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Demand Forecast Process as a Part of Inventory Management

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TABLE OF CONTENTS

FIGURES

TABLES

1 INTRODUCTION

Nowadays, demand forecasting is becoming an evident part of corporations' activities. Firms need to be able to respond to the customer's need quickly and efficiently, if not the customer will find someone who can. Add to this, a company needs to be able to offer the greatest profit to its shareholders. It needs to be able to work at the minimum cost to gain the maximum profit. Usually, this means that inventory should not carry unnecessary items and the manufacturing should be organised in a way that the right items are made when needed and sent immediately after this, not left lying to the stock. Therefore, it is important to pay attention to the inventory management system that concentrates on finding the correct level of inventory that is sensible to carry in order to keep both the customers and shareholders pleased. When demand forecast is made correctly with a minimal forecasting error, it minimizes the physical inventory and replaces it with knowledge. In the end, this will lead to a situation where the firm is operating effectively and yet it is still able to offer its clientele good customer service.

This thesis is a case study of Teleste Corporation. Being one of the key companies of its own field Teleste Corporation needs to be able to answer its customers' demands quickly. It is working in an industry where technological changes play a big part and the competition is fierce. Consequently, there is no time to stand still. On the other side, being listed in the Helsinki Stock Exchange, the corporation is responsible to its shareholders. Thus, the firm has to act in the most efficient way to increase the profit. When a demand forecast is accurate, it can be seen as a tool for both of these matters. It offers the clientele timely deliveries but decreases the costs inside the company as well. The main focus of the thesis is in the demand forecast process that can be seen as a major source of information in the inventory management. Eventually, it should lead to increased product availability. These matters are closely related to the good customer service and efficiency of the company. Therefore, it is important to explore the demand forecast process and find its positive sides as well as the negative ones. The outcome should result in increased value offered to customers. This could be seen as a risen number of on time and faster deliveries together with higher profit for the shareholders.

The first part of the thesis concentrates on theory related to the demand forecast process that is conducted for a short and medium term. Additionally, it points out the importance of carefully made demand forecast as a base for inventory management which has an effect on the product availability. Second part includes empirical studies related to the demand forecast process in Teleste Corporation. It is mainly based on an interview made for two of the company's salespersons. Add to this, an email from a production planner and an information package from Teleste Corporation were received. The empirical part ends with an overview of the company's net sales, inventories and inventory turnover ratio. These are investigated to discover the efficiency of the inventory management. Then, in the conclusion a SWOT analysis for demand forecast process and inventory management is created. It collects the pros and cons together. Last part makes suggestion and introduces some ideas on how to improve the demand forecast process. Furthermore, it considers how it could be made more tempting to the creators in the future to take part in the process. In the end, it makes suggestion for further studies that could be made related to the topic.

1.1 Research Problems

The thesis has concentrated on two main research problems:

1. How can a firm enhance the demand forecast process?
2. How could a demand forecast process be made more profitable for the forecasters?

To answer the first question, the demand forecast process will be investigated closely to discover the problematic areas there. In other words, all the seven steps that are seen important in the creation process are explored. In the end, suggestions will be made on how the negative factors affecting the forecasting could be eliminated

In order to solve the second problem, the thesis concentrates on exploring the reasons behind negativity towards the demand forecast process amongst forecasters. They are the salespeople of the company but also, to some extend, the customers who occasionally give some input to the forecasting process. Therefore, the opinions of

salesmen about the success of the demand forecast process and the inventory management system will be researched. The matters that have previously caused irritation, like poor product availability, will be stated. Finally, suggestion will be made to increase the positivism towards the demand forecast process.

1.2 Objective of the Research

The research will focus on the creation of the demand forecast from salespeople's and customers' perspective. Due to the fact that production planning has a great impact on the availability of the end products and because the production planners have important duties in the demand forecast process, there will be parts including this area. However, to avoid making the topic too complicated, it has excluded procurement and finance and mainly concentrated on the end product forecasting. Additionally, the main weight of the research is put to only one of the business units of the company, broadband cable networks (BCN), and the other one, video networks (VN), is not investigated in this thesis. The reason behind this is that the units have different clientele as well as salespeople and production. Moreover, the forecast process is not identical. Then, the demand forecast process is explored from a short to medium term without a consideration for a long term forecast. The latter one impacts to different matters and requires its own forecasting methods and forecasters. The objectives of the long term forecasting differ greatly from the shorter ones. Thus, it is not included.

The objective of the thesis is to investigate the demand forecast process and its complex nature to be able to make it more efficient. It tries to offer the reader alternatives how the forecasting error could be minimised by stating the most common mistakes that can happen during the forecast process and mention some of the issues that might have an impact on the result. Consequently, it aims to show how these need to be taken into account in the process in order to improve different operations that rely on the information received from the demand forecast. The thesis aims to discover some of the possible defects of the forecast process in Teleste Corporation and suggest some improvement how their influence could be decreased. In the end, some of the basic element of inventory management will be investigated as they rely greatly to the demand forecast information and can be seen important to the product availability.

Additionally, the current efficiency of the stock will be explored by calculating the inventory turnover ratio and by creating figures stating the inventories compared with the net sales of the company. As a summary, the efficiency of demand forecasting process and inventory management are the key topics of the thesis.

2 DEMAND FORECAST PROCESS AND INVENTORY MANAGEMENT

2.1 Demand Forecast

A demand forecast is a central piece of the operations of a modern firm. It is a decision making tool which considers different factors and justifies decisions. The main idea is to make the prediction and estimations of the future demand and consequently determinate the potential markets for the product or services for the following period. It is important to understand what happens in the environment as well as know about the company's own activities. A demand forecast states the needed inventory that helps to overcome the fluctuations in demand. According to the information, a firm can start to plan its upcoming activities in a way that they can most efficiently transform their inputs into outputs. Additionally, a demand forecast enables a corporation to provide its customer higher value. It distributes the operations the information including the needed products and stock keeping units (SKU), their quantities and the facilities required to fulfil the future needs. This way, the firm can gain better profit as forecast offers them a chance to lower their costs. (Keath&Young 1996, 217-219; Rushton 2006, 213; Heizer&Render 2004, 105; Viale 2006, 29.; O´Connor 2000, 98)

To sum it up, a demand forecast creates a data bank that helps the decision makers settle targets, create plans and demonstrate the changes in environment. Moreover, it guides a firm to act in the best possible way to increase the efficiency without decreasing the service value offered to the customers.

2.2 Demand Forecast Process

There are a few general rules that should be kept in mind when considering the demand forecasts. It is important to remember that forecast is never correct; in stead, there is always some error. After all, the whole process is making prediction for the future, not knowing it. Yet, a demand forecast might be successful with a very small difference when compared with the actual sales. Generally, forecasting is divided into seven

different stages like it can be seen from figure 1. It is important to understand that forecasting is a system that is not only created once but in stead it needs to be made and maintained constantly. (Heizer & Render 2004, 105.; Frazelle 2001, 114-115.)

In the following part, all the different steps are introduced shortly in two chapters. Formatting of a demand forecast concentrates on introducing the matters that need to be considered before the actual creation of demand forecast starts. Execution of demand forecast explores the matters starting from the collection of data and ends to the revision of a forecast.

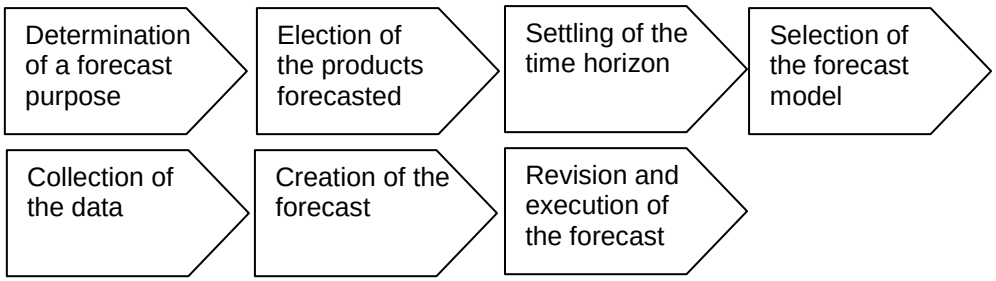

Figure .1 Demand Forecast Process (adapted from Heizer & Render 2004, 105).

2.2.1 Formatting of Demand Forecast

In this chapter the first four steps of the demand forecast process will be studied. As it can be seen from figure 1, these are the determination of the forecast purpose, the election of products which are being forecasted, the settling of the time horizon and last the election of the forecast model.

The whole process begins with the determination of the forecast purpose. It is good to know that different targets require different kind of information, some need to be more precise than others. Nobody wants to do unnecessary work while less would be enough. On the other side, too general information in a complex situation might not be sufficient. Therefore, it is important to be aware of the purpose of the forecast and the information requirements for it.

The election of the items included in the forecast follows next. At this point it is good to know that usually the fidelity of the distinctive product forecast is lower than the one made for product family. Consequently, the extension where to take the forecast should be carefully considered. (Simchi-Levi D, Kaminsky,P. & Simchi-Levi E 2003, 27.)

The time horizon for the forecast needs to be clarified to the forecasters. The forecasts can be made for a time period happening within the following three months or then it can be conducted to the one after ten years; the forecasts made to the near future are more precise while the ones made for further will be less accurate. When choosing the most proper forecasting method, a company should keep in mind that there are several different methods available. These differ in accuracy, complexity and costs as well as in the personnel required providing the different steps of the forecasting process. All of the methods are not suitable for all situations. The long term forecasting is commonly very general in nature and investigates demand as wholeness. Usually, it is conducted by the top managers. The targets of these forecasts are to discover the long term trend and turning points in demand. The decisions affected by these forecasts are related to the capacity planning and product life cycles. Medium-run decision might have an affect to the issues that will happen during the next half a year or even to the ones happening after three years. People who are creating the forecast are usually marketing and operations managers. The information that is used to make the decisions has to be accurate as it will have a straight impact on many operations. The need for a carefully conducted demand forecast is crucial. A short run forecast is the most detailed one. It needs to be accurate and precise. Actual sales order can be the source of data to this forecast. Production is planned according to this information and the procurement acts by following it. The people responsible for it are the low level managers. As a summary, when considering how a short-medium term forecast should be conducted, a company should concentrate on keeping it as simple, affordable and easy to implement as possible. (Summers 1998, 77-78.; Simchi-Levi D, Kaminsky, P. & Simchi-Levi E 2003, 27.))

After the baseline has been settled, the appropriate forecasting model is chosen. Characteristics of the target of the forecast settle limits that should be taken into account when choosing the method. In other words, a demand might be seasonal or it might be easily affected by a variable like a new technological invention. Both of these require their own way of forecasting. In some cases, the forecasters solely investigate the past data. Consequently, it is important to know if it is likely for the same trend to continue in the future or are there lots of random fluctuations that can not be predicted. Add to this, different states of product life-cycles might require different forecasting methods. For instance, it is wise to use judgemental forecasting for the new items as there is no previous data. In contrast, if a rapid growth in the sales is seen or when a product achieves its mature state, it is more common to investigate the time series data. Yet, it should be remembered that one forecasting method does not prevent the usage of another.

As one can see from figure 2, there are two different kinds of methods of investigating the future demand; quantitative and qualitative ones. Quantitative methods search for mathematical consistencies in the history. They can be divided in to two subcategories; time series model and correlation model. In contrast, a qualitative forecast is based on humans' judgements according to their past experiences, premonitions and emotions. Yet, the selection of the most suitable forecast model does not need to be based solely to either quantitative or qualitative ones; a combination of models from both approaches is often the most effective one. Forecasters should consider that the chosen methods are as accurate, costs efficient and facility as possible. (Heizer & Render 2004, 106; Summers 1998, 79.)

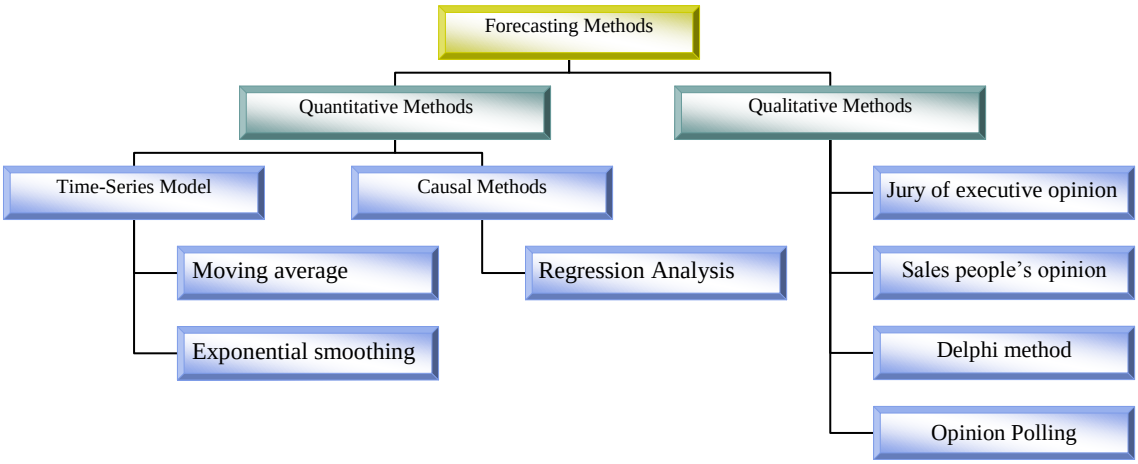

Figure 2. Demand Forecast Models.

There are several different mathematical analyses that can be used while creating a demand forecast. Some of them are more complex than the others. In its simplest form, a time series model, it investigates the past data without considerations about the other factors that might have influenced the demand. Yet, there is another way to conduct a forecast according to the past data, a causal model. It takes into account another variable that might impact on the demand and will therefore conduct a forecast by using this information. Due to this clear division, these models will be investigated separately.

A time series model is one of the cheapest and fastest ways to conduct a demand forecast. Moreover, it is easy to use. Yet, the simplicity of the method has its downside: as the model only concentrates on investigating the numbers it neglects the reasons behind the changes. In other words, it is naïve. Consequently, if a corporation decides to use this model it should constantly follow the progress of the data in order to notice the deviations and take actions according to them. The basic idea behind the model is that the past demand patterns will continue similarly and therefore it can be projected to the future. In this model, time is always an independent variable. Dependent variable changes according to the issue that is being forecasted. Therefore, in this case it is the demand. Then, there are four basic elements that a forecaster interprets from past periods. Firstly, trends appoint the upwards and downward of the general demand curve. Often, it is a linear curve or close to it. Secondly, seasonality is a data pattern,

fluctuation in the curves, which occur every year at the same time. Additionally, other repetitions of patterns that are taken a place in a shorten time period are called similarly. Thirdly, cyclical changes are patterns appearing in several years, for example, due to economic cycle. Finally, random variation is an unexpected change in the demand that can not be foreseen. It appears irregularly and the only thing that can be done is to measure the error in order to be aware of it in the future.

Moving averages is a simple and widely used method. It is suitable especially for situations where random fluctuation appears. The model computes the average of the decided number of most recent periods of data to solve the upcoming one. The correspondence depends on the number of periods chosen; the more periods there are included in the research the slower is the response. If sudden changes need to be seen quickly, the number of time periods should then be low. (Heizel & Render 2004, 108-110.; Summers 1998, 80-83)

$$MA: \frac{\sum \text{demand in previous n periods}}{n}$$

If a more sophisticated method of forecasting is needed, then a forecaster should consider an exponential smoothing model. It is often used when there are no bigger changes in the demand. It adds the previous forecast to the most recent error. Unlike the moving average, exponential smoothing emphasizes the most recent data. Forecast for the next period (F_{t+1}) is calculated by counting the difference between the last periods actual demand (A_t) and forecast (F_t). This error can be either positive or negative. Then, the error is multiplied by the chosen smoothing constant (α), which is a fraction between 0 and 1, and in the end added to the previous forecast. The bigger the fraction is the greater the change between the forecasts will be. A lower fraction offers stability to the forecast. (Heizel & Render 2004, 108-110.; Summers 1998, 80-87.)

$$F_{t+1} = F_t + \alpha (A_t - F_t)$$

Causal models investigate the mathematical relationship between demand and another variable, for example a price. This model takes more time and is more expensive than the previous ones. However, it provides a company information about the changes that will happen when the other variable changes. Still, finding a suitable variable is a hard task. One of the most common methods is regression analysis which aims to discover the function that could state the link between the causal variable and the variable. When doing this the variable, in demand forecast the demand, needs to be clarified and the causal one or ones. Then, it is necessary to discover lots of data points to interpret as it is not useful to start with this method if the number of data is limited. Finally, the relationships between the variables need to be cleared. It can be for example linear or exponential. (Friend 2004, 118-119; Summers 1998 85-87)

A judgemental view in the demand forecast process might occasionally be reasonable. Statistical methods do not always present the whole truth. Sometimes, important variables in the environment change dramatically and the influence of these can not be seen from the past data or then the data is not current or is otherwise inadequate. First of all, technological changes might have a huge impact on the activities of the firm or its competitor. Secondly, promotional activities like exhibition, shifts in pricing and product launches might cause some unpredictable influence on the sales which can not be found in the numbers. Furthermore, changes in the distribution channels might have an effect on the company. These kinds of issues that can't be judged by the statistics needs to be seen by experts who have the knowledge about the factors and their influence on the sales and over all activities. Usually, people who are responsible for qualitative forecasting are salespeople and managers who have the best information about the environment and market behaviour without the need to rely on the quantitative methods. They can predict how different factors might and will affect the future and they know how to act so that the corporation can continue to work in the most profitable way. (Boulton [13.9.2008], Answers Corporation 2009 [13.9.2008])

Jury of Executive Opinion is a panel consisting of corporate executives mastering in their own field. They gather to share their thoughts and ideas that result as a forecast. Depending on the situation, the members of the panel might be from inside a company

or consist of people from several companies. Forecasts are made during a few meetings where the experts meet, determinate the variables and share their expertise with the others. In the end, the forecast is made according to the knowledge received from these people. However, even thought the participants are experts the outcome might be suffering from bias opinions.

The view of individual sales people is another method that is constructed upon the expertise opinion. However, in stead of collecting the members of different business units together, it collects the data from the salespersons that are assumed to have the most recent and adequate information about the market environment and clientele. However, quite often the people appear to be biased: they either overestimate or underestimate the situations. Additionally, they might not be aware of the overall economic conditions which might have an impact on the sales. (Keat & Young 1996, 221.)

Sometimes it might not be reasonable to gather experts as the members of a panel might be affected by each other. The main idea behind the Delphi method is that all the people involved receive the same questionnaire including several questions which they should process independently. After the organizer has collected all the answers, the questions will be modified according to them. People will be asked to make justifications and explanations to some of their answers. Then, they hold a new questionnaire. In other words, the members never meet to negotiate but instead the decisions will be made according to the results of several questionnaires. The process will be over when the participant will not be willing to change their opinion. The greatest advantage that is accomplished by using the Delphi method is that when there is no hierarchy and group pressure people are more likely to give new and surprising views and ideas that would not even be discussed in a panel. The down side is that there might be some difficulties for receiving the answers. Furthermore, the results are based on predictions which might, in the end, be totally wrong. Additionally, the expenses might increase.

Opinion polling helps to recognise and understand the customer’s need by making an interview or making a written questionnaire. Instead of relying to the experts and

consults, the answers are got from the clientele, from a sample of population carefully chosen. Pitfalls in these cases are the selection of the correct sample population and the misunderstanding of questions. On the other hand, the recognition of a future trend can be achieved by using opinion polling. (Keat & Young 1996, 128, 221-222.; Routio 2005 [28.7.2008])

In short, before a demand forecast can be executed, clarifications and decisions need to be made in order to receive the best outcome from the process. Targets, items and the time horizon need to be clearly mentioned. Later, these issues will help to choose the most suitable forecast method for the purpose. After all the pre-work have been done, the following steps will be easier to conduct.

2.2.2 Execution of Demand Forecast

After the preliminary work has been done, the demand forecast team is then collecting the data required for the forecast. People who are responsible for doing this are commonly managers in some level or sales people who have the knowledge related to the markets and demand. The actual creation of the forecast takes place after all the parties have distributed their information. (Summers 1998, 77-78.)

A next step after the demand forecast has been created is to execute it. Furthermore, it needs to be revised. One of the most important parts of the demand forecast process is to investigate the forecasting error from the historical data. It is calculated by subtracting the forecasted demand from the actual sales. When this is resolved, it is easier for a company to compare different forecasting methods and choose the most suitable one as well as to discover the required stock levels. A rule of thumb is that the greater the forecasting error is, the bigger should the maintained inventory be to meet the customers' needs. For a certain period, the error can be calculated by taking the difference between the actual demand and the forecast demand. Add to this, there are other patterns that are used to investigate the forecasting error. Yet, the main purpose of the thesis is to see the whole process of forecasting and thus these will not be introduced here. (Viale 1996, 29.)

Forecasting error = Actual demand − Forecasted demand

2.3 Pitfalls of Demand Forecast

To avoid draw backs in a forecast it is important to recognise the most common mistakes that can be made while creating one. As stated before, demand forecast is always a guess about the future, not knowledge. Therefore, there are differences between the demand forecast and actual demand. Yet, the main reasons why the inaccuracies exist can be named.

The goals and their pursuit should be carefully considered. If a firm settles distorted assumptions and puts unreasonable targets, they will cause unfavourable results for the company in the future. As a general rule, it should always be kept in mind that all the presumptions should be based on information. To be able to meet the settled targets, it is sensible to understand not only the important matters inside the corporation but also the environment and the existing circumstances. Then, after the targets have been stated, forecasting should follow them without changes. In other words, issues like time structure and the projected target numbers should stay the same through the whole process. The operations that should lead to the targets should be coherent with the goals. The demand forecast should follow the managerial purposes at all times.

The denial of the error causes distortion. Getting feedback for the assumption and goals that have been settled will ensure that issues have been considered on each side and corrected if necessary. Yet, often, there is no single person pointed to be responsible for the accuracy. Therefore, a firm needs to ensure that the forecasting error is measured properly, interpreted and understood and it has to take actions according to the situation. It can be devastating to continue to do business that relies only on assumptions that can be distorted.

Bias can affect a demand forecast. It can be caused by a human nature seeking to profit the most suitable situation. In other words, forecasters might be over- or underestimating the real need in order to gain in another aspect of the business. Over optimistic assumptions result in a situation where the resources are tied in to wrong

places. In other words, the products moving with a slow pace will occupy the inventory. Add to this, a decreased profit margin will occur due to the over production. On the other side, inefficient deliveries will take place and the number of unsatisfied customers will increase when the assumptions are over pessimistic. Additionally, the real demand might not be interpreted correctly due to the situations when a firm hasn't been able to satisfy the actual need in the required way or when the demand has been overstated. These can be seen, for instance, from the numbers of substitutions, returns and back orders.

Ignorance of the information causes a firm to operate without considering all the possible matters that might have a great impact on its demand. Trusting too much to a single source of information will leave a demand forecast without different aspects. Therefore, it is not reasonable to neglect the opinions of different experts. As people are interested in different matters one thing that might stay unrecognised by one person will catch someone else's eye. On the other side, the firm should keep a close eye on its environment. The information there can concern the clientele, economic or industrial conditions, as well as marketing events. There should be enough data used in the analysis and moreover interpreted in a correct way. Yet, there should not be too much different kind of information used as in the end it might cause confusion. Without considering the effects of different information, a company might not recognise an upcoming shift in demand. To get a wider perspective about the situations it is wise to consider the issues from the past and present in order to draw a better picture about the future.

Supply chain ripple effect occurs due to the multiple parties in the supply chain that are distributing their own forecast through the network. It is evident that when a retailer gives a forecast to a wholesaler who makes one for a manufacturer the information will suffer. (Frazelle 2001, 114-115; BearingPoint [15.8.2008], L2S Inc 2000 [19.8.2008])

All in all, there are several matters that might distort a demand forecast. Some of them can be caused by human nature, like the denial of error, bias and the poor use of information. On the other hand, the supply chain ripple affect is caused by the long

chain of information distribution. Occasionally, the goals are not coherently chased. No matter what causes the error, it is important to recognise the different matters and try to do the best to minimise them.

2.4 Inventory Management

Inventory management could be defined as the activities that aim to make the holding of inventory as efficient as possible with the lowest possible cost in order to receive the greatest profit. Yet, this can not happen in the expense of the clients: their needs should still be fulfilled without delays and a company should even be able to offer them increased customer service. In real life, the way to achieve this is to replace the physical inventory with current and trustworthy knowledge that can be achieved through demand forecast. Determination of the required inventory against the forecasting error, unexpected demand and changes in supplier deliveries, can be seen as an important task of the inventory management. It should enable that production and procurement could work in the best possible way without facing delays due shortages. The planning of these activities is highly leaning on the data received from the demand forecast. If the information is incorrect and misleading, the consequences will be harmful. In stead, the outcome should lead to a situation where the return of inventory (ROI) and return of assets (ROA) would be enhanced and become favourable to the corporation. (Viale 2006, 3;)

The following part of the thesis will aim to point out the importance of demand forecast and physical stock to the inventory management. Additionally, it will discuss the efficiency of the inventory as well as demonstrate the costs related to it.

2.4.1 Purpose of Physical Stock and Demand Forecast

If the general guideline of today's inventory management is that the physical stock should be replaced with information, one might wonder why to even have any stock at all. Yet, there are some important reasons why it is being carried. One of the biggest reasons is the fluctuations in demand. A well-planned inventory management system

together with the demand forecast aims to solve how it should be overcome. In other words, these activities try to discover the forecasting error and plan how to buffer against it. In the following part, the importance of the demand forecast will be discussed together with the purpose of stock to different operations of a firm, to procurement, production and customer service. All of them are linked to the matter why there should always exist some stock to increase the customer service and efficiency of a firm.

A firm can not only pay attention to the upcoming needs of its customers. In stead, it has to be able to understand the impact of the orders for the procurement in order for them to improve the deliveries coming from the suppliers. Purchasing department needs to concentrate on reducing the inventory levels. When a company knows about the future sales orders, it is able to purchase the needed components for them at the right time in correct quantities and, in contrast, avoid having unnecessary items in stock. Yet, procurement is not always able to act according to the philosophy of replacing an inventory with knowledge. Reasons behind this are that purchasing departments aims to work in the most cost-efficient way which might not always follow this guideline. Bulk discounts as well as the high transportation costs and price fluctuations drive the buyers to order greater quantities. Therefore, in the case of procurement the handling of inventories is not unambiguous. (Viale 2006, 5-6.)

The productivity can be increased through a demand forecast. A forecast provides a company with the knowledge about how its production and capacity should be planned in the best possible way. There are numerous parts that need to be conducted when designing a production process. It all begins with demand forecasting and therefore all the other upcoming activities will be designed based on the information received from it. Therefore, a demand forecast should state as accurately as possible the products, quantities and schedules that the customers will need in the future. Second part of the process is the capacity planning. The company has to be aware of the required resources that are needed to be able to fulfil the future demand. As capacity planning might be a long term investment, they are expensive and hard to be changed. Thirdly, production facilities need to be located in a place where the costs will be minimized without decreasing the efficiency and quality. These costs consist of matters that occur

regionally, like labour and energy; transportation cost, taxes and the availability of raw-material. Fourthly, to be able to act in the most efficient way, the facilities need to the organized in the way that all the needed operations are close to each other. The purpose of this is to be able to decrease the expenses, make the operations moving smoothly and efficiently. Finally, when everything else has been organised the production needs to be scheduled. All the needed items should be delivered to the customer in the required time in right quantities. Thus, the avoidance of outage and delays can be seen as one of the most important reasons to hold a stock. Demand might not always be steady but in stead there might be fluctuations over time. Moreover, occasionally the supplier might have some problems that will appear as longer lead times. It is essential to make the production run as easily as possible and therefore it is important to have spare parts and semi-finished products to cover unwanted situations which result in a delay. Yet, it should be kept in mind that products might become obsolete and thus the inventory should be carefully considered. On the other hand, it is good to keep in mind that, generally, it is more efficient to manufacture larger lot sizes at once without paying attention to the excess inventory. In other words, the production cost is one issue that should be monitored as the set-up cost of machines might be high and consequently in order to keep the unit cost as low as possible it might be reasonable to manufacture bigger lots. (Viale 2006, 5-6.; Schutt 8-9; Boveé 2001, 180-185; Rushton 2006, 198-199.)

Inventory and a demand forecast have an influence on the customer service. It is vital to maintain the clientele and therefore it is important to know about them and their future. By finding out their plans, opinions and ideas a firm can ensure that it will recognise their upcoming needs and be ready to satisfy them efficiently. Consequently, it is sensible to have some inventory to enhance service. In the modern markets, time is an important factor. To be able to fulfil a customer need immediately might become the winning factor in business. A good customer service requires a few basic elements to be able to achieve and maintain the required level: accurate demand forecast, solid and unmodified customer orders and consistent account management. However, this is not always the case. Therefore, there is a great importance of buffer stock against the difference between supply and demand. A proper demand forecast together with

reasonable buffer stock would ensure that the inventory would maintain its value; production costs would be low and in the end the profit margined would get higher. When all the planning is executed in a sensible way, the business strategy can be followed and the customers will be given the promised service. Lead time will be steady and the products will be on markets when promised. Furthermore, the inventory management will be enlightened as the product flow will be steady. In contrast, if the capacity has been wrongly used resulting in a shortage of inventory, unsatisfied customers will cause extra work in the customer service due to the increased contacts which will require procedures afterwards. (Viale 2006, 4-6, 29.; Schutt 2004, 8-9.)

As a summary, inventory management resolves the conflicts that occur when the requirement of good customer service and the pursuit of the cost efficiency meet. It aims to discover into which level these both can and should be taken in order to receive the greatest profit in short as well as in a long run. Demand forecast aims to guide the production planning in a way that machine capacity would avoid unnecessary production. Moreover, it would lead to a lower holding of inventories and release space and assets reserved for it. If the forecast is not truthful, a company might end up in a situation where the inventory is holding wrong quantities of items which might become obsolete or, in contrast, face lack of material availability. It is important that the production has all the necessary raw materials available when needed and the amount of under or overloading of the machines as well as inefficient usage of the employees is minimized. Finding the balance is crucial. An accurate forecast creates a chain of matters that would be profitable for the company: with only a little forecasting error a company could maintain a lower inventory and still be able to offer the required customer service level and avoid heavy costs in manufacturing and logistics. Thus, when planning is conducted well, the costs will be minimised as the last-minute services from procurement, transportation and manufacturing won't be needed. There will not be any unnecessary binding of assets as the flow of products from raw material to the end customer will be steady.

2.4.2 Inventory Costs

Being one of the greatest costs of logistics it is useful to understand the different parts of the inventory costs. One of them is holding costs that consist of the following parts. Firstly, the biggest one of these is the capital cost. It represents the amount of money tight to physical stock held and additionally the opportunity cost that is seen as the resources that are tight to the inventory assuming that they are in the most profitable usage, in other words, the firm would not profit more if it was tight to another place. Secondly, service costs can be seen as the ones including stock management and insurance. The more a company holds the inventory, the greater are the expenses. Thirdly, issues like space, handling and associated warehousing costs can be labelled under the storage cost. Finally, there is the risk cost against obsolescence, destruction, theft and lower quality items. These four different costs could be seen as the holding cost of inventory. Yet, there are still some other ones. The reorder cost includes matter like order raising, communication, delivery and receipt, all the activities that are needed to get a product to a plant. Setup cost on the other hand involves resources used for manufacturing a particular product for a company. The larger the lot size is the bigger the profit will be. Last, the shortage cost refers to the loss of customer order which might, in the end, have an affect to the overall relationship and company's reputation. (Rushton 2006, 204-205.)

As a summary, there is lots of money tight to the stock. Minimizing the stock enables a firm to avoid an unnecessary binding of capital that could be used elsewhere and additionally ensure that the resources won't be lost.

2.4.3 Efficiency: Inventory Turnover Ratio

As stated above, the inventory carries lots of expenses. Therefore, it is important to keep a close eye on the efficiency of it. The inventory turnover ratio is a financial tool that aims to discover how many times per a time period company's inventory is sold. Generally, it is seen that the bigger the given value is the better. Yet, all the received numbers should be compared with the industry average. There are two different

formulas to calculate the value. First one is net sales divided by inventory. These values are easy to find in a company's balance sheet. Another way to calculate it is to find out the cost of goods sold (COGS) and divide it with the average inventory. As the COGS includes the material value of the sold items in stead of the number received from the selling price, it might be reasonable to use it occasionally.

Even though the inventory turnover ratio should be compared with the industry average it is good to understand the possible reasons behind periodical changes. If the value of the ratio is low, it often implies to low sales and to too big inventories which might be a result from overstating demand forecast. Procurement might need to purchase raw material in bigger lots or then it is just inefficient. Yet, the company might be working in an industry where the stock plays a big part or then it is service orientated. In contrast, a higher ratio can be seen as bigger sales. However, it can be a sign from the inefficient procurement or poor product availability. Investopedia [15.3.2009]; Fields 2002, 88, 92-93.)

All in all, the efficiency of inventory should be monitored. This can be done by investigating the past numbers. Yet, it might be reasonable to see how the other firms in the industry are working. Together these two activities enable the more efficient holding of inventory.

3 DEMAND FORECAST PROCESS AND INVENTORY MANAGEMENT IN TELESTE CORPORATION

3.1 Background of the Company

Teleste Corporation is a Finnish technology firm. The company was established in 1954. Today, Teleste Corporation has three production plants; in Nuosiainen , Littoinen and Suzhou. In 2007, it had more than 672 employees. Company has been listed in the Helsinki Stock Exchange since the year 1999. Company's revenue was 125.1 million euro in 2007, over 90 % coming from the exports. Nowadays, Teleste Corporation is divided into two main business units; broadband cable networks (BCN) and video networks (VN). Broadband cable networks offer digital video and broadband access network solutions for cable operators, telecommunication operators and distributors. In 2007, most of the firm's income, 86%, came from BCN. Video networks concentrates on digital transmission systems offering solutions for public sectors and selected industries related to surveillance, traffic monitoring and security. Both business units are market leaders in Europe in their own field but the target is to become one of the top three in the whole world.

In this research it was decided to concentrate mostly on the business unit of BCN. Often, it is further divided to two sub units; HFC Networks and Services (HFCNS) and Digital Video and Broadband Solutions (DVBS). As they have some differences in the demand forecast process, they will be partly distinction between them in the research.

3.2 Methodology

A case study is a research of a company, group, individual etc. In business studies, it is common to investigate a corporation and the named existing factors. In other words, often a phenomenon is being researched. Information is mainly collected using interviews and historical data. A case study combines the presented theory to empirical

studies. It aims to investigate a topic from different dimensions and make conclusions according to the study. (Ghauri P. & Grønhaug K. 2002, 171-173.)

The main purpose of the thesis is to explore how the demand forecasting process is made in Teleste Corporation and how it affects the company's inventory management, especially to the availability of end products. The thesis tries to demonstrate how the corporation increases its efficiency and customer service by conducting a well-organised forecast process. The most suitable way of doing it was a case study that goes deep into the firm's forecast process and inventory management to find the problematic parts there. After discovering them, the main idea is to point them out and suggest alternative activities to correct them.

The research will be based on qualitative methods. Interview, email and an information package related to the demand forecast process in Teleste Corporation were used as primary sources of data. Reason behind choosing these two different groups, interviewees and email contact, was that they are all important parts of the demand forecast process and consequently have created opinions and ideas about the matters according to their experiences. Yet, their activities differ from each other and they both have their own interests in it. Thus, it was interesting to discover their ideas about the process and its fluency from their own point of view.

An unstructured interview was held to two of the company's salespeople. Open questions served the purpose in the most convenient way as the main idea was to solve people's opinions about the matters near demand forecast process and inventory management as well as give them the liberty to express their own ideas and feelings. In this way, the discussion could reveal thoughts that would not otherwise be considered. The group interview was held on the 4th of July 2008. Attendants were the interviewer and two of the corporation's salespeople, Juha Pihkanen and Timo Lummejoki. The interview was held face to face. One of the respondents is responsible for the sales of broadband cable network systems nationally while the other interviewee is doing business in the Baltic States and Eastern Europe in the same field. They both have several years behind in Teleste Corporation and therefore they are familiar with the

company's policies. Their clientele consists mainly of cable TV operators and distributors. As they were both located in the firm's main office in Littoinen the interview took place there. For them, it is important to have the needed items in stock when clients require them. This way they can offer them the best service and ensure that the clients will order again. On the other side, they have the best knowledge about the clientele. In the demand forecast process they are in the part of information collectors and distributors and thus they are aware of the difficulties of interpreting and collecting the data from the field.

An email was sent on the 29th of December 2008 to one of the company's production planners, Heli Lehto. The main duties of hers in the demand forecast process are to receive the forecasted numbers, implement them into the enterprise resource planning system (ERP), plan the upcoming production works according to them and calculate the forecasting error before distributing it to the business units. Consequently, many of the duties of a production planner are linked to the forecast process and the rest are closely affected by it. All in all, the interest of these two groups, salespeople and production planner, occasionally conflicts. Often the salespeople try to do their best to satisfy their own clients while production planner needs to see the whole bigger picture where they need to answer several people to keep the manufacturing as efficient as possible. Therefore, it is reasonable to investigate the matter from both sides as it increases the validity of the research.

The topic of the research package was the forecast process description in Teleste Corporation. It was created by a controller, Lauri Rantala, the 14th of July 2007. The main purpose to use this was to create an overall picture about the process. Furthermore, it was easier to conduct the questions to the interview and email when the bases of the process were familiar. Additionally, it was reasonable to discover if the process were satisfactory and followed as stated in the information package in the forecasters' opinion.

The reliability and validity of the thesis can be argued as it is highly based on the interview with the two salespeople. As they only present a small portion of the total

number of salesmen, their answers can not present as an overall view. They have created their own opinions and might be unwilling to consider other aspects. Then, the critical situations in the near past might play a bigger part in their answers than the over all success of the demand forecast process. Moreover, they might not be aware of the overall activities and problems of the demand forecast process and are thus unable to consider these factors in their answers. Therefore, the main purpose to include the production planner in the thesis was to decrease this and give another perspective to the research. These two groups give balance to each other's answers. Finally, when interviewing people, it is easy to receive bias answers. The salespeople are mainly interested in satisfying their customers and consequently they will give their answers accordingly.

In the end, a SWOT analysis will be conducted according to the investigated material. It represents a business strategy both from inside the company as well as from the business environment. Strength (S) and weaknesses (W) shows the internal issues existing in the operations. Opportunities (O) and threats (T) in turn present the external matter that might have an impact on the company's performance. (Wall 2004, 228)

As stated in the theory of the thesis, demand forecast process generally includes seven different stages. In the following part it will be discovered how these are handled in Teleste Corporation.

3.3 Demand Forecast Process in Teleste Corporation

As it can be seen from figure 3 the business units commonly create the demand forecasts. There the main actors are salespeople, business controllers and product managers. After different steps of forecasting are taken, it finally reaches the production planning. The production planner inserts them into the system and starts organising the production orders accordingly. After the customers have sent their orders the production planner calculates the forecasting error and reports it back to the business units for further action. However, a demand forecast process does not have a homogeneous way of moving in the company. In one business unit, the correspondents may differ as well

as the time horizons. These two matters are seen frustrating amongst the salespeople. Moreover, lack of sensible forecasting instruction has increased the difficulties. It is found that written rules would be helpful to enhance the process. Additionally, salespeople find that there should be a better support system for them to make the demand forecasting easier. In stead, now there is confusion due to the varying characteristics and often changing forecasting rules. (Rantala 14.6.2007; Lummejoki & Pihkanen 4.7.2008)

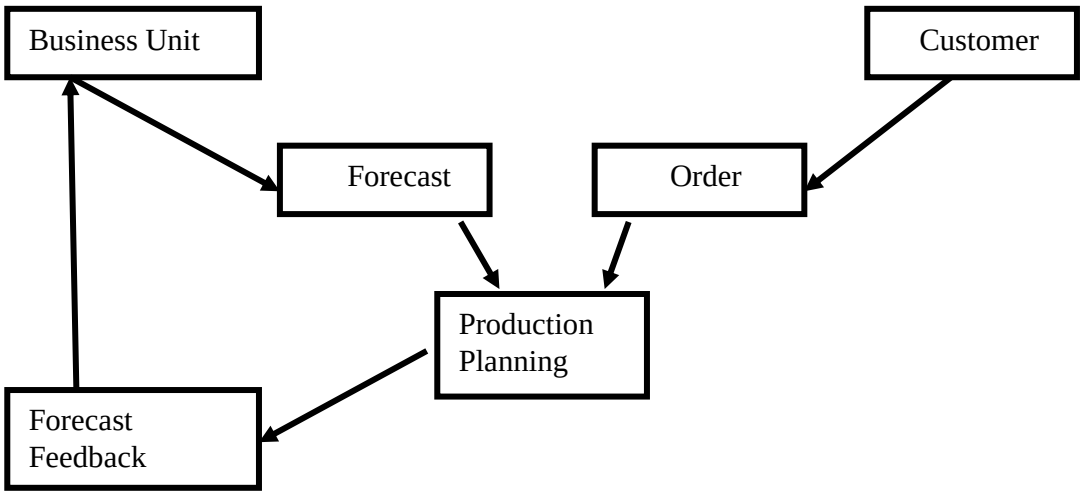

Figure 3. Demand Forecast Process in Teleste Corporation (Rantala 14.6.2007)

3.3.1 Formatting of Demand Forecast in Teleste Corporation

According to the material received from Teleste Corporation the company has three main purposes that it aims to achieve by creating demand forecast. Firstly, to be able to serve the customer better, the firm has recognised the importance of delivery times of the products. To be able to increase the required level of service the company tries to make the delivery times as short as possible. Secondly, the availability of the products is another important issue that Teleste is trying to maximise. Therefore, it can be seen that time is a crucial element in the operations of Teleste. Finally, even though fulfilling the customers' needs as efficiently as possible is seen important, it should be kept in mind

that this should not be achieved on the expense of the company. The capital should be tight to the correct places so that the stock levels would stay as low as possible. Consequently, the third target of Teleste is to enhance its cost structure. As a summary, providing the clientele accurately on time deliveries of quality products and enhance the product availability without increasing the overall total cost of the company can be seen as the purpose of the forecasting process in Teleste Corporation. To make the targets more tangible the company has settled some numeric goals to pursue: the overall cost decrease by 7,5 %, the inventory of raw material obtains 6 and forecasting accuracy +-15 %. (Rantala 14.6.2007)

The selection of the forecasted items is not a simple task. In the case of Teleste Corporation, the company has not only standard products but in stead they manufacture configurative items. Therefore, if Teleste forecasted all its products, including different configurations, the number of the forecasted items would rise to several thousands. At the moment, the company is creating forecasts for approximately five hundred different products. The items that are not forecasted are mainly the rarely sold ones or the products that include very expensive components. In these cases, the lead time of a product is the lead time of the hardest got components of the items plus the production time. In a standard case, salesmen are not creating any forecasts for the configurations but instead they only forecast the basic trunk of a product. When two of the salesmen of the company were asked about the forecasted items, they found it reasonable to narrow the products to the basic trunks. The main reason for this was that forecasting would get much too complicated if they needed to forecast the configurations. However, when asked about the same issue from a production planner, she thought that it might be good to receive final configurations. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008)

The time horizon for the forecast can be done for short-, medium-, or long-term. In this thesis it was decided to concentrate on investigating forecasting in a short-medium-term. In the case of the most general amplifiers, the salesmen give their forecast quarterly in the HFCNS. In the DVBS unit they make their forecast monthly. Yet, if there is a sudden potential bigger deal on the horizon the salesmen inform this separately. The forecasts for little items, like plug-ins, are taken only from the sales

history. The production planner finds out from the ERP about the past six months sales. The numbers received are then divided by six and the result is the forecasts for the following months. These forecasts are updated every three moths. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008)

Teleste Corporation uses both qualitative and quantitative methods when creating a demand forecast. When talking about the chosen forecasting methods, it is quite common to rely mostly to the information received from the history. This is the case in the firm. According to a production planner, they are investigating the past sales of the products every three months from the ERP system. By using this information, they create the production plan for the upcoming period. On the other hand, there are a few qualitative methods used in demand forecasting. The view of individual sales people is one of the most common one used in Teleste Corporation. The salesmen create their own forecast. These are mainly based on the historical demand data received from the business controller. Together with this information and the information that they receive from the field they create their demand forecast. These are then pasted forward to the business controller in HFCNS and to product managers in DVBS. Occasionally, there are some forecasts received from the biggest clientele as separate wholeness. After salespeople have distributed their forecast to the business controller or to product manager, he makes his own changes to them according to the knowledge about the markets. To make some kind of prediction for the final products, in other words about the configurations, the production planner needs to take an overview from the ERP system. These are divided into the basic trunks forecasted by the business units. Yet, the opinion of sales people is not the only qualitative method used in Teleste Corporation. In both business units, after the demand forecasts have been collected together arranged a panel is arranged where people discuss about the received numbers. It is possible that if a clear answer and justification are not received to some demand number the forecast will be modified. Therefore, it can be seen that one of the methods used in Teleste Corporation is the jury of executives. (29.12.2008; Lummejoki & Pihkanen 4.7.2008)

To sum it up, the company uses methods like moving average, sales people’s opinions and jury of executive opinion for demand forecast. In special cases, the demand forecast

might be received straight form the customer. In other words, occasionally opinion pooling is used as a tool. Therefore, the company is not relying on one forecast method but in stead aims to achieve the greatest advantage by using numerous ones, both quantitative and qualitative methods.

3.3.2 Execution of Demand Forecast in Teleste Corporation

Collection of the data requires the efforts of a few different parties. As stated above, salesmen creates their own forecast. They get their data from the historical information received from the business controller. They can see their past orders from the Customer Relationship Management (CRM). Add to this, they might get some input from their clients as well as know some general information about the markets. Next, the production planner receives the historical data from the ERP system. This data includes the actual bulk sales and the number of the same items sold as a part of a configuration. This information is then delivered to the business units where the people in charge, in other words business controller or product manager, modify the collected demand forecasts according to their own knowledge and past sales. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008; Rantala 14.6.2007)

Creation of a forecast is mainly the duty of business units. There the main respondents are the salesmen, product managers and business controllers. Depending on the business unit the distribution of a forecast varies a little. In the case of HFCNS, a business controller makes an overview from all of the forecasts received from the salesmen and pasts it to the production planning. On the other hand, the forecasts for DVBS are created by the salespeople who then past them to the product managers, not to a business controller. Sometimes they are in the form of excel sheet. Yet, occasionally forecasts need to be distributed to CRM. After all the forecasts have been created and past to the operations the people involved gather to talk about the result. If some peculiarities rise in the numbers, they need to be justified and explained. Then, the agreed data is inserted in to the ERP system by production planner and upcoming works are planned accordingly. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008, Rantala 14.6.2007)

Revision and execution are the duty of different parties. Salesmen need to correct their numbers if they are aware of any sudden bigger change. On the other hand, production planners monitor and compare the forecast with the actual sales. This information about the forecasting error is then forwarded back to the business units who can then take it into account in their future forecast. The forecasting error is calculated by taking the number of forecasted items minus the shipped items of the period. Lately, due to the uncertain situation, the forecasting error has not been decreased. People are afraid to give their forecast and therefore the numbers are not matching. All in all, the sales people find that the production is too dependent on the forecast. For them, it would be more sensible to have chance to answer a bigger number of an unforeseen demand. This way they could offer their customers better service. On the other hand, another problem was that the flow of information was not totally satisfactory which made it sometimes harder to create forecasts for the upcoming period. The salesmen found that the feedback did not reach them constantly. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008)

3.4 Special Cases of Demand Forecast

There are a few cases when the demand forecast process differs from the standard one. Some of the Teleste's most profitable clients act in a project basis. In these cases, the salesperson gets a forecast from the client and distributes it to the operations. The clients have often limited the number of a different configuration and thus they can more easily deliver demand forecasts for configurations. Generally, these clients are getting the best treatment, occasionally in the expense of the other clients. Yet, to some extend this special treatment can be seen justified as they create large parts of the firm's income. In theory, forecasting a project is easier; when starting a project, the client is aware what is needed, how much resources they have available to use for the project and within which time structure should issues happen. Add to this, some of these projects have their own stocks in the ERP system and therefore they are more likely to get their orders on time. In other words, the products of the project customers are manufactured to their own stocks and therefore the other clients are not able to receive

them. In ERP system, the forecasts are inserted separately for them as the production orders follow mainly the forecasts. However, it is good to know that even if a company is acting on a project basic it does not always mean that their demand forecast is with minimal error. In the case of Teleste Corporation, one of their clients is this kind of ideal player but there are others that do not order according to the forecast. In stead, it may order other products. This will cause not only extra left over inventory but cause lots of disturb in the manufacturing department. In the worst case, the goods will still need to reach the customer on time and therefore the company needs to use faster delivery service on its own account due to the important position of the client. (Lehto, 29.12.2008; Lummejoki & Pihkanen 4.7.2008)

3.5 Demand Forecast in the Customer's perspective

The interview with the company's salesmen revealed some interesting points about the attitudes toward the forecast process when investigating it from the customer's side. First of all, the customers are not eager to give a forecast to the company without gaining some greater advantage. During the past a few years, the company has not always been able to offer all the clients' solid delivery times even though they had forecasted. Usually, the projects and the most profitable clients have overtaken the others. Therefore, the clientele is not keen on making a binding forecast. Yet, they occasionally place their sales orders with a delivery time after three to four months which can, in a way, be seen as a forecast. Secondly, there are some differences in the attitudes of the companies working in East Europe and West Europe when talking about forecasting. The western clients are more organised. They plan their future activities further and are more capable of telling about their upcoming needs. In contrast, Eastern European customers are more complex, their demands are often unforeseen. Moreover, it appears to be that the clients working in East Europe are not that willing to expose their plans to the outsiders. Thirdly, the interpretation of the forecast differs geographically. The clientele in Western Europe sees a forecast as a forecast, a prediction of the future. Yet, the companies in Eastern Europe can not separate the difference between demand forecast and sales order. If they are not able to fulfil their forecast, they think that they loose their face. Therefore, they are afraid to give a

demand forecast. In conclusion, people located in different parts of the world do not see matters in a univocal way. The understanding about the word differ and therefore the demand forecasts are not seen similarly everywhere which makes is more complicated for the salespeople in Teleste Corporation to interpret them. However, one issue is sure, no matter where the customer is located or which culture it represents it will not give a seriously taken demand forecast without better service, i.e. Teleste Corporation needs to be able to offer good and solid delivery times for them. (Lummejoki & Pihkanen 4.7.2008)

3.6 Inventory in Teleste Corporation

In order to investigate the inventory in Teleste Corporation it was decided to calculate inventory turnover ratios for the past a few years. The selected years were from 2005 to 2008. The figure 4 is representing them. The values there were calculated by dividing the annual net sales of Teleste Corporation with the value of the inventory.

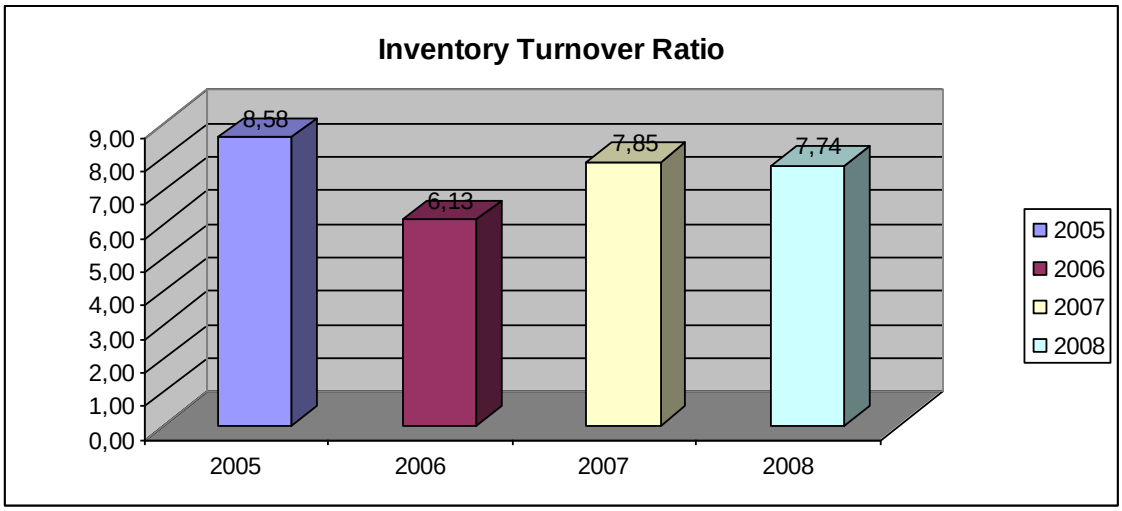

Figure 4. Inventory Turnover Ratios in Teleste Corporation

To investigate the numbers and reasons behind the inventory turnover ratio it is reasonable to add figure 5 stating the net income and ending inventory of the years

2005-2008. In the following part, the time period will be investigated shortly and then compared with one of its competitors in the same field.

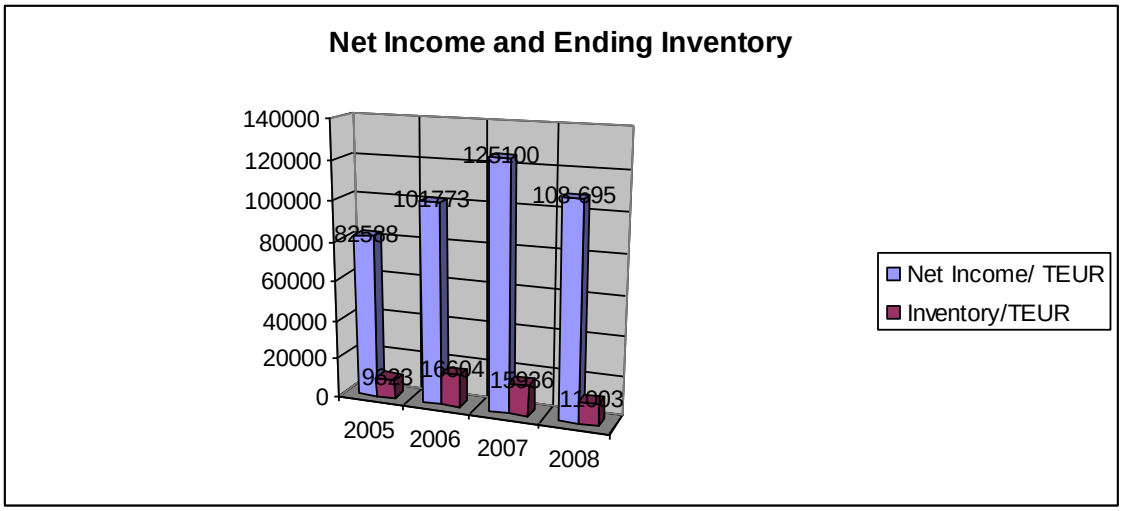

Figure 5. Net sales and Ending Inventory in Teleste Corporation

In the year 2005 the sales of the company were 82.5 million euro. It held an inventory worth 9.6 million euro. At the time, inventory turnover was 8, 58. In the following year 2006 the ratio fell to 6, 13. Even though the sales were increased to 101, 8 millions euro it did not follow. The value of inventory was increased by six million which causes the decrease of the ratio. In the year 2007 the sales reached its peak at 125.1 million. Due to the decrease in inventory, at the time value 15.9 million euro, the inventory turnover ratio increased to 7, 9. At the point, it is noticeable that the value of inventory was even lower than the one in the previous year even though the sales were much higher. Finally, in the year 2008 the sales decreased closer to the ones that existed in 2006 than the one previous in year. The inventory value was lowered to 11.0 million euro that kept the inventory turnover ratio still above the one from 2006, in 7, 7. As a summary, the company has positively increased its inventory turnover since the year 2006. This can be due to the increased sales and enhanced inventory management. Yet, it can be that the careful demand forecast has decreased the inventories and therefore items are not piled in stock. (Annual Reports 2006, 2007 & 2008)

When the firm's inventory turnover was compared with one of its competitors, Cisco systems Inc, it was revealed that Teleste Corporation's was quite much lower. Cisco has a ratio of 12,0. The same source revealed that the industry average is approximately 10,4. Consequently, Teleste would need to increase its inventory turnover ratio to reach the others working in the same field. The question here that rises is whether Teleste Corporation is keeping too big inventories compared with its sales when it is put side by side to its competitors in the same field. Another alternative is that it is making too optimistic demand forecast that can result in lower inventory turnover. (MSN money 2009 [24.3.2009])

As a summary, Teleste Corporation has created a demand forecast system where exists all the seven steps stated in the theory. It has settled reasonable and measurable targets that it is pursuing. Additionally, it has selected the items that are forecasted and it is not trying to guess the future demand for all of its numerous product variations. Next, there is the time horizon that the forecasters need to follow when creating their forecasts. Furthermore, the company is taking advantage of different forecast methods, both qualitative and quantitative ones, to receive the best result. Then, the business units, in other words salesmen, controller and product manager, are creating the forecast according to the collected information from the field and past without forgetting the usage of their own knowledge related to the industry. After the production planner has inserted the numbers in the ERP system she monitors the forecast error and reports it back in order for the business units to improve their future forecast. Yet, the forecast process can not be seen as a simple task as there are differences between the business units as well as varying clientele that might cause distortion. Add to this, special cases like project require their own way of forecasting. Finally, to keep the system as good as possible, it is important to investigate the efficiency of the inventory. According to the inventory turnover ratio, the corporation has lately positively enhanced its inventory holding.

4 CONCLUSION

To collect all the pros and cons that are related to the demand forecast process and inventory management it can be seen reasonable to create a SWOT analysis, see table 1. All the positive issues are stated there that can be found both from inside the company as well as from its environment. In contrast, it will also state the negative ones that might have an impact on them.

As one can see from the SWOT analysis, there arise a few weaknesses when the demand forecast process was investigated. The absence of a proper forecasting instruction made it sometimes complicated for the salesmen to create their forecast. They would appreciate if rules of some kind were written that could be used in the process. Add to this, the guidance and support related to the creations process was not satisfactory. Additionally, the varying characters of forecasting between the different business units, DVBS and HFCNS, were not appreciated. In the salespeople's perspective, the demand forecast process lacks of a clear guideline stating how a forecast should be done, which forecasting method should be used; to whom it should be pasted, controller or product manager and which form should be used, excel or by using CRM. This is mainly caused by the constantly modified rules. Then, due to the fact that in the general case the forecasts were not handled on a customer base, but in stead as wholeness, it did not guarantee that the forecasted clients would get the products when needed. It was seen that the relationship between the forecast and the production is too tight. In other words, the company should be able to respond to sudden purchase orders, to some extent. Next, salespeople found it difficult to forecast due to the great variety of clientele and great number of products. Finally, the demand forecast process lacks an award that would make it more tempting for the people to create solid forecast. These were the main reasons why the salesmen were not highly satisfied with the demand forecasting system and inventory management.

There are some threats coming from the environment which the company should be aware of. At the moment, the eagerness towards distributing a solid demand forecast to the corporation is not high. There are a few reasons behind this. The great variety of customers makes it hard to receive a proper forecast, or to create one. Amongst them, there are cultural differences that influence their decisions. These are matters that might be related to culture, like the fear of loosing face when distributing a poor demand forecast. Additionally, some corporations are not willing to reveal their plans as it could have a negative impact on their own business. Then, some firms do not have very long term plans that could be modified to demand forecast. Generally, the demand in the field is occasionally unforeseen and consequently the firms might not be able to give a proper demand forecast. Next, the other firms working on the same field are experiencing higher inventory turnover ratios. It might be that Teleste Corporation in holding too big inventories or that they have a high number of obsolete items. The reasons behind this should be discovered. Finally, at the moment one of the issues that are affecting the forecasts is the overall economic situation of the world. People are afraid to give a demand forecast due to the unstable environment.

The SWOT analysis reveals that there company carries some strengths that can be seen positive for the demand forecast process. One of the most important ones is that the amount of historical data is huge. Nevertheless, it can be easily accessed through the ERP system. Additionally, there are several people involved in the forecasting process which enables the usage of different kinds of expertise and know-how. Next, the demand forecast targets are clearly stated and measurable. Then, the company is not only relying in one source of information. It uses quantitative methods that are based on the interpretation of the past sales data. Add to this, it has not neglected the information and knowledge of different people. In other words, the company take advantage of the view of individual sales people by collecting forecasts from them. Add to this, in some cases the sales people receive input from the field, from customers who know what they want and when. Finally, it seems to be that the inventory management has been improved a little during the past periods when one compares the inventory turnover results. The company is able to cope with a fewer stocks but still, at the same time,

increase the sales. All these matters should have a positive impact on the corporation's customer service and efficiency.

There are opportunities that the environment offers to the company. Some of the customers are highly organised and know how the advantages of demand forecasting. They have a good picture about their future. So far some of the best results of the demand forecast have been achieved with the project customers who have gained the greatest profit in the sense of product availability.

Table 1. SWOT analysis for demand forecast process and inventory management in Teleste Corporation

Strengths • Amount of historical data • Clearly stated targets of the demand forecast process • Knowledge of different people • Diversity of forecasting methods used • Enhanced inventory turnover ratio	Weaknesses • Lack of the guidelines for information collection • Unawareness of the presentation methods • Often modified forecast rules • Product variety numerous • No rewarding system for successful forecast • No guarantee for product availability • No enthusiasm towards forecast • Forecast process differences between different business units • High dependability in production to forecast • Lack of overall guidance and support
Opportunities • Some well organised customers • Projects	Threats • Lack of eagerness to forecast amongst clientele • Great variety in clientele • Cultural differences • Unforeseen demand • Reluctance amongst customers to reveal plans • Unstable economic situation • Inventory turnover ratio lower than competitor's

5 SUGGESTIONS

On the basis of the findings during the research there were several reasons why it is hard to produce a solid forecast. The reasons could be found both from inside as well as outside the company.

The issues affecting inside were mainly related to the fact there are no well-conducted demand forecast instruction that would state all the important matters related to the creation process. Due to the fact that different business units handled their forecasting slightly differently, it was found frustrating to follow the unwritten rules that are often modified. Therefore, according to these findings, it would be reasonable to start to make the demand forecasting more visible. For the salespeople, it would be wise *to create written demand forecast rules* that would support them when conducting a forecast. This piece of work could provide them with the official data related to the forecasting process. Meaning that there they could find the information about the selected products for forecasting, time structures and methods that need to be used when creating the forecast. Additionally, it could state the special situations, like projects, that might require different kind of handling compared with the normal process. On the other hand, it could demonstrate the consequences and outcomes of the sales orders that rise suddenly out of nowhere. It could state the circumstances that can be expected for these orders, more precisely, about the length of the lead time. Then, it would be important to write clearly where to contact in different cases when support is needed. On the other side, it could be wise for the salespersons to put some input in this manual. They could share their own experiences from the past, like issues related to the cultural aspects that might affect in a certain area for the creation of a forecast or even the case studies of clients of different kind. This way all of them could be aware of them in the future. Some updates for causal matters could be added there, for instance, the expected influence of the present financial crises. In the end, it would be reasonable to make the forecasting rules of both business units similar. Yet, if this is not possible, it would be good to have both processes stated separately and clearly in the manual.

It was found that the enthusiasm of clientele toward demand forecasting is not high. In the past, the delivery times have not always equalled their forecasts. Add to this, the understanding about the meaning of the word has not been univocal. In order to increase the customers' willingness to be involved in the demand forecasting process it should be made as easy as possible for them to attend it. It could be wise *to create a newsletter* or *a manual* that could be sent to the main customers whose demand creates most of the company's sales. There they could find the information about the advantages of a distributed demand forecast. It could clearly mention where the forecast obligates the client and the company. The clientele should be aware of the possibilities that demand forecast could offer them. As many of the clientele answers to their own customers it would be good for them to enhance the deliveries through the demand forecast. However, it should clarify the common rules under which the company is operating. Other way stated, it should be clear to the clients that the lead time will be longer without a proper demand forecast. Otherwise, who would bother to create one if they will receive the needed goods anyway, perhaps on the expense of others, or in contrast, why to distribute it if the goods will anyway have uncertain delivery time. In the beginning, it could be wise to organise some training to both customers and salespeople that could clarify all the different aspects of demand forecast process and its outcome in today's market.

The implications of the research show that the inventory management system does not totally respond to the demand forecast. If the forecasting accuracy needs to be increased, it is evident that there are items are in the stock when needed. Salesmen together with the clients want to have some respond to their demand forecast. It goes without saying that if the manufactured items would be marked for the clients according to their forecast they would get what they asked. Yet, in reality, this is not easy to conduct. There are problems like limited space. They would need to have personal to follow that all the correct goods go to right places. Then, it would need to be decided what will happen to the goods left on the shells, moreover whose responsibility are they, the sales person's or client's. However, it would be wise to create some kind of *a tracing system for the orders* to ensure that wrong customers will not end up with the products. Maybe the production should follow the manufacturing on the salesperson

base or on the sales area base. The problem here would be that it takes time to make the comparison. However, it could be seen as only a little sacrifice if the efficiency enhance.

The lack of interest should somehow be minimized amongst the salespeople as well as clientele. Thus, it would be wise to consider some kind of *an awarding system* for the people who can conduct a forecast with the smallest forecasting error for a certain time period. At the moment, this could apply to the salesmen as the forecasting is not happening on the customer basis. They could be offered some extra bonuses, for instance. Yet, if the biggest clients distribute sensible demand forecast, they could be awarded for the good job. It goes without saying that one of the greatest things to offer would be the constant product availability without delays which would make the operations of the clientele smooth and easy. On the other hand, the awards could be, for example, seasonal discounts or benefits of other kind related to the orders. No matter what kind of a price it would be, it is important to recognise the achievers and give them credit for their forecast.

In short, to be able to decrease the forecasting error, it would be advisable for the company to create written guidelines that would not only work as a help for the salespeople but also for the clientele. To increase the validity of the notebook it would be sensible to organise meetings in the beginning that would increase the value of the manuals. It can be seen that there does not exist a reward system that would tempt neither ones, salespeople or customers, to pay a lot of attention to the demand forecast. If the new written guidelines helped to minimize the forecasting error, the customers would receive faster and on time deliveries. At the same time, the salespeople would gain more sales due to the satisfied customers that return to do business with a trustworthy corporation. Yet, after the demand forecast process has been made more user-friendly, the firm still needs to pay attention to the inventory management. The forecasters have to be sure that the product availability will increase and their hard work will be awarded while the efficiency will be increased.

This thesis introduced the topic from the company's perspective and even though the clientele was considered the opinions came from the people working in Teleste Corporation. Therefore, it might have suffered from bias. It would be wise to interview or make a questionnaire to the customers of the firm and find their opinion and ideas about it in the future. Furthermore, a review to the other company's working on the industry should be made in order to solve the differences in efficiency ratios. The demand forecast can be investigated in many different views. This thesis was mainly concentrated on the importance of product availability to the clients and salesmen that could be achieved through forecasting and inventory management. Yet, it has great impact on other operations of a firm. Therefore, there are lots of issues that can be investigated in the procurement, finance and even in human resources that can be related to the demand forecasting. On the basis of this thesis it could be found interesting to get a deeper insight to the cultural differences and their affects to the distribution of demand forecast amongst clientele. Nevertheless, as the companies are nowadays often multinational there are different ways to understand forecasting even inside the corporation. Thus, this area would be sensible to research.

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APPENDIX 1. INTERVIEW GUIDE

How do you create a forecast?

Is the demand forecast process made clear enough?

How much do you use the historical data in your forecast and from where do you receive it?

How often are the forecast collected? Should they be collected more often/less often?

How far the forecast should be taken (i.e. should all the products be forecasted)?

Should the company be able to answer the sudden sales orders without delays?

Should there be production outside the forecasts?

Do you create forecasts on the customer basis? Should they be collected?

How do you select the forecasted customers?

If a customer is distributing a forecast, what kind of service is he/she promised?

Would the customers be willing to give binding forecasts?

How do the customers see the demand forecast? Is it seen as a burden or more as a tool for greater efficiency? Are the customers satisfied with the process?

Are the differences between cultures on how they see forecasting?

Do the customers give sensible forecast?

How does the project differ from the day-to-day forecast?

Is it easier to forecast a project?

Do the projects gain greater advantage from the forecasting?

Do you measure the forecast error yourself? Do you make adjustments to the forecasts?

Do you receive enough feedback for the forecasts?

How do you distribute a forecast and to whom?

Should there be more guidelines related to the forecast process?

Who gives you the forecast feedback and what kind of feedback should it be?

What would be the ideal way to create a forecast in salesman perspective?

Is the positive influence of a forecast great enough to motivate to create one?

Do the right clients get their products?

TURKU UNIVERSITY OF APPLIED SCIENCES

ABSTRACT

Degree Programme in International Business

Saana Sundberg

Title: Demand Forecast Process as a Part of Inventory Management

Specialization line:	Instructor(s):
International marketing and financing	Taru Penttilä
Date:	Total number of pages:
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This thesis is a case study of a Finnish technology firm Teleste Corporation. There the pursue of efficiency and good customer service are important. A demand forecast offers the possibility to make the operations more profitable but still offer the customers' higher value. It provides the inventory management the needed information about the buffer stocks that should be kept overcoming the fluctuations in demand. Additionally, it ensures that no unnecessary stock is carried.

The thesis has concentrated on discovering the matters that affect the efficiency of the demand forecast process and the inventory management. A seven step forecast model is investigated in order to solve the critical aspects related to it. It states the issues that increase the complexity of forecasting. Furthermore, it argues about the fact that to be successful in the process, the company needs to create written rules for forecasting. Additionally, constant support during the forecast creation is another element desperately needed. These two matters should be provided for the sales people who are responsible to the creation of a forecast. Add to this, as the clientele is wanted to give some input to the forecasting, it would be advisable to increase their awareness about the process and its advantages.

Finally, the demand forecast process lacks of a good awarding system. There is no guarantee that if a sensible demand forecast is created, the creator will receive his or her goods on time. Therefore, to increase the motivation amongst the creators, it would be reasonable to pay attention to the inventory management. In the future, to be able to increase the efficiency of the demand forecast process, the company has to be able to enhance the product availability. Furthermore, it should consider other awards for the most successful forecasters, like discounts for clients and bonuses for salespeople, which would increase the eagerness to forecast.

Keywords: Demand Forecast, Inventory Management

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TURUN AMMATTIKORKEAKOULU

TIIVISTELMÄ

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Saana Sundberg	
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Opinnäytetyö on tapaustutkimus teknologia yritys Teleste Oyj:stä ja sen kysynnän ennustamisprosessista. Lisäksi varaston hallintaan, joka vaikuttaa tuotteiden saatavuuten, on kiinnitetty huomiota. Tänä päivänä on tärkeää pystyä tarjoamaan hyvää asiakaspalvelua, mutta samanaikaisesti myös kyetä tehostamaan yrityksen toimintaa. Kysynnän ennustaminen mahdollistaa sen, että oikeat tavarat ovat varastossa oikeaan aikaan. Tällöin lähetykset voidaan lähettää ajallaan asiakkaille ja sen lisäksi pitää fyysinen varasto minimaalisena.

Kysynnän ennustaminen ei ole yksinkertainen prosessi. Tässä työssä esitellään seitsenportainen malli, jota käytetään ennustamisessa. Jotta prosessista tulisi mahdollisimman tehokas, on tärkeää tutkia ja nimetä asiat, jotka saattavat hankaloittaa ennustamista. Suurimmat ongelmat, jotka tällä hetkellä nousevat pintaan Teleste Oyj:ssä, ovat ennustusohjeiden puuttuminen ja minimaalinen tuen määrä ennustusprosessissa. Nämä heikentävät ennusteen lopputulosta ja osaltaan aiheuttavat myös motivaation laskemista ennusteen luojien keskuudessa. Koska asiakkailta toivotaan tulevaisuudessa suurempaa osallistumista ennusteiden tekemiseen, tulisi myös heitä informoida enemmän prosessin eduista.

Motivaation lasku ennusteen luojien keskuudessa voidaan myös nähdä johtuvan palkitsemispolitiikan puuttumisesta. Aikaisemmin onnistuneet ennusteen luojat eivät ole välttämättä nauttineet varmoista ja tehokkaista toimituksista. Toisin sanoen tuotteiden saatavuus ei ole ollut taattu, vaikka ennuste olisikin ollut paikkansa pitävä. Näin ollen yrityksen tulisi keskittyä varaston hallintaan, jotta oikeat asiakkaat saisivat tilaamansa tuotteet. Pitävien toimitusaikojen lisäksi yritys voisi harkita myös toisenlaista palkitsemista motivaation lisäämiseksi, kuten alennuksia asiakkaille ja bonuksia myyjille.

Hakusanat: Kysynnän ennustaminen, varaston hallinta

Säilytyspaikka: Turun ammattikorkeakoulun kirjasto