How to optimize warehouse management and the inventory level in the fast-moving fashion industry?

Focusing on the effect of inventory system and warehouse management system at Sun Enterprises

Graduation Research Report	
Student name	Kecskemeti Zsofia
ASIS student number	2075068
ASIS mentor	Bob Dyson
ASIS Programme	International Business and Management Studies
Double Degree University Name	Budapesti Gazdasagi Foiskola (Budapest Business School)
Double Degree University Student number	C4C01X
Double Degree University Mentor	Dr. Habil Vasary Viktoria
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Introduction of the company

Sun Enterprises is a leading manufacturer and supplier of jewelry items, such as leather, locks, silk and jewelry components. It is a family owned company headquartered in the USA and the Netherlands, but due to its online presence, it is represented all around the word. It has its production in India and South Korea.

The distribution center of Sun Enterprises (Europe) has been located in Almere, The Netherlands since 2004, as that is close to the international Schiphol airport, the Amsterdam harbor and the Rotterdam port.

Products:

Sun enterprises offers 35 – 40,000 type of jewelry components:

- Sterling silver
- Metal beads in different plating(silver, gold, rose gold, steel)
- Natural beads (horn, bone, wood, ceramic)
- Leathers (snake, cow, sheep)(real and eco)
- Mink (fox, rabbit)
- Silk
- Cotton

Its aim is to work closely with their customers to be able to produce designs based on specific needs; customized products with prompt delivery and in the highest quality. The company is focusing on the business to business market, European office's target customers are designers, small businesses and online retailers, meanwhile the US. Office supplies for wholesalers (Sun Enterprises, 2014)

Industry	Fashion retail industry
Founded	1982
Headquarters	Almere, The Netherlands;
Aria served	Worldwide
Products	Jewelry components
Distribution centers	Almere, The Netherlands and Los Angeles, US
Employees in the Netherlands	8-10
Factories	India and South Korea
Size of the warehouse in the Netherlands	500 square meter

Figure 1: Main characteristics of the company

Rationale

The main objective with this research is to find out how to optimize the inventory level in the fast moving fashion industry, focusing on jewelry components at Sun Enterprises. The aim is to achieve the best possible level of inventory by implementing an efficient inventory system and warehouse management system. It is a fundamental requirement for almost every company in the fashion industry to be able to serve customers quickly, which requires having the right products and the right quantity of products on stock. Having the right quantity on stock makes the businesses able to shorten the deliver time and decrease inventory costs. Inventory holding is a significant cost in the supply chain, therefore drives attention on investments on the improvements of the inventory system. (de Leeuw, Holweg, & & Ferrin, 2011) An efficient inventory system positively affects the productivity of businesses. Productivity of businesses is getting more and more important due to globalization, as the number of competitors has grown by a large amount. (Daniels, Radebaugh, & Sullivan, 2012) Moreover, optimized inventory level helps to increase the on-time delivery which positively effects the customer satisfaction.

Furthermore, the companies are forced to improve their business continuously, if they want to stay competitive on the market. One of the most important competitive factors is the ability to supply the products effectively and efficiently, because in the free market the customers are free to choose their suppliers and most likely they will choose the supplier based on the added value they receive. Criteria of the customers are mainly focused on speed, dependability, flexibility, quality and price. (Little, 2006) Regarding Sun Enterprises, the prices are already low compared to the competitors and according to Mr.Mundhra – the owner and supervisor of the company – the company is already offering high quality products. Moreover, the company is offering possibilities for customized products, what provides flexibility for the customers. The last two factors are: speed and dependability are connected regarding Sun Enterprises. Speed and quality is key for the customers of Sun Enterprises, thus focusing on them is an important success factor for driving profitability. The delivery time is generally affected by the efficiency of the supply chain. Supply chain is a complex network creating the flow of products and services from raw material to end customers through sharing information in the whole network and physical distribution of the goods and includes the warehouse functions as well. (Dreckshage & Kerber, 2011).

This paper is focusing on the creation of an efficient warehousing, inventory management system in order to ease the decision of the reordering and optimize the stock level at the fast moving fashion industry. In conclusion, Sun Enterprises should improve its

inventory system including ordering, reordering and other warehousing functions to increase the level of speed and dependability. Effective inventory system requires an organized warehouse as it acts as a node in linking the flow of goods between the supplier and the customer. (A., Subramanya, & Rangaswamy, 2012). Furthermore, this system requires continuous monitoring in order to have adequate data of the current stock level, which is a base for reordering.

An inventory system and warehouse management system helps to make the decision for reordering, better reordering create an inventory level which is matching with the customer demand, then implementation of these systems can be a possible solution for optimizing the inventory level.

Structure of the company

As stated before Sun Enterprises is a family owned Indian company. The company has three departments: US. Office which is supplying several wholesaler, European Office, which is handling the small size businesses and designers all over the world and the Asian Office, where the production is located. These offices are serving approximately three thousand customers. The head of the departments are the family members of Mundhra family. Two brothers, namely Dinesh Mundhra and Harish Mundhra are the supervisors of the European office, which has 10 employees. There are no permanent employees, only international business students, who are doing their internship at the company generally for 3-6 months. The workers are responsible for carrying forward the fulfillment of customer orders, maintaining the inventory and some marketing and sales related activities.

The customers can place orders through the company's website (e-catalogues are placed in the website) or by email. But they can visit the company's warehouse where they are allowed to take the chosen items directly from the shelves. The company earns the larger part of its profit from web orders. The minimum value of an order is 150 euro. The company receives 15-20 orders per day. The average amount of an order is 400 Euro, average number of the ordered items are 20-25 pieces. A personal handles around 3-4 orders per day depending on the size of the order.

Current inventory distribution process:

1. Employees are checking whether the products are on stock (it is time consuming because the location some of the products are unknown or disorganized)
2. Packaging list and a pending list are created in an excel file. It means the employees write the name, quantity, price/piece, total price to an excel sheet.
3. The employees send the packaging and pending list to the customers by email.   The customers decide whether they want to wait 5 to 7 weeks (sometimes it can take up to 2 months) for the missing products or they can replace it with another product.
4. The employees pack and ship the items for the customers by Fedex or DPD or by post.

check stock → create packiging list → send list to customer → send product to customer
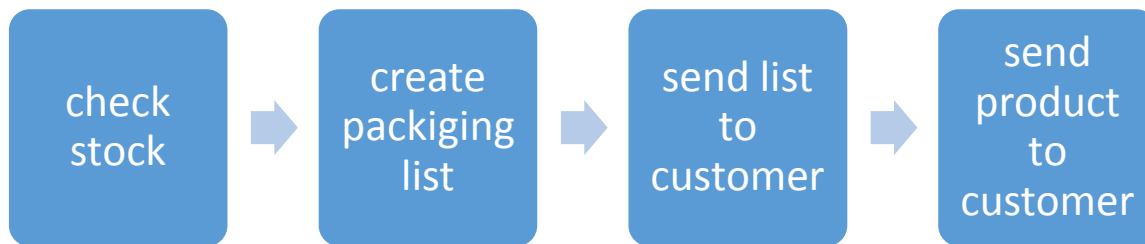
Figure 2: Current inventory distribution process

Current inventory level, Location of the products and Current inventory checking system

Location of the warehouse	Almere, The Netherlands
Size of the warehouse	500 square meter
Stock level	2 months
Number of fast moving products	4000
Production time	4 to 6 weeks

Figure 3: Overview of the warehouse and inventory level

The company's 500 square meter big warehouse is located in Almere, The Netherlands. The stock level at the warehouse relates approximately 2 months stock, which accounts over 5 million euro; however the company does not have any collected data of the current inventory level. Only around four thousand from the forty thousand are fast moving products, and approximately the half of the total products are slow moving and the rest is dead stock.

	Fast-moving	Slow moving	Dead stock
Sold out in	2-3months	4-10 months	More than 11 months
Percentage of the total product line	10 %	50%	40%
Percentage of the total turnover	80 %	20%	0 %
Description	Products that have large customer demand over a given time period	Products that have little customer demand over a given time period	Products that the company is unable to sell

Figure 4: Fast moving, slow moving and dead stock at Sun Enterprises

Fast moving products are the products which are sold in 2-3 months, slow moving items are sold between 4 to 10 months after receiving it, the rest are called dead stock, which are staying in the warehouse more than 11 months. Sun Enterprises collects around 80% of the total turnover from the fast moving products, what are constantly changing. For example, 3-4 years ago, Sun Enterprises earned its main profit from selling beads. Today, it just accounts for a small percent of it. The company believes that the current popular items are the leathers and the locks.

The current inventory level does not match with the customer demand. Almost every customer order cannot be fulfilled completely, because at least one product is out of stock, which effects negatively to the level of the customer satisfaction. The company receives many complains about late delivery caused by out of stock situations.

The organization of warehouse in Almere could be improved. The most popular products like real leathers, eco leathers, locks and part of the beads are located on the first floor. The less popular ones like leather bags, crystal beads, silks, stones, pliers and other products are on the second floor. The shelves used to be labelled with the products types, which are kept on that shelf. However, as the location of the products were changed due to the new arrivals (new type of products or overstocks), the labels were not changed, so now the labels are not matching with the current inventory. Moreover, some products from the same type are stored at different places at the warehouse and many of the removed products are laying somewhere and mixed with different items.

The company checks inventory every second month, however not performing a full stock count, and only checking for selected items. The employees are checking only the

specific items which are in the catalogue of the company. The checked items are representing just a small part of the total products of the company. The reordering is based on these collected data, visual checking and the prediction of the Supervisor. The production time is around 4 to 6 weeks, but it can be longer at the busy periods. The shipping time of approximately a week between the factories and the distribution center is adding up to the arrival time.

Factory overview

Sun Enterprises' factories are situated in India and South Korea, which spread over 50.000 square meters, where over 740 personals works. Production plant meets the ISO 9000 quality standard and has been setup for production of bags, leather straps, locks and various other products. The plant has a production capacity to produce over 50.000 meters of cords daily and over 10.000 locks. The production follows both manual and automated processes and each stage has pre-defined quality standards, namely statistical process control (SPC) and total quality control (TQC).

Quality and Variation of the products

Sun Enterprises is aiming to reach the highest level of quality of the products as possible, in order to create competitive advantages. Therefore, the company performs quality check at several stages. However, the quality of the products can differ by product types, for example the company is selling lower priced silver plated locks, but in the same time it is offering high quality stainless steel items. It is almost impossible to reproduce the exactly same color for leathers due to the fabric, so the color of the reordered leathers can differ from each other. This means the further batches will be slightly different from the previous ones.

The company provides a large variation in their products by having multiple colors, styles and sizes, because company believes that the large variation of their products is one of the main attractive factors for customers in this industry. Sun Enterprises uses style and color codes for most of the items, and it is written on the label of the products, but many times the products labels are wrong, or incomplete.

Current Challenges

Sun enterprises are struggling with over and under stocking due to the fact that they do not have a functioning inventory system in place. The company does not have an organized warehouse or an inventory counting process. As a consequence, extra supply is often ordered for products which already have high stock level. This results in a large overstock of certain products. In addition, the company is not keeping track of products that are low on inventory either, so they are unable to fulfil customer demand which leads to low customer satisfaction. Only 10 % of the orders are delivered in full on time, which is really low, because the optimal in full and on time delivery what the company would like to achieve is 55% of the total number of orders.
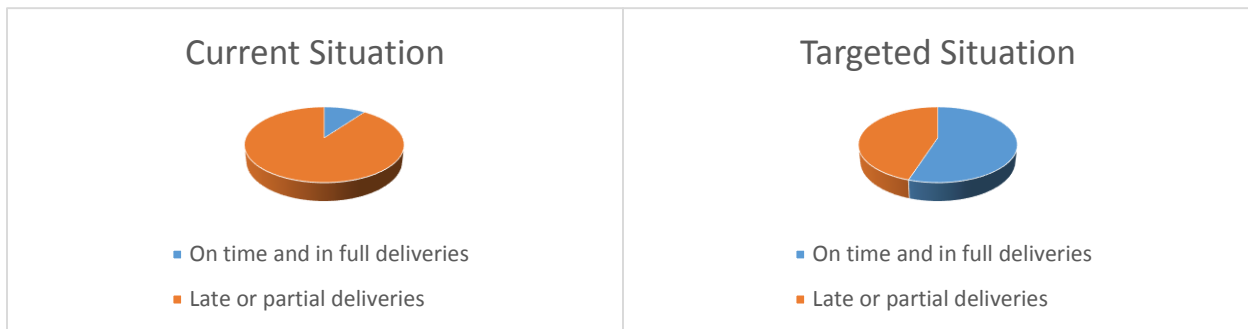
Figure 5: Current and Targeted situation of on-time and in full delivery

Moreover, the e-catalogue is not synchronized with the current stock. It means some of the products are not shown in the catalogue from which actually the company carries stock, or some products are in the e-catalogue, but these are not produced by the company anymore. It is a problem, because the company is only able to sell these products when a customer is visiting the warehouse, meanwhile the company's main sale channel is through the website, causing a loss to the company.

Furthermore, there are many products from past orders which are unnecessarily stocked for a long period of time. This has a negative impact as customers are not interested in those products anymore due to changes in fashion. For example, the horn beads were really popular a few years ago, but now many full boxes of horn beads are laying under the tables in the back of the warehouse, unable to be sold.

Also, the current inventory distribution process is time consuming. Typing the details of the products takes a long time and increases the possibility of human mistakes. The visual checking takes a long time too and the employees cannot be sure if the product is out of stock or just placed somewhere else.

Moreover, the wrong, incomplete and missing labels can cause misunderstandings with orders and make it more difficult to identify the ordered item and to find it at the warehouse. The disorganized warehouse creates similar problems for the company as well.

Lastly, the motivation of the employees is really low due to that they are just working at Sun Enterprises for a short period. The result of this problem can be seen mostly on the warehouse and they spend more time on unrelated activities. They are not intent to come up with improvements, but actually they do not spend enough time at the company to know enough to be able to come up with any improvements.

Exploration

Situational Analyses

Review of topic related case studies

Some companies had similar type of problems as Sun Enterprises, caused by poor inventory system and warehouse management system, even in different industries, as described in the following:

In 2008 St. Joseph's Health center is a community teaching hospital began to review of its inventory management system and possible improvements. The review was focused on replenishment processes and optimization of the inventory level. As at Sun Enterprises, the products were not stocked in a uniform manner and the current inventory level was unknown. They were struggling with overstock situations too and the demand for the products was changing fast due to improvements in the Health Care. The center had losses from its insufficient inventory system.

The Health center first action was to form a team for cleaning and rebuilding the storage. They organized the products by item types, it was easily found by the employees. The workers gave positive feedback, but the managers received some complain of the lack of the education on new item locations. Health Center decided to dedicate someone to maintain the storage, which enabled them to have an up-to-date inventory database, which can be used for base for reordering. (Nigro, 2011)

Another company in the industrial technique industry, namely Atlas Copco AB, was not able to maintain the current stock level due to the unsufficient information system, and could not optimize its inventory level caused by the lack of knowledge of inventory management.

In 2006 they started to implement a new information system, so called MOVEX, which is assessing the flow of the information through the whole supply chain, and a new inventory management system which allows them more visibility. Moreover, this company started to use Business Planning and Control System which enable them to analyze the collected inventory data and use it for sales forecast. However, Atlas Compo AB believed that transparency of these analyses should be improved continuously in order to optimize the inventory to the demand level. The company divided its products into two categories: Make-to-stock, and Make-to-order. They sorted the relative stable demanded products into Make-to-stock; the rest of the products, the slow moving items were classified as make-to-order. Their policy for the slow-moving items is that cannot be returned back to the production warehouses, it has to be sold-out if it still on stock after sell-out period, the products have to be scrapped.

 In order to receive improvement on its inventory system, Atlas Copco AB focused employing higher educated people from relevant industry. This decision drove to a successful implementation of the new systems. These changes lowered the delivery time and increased the level of customer services (the higher number of the on-time deliveries showed the successfulness of the changes, improvements for Atlas Copco). Therefore, today it is taking even more effort on optimizing the inventory level in every department of the company.

Theoretical Background

Inventory management and Inventory system

Inventory is the goods held in a warehouse to satisfy a future demand. It needed to be controlled to reach the optimized inventory level. Inventory level considered optimal when it reaches the level of the demand. (Goetschalckx, 2011) Inventory management is the part of management which plans and controls inventories. It is aimed to maintain a desired stock level for every item. Inventory management uses inventory system to optimize the inventory level. An inventory system should be based on the product life cycle, customer demand and process of supply chain. As described in the Rationale, Supply chain means the process from raw material through all of the manufacturing, transporting and warehousing to the end product till it reaches the end customer. (Tommey, 2000). One of the most important, fundamental parts of the inventory system is the sales tracking system. Sales tracking system is tracking the out-going and in-coming items, which by the companies enabled to know the current inventory level so the goods sold out can be reordered immediately in order to keep

customer services level high. But the question still remains when and how much to order. (Goetschalckx, 2011) It mostly depends on the demand, trends and delivery time. There are some types of production method which were created to help to find the answer: such as just-in-time, where the products are produced and delivered just what is needed, and only the amount ordered by customer. This production is a type of pull system. Pull system is method of production which simply trying to replace what has been used. (Dreckshage & Kerber, 2011). The other type of manufacturing philosophy is the push system, which is the opposite of pull system. It is focused on machine-process efficiency and the company waits until the customers to consume the products. The problem with the push system is that generally the produced quantity is larger than the customer demand according to a lean manufacturing specialist, Robert W F Krause II. (Krause II, 2007). The current trend is to order more frequently in smaller quantities, meaning more and more company use pull system. (Goetschalckx, 2011) The suitable method for Sun enterprises is a mixed version of these methods. For the customized products, the company should use pull strategy, because the exact quantity of product are given and the company cannot sell those items for other customers due to the customer's brand protection. Moreover, the company should use pull strategy for the slow moving items in order to avoid overstock situation. On the other hand, the most likely strategy for the general items – such as 1, 2, 3mm round leather cords, especially black, natural, brown and white colored items – is the push strategy, because these products are base for jewelry making, so it will be a continuous demand for these products.

One of the main functions of the inventory is to serve the customer. That is why it is really important to create an inventory system, because the inventory is a safety stock for covering demand fluctuations and forecast errors. The companies have several options to keep safety stock: it can keep safety stock from finished products, which are ready to sell. Alternatively it can keep work in process inventory, such as items before dying. In this way the company can improve the delivery time at understock situations. (Tommey, 2000). To maintain well the inventory level requires having an inventory system which is compatible with goals of the company and the function of the particular inventory. The best control method differs to company to company. There are several kinds of system:

- Order Point/ Reorder Point system: The order point is based on the forecasted usage during the replacement lead time. But sometimes it requires having safety stock or safety lead time.
- Time-Phased Order Point system: This system is suitable when the goods are controlled in more than one location and the forecasted level is irregular. Moreover, it

is based on the Material requirements planning logic of time-phasing and offsetting net requirements.

- Periodic Review system: This control system has fixed replacement period and calls for varied replacement periods.
- Hybrid system: It is the mix of Time-Phased order point system and Periodic review system.
- Material Requirements Planning system: The most common way for dependent demand items. It settles requirement for all products at each level of the supply chain through explosion of the bills of material. This system gives recommendations to release manufacturing and purchasing orders.
- Distribution Requirements planning system: With the help of material requirements planning logic relates the central supply center requirements with the requirements of the branch warehouses to the manufacturing at the Master Production level.
- Enterprise Resource Planning: It plans the inventory system based on supply and demand information taken across the entire network. It requires having an electronic communication technique to be able to monitor well this planning. (Tommey, 2000)

Sun Enterprises could benefit the most from reorder point system, because it is based on the reorder point and order quantity factors rather than on the time factor. The company has a large variation of products and the demand is volatile between the products therefore it is better to use a system which needs only attention when the stock has reached the minimum inventory level. However, the main challenge of this system that it requires continuous monitoring of stock level of each item. (Mathur, 2014)

It is necessary to create a good environment for the application of the inventory system. When the inventory control is used for lots of items, it is better to use computerized system in order to make it faster and lower the number of human mistakes. First of all, the company needs data of the stock on hand, stock on order and backorders and lead times. In order to avoid errors, it is better to update the records in connection with various transactions and it should be followed time to time. Supervisors must take responsibility for maintaining record accuracy and keep the employees motivated to follow this recording accurate. Moreover errors should be analyzed and the correction should be introduced for all. To have more accurate information, it is better to use automatic identification. A major tool for this is bar coding, but it is an expensive tool. Furthermore, a well-ordered warehouse will reduce problems such as missing or lost products. It is recommended to have fixed locations for the items, so it makes easier to find the products. (Axsater, 2006)

All inventory balances must be double-checked by manual counting time to time. The counting frequency should be higher for goods with high demand. The most common is to use periodic counting, like every half year or every year and the items is counted twice by different persons, to lower the level of errors. However, nowadays the cycle counting is getting more and more popular. Cycle counting means each day a limited number of items are checked. Furthermore, it is easier to check the inventory level when it is low. (Axsater, 2006)

Implementation of an inventory system

Implementation of the inventory system should be step by step and it should be carried out under supervision. It should be implemented by product groups. At Sun Enterprises, like by locks, leather, silk and so on. In this way the business can adapt to changes. Furthermore, the employees should be enough educated for a successful implementation of an inventory system and for monitoring it in the future. Often an inventory system deteriorates when a key person leaves the company and the person taking over does not have adequate training. Therefore it is important to train someone before the key person leaves the company. Moreover, it is recommended to involve all personal to the education program once, although the key person should be trained continuously in order to motivate the employee to generate improvements by himself. (Axsater, 2006)

Sales Forecast

All of these systems require having forecasting. An accurate sales forecast will help to make the reordering more precise. Sales forecast is an estimated average of the demand size over some future period. Sales forecast are usually more accurate for the near future, especially at the fast moving fashion industry. It is important to know the certainty of the forecast, because a more uncertain forecast needs a larger safety stock. It also necessary to estimate the forecast error, which can be represented by standard deviation. There are two types of approaches related to forecast. One is the extrapolation of the historical data, where the forecast is based on previous demand data. Collection of previous data can be done easily by use of computerized inventory control system, moreover this system simplify updating regularly the forecast for all the items. This approach is the most common to obtain forecasts over a short horizon. (Axsater, 2006). The other approach is the forecasts based on other factors, such us dependent items, for example an item that is used as a component when assembling the final product. Other factors which can effect on the sales forecasts are sales campaigns and new competing products in the market. In this case it is better to adjust sales forecast manually. In the fashion industry a factor can be the seasons, for example customer are more willing to buy shiny, light colors such as white, light blue and rose before summer,

but before winter they prefer to have darker colors like black and brown. However, various problems can occur with forecasting systems. It means it should be checked periodically. If necessary the forecasting procedures can be reinitiated for some of the items with new initial value and new information such as price changes, sales campaigns, new regulations and new competitive products on the market. (Axsater, 2006)

Inventory Position

Not only the forecast effect on the decision of the reordering, but the inventory position is another important factor. Inventory position means stock on hand plus outstanding orders without backorders. Outstanding orders are the goods that have not yet arrived, the backorders are items that have been demanded but not yet arrived. It is better to calculate with the inventory position, not only with stock on hand, because outstanding orders can make big changes in the inventory level. (Axsater, 2006)

Warehouse management system

According to the related case studies implementation of an inventory system requires a well-organized warehouse. Warehouse management system helps to create this situation. This system includes determination of the product type's location, capacity planning, inventory tracking, goods picking, receiving and shipping. (Wilson, 2006). It should be synchronized with the inventory system and supervised by the management due to the complexity of the system. The location of the certain products should be fixed in order to help the work of the warehouse personals. (Piasecki, 2004) One major tool which can help the decision of location of the products is the ABC classification, which classifies the products by annual earnings volume. It categorizes the fast-moving products to category A, mid-range items to B and slow-moving products C. For example, in Sun enterprises the leather and locks can be categorized to group A, beads for group C. ABC help to decide where to locate the categories, the fast moving products(category A) should be placed closed to the shipping and receiving area in order to decrease the travel time of picking. As the category C is the slow moving items, it can be placed a bit further from the shipping place. (Dreckshage & Kerber, 2011). All the laying items should be placed back to adequate place. The location of the products at Sun Enterprises is mostly matches with the ABC classification.

There are several retrieval strategy, such as

- FIFO (first-in-first-out): picking the first item from the shelf, this is the most simple one,

- LIFO (last-in-first-out): picking the last stored loading item, it is useful when the products has expiration date,
- Time-phased: picking is scheduled according to the presumable time of demand, tour-optimized retrievals are scheduled according to down-stream transport means. (Hompel & Schmidt, 2007)

Sun Enterprises most likely would benefit from LIFO due to the complexity of the order type and product type.

Warehouse management system includes the tracking the movements of the products, it recommended to use software system to decrease human mistakes. (Piasecki, 2004)

Capacity planning is important to be able to maintain successfully the task of the warehouse management system. Company should have enough personals to fulfill the daily task. To know how much capacity needed to know the total of standard labor hours per task, then the company will be able to know how many personals needed. (Piasecki, 2004)

Management

As previously mentioned, implementation of systems should be carried out under supervision. Not only the implementation, but every operations, such as capacity planning, should be controlled by management. "Management is the process of reaching organizational goals by working with and through people and other organizational resources." (Management innovations, 2008). Managers' task is to plan, organize, direct and control operations to achieve company's goals. Moreover, they are responsible to motivate the employees, communicate the information through the company and make the decisions. (Carlos C. Lorenzana, 1993). Consequently, the successful implementation of an efficient optimization process depends on the management's way of working.

Delivery Time

The companies had to take under consideration the delivery time when they are making the decision for reordering. The delivery time includes production and shipping time by which the company can decide the timing of the reorder. Generally the delivery time of the products at Sun Enterprises is 4 to 6 weeks, so the order should be done 4 to 6 weeks before it wants to have it on stock.

Fashion and Fashion industry

Fashion is an important part of human experience, because the people want to wear fashionable items. The main difference can be made between fashionable and simple products by color, fabric or style. (Grey, Peter Schmitt, & Kassam, 2014) Moreover, fashion is always changing, mostly because people get bored with the current fashion. It is really hard to predict the future fashion; it has a long change of process to forecast the next fashion moves. Forecasting the color trend helps for the business to make the decision what and how much to keep on stock from different colors. There are several statistical models which help to create these forecasts, such as Auto Regression Integrated Moving Average, Bayesian forecasting and linear regression. Auto Regression Integrate Moving Average is based on statistical assumptions which made by the use of historical data. The accuracy of these data is inconstant due to the high volatile fashion trends. (Blumer, 1969) But computational tools can be used to ensure more accurate forecasts. One of this tools which is used in fashion industry is the Artificial Intelligence model, which were used by Lin and Lee. (Yu & Chi-Leung Hui, 2012). Lin and Lee used Grey forecasting model made by J.L. Deng and Markov-Fourier Grey forecasting model in the procedure of the creation of an expert system. Nevertheless, these systems require experts to create an accurate forecast. However, an empirical factor can be used for forecasting the colors, it is the season. Fashion products can be divided in five categories:

1. Fall 1-(July –August)
2. Fall 2- (September-October)
3. Holiday-(October-Mid November)
4. Spring-(Late January-March)
5. Summer-(March-mid April)

These seasons are affected on the demand regarding to the color. (Alper, Volume 114, Issue 2, 2008)

All of these seasons have their own popular colors:

- Summer: pastel colors such as light blue and turquoise, orange, fuchsia so the light, shiny colors
- Fall: brown, red, blue green
- Winter: taupe, grey tones, navy blue, black, gold, silver
- Spring: yellow, rose, Bordeaux, pistachio, emerald, green

Black, white and natural colors are fashionable during the whole year. The companies in the fashion industry can use this classification for optimizing the inventory level. Regarding to Sun Enterprises, the seasonal color classification is correct, the customer demand is higher for the listed color at the appointed season, but due to that the company sells raw materials and the designers needs time to create its designed products, the demand for the seasonal colors are higher before the upcoming season.

The fashion industry accounts over 1.3 trillion euro. (Grey, Peter Schmitt, & Kassam, 2014) It is characterized by short product life cycles and unpredictable demand, large product variety and a complex supply chain. In the fashion industry, efficient inventory system is a principal for successful business. (Alper, Volume 114, Issue 2, 2008).

The fashion market can be divided into three categories:

1. Fashion products with around 10 weeks product life cycle
2. Seasonal products with around 20 weeks product life cycle
3. Basic products, sold throughout the year

This categorization is made by (Abernathy, Dunlop, J.H, & Weil, 1995), which can be used in the creation of the sales forecast. Although, sometimes it is hard to categorize the items, and the product life cycle can be different. Sun Enterprises' basic products are the leather cords, especially the round leather cords colored by black, natural and shades of brown. The company items can come under seasonal products by colors as it is been already discussed before. At last, items classified to fashion products are continuously changing according to the current trend. Trends can differ by type (for example: style (snake style, plain style, round, flat, material etc.), color, size.

Conceptual Model

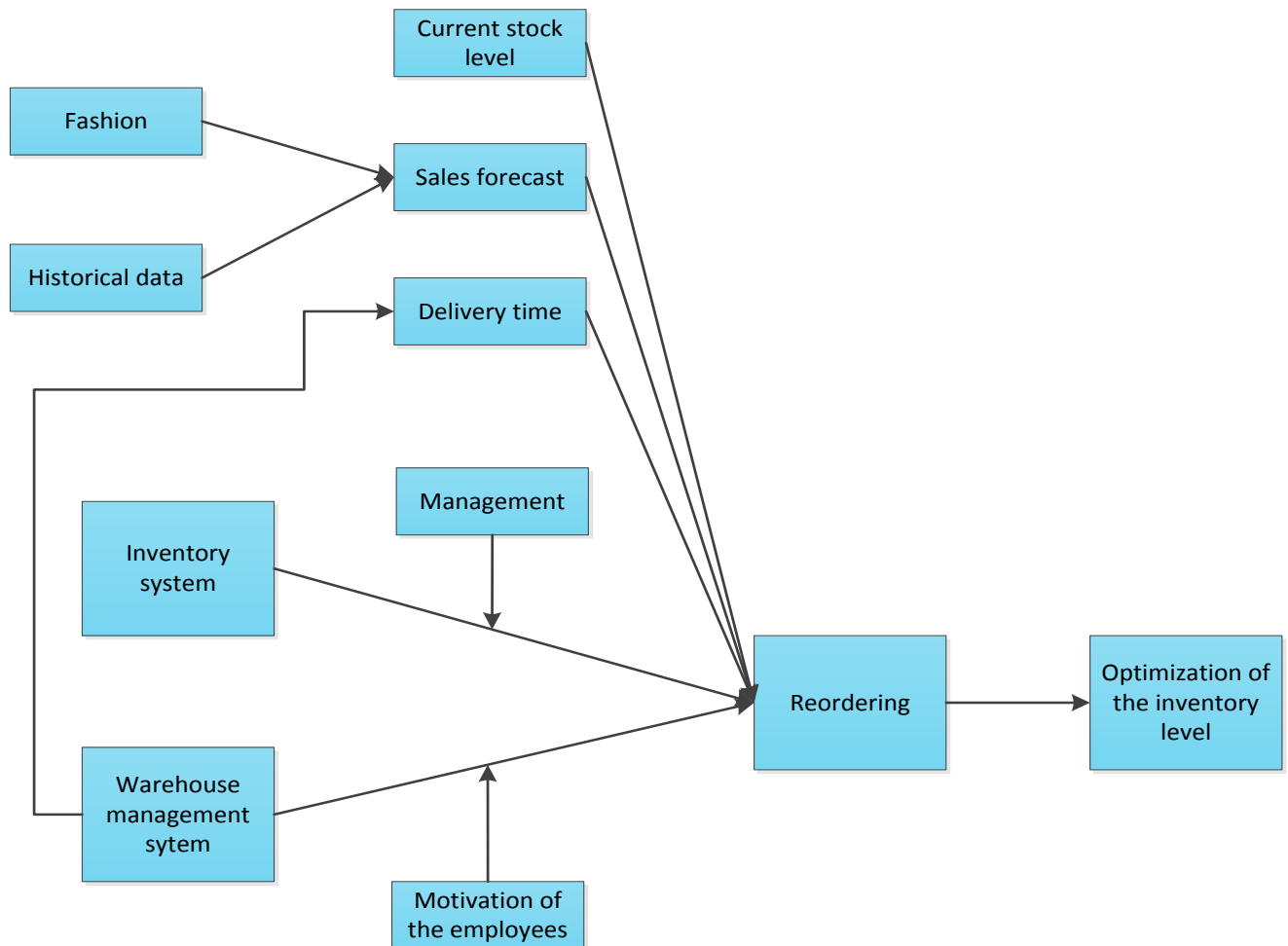*Figure 6: Conceptual Model, created by Zsofia Kecskemeti, 2014*

According to my findings, the company can optimize its inventory level by making the right decisions about the products and quantity to be ordered from its factory. There are several variables which affect this decision. These include the following:

- Inventory system
- Warehouse Management System
- Delivery time
- Sales Forecast
- Current stock level

The two most important variables which effect on the reordering are the warehouse management system and inventory system. A well-organized warehouse is necessary in reaching the optimized stock level therefore the importance of having a warehouse management system is high. The efficiency of the warehouse management system depends on the motivation of the employees, since the personnel are responsible for warehousing. As stated in the exploration, the motivated employees work better and more accurately, and accuracy is essential in the creation of an optimized inventory level, Furthermore, creation of the warehouse management system positively affects the delivery time, implementation of the inventory system and the monitoring of the inventory system.

According to my hypothesis, implementation of an inventory system helps to make the decision of reordering. As it mentioned in the exploration, an inventory system aimed at finding out what, when and how much to order in order to reach the optimal inventory level.

The efficiency of the inventory system depends on the quality of management, because the complexity of the inventory system requires management control, especially at the stage of implementation. Moreover the main decisions are done by them – including reordering –, therefore the management is a moderating variable.

When the company starts reordering, it has to take under consideration the delivery time and the current inventory level in order to have the right quantity on time. Sales forecasts can help to find out the right quantity that has to be ordered, but the company should focus on the accuracy of the forecast, because a wrong sales forecast can create losses in the end. Two variables affect the sales forecast: Fashion and historical data. When the company is creating the sales forecast, it should analyze the current and possible future fashion trends. Moreover, the company can use the data of the previous sales for the creation of the new sales forecast; that is why it is important to accurately track the flow of the items.

The testing hypothesis of this conceptual model can be the following:

The implementation of an inventory and warehouse management system combined with proper employee motivation and sales forecast will lead to make the right choice for reordering by which the company will have an optimized inventory level.

Proposed solution

The proposed solution is to create an inventory system and a warehouse management system which help to decrease the delivery time and to optimize the inventory level. The implementation of these two systems is the most important factor which affects the decision of reordering, as these systems will provide the basic information needed for the decision.

The basis of an efficient inventory system is knowing the actual stock level. For an accurate measurement, the warehouse should be well organized and the products should be placed in the correct order. In order to find the products easily and to have an organized warehouse, the company should keep similar products in the same area and synchronize the labels on the shelf with the items. Any products with wrong or incomplete labels should be corrected, and future mistakes should be avoided through a system of checks and controls. In addition, the company should keep the popular products at an easily accessible location in order to reduce process time. After putting the items back on the right shelves, they can be counted. After counting the goods and collecting the necessary information - such as a product's name or code, style, color, price per piece or meters and pieces or meters by packaging- the company will be able to start creating the inventory system.

The inventory system should track the incoming and outgoing items and should receive information from the factories on the status of the products in manufacturing. Tracking the flow of goods will enable Sun Enterprises to know "right away" if a product is out of stock, and it can give warning as well when the stock level is getting really low.

Secondly, in order to ease data tracking and analyses, the company should use a computerized system. Nowadays, there are many software which were created to help inventory systems. The company already purchased a software called INFLOW two years ago, but it was never implemented. This software is designed to track the incoming and outgoing items. So the proposed solution also includes the implementation of this INFLOW program into the daily procedures of the company

Thirdly, the e-catalogue should be synchronized with the current product line, -items from the e-catalogue what the company not producing anymore should be removed and the products what the company is currently selling should be added. This development can lower the number of unfulfilled orders in the future, because the items which are not produced anymore will be not selected by the customers. Moreover, it will increase the sales for those products that are in stock as well.

Nevertheless, the operation, goals and advantages of the system should be explained for all of the employees to get their commitment for the change and ensure utilization of the advantages. The company should focus on motivating them in order to achieve better results. However, at Sun Enterprise, it is unlikely that the employees' motivation will reach an optimal level due to the fact that the company does not hire any of them on permanent basis. As an example, students who join the workforce typically only stay with the company for a period of three months.

Research design

The suggested research measures the saving potential of efficiency increase gained from implementing an inventory system and a warehouse management system at Sun Enterprises and tests if the proposed solution helps to optimize the inventory level. The researcher is a complete participant in this experimental research, which means the researcher will be doing the implementation of the proposed systems with the co-workers. Participant observation is a qualitative method where the researcher observing and participating in the same time. Moreover this searching method is useful for understanding of the physical, social and economic contexts and uncovering unknown important factors which might effect on the research problem. (Mack, Woodsong, MacQueen, Guest, & Namey, 2005)

The implementation of my suggested inventory system and warehouse management system takes approximately 10 weeks. It has been decided at the beginning that only a part of the products will be included, namely the popular products of real leathers and locks, to see if the proposed solution helps to optimize the inventory level. The real leathers and locks were chosen, because these are fast moving items which give 80 % of the total turnover.

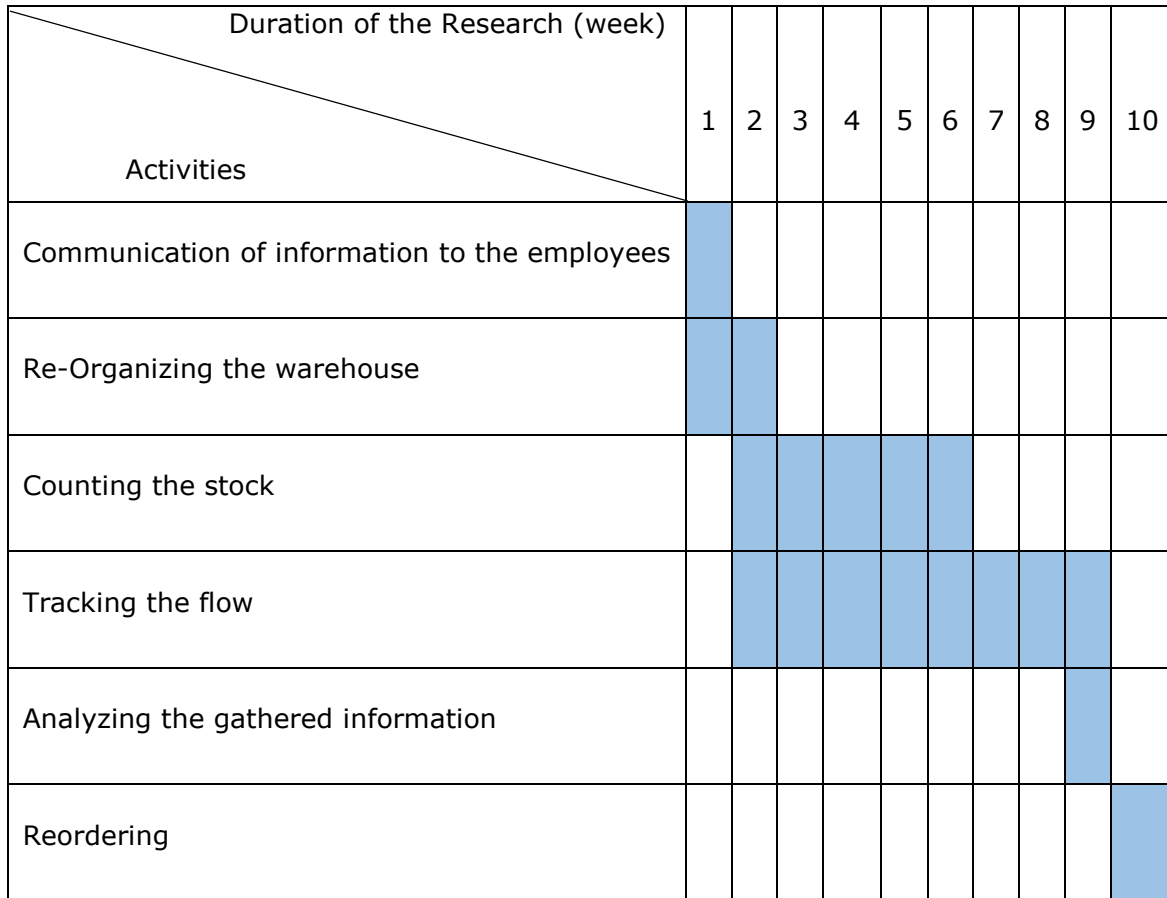The following Gantt chart shows the implementation of my research design.

Duration of the Research (week) / Activities	1	2	3	4	5	6	7	8	9	10
Communication of information to the employees	■									
Re-Organizing the warehouse	■	■								
Counting the stock		■	■	■	■	■				
Tracking the flow		■	■	■	■	■	■	■	■	
Analyzing the gathered information									■	
Reordering										■

Figure 7: Gantt chart

First of all, advantages, challenges and the process of the inventory system will be explained to the employees with the help of the supervisors. Secondly, according to my proposed solution, the implementation of an inventory system needs an organized warehouse, which can be created by warehouse management system. So my co-workers and I will re-organize the warehouse and start to count the current inventory level. The arrangement of the products onto the correct shelves will take approximately two weeks. However, the counting of the products can be started with the products that are already arranged. The counting will take around 5 weeks due to the capacity of the workforce and the time-consuming nature of this activity. The data will be added to the INFLOW software where the company will track the further movements of the products. The tracking will be done by checking the product invoices, starting from the time when that particular product type is counted. The tracking will be continuous during the research to have the right information of the current inventory level. Meanwhile, a synchronization of the product line and e-catalogue will be done.

After the analyses, the decision of reordering, based on the findings, will be made at week 10. However, the reordering process will have to be continued during the research, as the company cannot change processes instantaneously and still needs to order products in order to remain profitable during this time of change.

Disadvantages of this research design is that it is time-consuming, and it needs people to invest a lot of work, but if the hypothesis is correct, then the company can continue it easily. Moreover, human error can occur, but it can be controlled by double checking and raising awareness of the importance of accuracy. Another disadvantage is that it is an inherently subjective research type, meanwhile the research requires objectivity, so the researcher should make effort at objectivity. Moreover, research circumstances and activities are influenced by the researcher's personal beliefs of what is important and relevant, so the researcher might overlook some important factors. (Mack, Woodsong, MacQueen, Guest, & Namey, 2005) Furthermore, in a way this research design is controlled by the supervisor of the companies as well, so it is highly possible that the proposed solution is not fully implemented or it is implemented differently according to the supervisors, which can differ from the researcher's proposed solution.

The main advantages of this research type is that it is tested in the real environment, so it will be known if it is suitable solution for Sun enterprises to optimize the inventory level. In addition, it helps to identify the hidden problems, improvements, and if it is required, the changes can be easily added during the research. Furthermore, the experiment can be repeated simply, the research design is suitable for every type of product at Sun Enterprises. (Occupy Theory, 2014)

The success of the proposed solution can be checked by the number of on-time and in-full deliveries regarding to the locks and leathers. The result of my proposed solution will be known after a longer period of time (at least 5 to 6 months).

Analyses, Results and Findings

As it is stated in the research design, an inventory system and a warehouse management system was implemented for leathers and locks. In this part, the result of the implementation will be discussed.

Results of the implementation of the Warehouse management system

As it was discussed in the research design, firstly the products were arranged onto the correct shelves and same kind of colors, sizes was placed together. As it was expected, it took a week due to that so many products were laying on the floor in boxes, moreover many of the items were unlabeled and had to be identified.

The following picture shows the changes:

Before

After

Before the research, the product types were already organized according to ABC classification, so the location of the product types did not need any changes. The new arrivals from the factory were placed onto the shelves at the day when the company received in order to ease the collection of the goods for the orders.

The organization of the products created some extra free space, and made it easier and quicker to find the products for the employees and for the customers as well. Moreover, the shelf/boxes were labeled according to the product, which helps in identification and finding the necessary product.

Result of the implementation of an inventory system

After the arrangement of the products (implementation of the warehouse management system), the stock level of the selected product types were counted. During the counting the following information were collected of all the products:

- Name of the product
- Color of the product
- Size of the product
- Quantity per packaging
- Price per piece/meter

It was necessary, especially in the case of the price, because a couple times the price on the package were different than in the website or in the catalogue. The required changes were done (when the product's label was wrong it was corrected and the factory was informed, when the price were wrong in the website, it was corrected to the correct one). Furthermore, the items which were not on the website/catalogue were added, and the items, what the company was not producing anymore, was removed from there. In this way, the company already reduced the number of pending items due that the customers are not able to order those products anymore.

Counting was really time-consuming and the employees needed much support (they became unmotivated quickly, as this activity is can be very tedious). Some counting mistakes appeared during the research period due to human mistakes. However, human mistakes could be lowered by double counting, but in this case was not done due to the lack of time. After counting, the current stock level was added to the software. All the items what the company sells were added, even if the product were not on stock.

The proposed inventory system was tracking the flow of the real leather and lock products. The tracking of the different kind of goods were started at the same time, however some products were not counted that time when the tracking started, so an estimated number was given for starting inventory amount and later when the particular product type were counted, the relevant inventory level was added. In this way the company was able to find out which are the most popular products, moreover which product is out of stock or just has a few left. The movements of the goods were added to the software by using the necessary information (incoming and outgoing items: from the invoices). At the beginning there was some problem with uncompleted packaging list (for example, the employees forgot to write down the size, color), but after a detailed explanation, the number of these mistakes could almost be eliminated. The company provided a sample sheet for all of the employees to help them to create a proper invoice.

The INFLOW software were designed to help the companies to see the changes in the inventory level and to plan the reordering. It provides possibilities for the companies to create different reports:

- Sales reports:

  - sales by product summary
  - sales by product details
  - sales order summery
  - back order report

- Purchasing reports:

  - purchase order summary
  - purchase order details
  - purchase order status
  - purchasing tax reports

- Inventory reports:

  - Inventory summary
  - Inventory details report
  - Historical inventory
  - Inventory movement summary
  - Estimated inventory duration
  - Stock Reordering reports

Now the company can check the current inventory level easily by creating a report. Furthermore, these reports can serve as a warning when a product type is getting close to be out-of-stock.

The following charts show the inventory level at the time when the last product was counted.
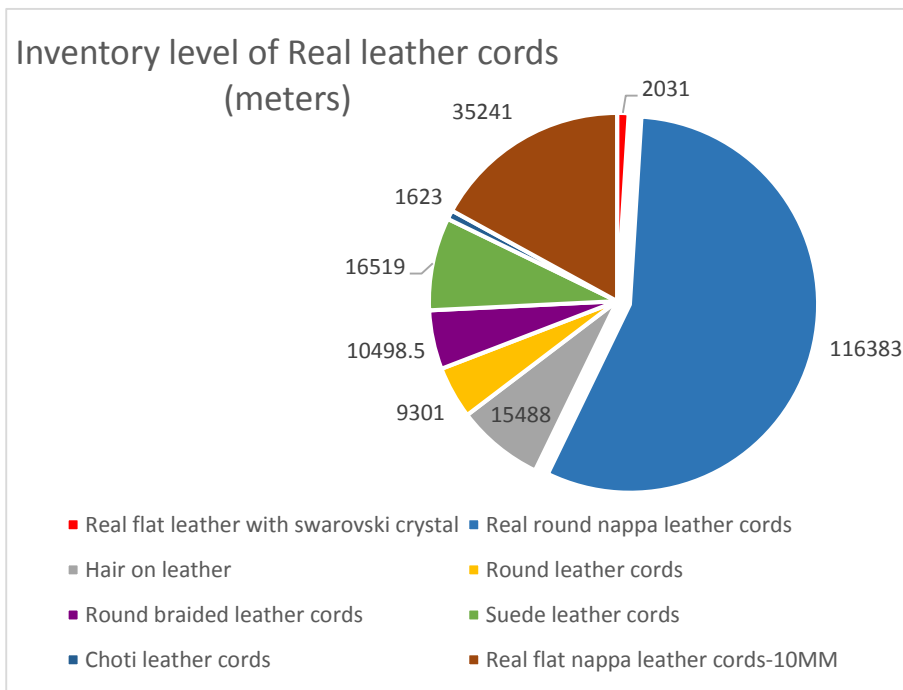

Figure 8: Diagram of inventory level of real leather cords
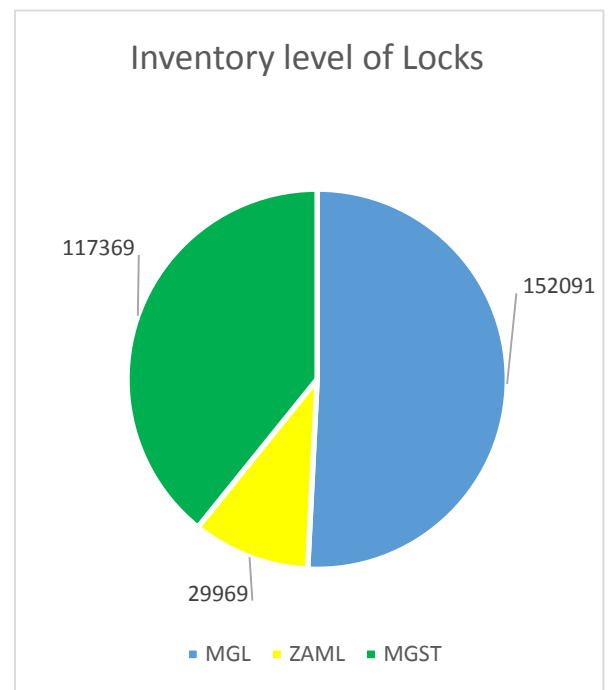

Figure 9: Diagram of inventory level of locks

As can be seen on the chart 'Inventory level of Real leather cords' which represents the inventory level of real leather cords by product groups, the company has the largest number of stock from real round nappa leather cords (nappa leather is a really soft leather made from cow or lamb by tanning), as the company believes this product is the most popular product, so that is why it keeps the most from it. The other chart, named 'Inventory level of Locks' shows that the company has the most from MGST (locks made of steel) on stock, then from MGL (lower quality silver/gold/rose gold plated locks) and it keeps the least stock from ZAML locks (these are silver/gold/rose gold plated locks).It is because the company has only 117 types from ZAML locks, meanwhile 601 types from MGL locks. However, these charts are only giving an overview on the detailed information what the company has.

Movement of the leather

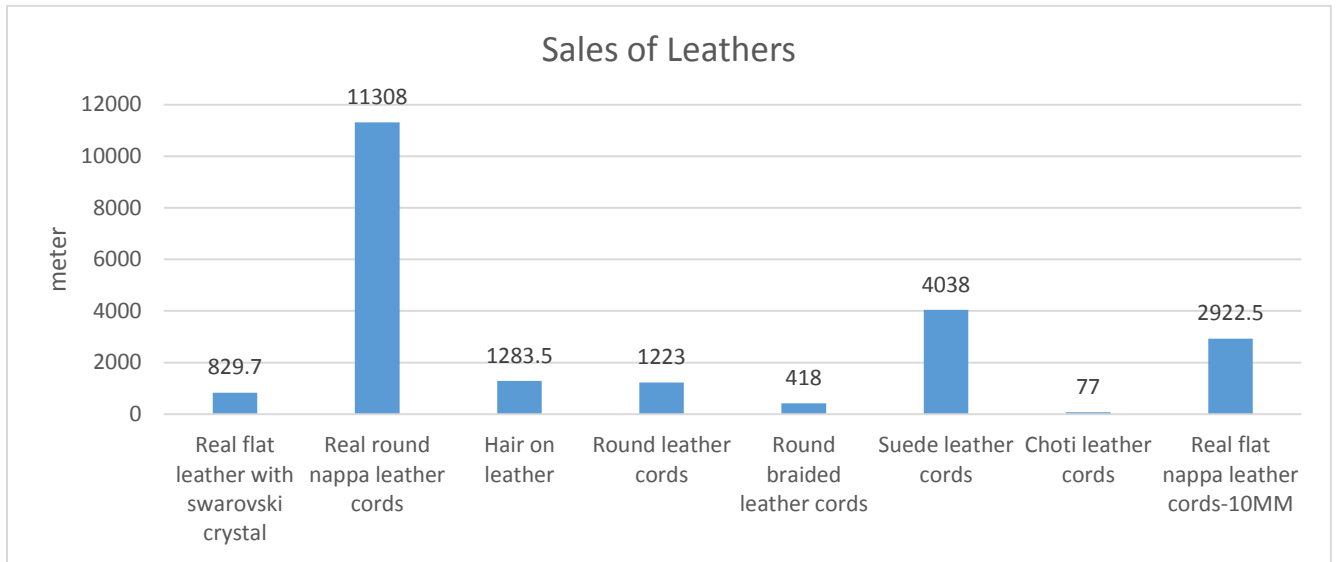The following charts show the sale of leathers from week 2 till week 9.

Figure 10: Diagram of sales of leathers

As you can see on the chart 'Sales of leather" the most sold product group from leathers is the real nappa round leather cords, the second is suede leather cords. The third is the real flat leather cord-10mm. So the company should focus on these 3 product type from the leathers, as the company will sell the most and earn the most from these products. However, it is not enough information for reordering, but this inventory system has the detailed information of goods sold (by color, type, size). The following chart is an example for this.

Figure 11: Diagram of sales of hair-on-leather-5mm

This inventory system provides information of the sales of every single product. As the previous graph shows the most popular product from Hair-on-Leather 5mm is the zebra color. It is beneficial to know the sales of the exact items for the company, because this information helps to make the right choice for reordering.

Movements of Locks

The company has the same detailed information of the locks. The following chart shows the first twenty most popular locks in the research period. As it shows, the most popular lock is the MGST-111-40*3.5mm-rose gold lock. The chart 'Sales of Locks' in the appendix shows the sales of the locks in the research period, the most sold lock type is the MGST locks.
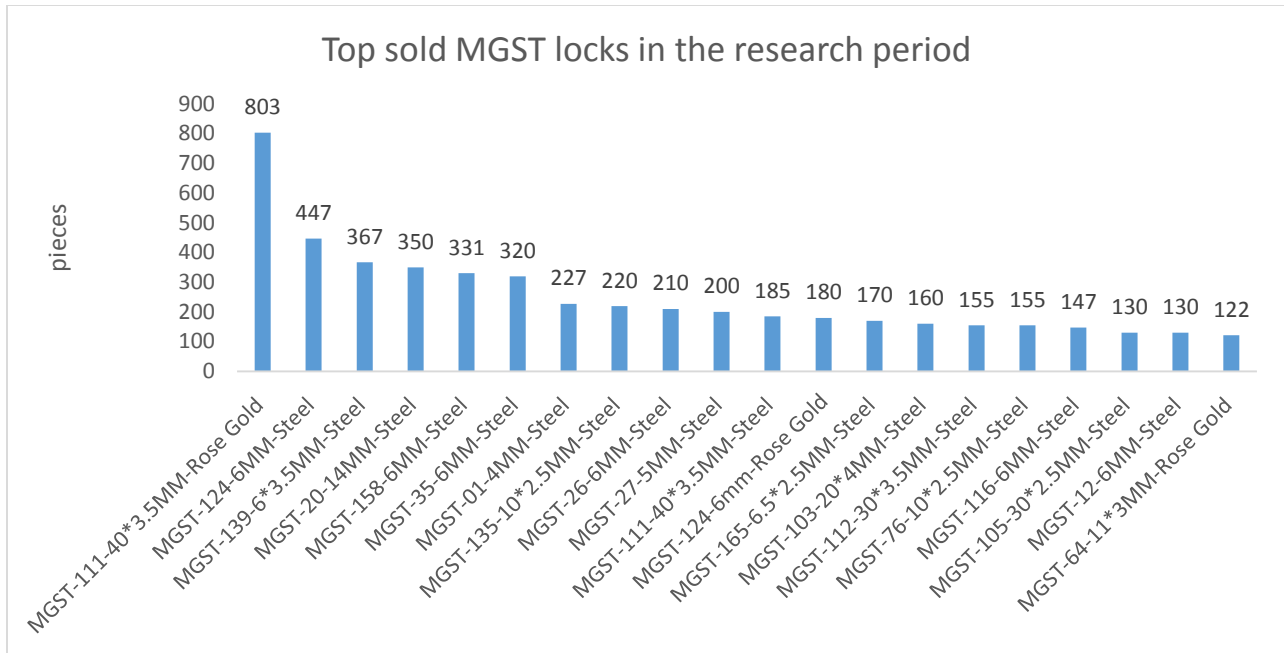
Figure 12: Diagram of top sold MGST locks in the research period

Reordering

The company decided to keep every type of lock on stock, because the tracking proved that the sales of the locks give a large part of the sales. According the findings, there was demand for almost every lock. But the size of the reorder differed lock by lock. From the more popular product were ordered more quantity than the least popular products.

The items were grouped to 3 groups by the size of the sales: popular, average and low sales items. The minimum quantity is 100 pieces for the popular items, 70 pieces for average, and 50 pieces for low sales items. When the inventory level of the popular product did not reach the minimum quantity the reorder was made. The minimum amount what the company can profitably produce 500 pieces.

	Minimum stock level	Size of the reorder
Popular items	350 pieces	500 pieces
Average sales items	200 pieces	500 pieces
Low sales items	80 pieces	500 pieces

Figure 13: Reorder points for locks

It was a bigger challenge to decide the reordering from the leather due to the extra-large variation of the products. The trends of the leathers are changing faster than the locks. However, the reorder was done by similar aspect than for the locks. When the inventory did not reach the minimum level then the reorder was made. The minimum quantity which has to be produced to stay efficient is 200 meters.

	Minimum stock level	Size of the reorder
Popular items	100 meters	300 meters
Average sales items	50 meters	200 meters
Low sales items	20 meter	200 meters

Figure 14: Reordering point for leathers

It was decided for the products which were not sold at all or just a little quantity that the company will stop producing and selling it. After the last product sold it will be removed from the catalogues.

Conclusion

A warehouse management and inventory system was successfully implemented for leathers and locks to find out whether the company is able to optimize the inventory level of these systems. The expected results were not fully confirmed during the period due to the short time-scale measured. However it already showed that the company benefits from these improvements. The warehouse management system created an organized warehouse where the employees and customers are able to find the needed items quickly and also generated free spaces for the new arrivals.

Inventory system enabled the company to know the current inventory level and the flow of the selected items. Moreover, it enabled the company to know the product's life cycle and popularity of the products. All of this information helped to make a better decision for reordering which were aimed to create an inventory which can fulfill the customer demand.

After analyses of the collected data, the company decided to carry every type of locks and leather on stock, as it gives the main part of the earnings and the demand for these items is quite similar. However, the goods were categorized into 3 groups by its popularity. The difference between these groups are the reorder point, the most popular products are reordered at a higher level of inventory level than the less popular items. As the minimum amount what the company can profitably produce is slightly high, the size of the reorder is same for every items without the most popular leather.

Some positive result of the implementation were already seen for the researched items, for example the waiting time for the items which were out of stock at the time when the order was placed was reduced by at least a week, because those goods were already under production. Even though the number of on time full deliveries has not been quantified due to the too short time period involved to make any findings statistically relevant, it has been observed and reported by the people involved that they have increased. The full on time deliveries cuts expenses in the way that the company does not have to pay for the extra shipping costs, and the employees spend less time on an order. Even though it has not been measured, it can realistically assumed that full on time deliveries will increase the satisfaction of customers and as it is known satisfied customers are more likely to make new orders. Therefore the company can increase its profit focusing on these systems.

If the company continue tracking the flow of the goods and use the collected information for reordering, then the company will be seen the result after a half year.

Recommendations

There is a definite need for a warehouse management system, because it created an organized warehouse, which is essential for a well-functioning inventory system. Moreover, it shortens the delivery time by finding the necessary product quicker. However, the inventory system is the one which provides the necessary information for reordering and serves as a warning tool when a product type reaches the minimal level.

All of the activities of these systems are interconnected so it is important to continue all to be able to reach the targeted inventory level. However, there are some other factors which could help to optimize the inventory level.

An accurate sales forecast can help to solve the challenges of reordering; therefore the company should create a sales forecast by using the collected data and study of the current fashion and the possible future trends. The sales forecast should be as accurate as possible in order to avoid losses, and it should be made for a short-period of time due to the violation of Fashion. Information of the fashion (current and future predictions) can be collected by asking the opinion of the designer and reviewing industrial publications such as journals, fashion shows.

Use of automatic identification would increase the level of accuracy and the speed of tracking of inventory movements and creation of packaging list. A major tool for this is bar coding, which is used by many retailers. Bar codes can be customized to contain all the necessary

information such as inventory and pricing information. Sun Enterprises could easily add bar coding to the inventory system, because the INFLOW software is compatible with bar code scanners.

The company should get rid of the large dead stock, because it is just increasing the inventory cost. It could be done by offering it in a lower price for the customers, or sending it back to the factory for raw material.

As it was described before, permanent employees could increase the level of success. They are more likely to work harder on the implementation of an inventory and warehouse management system since they could benefit from it in the future. They also can help to improve it as they get more efficient at their jobs through familiarity with the processes. Therefore Sun Enterprises should investigate employing a permanent employee, and hire more if it fulfills the expectations.

Lastly, the management should review the whole situation at the end of 6 months to see if the necessary improvements have been made and to see what financial savings have been gained. If the changes were successful, then the company should put all the items to the system.

Appendix 1- Inflow software

This software is designed to track products, movements of the products, inventory, orders, customers and payments. The products can be organized by locations and sub-locations and the costing method (FIFO, LIFO, moving average or standard costing) can be added to each product. Moreover it is compatible with barcode scanners and it can generate invoices, purchase orders, shipping documents and serial numbers, if it is needed. This database can be used by more people in the same time by using multi-user mode. Furthermore, it creates highly customizable reports for profit, costs, sales and backorders. (InFlow, 2014)

Appendix 2- Sales charts
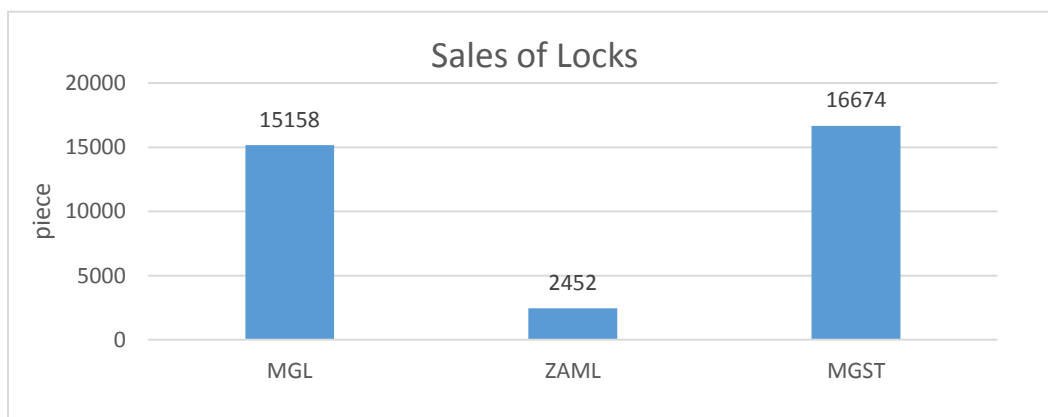
Sales of Round leather cords
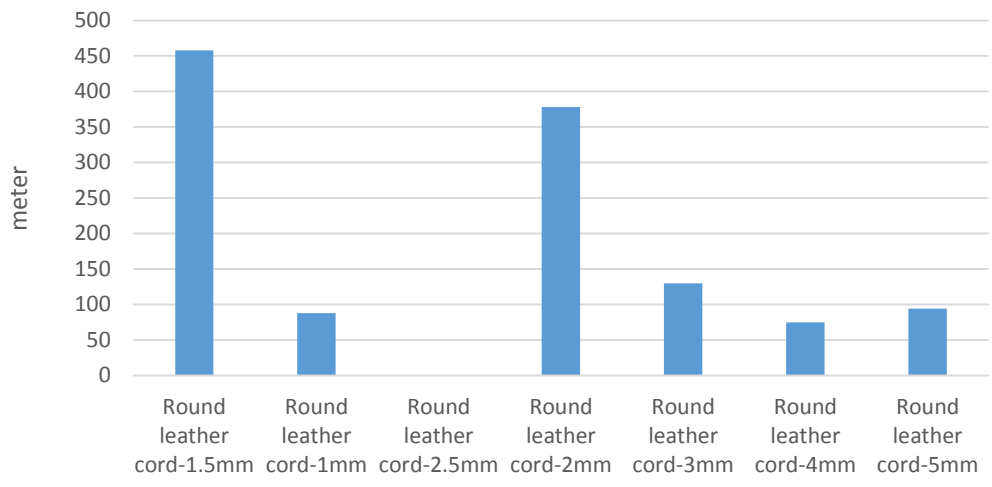
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