0,00	155	15 457,11
06-08-01	Augusti	0	0,00	25	2 675,00
06-09-01	September	300	11 820,27	297	30 190,67
06-10-01	Oktober	0	0,00	270	28 294,51
06-11-01	November	300	12 854,19	77	7 963,00
06-12-01	December	600	24 729,01	85	12 368,96
07-01-01	Januari	0	0,00	134	13 405,36
07-02-01	Februari	0	0,00	261	26 280,98
07-03-01	Mars	0	0,00	240	21 023,13
07-04-01	April	1 074	43 859,47	140	13 606,34
07-05-01	Maj	0	0,00	72	6 697,48
07-06-01	Juni	0	0,00	4	428,00
07-07-01	Juli	0	0,00	33	2 660,10
07-08-01	Augusti	0	0,00	220	19 568,28
07-09-01	September	0	0,00	208	20 760,55
07-10-01	Oktober	0	0,00	208	21 512,43
07-11-01	November	0	0,00	196	16 984,47

Art no 700506

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	21	895,55
06-12-01	December	0	0,00	0	-21,09
07-01-01	Januari	0	0,00	0	0,00
07-02-01	Februari	0	0,00	0	0,00
07-03-01	Mars	200	3 819,77	55	1 602,39
07-04-01	April	0	0,00	22	693,05
07-05-01	Maj	0	0,00	21	589,61
07-06-01	Juni	0	0,00	6	330,00
07-07-01	Juli	0	0,00	9	400,94
07-08-01	Augusti	0	0,00	18	722,46
07-09-01	September	0	0,00	32	774,74
07-10-01	Oktober	0	0,00	8	207,72
07-11-01	November	0	0,00	27	1 110,73
07-12-01	December	0	0,00	0	0,00

Art no 512003

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	70	1 840,44
06-08-01	Augusti	0	0,00	5	131,64
06-09-01	September	0	0,00	80	2 081,79
06-10-01	Oktober	0	0,00	75	2 809,46
06-11-01	November	0	0,00	34	899,40
06-12-01	December	0	0,00	4	99,19
07-01-01	Januari	0	0,00	63	2 732,65
07-02-01	Februari	0	0,00	46	1 720,00
07-03-01	Mars	402	5 655,68	26	970,54
07-04-01	April	0	0,00	180	5 096,16
07-05-01	Maj	0	0,00	15	645,00
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	32	916,07
07-08-01	Augusti	0	0,00	100	3 028,20
07-09-01	September	0	0,00	30	966,54
07-10-01	Oktober	0	0,00	58	1 898,17
07-11-01	November	0	0,00	0	0,00
07-12-01	December	0	0,00	0	0,00

Art no 512152

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	2	17,18
06-07-01	Juli	0	0,00	10	88,13
06-08-01	Augusti	0	0,00	138	1 860,60
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	156	1 484,52
06-11-01	November	0	0,00	15	210,00
06-12-01	December	0	0,00	86	881,61
07-01-01	Januari	0	0,00	250	2 082,47
07-02-01	Februari	0	0,00	154	1 545,14
07-03-01	Mars	112	527,95	80	1 121,36
07-04-01	April	0	0,00	2	32,00
07-05-01	Maj	0	0,00	36	466,43
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	1 008	4 799,09	30	275,76
07-08-01	Augusti	0	0,00	52	492,09
07-09-01	September	0	0,00	14	195,20
07-10-01	Oktober	0	0,00	0	0,00
07-11-01	November	0	0,00	268	2 907,00
07-12-01	December	0	0,00	140	1 433,57

Art no 512363

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	75	11 917,36
06-07-01	Juli	0	0,00	84	14 326,15
06-08-01	Augusti	0	0,00	43	7 018,44
06-09-01	September	0	0,00	17	2 725,54
06-10-01	Oktober	0	0,00	48	8 590,66
06-11-01	November	350	27 979,07	5	1 225,55
06-12-01	December	0	0,00	52	7 865,75
07-01-01	Januari	0	0,00	100	17 554,52
07-02-01	Februari	0	0,00	12	3 192,00
07-03-01	Mars	0	0,00	58	10 232,90
07-04-01	April	0	0,00	26	4 093,41
07-05-01	Maj	0	0,00	44	6 872,12
07-06-01	Juni	0	0,00	20	3 169,60
07-07-01	Juli	0	0,00	38	5 843,14
07-08-01	Augusti	0	0,00	14	2 161,70
07-09-01	September	200	16 457,40	201	30 854,21
07-10-01	Oktober	0	0,00	18	2 690,35
07-11-01	November	200	16 355,52	30	4 846,90
07-12-01	December	0	0,00	34	6 154,44

Art no 312020

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	0	0,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	6	26 406,48	0	0,00
07-02-01	Februari	3	13 226,71	1	11 507,00
07-03-01	Mars	0	0,00	4	38 625,24
07-04-01	April	0	0,00	8	61 003,00
07-05-01	Maj	0	0,00	-3	-22 334,06
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	0	0,00	2	23 146,41
07-11-01	November	14	59 856,72	14	140 609,48
07-12-01	December	0	0,00	0	0,00

Art no 312005

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	4	5 757,20
06-07-01	Juli	0	0,00	2	3 126,00
06-08-01	Augusti	20	12 583,82	6	6 994,48
06-09-01	September	0	0,00	1	1 077,79
06-10-01	Oktober	0	0,00	8	8 583,86
06-11-01	November	0	0,00	2	3 126,00
06-12-01	December	0	0,00	5	5 674,42
07-01-01	Januari	40	24 441,84	15	17 489,40
07-02-01	Februari	0	0,00	7	7 069,88
07-03-01	Mars	0	0,00	12	13 070,03
07-04-01	April	0	0,00	6	8 175,87
07-05-01	Maj	0	0,00	4	4 154,61
07-06-01	Juni	0	0,00	5	6 399,86
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	0	0,00	0	0,00
07-11-01	November	10	5 631,12	7	10 583,93
07-12-01	December	0	0,00	0	0,00

Art no 512858

Periodstart	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning (BVA)
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	80	4 665,06	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	42	2 395,29
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	0	0,00	0	0,00
07-02-01	Februari	0	0,00	60	5 522,26
07-03-01	Mars	0	0,00	20	1 840,93
07-04-01	April	0	0,00	0	0,00
07-05-01	Maj	0	0,00	50	4 406,81
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	300	16 849,80	6	636,31
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	4	293,03
07-10-01	Oktober	0	0,00	60	5 661,06
07-11-01	November	0	0,00	90	8 300,86
07-12-01	December	0	0,00	0	0,00

Art no 312017

Periodstart	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning (BVA)
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	10	34 645,31	3	21 609,32
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	1	7 997,00
06-11-01	November	0	0,00	3	23 991,00
06-12-01	December	0	0,00	1	7 997,00
07-01-01	Januari	0	0,00	3	18 695,99
07-02-01	Februari	3	10 111,81	0	0,00
07-03-01	Mars	0	0,00	1	6 003,61
07-04-01	April	0	0,00	2	18 729,11
07-05-01	Maj	0	0,00	1	5 747,15
07-06-01	Juni	0	0,00	-1	-5 843,95
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	1	5 672,11
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	0	0,00	0	0,00
07-11-01	November	6	18 686,97	6	32 387,48
07-12-01	December	0	0,00	0	0,00

Art no 512068

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	96	2 423,03
06-07-01	Juli	0	0,00	86	2 609,20
06-08-01	Augusti	0	0,00	62	1 717,90
06-09-01	September	0	0,00	12	371,03
06-10-01	Oktober	80	2 880,00	46	1 343,32
06-11-01	November	0	0,00	106	2 525,55
06-12-01	December	1 000	12 815,96	268	7 973,50
07-01-01	Januari	0	0,00	298	8 657,02
07-02-01	Februari	0	0,00	67	1 888,20
07-03-01	Mars	0	0,00	208	5 763,03
07-04-01	April	0	0,00	86	2 202,20
07-05-01	Maj	500	6 552,00	60	1 831,68
07-06-01	Juni	0	0,00	20	283,82
07-07-01	Juli	0	0,00	87	2 236,69
07-08-01	Augusti	0	0,00	134	3 692,01
07-09-01	September	0	0,00	124	3 293,35
07-10-01	Oktober	0	0,00	20	492,26
07-11-01	November	384	4 967,23	86	2 233,03
07-12-01	December	0	0,00	0	0,00

Art no 512114

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	11	2 829,02
06-07-01	Juli	0	0,00	4	1 046,43
06-08-01	Augusti	0	0,00	5	1 471,96
06-09-01	September	0	0,00	12	4 061,85
06-10-01	Oktober	0	0,00	20	3 194,33
06-11-01	November	0	0,00	4	1 538,51
06-12-01	December	0	0,00	5	622,84
07-01-01	Januari	0	0,00	9	3 219,71
07-02-01	Februari	8	2 000,00	2	333,20
07-03-01	Mars	0	0,00	1	245,16
07-04-01	April	0	0,00	18	4 388,38
07-05-01	Maj	100	12 432,00	41	12 710,56
07-06-01	Juni	0	0,00	-9	-2 053,55
07-07-01	Juli	100	12 541,34	28	6 832,54
07-08-01	Augusti	0	0,00	21	5 669,61
07-09-01	September	0	0,00	20	5 533,70
07-10-01	Oktober	0	0,00	17	3 793,88
07-11-01	November	0	0,00	21	5 255,71
07-12-01	December		0,00	0	0,000

Art no ASA059B

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	23	1 502,33
06-07-01	Juli	0	0,00	2	160,00
06-08-01	Augusti	100	2 937,15	65	4 312,17
06-09-01	September	0	0,00	17	1 347,46
06-10-01	Oktober	0	0,00	35	2 728,22
06-11-01	November	0	0,00	13	1 040,00
06-12-01	December	100	2 825,02	69	4 584,54
07-01-01	Januari	0	0,00	81	7 071,89
07-02-01	Februari	0	0,00	49	4 541,98
07-03-01	Mars	0	0,00	74	5 404,55
07-04-01	April	0	0,00	77	4 676,06
07-05-01	Maj	0	0,00	24	1 734,50
07-06-01	Juni	0	0,00	62	4 166,61
07-07-01	Juli	0	0,00	27	2 178,08
07-08-01	Augusti	0	0,00	102	6 099,89
07-09-01	September	0	0,00	66	4 032,11
07-10-01	Oktober	0	0,00	36	2 678,65
07-11-01	November	0	0,00	60	3 605,99
07-12-01	December	0	0,00	10	1 500,00

Art no 312050

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	0	0,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	0	0,00	0	0,00
07-02-01	Februari	0	0,00	0	0,00
07-03-01	Mars	0	0,00	0	0,00
07-04-01	April	0	0,00	0	0,00
07-05-01	Maj	0	0,00	0	0,00
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	1	4 034,07	0	0,00
07-11-01	November	4	11 734,98	4	22 849,91
07-12-01	December	0	0,00	0	0,00

Art no 313001

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	0	0,00
06-12-01	December	0	0,00	3	15 193,02
07-01-01	Januari	0	0,00	0	0,00
07-02-01	Februari	0	0,00	2	10 473,17
07-03-01	Mars	0	0,00	0	0,00
07-04-01	April	0	0,00	0	0,00
07-05-01	Maj	0	0,00	0	0,00
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	14	46 616,79	7	35 968,07
07-09-01	September	0	0,00	2	10 154,84
07-10-01	Oktober	0	0,00	0	0,00
07-11-01	November	0	0,00	2	10 368,98
07-12-01	December	0	0,00	0	0,00

Art no 700004

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	34	10 852,72
06-07-01	Juli	0	0,00	21	6 179,62
06-08-01	Augusti	0	0,00	24	7 206,89
06-09-01	September	0	0,00	117	37 817,04
06-10-01	Oktober	0	0,00	76	21 733,53
06-11-01	November	0	0,00	59	18 314,33
06-12-01	December	0	0,00	44	19 625,89
07-01-01	Januari	600	91 553,37	95	27 149,88
07-02-01	Februari	0	0,00	42	12 556,16
07-03-01	Mars	0	0,00	101	29 650,12
07-04-01	April	0	0,00	18	9 348,80
07-05-01	Maj	0	0,00	68	27 956,43
07-06-01	Juni	0	0,00	14	4 648,00
07-07-01	Juli	0	0,00	18	4 887,84
07-08-01	Augusti	600	91 098,54	137	47 632,92
07-09-01	September	0	0,00	240	81 927,55
07-10-01	Oktober	0	0,00	241	52 614,38
07-11-01	November	0	0,00	0	0,00
07-12-01	December	0	0,00	5	1 303,82

Art no 700008A

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	1	284,00
06-07-01	Juli	0	0,00	4	1 165,30
06-08-01	Augusti	0	0,00	147	52 690,79
06-09-01	September	0	0,00	37	10 602,42
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	2	1 700,00
06-12-01	December	0	0,00	52	14 499,78
07-01-01	Januari	235	35 031,43	20	5 491,28
07-02-01	Februari	0	0,00	0	0,00
07-03-01	Mars	65	9 709,12	32	9 018,62
07-04-01	April	0	0,00	41	11 319,51
07-05-01	Maj	0	0,00	15	4 032,00
07-06-01	Juni	0	0,00	1	234,60
07-07-01	Juli	0	0,00	8	2 208,00
07-08-01	Augusti	0	0,00	63	18 443,08
07-09-01	September	0	0,00	9	2 458,80
07-10-01	Oktober	0	0,00	3	269,60
07-11-01	November	0	0,00	6	1 516,40
07-12-01	December	0	0,00	0	0,00

Art no 312051

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	1	12 336,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	7	33 027,43	0	0,00
07-02-01	Februari	0	0,00	0	0,00
07-03-01	Mars	0	0,00	1	8 368,08
07-04-01	April	0	0,00	1	12 336,00
07-05-01	Maj	0	0,00	0	0,00
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	2	15 907,89
07-09-01	September	0	0,00	1	8 111,78
07-10-01	Oktober	0	0,00	1	1,00
07-11-01	November	5	22 941,60	3	31 033,86
07-12-01	December	0	0,00	0	0,00

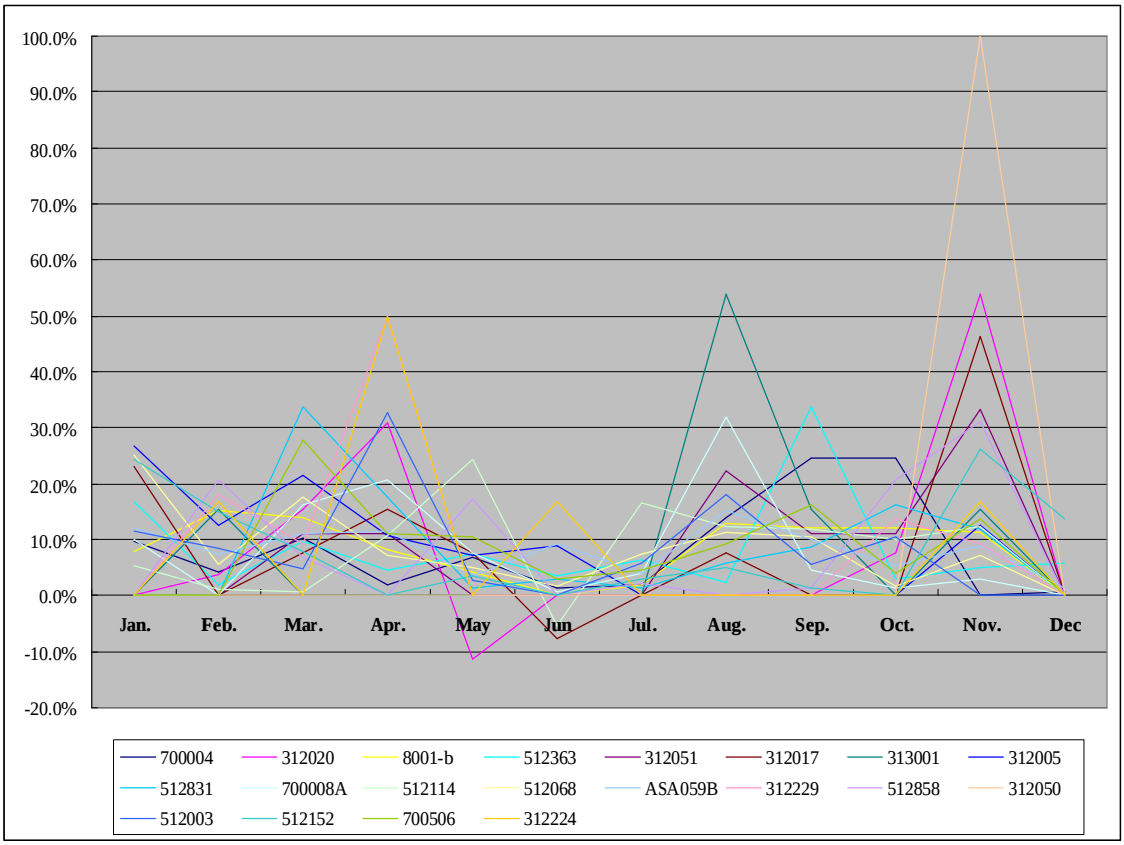
Art no 312229

Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	0	0,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	4	3 248,60	0	0,00
07-02-01	Februari	15	12 203,91	4	6 194,22
07-03-01	Mars	0	0,00	2	2 711,00
07-04-01	April	0	0,00	11	15 235,11
07-05-01	Maj	0	0,00	0	-1 249,25
07-06-01	Juni	0	0,00	0	0,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	0	0,00	3	4 103,11
07-11-01	November	10	7 508,16	2	2 592,25
07-12-01	December	0	0,00	0	0,00

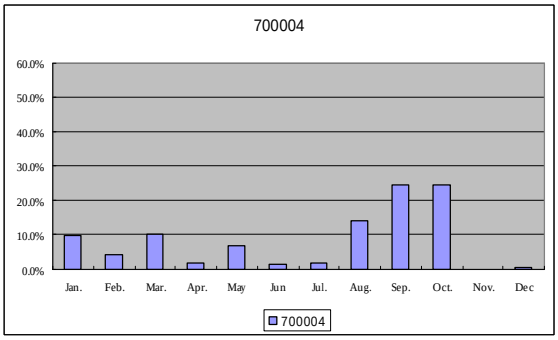
Art no 312224

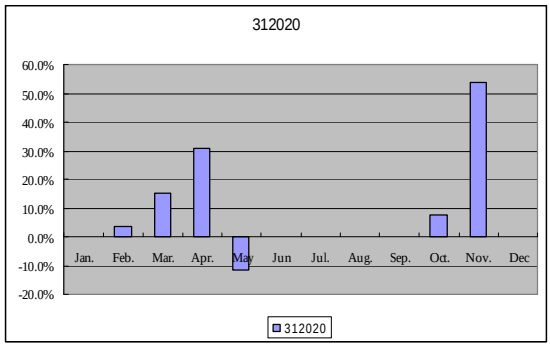
Periodstart (BVA)	Periodnamn	Inköpt antal	Inköp (BVA)	Försäljning antal	Försäljning
06-01-01	Januari	0	0,00	0	0,00
06-02-01	Februari	0	0,00	0	0,00
06-03-01	Mars	0	0,00	0	0,00
06-04-01	April	0	0,00	0	0,00
06-05-01	Maj	0	0,00	0	0,00
06-06-01	Juni	0	0,00	0	0,00
06-07-01	Juli	0	0,00	0	0,00
06-08-01	Augusti	0	0,00	0	0,00
06-09-01	September	0	0,00	0	0,00
06-10-01	Oktober	0	0,00	0	0,00
06-11-01	November	0	0,00	0	0,00
06-12-01	December	0	0,00	0	0,00
07-01-01	Januari	1	572,38	0	0,00
07-02-01	Februari	8	4 587,12	2	1 845,22
07-03-01	Mars	0	0,00	0	0,00
07-04-01	April	0	0,00	6	6 122,70
07-05-01	Maj	0	0,00	0	-440,16
07-06-01	Juni	0	0,00	2	2 520,00
07-07-01	Juli	0	0,00	0	0,00
07-08-01	Augusti	0	0,00	0	0,00
07-09-01	September	0	0,00	0	0,00
07-10-01	Oktober	0	0,00	0	0,00
07-11-01	November	0	0,00	2	2 280,00
07-12-01	December	0	0,00	0	0,00

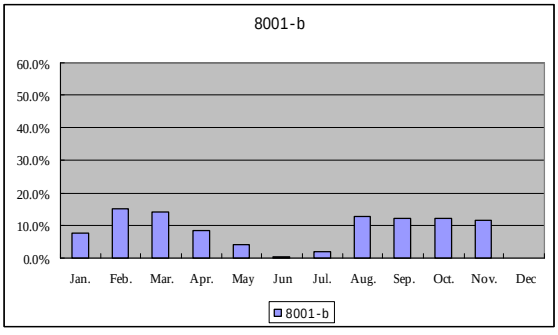
Appendix 2 - Twenty items' annual demand analysis

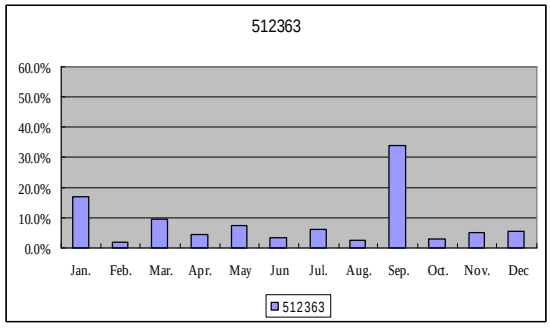


Appendix 3 - Each item's annual demand analysis for A items

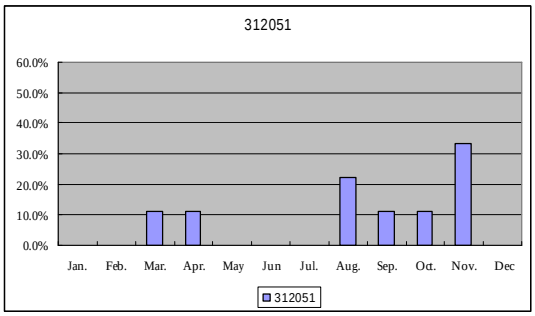


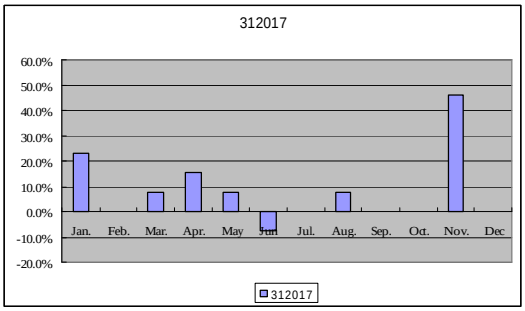


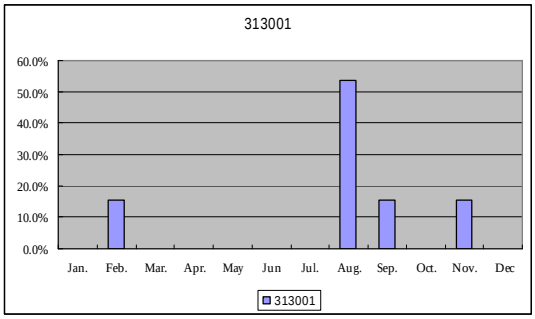


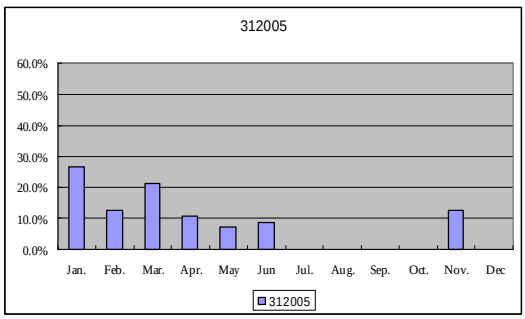


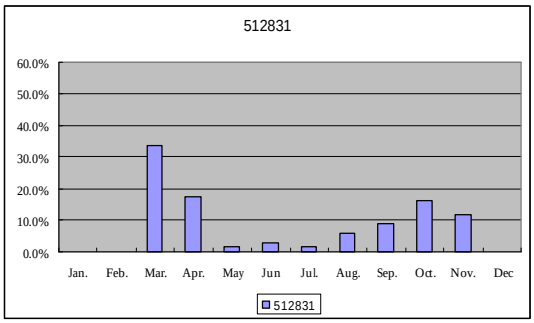
Appendix 4 - Each item's annual demand analysis for B items

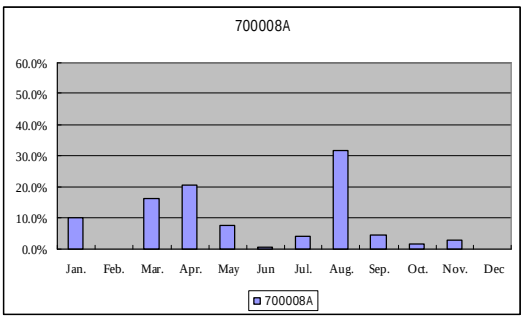


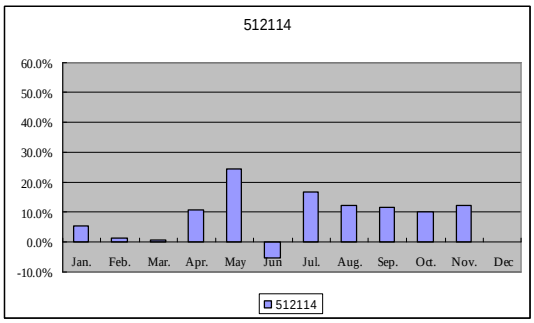


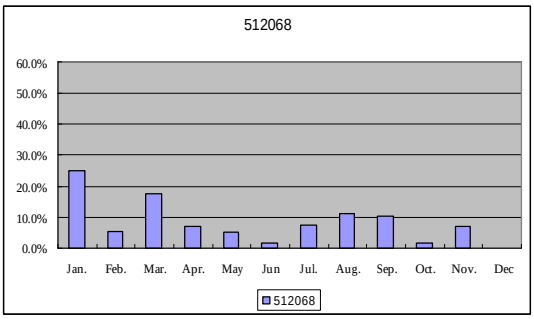




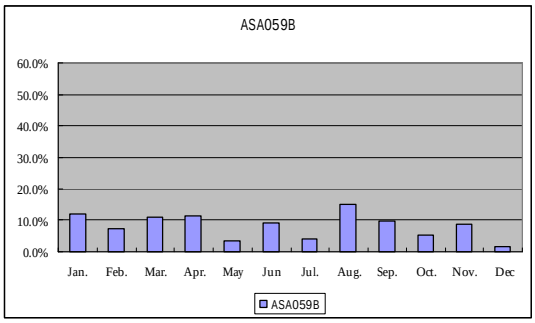


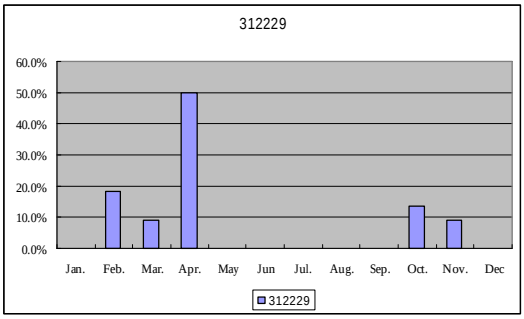


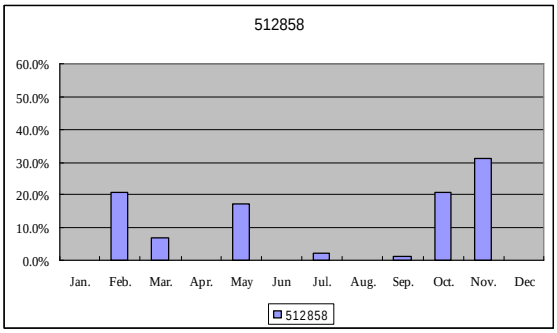


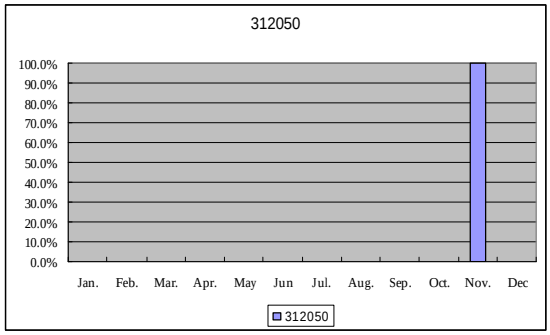


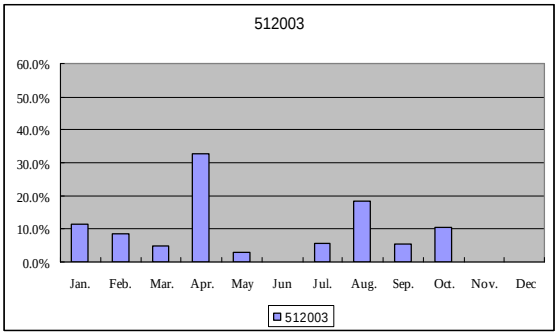
Appendix 5 - Each item's annual demand analysis for C items

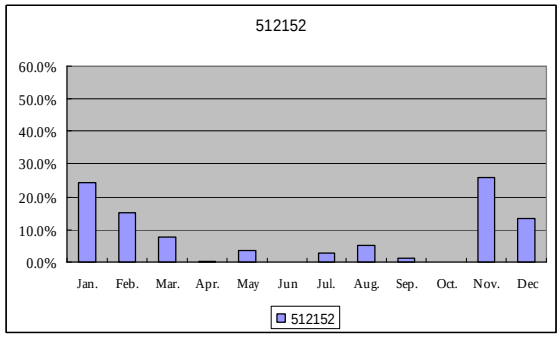


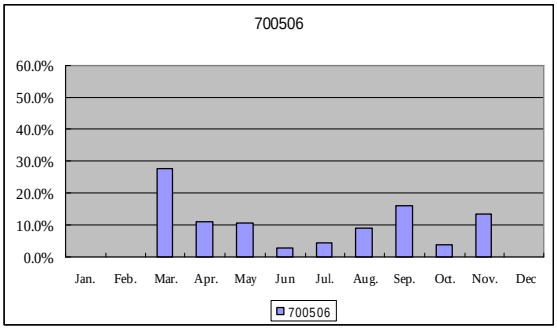


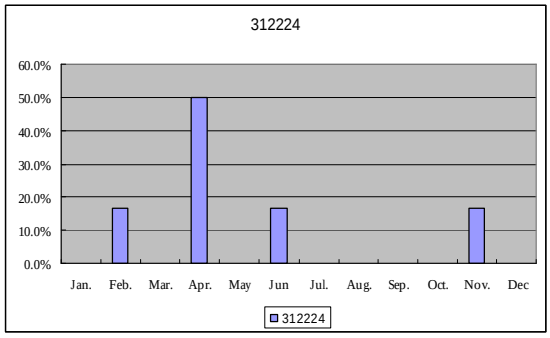












Appendix 6 – Proposed Interview Questions for HEM-SOL

Company Information:

1. Please state the company's background.
2. What is the company's organization structure?
3. How many suppliers do you have and where they are located?
4. What kind of customers do you have?
5. How many different kinds product do you have?
6. What is turnover of this company?

Warehouse and Inventory:

1. How many warehouses do you have?
2. What kind of warehouse do you have?
3. What is the situation of company's inventory?
4. What is the frequency foes the company receive containers and how many for each time?
5. How long is the lead time for the product from Asian suppliers and other suppliers in Europe?
6. How can you decide each item's inventory quantity level empirical?
7. How does the company monitor incoming and outgoing goods in warehouse?
8. How long do inventories stay in the warehouse in average?
9. Why not ask the suppliers to use bar code to facilitate warehouse management?

Operation Process:

1. What are the payment terms between the company and suppliers from different areas?
2. What is your company's purchase order process?
3. When do you know you should place new order? And how much do you know to order?
4. Did you set the forecast for most items to help you to determine the new order?
5. Did you set the safety stock for each item?
6. Who arrange the logistics for customers and what kind of trade term is used between the company and customers?
7. Please show us some shipping documents?

Information System:

1. When does the company start to use information system to involve into daily operation?
2. What kind of information system do you have?
3. What functions you are using of your information system?