

New Product Forecasting - Empirical evidence from Finnish textile companies

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New product introductions have become necessity for many companies. The business environment has changed to be more competitive and customers more demanding therefore in order to stay profitable and in business many companies introduce new products continuously. New product forecasting is a challenging part of new product development since forecasting is about predicting consumer preferences and market trends. New product forecasting is an interesting research subject since it involves several variables.

Objective of this thesis is to provide a comprehensive understanding of forecasting challenges with the focus being new product forecasts. The aim is to discover factors which help in developing quality forecasts, in other words forecasts which are both accurate and creditable. Another research goal is to gain knowledge how to increase forecast quality. A comprehensive literature review was conducted about forecasting, new product forecasting, and forecasting in the textile industry. The empirical research was conducted as an explanatory qualitative study. Semi-structured interviews were used as the research methods since they provided the best way to discover the attitudes and practices of business professionals. Representatives from four Finnish companies operating in the textile industry were interviewed to discover how forecasts are created in the companies they work at and to gain understanding of the overall state of forecasting in these organization. Also the researcher wanted to assess how well the recommendations provided in the literature review correspond to the actual company practices.

The research discovered that the practitioners understand the importance and challenges of forecasting. Most companies create forecasts based on collaborative efforts of multiple departments instead of using a forecasting system. Receiving orders from customers before final forecast decisions are made is preferred. This is not always possible however many of the companies were working on finding ways to make this possible. Some of the main factors which contribute in the creation of quality forecasts are experienced sales personnel and knowledge of the products, customers, and the market. Ways that the quality of the forecasts could be increased included availability of customer orders, conducting market research, and analyzing and utilizing historical demand information. The recommendations provided in the literature review, creating a forecasting process which emphasizes monitoring and evaluating corresponded fairly well to the way the practitioners viewed forecasting. Forecasting is a critical function in all the companies however availability and usage of historical demand data and evaluation of forecast error was not systematically used to help in forecast creation. These aspects could be improved by unifying the forecasting practices to enable collective comparison of the forecasts and also to enable easy access to view historical demand data.

Keywords: Forecasting, new product forecasting, textile industry

Total number of pages (with attachment): 83

UUTUUSTUOTTEIDEN MENEKIN ENNUSTAMINEN

Uutuustuotteiden lanseeraus on tullut tärkeäksi osaksi monien yritysten normaalia toimintaa. Liiketoiminta ympäristö on muuttunut kilpailuhenkiseksi ja kuluttajista on tullut vaativampia, jonka vuoksi useat yritykset tuovat uutuustuotteita markkinoille jatkuvasti. Uutuustuotteiden menekin ennustaminen on haasteellinen osa uutuustuotteiden kehittämistä koska ennustaminen on kuluttajien käyttäytymisen, mieltymysten ja markkinoiden tyylien ennakoitua. Uutuustuotteiden menekin ennustaminen on mielenkiintoinen tutkimusaihe, koska korkea ennustetarkkuus ei ole helposti saavutettavissa.

Tämän tutkimuksen tavoite on antaa kokonaisvaltainen ymmärrys menekin ennustamisesta ja etenkin uutuustuotteiden menekin ennustamisesta. Tutkimuksen päätavoite on saada selville mitkä tekijät edesauttavat laadukkaiden ennusteiden tuottamisen. Laadukkaat menekin ennusteet ovat sekä tarkkoja että luotettavia. Toinen tutkimustavoite on etsiä keinoja, joilla ennusteiden laatua voidaan lisätä. Teoreettinen tutkimus käsittelee kattavasti menekin ennustamisen, uutuustuotteiden menekin ennustamisen ja ennustamisen tekstiilialan yrityksissä. Teoreettisen tutkimuksen perusteella on luotu malli, joka esittää uutuustuotteiden menekin ennustamisen tärkeät perusteet.

Empiirinen tutkimus tehtiin kvalitatiivisena tutkimuksena, joka suoritettiin haastattelemalla neljää eri tekstiilialan yrityksen edustajaa. Tutkimusmenetelmänä käytettiin puolistrukturoituja haastatteluja, koska ne antoivat parhaan tavan tutkia asenteita ja ammattilaisten käyttämiä menekin ennustamisen menetelmiä. Tutkimuksessa haluttiin myös selvittää, miten hyvin kirjallisuuden suositukset menekin ennustamisesta vastaavat yritysten käytäntöjä.

Tutkimus vahvisti teoreettisen tutkimuksen mukaisesti menekin ennustamisen tärkeyden ja haasteellisuuden. Ennusteet tehdään yleisesti yhteistyössä myynnin ja johdon kanssa. Laadukkaiden menekin ennusteiden luontiin vaikuttavat henkilöstön kokemus sekä tietämys tuotteista, asiakkaista ja markkinoista. Tapoja joilla ennusteiden laadukkuutta voidaan lisätä ovat aikaisen myyntitiedon tai ennusteiden saaminen, markkinatutkimusten tekeminen ja historiallisen myyntitietojen hyväksikäyttö. Uutuustuotteiden menekin ennustamisen alueita joita olisi mahdollista parantaa ovat historiallisen myyntitiedon hyödyntäminen ja ennustevirheiden laskeminen, arviointi sekä tallentaminen. Näiden asioiden huomioiminen auttaisi yhtenäistämään menekin ennustamisen prosessia ja mahdollistamaan ennusteiden vertailun ja historiallisen myyntitiedon tarkastelun ja hyödyntämisen.

Avainsanat: Menekin ennustaminen, uutuustuotteiden menekin ennustaminen, tekstiiliala
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NEW PRODUCT FORECASTING

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1. Introduction

“The optimal matching of supply and demand is one of the most important things a company needs to do to thrive profitably over the long run.” (Lapide 2010)

Forecasting, the matching of future supply and demand, is a challenging and imperative task for many companies. It is a challenging task because forecasting requires predicting consumer and market behavior and it is imperative task because it can directly affect companies' profitability. The best way to forecast upcoming demand is to create a forecasting process which guides the forecasts continuously to be monitored and measured. The benefits gained from accurate predictions are worth the effort and financial investment needed to create an efficient forecasting process. Accurate forecasts can be beneficial contributors to improving companies operating performance and in helping supply chain management to plan better for short- and long-term changes in the market conditions (Fildes & Beard 1992; Gardner 1990; Wacker & Lummus 2002).

Forecasting will provide companies valuable benefits if the organization is committed in creating a forecasting process which is managed effectively. Producing quality forecasts requires time, determination, and commitment. One basic principles of forecasting is that forecasts are usually wrong hence it takes time to develop a process which provides reasonably accurate predictions (e.g. Arnold & Chapman 2004, 204; Makridakis et al. 2010; Ross 2004). This thesis will examine and explain recommended demand forecasting process and best practices. The main focus of this research is new product forecasting (NPF) which has its unique set of factors to consider. NPF is especially important in industries which continuously need to create new and updated products in order to stay up to date with current trends and fashion. Textile industry is one such an industry and NPF practices are examined more closely in this specific industry.

The following sections will provide an introduction for this thesis. Motivation of the study will be explained in section 1.1. which highlights the reasons why this research subject was selected and explains the specific need for this kind of research. Section 1.2. will describe the main goals

of this thesis by providing the research objective. This is followed by an explanation of the research questions in section 1.3. Section 1.4. will provide details of the research approach and also the structure of this research paper will be explained. The final section of the introduction 1.5. provides definition of the type of new products this thesis concentrates on.

1.1. Motivation of the Study

New product introductions have become a crucial part of survival for many businesses. One of the reasons for the frequent product introductions is that product life cycles have become shorter, therefore a way to stay ahead in today's market is to continuously introduce new products (Jain 2007; 2008). In the recent years also the business environment has changed. Jain (2008) states that new product development (NPD) is not an option anymore it has become a necessity. A fact of today's business environment is that introducing new products and/or services have become vital for companies long-term growth (Fisher 1997; Simon 2010).

Demand forecasting is a challenging task since multiple factors need to be considered before a forecasting process can be established and after the process has been created, continuous monitoring is a key factor in improving the accuracy of the forecasts. When forecasting activities are executed and monitored correctly, companies are able to be more efficient and more profitable. Golden (1994) explains that if forecasts are created but not monitored, significant monetary losses or even bankruptcy might occur. Especially when economic conditions are uncertain, it is important for companies to cut costs in the supply chain and creating accurate forecast is one way to accomplish this (Bursa 2009). All these issues related to forecasting emphasize the fact that demand forecasting and especially NPF is a task which needs time, attention, and dedication in order to provide the best possible results.

The subjects of new product development (NPD) and forecasting demand for ongoing products have been quite widely covered topic in literature however the number of publications available about new product forecasting (NPF) is considerably less (Kahn 2006, 3). It also seems, according to Kahn (2002), that majority of the literature regarding NPF concentrates on the

forecasting techniques and not on management issues. NPF is an intriguing and challenging research topic which can be studied from many perspectives and it is definitely a topic which needs more research.

All the reasons above indicate that NPF is a complex but also very intriguing research subject. The motivation of this thesis is to investigate NPF recommendations and to gather insights about NPF practices and forecasting challenges in Finnish textile companies. Two common reasons why many companies struggle with NPF are due to its characteristics of low credibility and low accuracy rates (Kahn 2006, 3). The aim of this thesis is to discover which issues should be considered and what actions should be taken to be able to create quality forecasts for new products. Quality forecasts should be both accurate and credible. Literature review section will provide information and insights about forecasting best practices gathered from variety of publications and journal articles written by experts to guide the analysis in the empirical section. The empirical section will explain forecasting practices in the selected companies and discuss the findings of the literature review and empirical research.

1.2. Research Objectives

The objective of this thesis is to provide a profound understanding of the factors that should be considered when creating forecasts for new products. This was chosen as the objective because NPF has gained importance over the years. Now efficient NPF process is one of the key subjects when discussing companies' possible competitive advantages. As mentioned earlier, the business environment has changed to be more competitive and in order to keep up and stay ahead of the competition many companies are introducing more new products than ever before (Fisher 1997).

Comprehensive literature review will examine the process of forecasting and explain other factors which should influence decision making when creating forecasts. Literature review will provide a foundation for the empirical research which explores the NPF practices in specific companies. Empirical research will aim to discover the methods these companies are using to create their forecasts and how well those methods correspond to the recommendations provided

in the literature. The aim is to discover which practices have been applied, which methods actually work, and how NPF is viewed by the people who create and evaluate them.

1.3. Research Questions

Research questions are divided into primary and secondary questions. The first set of questions below lists the primary research questions. These questions are the main focus of this thesis and the key section for answering these is the empirical research. The secondary research areas concentrate on general knowledge and the focus will be on the literature review to provide answers to these questions.

Primary research questions

1. What are the main factors that aid in creating quality forecasts for new products?
2. Which are the best methods to increase the quality of new product forecasts?

Secondary research areas

1. To understand principles of demand forecasting.
2. To examine the phases of new product forecasting process.

Both of the primary research questions mention quality of the forecasts. One of the main challenges in NPF is low credibility and low accuracy (Kahn 2006, 3) therefore the word quality in the research questions stated above refers to the evaluation of forecast accuracy and forecast credibility.

1.4. Approach and Structure of the Study

The main purpose of this thesis is to find practical tools for creating forecasts for new products. Also the aim is to discover the ways forecasting is handled in daily operations at the practical level. In order to fulfill these aims relevant literature was extensively examined to find the best practices and qualitative research approach was selected to examine the NPF practices in the selected companies. Qualitative research approach was the most appropriate method for this

research since the purpose is to discover attitudes and forecasting practices that are used by the practitioners (White 2002, 29). To enable possible generalization of the findings, multiple-case study method was the most appropriate (Yin 2003, 37). Empirical section of the research will analyze the forecasting practices of four Finnish companies operating in the textile industry. Textile industry was selected because the focus of this research is NPF and textile industry offers excellent research opportunity since the industry is very dynamic and often majority of the overall sales are accrued from new products (Thomassey 2010).

As mentioned, qualitative research design was selected and the empirical research was carried out as semi-structured interviews. The interview data was analyzed using theoretical propositions (Yin 2003, 111-112) to find out how well the forecasting business practices in these four companies correspond with the recommendations provided in the literature. Examination of the interview data will reveal the current business practices the companies are using to create and improve the quality of their forecasts and important information is also to analyze whether the case companies are satisfied in their current NPF practices.

This thesis is divided into eight sections. The thesis begins with section 1 which provides an introduction for this research by providing the motivation of the study, research objectives and questions, and research approach, and structure of the study. Literature review begins with section 2 which presents an overview of demand forecasting. The focus of the literature review segment is section 3 which explores NPF in detail. Section 4 provides specifics of forecasting in the textile industry. The theoretical framework which outlines the main subjects of this research is shown and explained in section 5. The framework is constructed based on information discovered in the literature review sections 2, 3, and 4. Research approach and research validation will be described in the methodology section which is section 6. Empirical research background and findings are explained in section 7. The final section 8 will provide a conclusion of the thesis by explaining the key finding of the research and managerial implications. Conclusion section will also explain the limitations of the research and provide suggestions for further research.

1.5. Definitions

This thesis investigates new product forecasting practices. The words “new product” can mean different kinds of new products in different business scenarios, therefore the meaning of new product should be defined for this thesis. Kahn (2006, 7) explains that new product initiatives can be divided into the following seven categories; cost reductions, product improvements, line extensions, new markets, new uses, new category entries, and new-to-the-world products.

Below table 1-1 shows a division of all these product types in a product-market matrix (Kahn 2006, 9). The matrix divides new products into four categories according to new and current markets and new and current product technology. Jain (2007) comments that usually a very small portion of new products are complete new (new-to-the-company or new-to-the-world), he states that majority of new products are product improvements, line extensions or market extensions.

Table 1-1 Product-Market Matrix

		Product Technology	
		Current	New
Market	Current	Market Penetration (Cost Reductions, Product Improvements)	Product Development (Line Extensions)
	New	Market Development (New Uses, New Markets)	Diversification (New-to-the-Company, New-to-the-World)

Source: Kahn 2006, 9

In light of the explanation provided above, “new product” in this research paper refers to new product initiatives which are cost reductions, product improvement, line extension, market extension, or new use. The Product-Market Matrix in table 1-1 above has three shaded quadrants which are the types of new products this research concentrates on.

2. Key elements of Demand Forecasting

Key elements of demand forecasting section will provide a comprehensive explanation of the important aspects of demand forecasting based on the reviewed literature. The purpose of the literature review, which includes sections 2, 3, and 4, is to present a clear understanding of the main issues and forecasting best practices emphasized in the literature that are most relevant and crucial in understanding the research problems of this thesis.

Demand forecasting is a challenging task which helps companies in their decision making activities. Forecasting has evolved significantly over the past several centuries (Makridakis et al. 1998, 2) and as mentioned earlier it is not an easy task since the one certainty about demand forecasting is that the forecasts are rarely accurate (e.g. Arnold & Chapman 2004, 204; Makridakis et al. 2010; Ross 2004). Even though in forecasting perfection is rare, in the recent year's companies decision makers have started to understand the core benefits of forecasting. Business environment can be very demanding therefore companies need to be more responsive to customer demand than even before. For these reasons the need to forecast is continuously increasing (Ross 2004). Jain (2007) states that according to a survey conducted by the Institute of Business Forecasting (IBF) at five various conferences and tutorials held in the United States in 2006, 57% of American companies had just started their forecasting process during the last five years. This shows that systematical forecasting is still an emerging priority for many companies.

This segment begins with section 2.1. which provides an overview of the essential topics of forecasting. Section 2.2. explains forecasting basics which can help companies in the creation of systematic forecasting process which can help to improve forecast quality. Section 2.3. provides comprehensive explanation of the forecasting process and finally section 2.4. provides insights of the purpose of forecasting.

2.1. Overview

According to Makridakis et al. (1998, 2) forecasting is needed since there usually is a time lag between upcoming need and the time the need occurs, this time lag is called lead time. Forecasts are created to predict future needs and these predictions are then used to help in effective and efficient planning (Makridakis et al. 1998, 2; Krajewski et al. 2007, 522). This section will explain some general factors of forecasting.

Makridakis et al. (1998, 5) explain that the need and interest for forecasting has been increasing since company management aims to decrease the dependence on chance while trying to analyze the environmental factors more scientifically. Management attitudes are changing but that is not the only factor increasing the significance of forecasting. Lapide (2006) explains that changes in the business environment and consumer behavior have caused forecasting to become a critical operational function, he clarifies that the changes in the business environment have caused companies to rely more on forecasting to be able to meet the market needs better. Lapide (2006) continues by saying that over the year's business environment has changed from push to pull manufacturing. This change from push to pull manufacturing means that instead of producing goods prior to customer need, now companies are using customer demand as the factor which initiates production (Krajewski et al. 2007, 349). Lapide (2006) explains that during this manufacturing style change also market power has shifted from manufacturers towards retailers and consumers. Also other changes in the business environment such as increased competition and shorter product development cycles have increased the need for forecasting schemes. All these changes have increased the significance of forecasting but these have also been detrimental to forecast accuracy and costs related to forecasting errors have increased (Fisher et al. 1994, 83; Lapide 2006). For this reason, further research is needed to examine how to increase forecast accuracy while maintaining the costs low.

Forecasting practices in organizations vary due to different planning needs and product types. According to Arnold & Chapman (2004, 204) forecasting has few basic characteristics which are very simple and understanding them will make forecasting easier and enable more effective

usage of the forecasts. Understanding the forecasting basics provides awareness to the forecast planners about the challenges of forecasting. These four characteristics are listed and explained below.

- **Forecasts are usually wrong**

Forecasting is about creating predictions about future therefore perfection should not be expected.

- **Every forecast should include an estimate of error**

Estimate of forecast error will help to evaluate the effectiveness of the forecasting process. Also measures, such as determination of safety stock levels, can be planned to minimize the effects of inaccurate forecasts.

- **Forecasts are more accurate for families or groups**

Demand for individual products is more random therefore creating a forecast for group of similar items usually provides more accurate results.

- **Forecasts are more accurate for nearer time periods**

Uncertainty increases the farther away the forecasts are created. This characteristic is important to understand especially when the delivery lead time is long. Reducing lead time will generally improve forecast accuracy.

This section provided an overview of the fundamental characteristics of forecasting. The following sections will provide recommendations and suggestions how to initiate and establish forecasting process.

2.2. Forecasting Basics

Before making decisions regarding the actual practice of forecasting, companies should make few basic decisions about forecasting department and forecast needs. These decisions will provide a foundation to which a forecasting process can be build on. When making decisions about forecasting fundamentals, it is important to make the system fit the company’s forecasting needs. Factors such as product life cycle, demand predictability, product variety, and market standards for lead times and service (Fisher 1997) should influence forecasting process creation.

Jain (2007) explains that the placement of forecasting function makes a difference in forecasting since each department has their own interpretations and expectations. In other words, each department has their own bias. Below graph 2-1 shows the departments responsible for forecasting according to a study conducted by Institute of Business Forecasting (IBF) in 2006. According to Jain (2007) the trend seems to be that companies are moving the forecasting function out of finance and strategic planning to supply chain planning. Supply chain planning in the graph below is considered to be both logistics and operation/production department. Jain (2007) further explains that also more companies are creating an independent forecasting function to make sure that forecasts are created by an unbiased department.

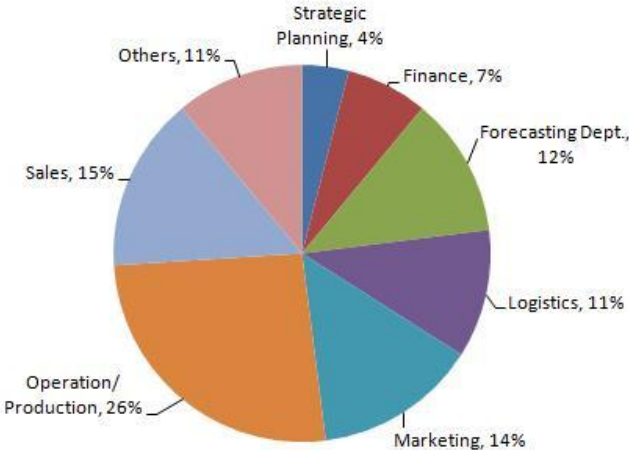


Figure 2-1 Forecasting departments (Jain 2007)

After the decision has been made which department handles forecasting, the company should decide the appropriate forecasting level, forecast horizon, interval, and form (Kahn 2006, 6). Forecasting level means the product level at which the forecasts are prepared. General levels are: stock keeping unit (SKU), product line, strategic business unit (SBU), company level, and industry level (Kahn 2006, 6). Forecast horizon is the timeframe how far into the future the forecasts are created (Kahn 2006, 6). Forecast horizon depends largely on the lead time (Jain 2007). Jain (2007) explains that most companies create forecasts for one year or more ahead. Forecast interval refers to the timeframe for which individual forecasts are created (Kahn 2006, 6). The forecast interval should be decided so that it is feasible to calculate forecast error. Jain (2007) explains that large number of companies use one month as their forecast interval which is appropriate time length for detecting possible forecasting problems. Decision about forecasting form refers to the unit of measure (Kahn 2006, 6). Kahn (2006, 6) explains that this can be monetary form or unit volume. Some interest groups, usually members of the management are more interested in the potential monetary value of the forecasts and others, such as production personnel, need to know the specific product quantities. Krajewski et al. (2007, 525) states that the recommended way is to forecast the number of units of demand and then translate these quantities into estimated sales revenue by multiplying the number of units with the product price.

After decisions about forecasting function placement, forecast horizon, buckets, and form are made, the actual forecast creation framework should be defined. The following section will provide recommendations of forecasting as a process. Forecasting process should include several elements which will help the company to achieve more accurate forecasts.

2.3. Forecasting Process

Forecasting should not be viewed as a single function, it is not just about selecting the best forecasting technique. Forecasting should be viewed as a process and it is important to keep in mind that forecasting should be a continuous dynamic process which needs maintenance, revision, and modification (Golden et al. 1994). Creating a documented process for forecasting

helps companies systematically to gather data and use the data to improve the forecasts in the future. This section provides recommendations to creating an efficient forecasting process.

The process should be designed so that it would take into consideration forecast accuracy, and also how to use the forecast to improve cost and delivery performance (Winklhofer & Diamantopoulos 2002; Smáros 2007). Jain (2007) summarizes the key elements of forecast formation process, he explains that the forecasting process should be created in such a way that it includes defining answers to the following two questions. Recommendations how the answers for these questions could be defined are provided in the paragraphs below.

- How are forecasts created?
- How is forecasting performance measured and monitored?

How are forecasts created?

In order for the forecasts to be as accurate as possible, it is recommended to use a forecasting framework. Below in figure 2-2 is a forecasting framework suggested by Silver et al. (1998, 74-75). This framework helps to explain how the forecasts should be created. Historical demand data is recommended as the starting point for the forecasts whenever possible since it provides a foundation which is based on actual demand information. Historical demand data can provide information about cyclical sales patterns such as seasonality and consumer reaction to sales promotions, this information helps to predict future demand patterns (Fisher et al. 2000). Mathematical model will provide more accurate forecasts and mathematical model is easier to create when it is based on historical demand data. The mathematical model can be also used to create a statistical forecast. After the statistical forecast has been created it is recommended to have judgmental input to make sure that forecast is reasonable. Judgmental monitoring and adjusting has a tendency to improve the quality of the forecasts prepared by forecasting systems (Jain 2007; Ross 2004; Silver et al. 1998, 75). Judgmental involvement can be used to adjust the forecast for factors which the demand history cannot predict (Jain 2007). These steps will create the demand forecast. After each forecasting interval, the forecasts should be compared to the

actual demand and forecast error should be calculated and evaluated. The analysis of the forecast error will provide beneficial feedback regarding the performance of the process.

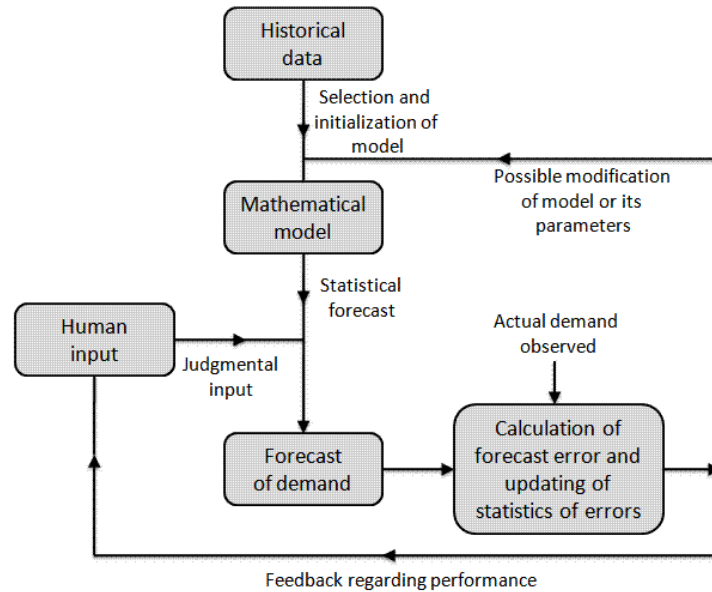


Figure 2-2 Suggested forecasting framework (Silver et al. 1998, 75)

The aim of forecasting is to be able to meet the demand with correct supply. It is challenging to create accurate forecasts therefore companies should continuously evaluate the success of the process. Determination of the forecasting success will be explained in the following paragraphs.

How is forecasting performance measured and monitored?

Calculating and evaluating forecast error is the other key element of the forecasting process - forecasting performance needs to be measured and monitored continuously. Recording and evaluating forecast accuracy is vital but unfortunately this seems to be a part of the process which some companies do not always view to be very important. Silver et al. (1998, 75) explain that measuring and evaluating the forecast error is important and beneficial for the following three reasons: calculating safety stock needs, evaluating the underlying assumptions of mathematical model, and providing information of the performance of the subjective component of the forecast. It is also important in determining whether the forecasts are meeting the expected accuracy goals. Analyzing forecast accuracy is explained in more detail in section 3.3.2.

Usage of the suggested forecasting framework as part of the forecasting process flow helps companies to develop more expertise of the factors which affect product demand in their field and how to predict those demand changes better. Knowledge of the demand behavior trends will help companies to increase their forecast accuracy. In some companies forecasting system fail due to not having a proper process in place (Jain 2007). In these cases companies seem to rely too much on forecasting software to prepare the forecasts. Jain (2007) comments that some companies have tried using expert systems which are computer systems which create a best possible forecast based on the available historical demand data and other factors such as seasonality. Companies which use expert systems solely rely on the statistical forecast created by the forecasting software which means that the forecasts are generated without judgmental input. In general the usage of demand planning software is beneficial since it will help companies to improve their forecasting process and the forecasts by decreasing the amount of manual work and allowing easy visualization and collaboration (Ross 2004). However companies must be careful in relying too much on statistical system. In some cases, the results of only using an expert system have been quite devastating. Jain (2007) explains that in 2007 Nike implemented an expert system and nine months later the company announced that it had lost 400 million dollars due to inaccurate forecasts. This example further confirms that the accuracy of the forecasts can be increased by using both statistical and judgmental methods (Jain 2007; Ross 2004; Silver et al. 1998, 75). Another factor companies should remember when creating a forecasting process, is the process fit to the company. Fisher (1997) explains that sometimes the cause for inaccurate forecasts can be a mismatch between the product type and the type of a supply chain. This means that the companies need to customize their forecasting process to fit their specific needs and products.

This section has explained the recommendations of the forecast process creation. Having a forecasting process in place, help companies to control and manage their forecasting activities better. The following section will provide an explanation of the forecasting purpose.

2.4. Purpose of Forecasting

The main purpose of demand forecasting is to estimate the upcoming demand in order for the company to make plan to create the products. The goal is to create as accurate forecasts as possible since accurate forecasts can be very profitable as forecasts help companies to meet the upcoming demand. If forecasts are too low, profits are most likely lower due to lost sales. Forecasts which are too high will create excess inventory which will increase the inventory carrying costs and products might have to be sold at a discount and discarded as obsolescence (Jain 2007). Industries which have highly volatile demand, markdown and stock out costs can sometimes be greater than the total manufacturing costs (Frazier 1986, 40). The effects of over- and under-forecasting are discussed in more detail in section 3.3.2.

The factors above demonstrate that forecasts are very important for organizations to help to meet the upcoming needs of their customers. Arnold & Chapman (2004, 199) confirm this by saying that the basic purpose of forecasting is to create estimates of the future demand. Organizations recognize the importance of gaining visibility and predicting consumer demand therefore they actively seek for best practices to creating and improving their forecasts (Bursa 2009).

Demand forecasts provide visibility into the future which is great benefit for organizational planning, forecasts not only help in planning but also in controlling the upcoming business needs. Forecasting can said to be a prelude to planning (Arnold & Chapman 2004, 199). Several different planning functions use forecasts for multiple purposes such as creating performance standards for customer service, planning the allocation of inventory investment, placing replenishment orders, evaluating the need for extra production capacity, and selecting the most appropriate operating strategy (Silver et al. 1998, 74). Lapide (2010) also explains that the ability to match supply and demand is crucial skill to prosper financially in the long run. Lapide (2010) continues by saying that the ability to create quality forecasts requires consistently good and accurate view of future demand in order to plan corporate operations which involve decisions regarding sales, marketing, manufacturing, financial, and other operational planning activities.

Forecasting is important for planning and Makridakis et al. (1998, 5) have divided forecasting planning tools into three areas, scheduling, acquiring resources, and determining resource requirements which are explained in more detail below. These areas explain the planning needs in short-, medium-, and long-term.

- **Scheduling**

Short-term forecasts are used to most efficiently allocate the available resources. Examples of these include the scheduling of production, transportation, personnel, and cash.

- **Acquiring resources**

Medium-term forecasts are used to estimate the upcoming resource requirements. Examples of these include acquiring raw materials, hiring personnel, and buying machinery.

- **Determining resource requirements**

Long-term forecasts are used to evaluate what resources the company wants to have in the future. Examples of these include determining market opportunities, environmental factors, and internal development needs of the company.

Forecasting provides obvious benefits for companies related to organizational planning. Companies should invest the time and effort in creating effective and efficient forecasting process in order to have a picture of the expected future sales and this will help companies to also gain the possible financial benefits. Forecasting also helps companies to keep their customers happy by being able to meet their needs when it is the most suitable for them.

3. New Product Forecasting

“New product forecasting directive: to accept that error will exist and then work to develop the best, most meaningful forecast possible coupled with an understanding of what underlies the forecast and its associated contingencies.” (Kahn 2006, 5)

New product introductions have become vital for the long-term survival for many companies (Jain 2008). Accurate predictions of new product sales can be very profitable for companies. As mentioned earlier, success of many businesses depends on their new products since a large portion of sales is usually accrued from new products (Jain 2008). According to a study conducted by Jain (2008) in 2007, 22% of a typical company’s sales come from new products when all industries are combined. Simon (2010) comments that new products usually increase profit margin as companies have less need to concentrate on promotional incentives. The following list shows the industries in which new product sales are much higher than the average (Jain 2008). For these industries NPF should be a vital process since they thrive on the sales of new products.

Apparel/Footwear	47%
Electronics	35%
Retail	38%

In the past many companies only viewed regular sales forecasting as a process. The research of Mentzer et al. (1999) suggests that as sales forecasting also NPF is more than an application of particular forecasting method. Their research also recommends that NPF should be viewed as an important and separate process from normal demand forecasting for ongoing products. It is even more crucial for NPF that the forecasts are continuously monitored and evaluated. Section 2.3 explained a recommended forecasting process, this process should have few modifications for new products when historical demand data is not available. Study conducted by the *Journal of Product Innovation* revealed that 53% of all companies were either dissatisfied or very dissatisfied with their NPF process (Kahn 2002; Simon 2010). This high rate of dissatisfaction

shows that NPF is a subject which should be studied in more detail to provide forecasting practitioners more recommendations how the NPF process could be improved to increase the quality of the forecasts.

The following sections will provide explanations of the common subjects which a forecast planner creating new product forecasts should consider. Section 3.1. provides details of forecasting techniques which are frequently used for NPF. Section 3.2. explains the challenges which make NPF such a complicated task. Section 3.3. explains three dimensions of NPF which provides information of the critical aspects of NPF process. Section 3.4. provides information about the benefits of early sales data availability and finally section 3.5. looks into two factors, lead time and the Bullwhip effect, which sometimes cause additional forecasting challenges.

3.1. Forecasting Techniques

This section provides a quick overview of some common forecasting methods. These techniques were selected based on a study conducted by Kahn (2002) which showed that these methods are preferred by practitioners when creating forecasts for new products. Most of these methods are simple techniques which can sometimes provide better forecasting accuracy than more complex forecasting techniques, as Lawrence et al. (2000) explain, complex forecasting techniques do not guarantee higher accuracy.

Forecasting methods are divided into two categories; qualitative and quantitative. Quantitative forecasting methods have become quite successful but Kahn (2010) points out that in NPF qualitative techniques often provide better forecasts. Kahn (2010) also comments that unfortunately literature published about NPF usually emphasize the usage of statistical forecasting methods. Silver et al. (1998, 79) comment that selecting the most suitable forecasting method should depend on the following five factors. These are explained in more detail below.

- Experience of the forecast planners
- Budget allocated for creating the forecast

- Reason for the forecasts, including timing and accuracy
- Amount and availability of historical and present data
- Managers' ability to accept and adopt sophisticated statistical and or other rational approaches

Experience of the forecast planner is important factor in producing quality forecasts since the forecast planner needs to review the forecast for its feasibility. Lapedis (2010) explains that the mission of a forecast planner should be to be able to produce a forecast based on facts and clearly expressed assumptions. Forecast planner should be able to obtain non-biased attitude when creating forecasts through objective analysis of the forecasts and experience. The forecast planner should have in-depth understanding of the forecasting methods in order to be able to take a full advantage of the method while staying objective.

Budget allocated for creating the forecast is a critical managerial decision since forecast accuracy can typically be increased with additional information however gaining this information usually demands more financial resources (Golden et al. 1994). Many times companies need to determine a balance between acceptable forecasting accuracy and the costs of reaching this accuracy. Some forecasting methods are very statistical and the best way to use statistical software in order to minimize the possibility of errors. Several reasonably priced forecasting programs have become available which allow more financial resources to be used for the forecasting analysis.

Reason for the forecasts is also a factor which varies in companies and should be considered when deciding on the forecasting techniques. Zotteri & Kalchschmidt (2007) mention the following nine different purposes for forecasts: budget preparation, production planning, subcontracting decisions, material/inventory planning, sales planning, human resource planning, new product development, facilities planning, and equipment purchase planning. Forecasting methods can vary depending which of these is the main reason for the forecasts.

Amount and availability of historical and present data is an important factor in selecting the appropriate forecasting technique. All quantitative and also some qualitative forecasting methods are based on a principle called *Assumption of continuity*. This principle means that it is expected that historical information will continue into the future (Makridakis 1998, 9). For the techniques which utilize this assumption some historical demand information is needed. Historical demand data will make forecasting easier therefore NPF is more challenging task due to the lack of historical demand data. Availability of present data, such as early sales information can also help companies to create more accurate forecasts (Fisher et al. 2000).

Managers' ability to accept and adopt sophisticated statistical and or other rational approaches can sometimes hinder the usage of more complex forecasting techniques. If the calculations are made manually, it is understandable that managers might be more apprehensive to accept the process if they do not understand the method and also having concern about the possibility of calculation errors. As forecasting has become more prominent task, managers are more accepting and willing to try new methods.

Below table 3-1 shows the popularity of new product forecasting techniques according to a study conducted by Kahn (2002). As can be seen in the table, qualitative methods are used more often than quantitative. The table shows only the most popular forecasting techniques and how popular these techniques are with the new product types, cost improvements, product improvements, line extensions, and market extensions, this thesis concentrates on. There is not very much variation of the popularity of the technique in relation to the new product introduction type.

Table 3-1 Use of new product forecasting techniques

Forecasting technique	Average	Cost improvements n=45	Product improvements n=117	Line extensions n=12	Market extensions n=108
Qualitative methods					
Customer/market research	52%	42%	54%	54%	57%
Jury of executive opinion	43%	49%	38%	40%	45%
Sales force composite	41%	38%	38%	46%	41%
Scenario analysis	12%	7%	14%	11%	15%
Delphi method	8%	9%	8%	8%	6%
Quantitative methods					
Trend line analysis	23%	29%	25%	18%	18%
Looks-like analysis	28%	22%	26%	32%	32%
Moving average	18%	24%	17%	17%	14%
Exponential smoothing technique	12%	7%	13%	15%	11%
Linear regression	8%	9%	9%	9%	6%
Expert systems	5%	4%	6%	4%	4%

n = sample size
Note that multiple responses were allowed.

Source: Kahn 2002

The forecasting techniques shown in table 3-1 above will be explained in the following two sections. Section 3.1.1. explains the qualitative forecasting techniques and section 3.1.2 provides explanations of the quantitative forecasting techniques. Kahn (2002) advises that NPF process should include the usage of multiple forecasting techniques since generating forecasts using multiple techniques increases the forecast accuracy. Kahn (2002) also has some critique about NPF literature, stating that literature presents many statistical techniques for NPF without discussion about the situation when the statistical methods should and should not be used. This shows that it is beneficial for companies to use multiple simple forecasting techniques in the beginning in order to select the most appropriate one for them.

3.1.1. Qualitative Methods

Qualitative techniques include **judgment methods** which are based on the opinion and estimates of managers, experts, sales personnel, or consumers (Krajewski et al. 2007, 525). These people use their experience, opinions, judgment and estimates to predict sales and these predictions are then translated into quantitative forecasts (Kahn 2006, 39). Makridakis et al. (2010) comments that empirical evidence has shown statistical forecasting models create better future forecasts than human judgment. Still it is good to remember that usually accuracy of the forecasts can be

increased by using both qualitative and quantitative methods. (Sanders & Ritzman 2001; Ross 2004; Jain 2007)

The following judgment methods are briefly explained in this section: Customer/market research, Jury of executive opinion, Sales force composite, Scenario analysis and Delphi method. These techniques are usually quite easy to initiate however implementation can be quite time consuming and difficult due to the employee involvement needs (Kahn 2006, 39).

Customer/Market Research is a forecasting method which predicts consumer interest by creating and testing hypotheses through data-gathering surveys (Krajewski et al. 2007, 528). Customer/market methods are divided into four general categories which are: concept testing, product use testing, market testing, and premarket testing (Kahn 2006, 13). These methods are used to gather data and analyzing it to make determinations which help with NPF.

Jury of Executive Opinion is a forecasting method in which knowledgeable professionals and experts provide ad-hoc demand predictions about the future demand. These predictions are provided for the highest level and then distributed accordingly which makes this top-down forecasting method (Kahn 2006, 39). According to Krajewski et al. (2007, 528) the main factor in using this method effectively is to make certain that the forecasts are not created individual but as a consensus among the experts with a single forecast.

Sales Force Composite is a forecasting method which combines individual sales staff predictions for their own sales district into an overall forecast. In some cases the best forecasts are attained from people closest to the external customer (Krajewski et al. 2007, 526). Sales people know their customers wants and needs very well therefore the responsibility of forecasting is often given to them. This method is opposite from the previous method, Jury of Executive Opinion, therefore this technique is called bottoms-up forecasting approach (Kahn 2006, 41). This process is very time consuming and also the possibility of intentional bias is greater (Gilliland & Guseman 2010).

Scenario Analysis a narrative forecasting method which does not produce a numeric forecast. The purpose of scenario analysis is a representation and description of a future state. This forecasting methods offers two approaches, exploratory or extend approach and normative or leap approach. In the exploratory approach the forecast planner uses current market occurrences and trends to predict the future. In the normative approach creates predictions of the future without consideration for the current trends (Kahn 2006, 41-42).

Delphi Method is a method in which panel of experts anonymously provide projections and comments and then these are combined and sent back to the panel members. Experts can then view predictions of the other members of the panel and they have an opportunity to adjust their own projections. This process is then repeated until consensus is reached (Krajewski et al. 2007, 528). This method aims to minimize the effects of social pressure by maintaining the members of the panel anonymous (Kahn 2006, 43). This is a way to try to avoid bias in the initial forecast. Effects of bias in a forecast will be explained later in section 3.3.3. Delphi method is time consuming and it is not very appropriate for situation when there is a need to create a large quantity of forecasts. For these reasons Delphi method is not very common forecasting technique (Gilliland & Guseman 2010).

3.1.2. Quantitative Methods

Most of the quantitative forecasting methods use historical demand data to build forecasts for the future. The premise of these methods is to evaluate the historical demand for patterns which are then used to create the forecast. Quantitative methods provide a fairly good estimate of the demand but past cannot always provide accurate prediction of the future (Makridakis et al. 2010). In this section explains only the quantitative forecasting methods which were identified in table 3-1. Makridakis et al. (1998, 9) comment that quantitative forecasting methods can be used when the following three conditions are met.

- Historical data is available.
- Historical data can be quantified in the form of numerical data.

- It is expected that some aspects of the historical data pattern will continue into the future. This condition is called *assumption of continuity* which was explained earlier.

Quantitative techniques include **causal methods** which are based on historical demand information on independent variables to create a future forecast. These methods are able to predict turning points in demand well however they are also the most complicated forecasting methods. The other set of techniques is **time-series methods** which are statistical methods that use historical demand information to build a forecast for the future (Krajewski et al. 2007, 525-529). Usually a graph or formula is constructed to predict the future demand (Kahn 2006, 13). As mentioned earlier, historical data helps to provide a basis for the most accurate forecasts. This is because historical demand data can be used to evaluate the demand data for sales patterns such as seasonality (Fisher et al. 2000). A third set of quantitative techniques include **hybrid methods** which is a combination of causal and time-series methods (Kahn 2006, 15).

The following paragraphs will describe linear regression for causal methods. For time-series method trend line analysis, look-like analysis, and moving averages are briefly explained. The only hybrid method explained here is expert system. The division of the methods to time-series and causal are not always clear. As mentioned earlier, in this research the forecasting techniques are divided these categories according to a study conducted by Kahn (2002).

Causal Methods: Linear regression

Linear regression method uses linear equation where one dependent variable is related to one or more independent variables. Krajewski et al. (2007, 529) explain that this method aims to discover values of a and b that minimize the sum of the squared deviations of the actual data points from the graphed line.

Time-series Methods: Trend line analysis, looks-like analysis, moving averages

Trend line analysis is a technique to analyze sales data and fit a line, either mathematically or graphically, to a specific set of data (Kahn 2006, 13).

Looks-like analysis is a quite common forecasting technique in which the forecasts for the new items are created by using historical demand data of products which are similar to the new products (Kahn 2002). This forecasting method can be used because it is expected that the demand for the new item will be similar to the demand for the older product (Gilliland & Guseman 2010). Gilliland & Guseman (2010) explain that looks-like analysis provides companies a way to assess possible range of new product demand statistically and visually. This will help the forecast planners to keep the forecasts as objective as possible. This method is especially popular technique for new items which are line extensions (Kahn 2006, 13-14).

Moving averages methods use averages from previous demand periods to predict future demand. These methods include simple moving averages, weighted moving averages, and exponential smoothing (Krajewski et al. 2007, 532).

Hybrid Method: Expert system

Expert system is a hybrid method of time series and regression techniques (Kahn 2006, 15). It is a program which automatically tests variety of models and then creates the forecast with the model which creates the best forecast (Jain 2007).

3.2. New Product Forecasting Challenges

Managing and controlling the NPF process provides several challenges. These factors are mentioned in different sections of this research, however to emphasize the importance of these NPF challenges this section will provide a summary of them.

Fisher (1997) states that one of the challenges of NPF is that frequent new product introductions usually cause a reduction of product life cycles. Other NPF challenges are lack of historical and present data, limited analysis time, and product and market uncertainties (e.g. Fisher et al. 2000; Kahn 2006; Simon 2010). Simon (2010) also comments that bias towards new products are factors which cause difficulties. These five challenges of NPF will be discussed briefly below.

- Reduction of product life cycles
- Lack of historical and present data
- Limited time analysis
- Product and market uncertainties
- Bias towards new products

Fisher (1997) explains that companies which continuously introduce new products usually see a **reduction of product life cycles**. This is also a trait of specific industries, such as fashion textile industry, in which the products are seasonal (Mostard et al. 2011). Trends and consumer preferences change therefore the company must introduce new products for each season. Another reason for the shorter product life cycles, according to Fisher (1997), is that competitors can introduce similar product which will cause a decrease in the product demand and reduce the life cycle.

As mentioned previously, quantitative forecasting methods usually create more accurate forecasts since historical demand data is used to predict the demand of the future. Usually with new products **lack of historical and present data** causes forecasts to be created based on well educated reasoning. Some people seem to question the purpose of recording historical demand data. Fisher et al. (2000) explains that even if historical demand data cannot be used to forecast the future, it can provide useful information such as seasonality, consumer reaction to promotions, and differences in sales patterns at different stores.

Lack of decision supporting data causes major challenges for NPF as stated above. This feature causes also another limitation which is **limited analysis time**. Kahn (2006, 3) explains that normal sales forecasting is usually created using some kind forecasting software which makes forecasting quite fast process. With new products the forecast creation process is often carried out manually which can be quite time consuming. For this reason Kahn (2006, 3-4) explains that time management is important and companies need to evaluate the satisfactory level of forecast accuracy to the costs accrued to create the forecasts.

Product and market uncertainties will always play an important part in creating NPF. Simon (2010) explains that the size of the market and changing customer needs create external challenges which the companies cannot have an effect on however companies should conduct research about these issues in order to diminish the uncertainties as much as they possibly can.

Sometimes it is difficult to be objective when creating forecasts for new products. **Bias towards new products** is a factor which should always be considered. Krajewski et al. (2007, 549) comment that bias is the worst kind of forecast error. For this reason, companies should have a system in place that systematically identifies the biases (Kahn 2009). Also profound understanding of the forecasting process and having transparency about the forecast decisions helps companies to be aware of the possible biases and this knowledge can help personnel to create more objective forecasts (Kahn 2009). Bias in forecasting is discussed in more detail later and also a table of most common biases in NPF is shown in section 3.3.3.

This section provided a brief overlook of the NPF challenges. As mentioned earlier, these issues are discussed in multiple sections of this thesis since these are important issues and companies need to recognize the impact of these challenges and prepare to diminish their effects as much as possible.

3.3. Dimensions of New Product Forecasting

Kahn (2010) has introduced three dimensions of NPF which shows “hard” and “soft” sides of NPF. The following figure 3-1 shows the three dimensions which are analytics, behavior, and strategy. The figure also shows how these dimensions relate to each other. This figure helps companies to visualize and observe the multidimensional aspect of NPF. Kahn (2010) explains that the three dimensions of NPF aims to show that all three dimensions should be considered in order to fully understand and incorporate all critical factors of NPF.

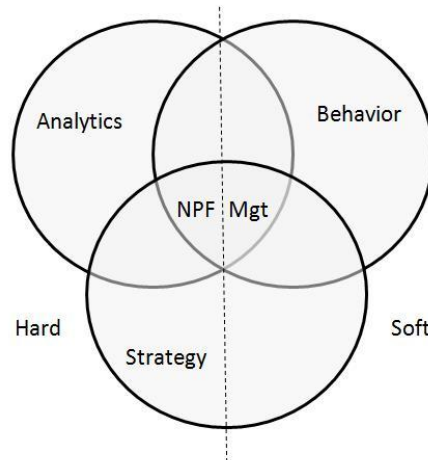


Figure 3-1 Three dimensions of new product forecasting (Kahn 2010)

An explanation of the three dimensions of NPF will be provided in the following three sections. Strategy dimension is examined in section 3.3.1. This section contains explanation of planning the new product forecasting process and assumptions management. Section 3.3.2. explains analytics which involves data availability, analyzes, and performance metrics. Sections 3.3.3. provides details about the behavior dimension which includes discussion of bias in forecasting and organizational communication.

3.3.1. Strategy

Strategy dimension is divided in half between “hard” and “soft” side of NPF. This dimension includes subjects regarding planning the new product forecasting process and assumptions management (Kahn 2010).

Planning the new product forecasting process

As mentioned preciously, forecasting should be a documented process which explains in detail the way forecasts are created and how performance is measured and monitored (Jain 2007). Jain (2007) comments that one key element in planning the forecasting process is managerial support. He further explains that managerial support is needed since financial resources and cooperation from internal (different departments) and external (distributors and customers) stakeholders are

needed to establish a successful and effective forecasting process. The process of forecasting should be accepted and understood by all the stakeholders who are affected by the forecasts and who need to utilize the forecasts. Making the forecasting process transparent is beneficial since in organizations where the forecasts are used and shared by multiple departments to support processes and for planning, increasing forecast accuracy is usually considered to be more important (Wacker & Sprague 1995; Mentzer & Kahn 1997; Moon & Mentzer 1998).

Assumptions management

Kahn (2006, 32-33) explains that NPF should be viewed as process of assumptions management. The process should include generation, translation, and tracking of assumptions. It is clear that NPF often requires decision making with very little or no supporting information. For this reason, assumptions regarding future are necessary. Kahn (2010) comments, that the inability to understand NPF as being assumptions management can cause greater tendency for incorrect forecasts. Assumptions management is more structured way of describing the necessity of having decision making in NPF to rely on predictions and hunches rather than on facts.

3.3.2. Analytics

Analytics presents the tangible factors of NPF that is why it is called the “hard” side of new product forecasting. This dimension includes data availability, analyses performed, and performance metrics.

Data availability

As mentioned throughout this thesis, forecasting is always easier if supporting demand data is available. This is the difficulty with NPF, previous sales data for new products does not exist (Kahn 2010). Kahn (2010) explains that in NPF some supporting data can often be found to aid decision making. Data can be gathered to provide overall market understanding and about the potential of the new product. Also demand data of similar items can be used as well as pricing and other marketing data of current and previous company products. Many companies have this type of data available however capturing and making data available can be considered to be too

laborious or not necessary. According to Kahn (2010), making these kinds of data sources available to the forecasters is as important as the data itself but he also add that some type of evaluation of the data creditability is needed before incorporating this information in the forecast creation.

Forecast analyses

Analyses involve the decision making about the forecasting techniques which will be used to create the new product forecasts. As mentioned previously one of the difficulties of NPF is the lack of historical demand data. For this reason judgmental techniques are more common with NPF. Kahn (2010) divides NPF methods into five general categories which are shown below. All the techniques which were explained earlier in section 3.1. fall into these categories. The aim of forecasting is to provide as accurate forecasts as possible however the information discovered about the relationship between the type of forecasting method and accuracy is conflicting (Peterson 1990; Kahn & Mentzer 1995). It seems that the selection of forecasting method is not as critical however the number of forecasting techniques used can improve the forecasts. Companies commonly use more than one technique to create NPF, the average being 2-4 techniques (Kahn 2002). The research of Gartner & Thomas (1993) and Makridakis et al. (2010) discovered that usage of more than one forecasting technique can correspond to greater forecast accuracy. Fisher et al. (2000) explain that using multiple forecasting techniques can also help managers to try to understand the differences of the forecasts created by different methods. This will help the companies to understand the reasons for inaccurate forecasts. Each forecasting technique will provide a slightly different forecast and the analysis of the forecast differences is critical.

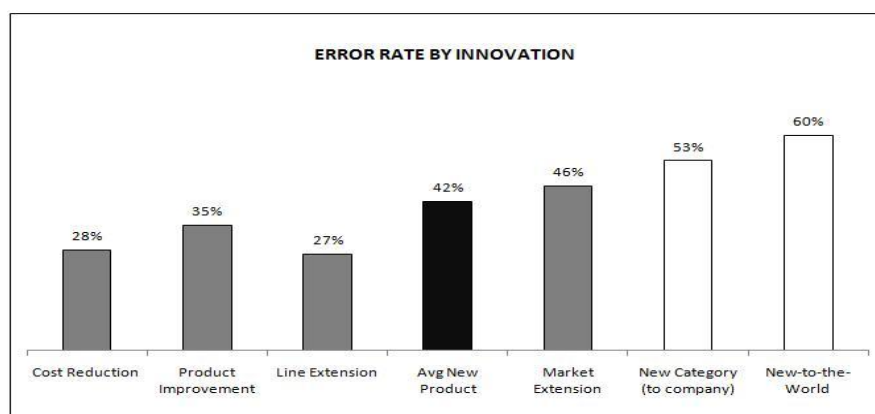
1. Managerial judgment techniques
2. Customer/market research techniques
3. Time series techniques
4. Regression analysis techniques
5. Other quantitative techniques

Performance metrics

As mentioned earlier, one of the critical steps of forecasting is to monitoring how accurate the forecasts for a specific forecasting period have been. Forecasts should be monitored and the error rate should be recorded and evaluated in order to continuously improve the forecasts. Analysis of the forecast error provides a starting point to examining the reasons for the errors so that the forecasts can be improved for the future. It is not enough only to calculate and track the errors, it is very important that the forecast planners, managers, and other stakeholders understand the reasons why and when the forecast errors occur (Fisher et al. 2000). Many companies are dissatisfied with their forecasting accuracy for new products since the error rate can be twice as high for a new item as for an existing item (Simon 2010). Usually a large portion of company sales are attained from new products (Jain 2008), therefore it is very important to investigate the reasons causing high forecast errors of new products.

Table 3-2 below shows the error rates for each new product initiative. As mentioned in section 1.5. this thesis concentrates only on a portion of these initiatives which are cost reductions, product improvements, line extensions, market extensions, and new uses. The columns for these new product initiatives have been highlighted grey in the table below. As table 3-3 shows this research focuses on the new product initiatives which have considerable lower error rates than brand new products.

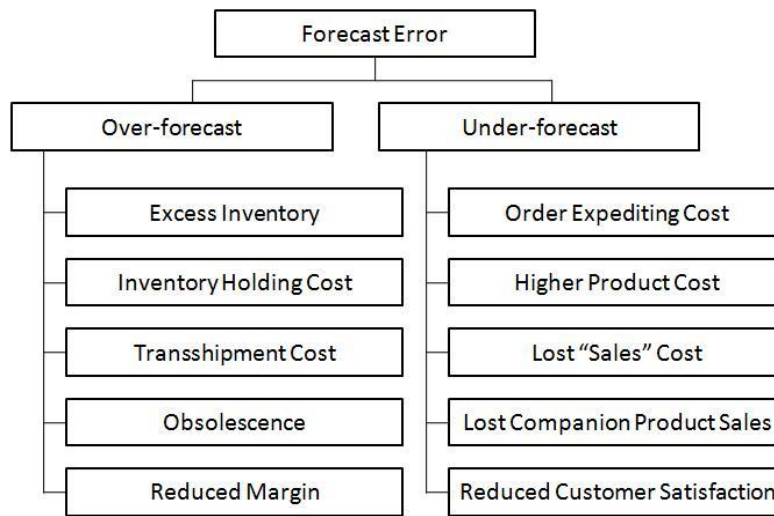
Table 3-2 Error rate by innovation



Source: Simon 2010

Inaccurate forecasts can be very costly for companies. Below table 3-3 shows a breakdown of the forecast error to over- and under-forecasts and shows what kinds of effects inaccurate forecasts can have. This breakdown of the forecast error provides companies a way to quantify the financial impact of the forecast error (Kahn 2003). All the consequences shown in the table cause financial losses therefore it is very important to monitor, evaluate, and improve the forecast error. Knowing why forecasts have been inaccurate is a beneficial method for improving forecasts in the future. Gartner & Thomas (1993) have studied the factors behind the low forecast accuracy rates for new products within the context of new computer software firms. Based on the study results, they provided the following recommendations to improve the accuracy: gain industry marketing experience, direct more attention and resources to new product forecasting, use personal data sources, and use more than one forecasting technique.

Table 3-3 Breakdown of forecast error



Source: Kahn 2003

The aim of forecast planner is to create accurate and credible forecasts. In order to make this possible, past performance should be recorded, measured, and evaluated. Companies should also outline a reasonable forecast accuracy level. Kahn (2009a) explains that forecast accuracy is usually a statistic to monitor other goals such as increased profitability or better customer service levels. For this reason the objective for forecast accuracy level should be determined first in

order to know the purpose for monitoring forecast error. It is often difficult to determine what the acceptable forecast accuracy level is therefore companies often utilize published data from industry surveys to decide the accuracy level for the company (Kahn 2009a). According to a study conducted by Kahn (2002) the overall accuracy of forecasts for new products is 58%. This means that companies are creating about twice as much inventory as needed or they are only able to meet half of the demand for the product. This shows that calculating forecast error is very important.

There are several alternatives for measuring forecast accuracy. Krajewski et al. (2007, 541-543) has identified five different forecast error measures which are explained below. Krajewski et al. (2007, 541-543) explains that forecast errors can be classified as bias errors or random errors. Bias errors happen because of systematic mistakes and the forecasts are always either too high or too low. Random errors are caused by unpredictable factors. The goal is to minimize the effects of bias and random errors, elimination of them is not possible. The measures explained below are quite common forecast error measures. The explanations below are brief and the formulas for these calculations are not provided. Companies must determine which methods will provide the most appropriate measures to evaluating the organizations main objectives. In the beginning it would be beneficial to use multiple error measures in order to determine which ones are the most useful.

- **Cumulative Sum of Forecast Errors (CFE)** measures the total forecast error. The downside of this method is that large positive errors offset the large negative errors. CFE is a good method for evaluating bias in the forecasts (Krajewski et al. 2007, 541).
- **Mean Square Error (MSE), Standard Deviation (σ), and Mean Absolute Deviation (MAD)** are measurements of the variability of the forecast errors (Krajewski et al. 2007, 541).
- **Mean Absolute Percentage Error (MAPE)** is an intuitive measure of variability which is expressed as a percentage. Error terms provided as percentages are usually easier for

managers to understand. MAPE is one of the most popular error measures among both practitioners and academics (Sanders 1997). MAPE is beneficial measurement in putting the forecast performance in the proper perspective (Krajewski et al. 2007, 542).

Analytics is extremely important section of the dimensions of new product forecasting since it discusses what is needed to create accurate forecasts, explains the different forecasting methods, and provides information of the key part of analyzing what happened during the forecasting period.

3.3.3. Behavior

Behavior is the “soft” side because it relates to the organizational and individual behaviors that occur consciously or unconsciously during new product forecasting process. Kahn (2010) explains that behavior includes bias in forecasting and organizational communication. These factors are explained in more detail in the paragraphs below.

Bias in forecasting

As mentioned previously, monitoring and recording forecast accuracy is vital for improving forecasts. One important indicator to monitor is biases. Bias can be observed in the forecast if the cumulative actual demand is different than the cumulative forecast for the same period (Arnold and Chapman 2004, 216). Herrin (2010) explains that “in an unbiased forecast, the sum of the error over a period of time will approach zero”. New products are usually more likely to have greater bias since the forecasts are more based on judgment methods. For this reason, companies should have a system in place to identify biases so that the effects can be minimized (Gilliland & Guseman 2010; Kahn 2009).

Forecasts can have random or systematic bias. Random bias is an error which cannot be predicted or controlled and systematic bias is often caused purposely but sometimes not consciously (Kahn 2009). Random bias forecasts can be caused by forecasting process deficiencies or due to insufficient information when creating forecasts (Herrin 2010). Systematic

bias can be subjective biases, which are always a challenge of forecasting. Subjective biases are the changes the demand planner makes into the forecast based on their own expectations (Golden et al. 1994). This is always a risk, since these are person's own interpretations. Golden et al. (1994) comment that studies have shown that forecast planners can incorrectly assume a run of good or bad luck as series of relationships between variables and outcomes which in actuality have no connection.

According to Simon (2010) a forecast planner usually has an optimistic subjective bias towards new products since the planner wants the products to succeed. Golden et al. (1994) provide the following three recommendations for minimizing the effects of bias in forecasts.

- Know the market
- Be independent
- Deflate forecasts for a margin of safety

Kahn (2009) identifies 10 most important systematic biases which are described below in table 3-4. Only few of these biases are discussed in more detail here however the whole table is provided in order expose the possibility of this type of behavior. As mentioned above, a way to minimize the effects of bias is to be informed and to understand the market. As mentioned earlier, companies often have high expectations for their new products therefore anchoring, optimism, and overconfidence are common biases in NPF. As mentioned in the table below anchoring, optimism, and overconfidence are caused by having high expectations for the new products. These biases can be managed by having a transparent forecasting process which includes usage of multiple forecasting methods and reference data to which the forecasts are based on.

Table 3-4 Ten new product forecasting biases

TEN NEW PRODUCT FORECASTING BIASES		
Bias	Definition	Ways to Manage
Accountability/ Management Commitment	An obligation to uphold a forecast that has been previously established.	Be open to diverging opinions on the new product forecast.
Advocacy	Inflating the forecast to overcome expected discounting by company personnel to ensure a level for the new product forecast is endorsed.	Stress that realism must underlie all new product forecasts and use independent parties as benchmark.
Anchoring	Fixation on an initial new product forecast number.	Employ outside experts to examine the new product forecast and entertain multiple forecasts.
Confirmation	The tendency of people to seek out information that validates an initial new product forecast hypothesis.	Seek out disconfirming evidence.
“Hard” Data	The presumption that any data are valid and provide substantial evidence, even if anecdotal.	Collect and compare data from multiple sources.
Optimism	Optimism is infused in the new product forecast to garner excitement and positive spin in order to receive management approval.	Triangulate onto a new product forecast through multiple data points and force counter positions to generate meaningful dialogue.
Overconfidence	Believing too much in the accuracy of the new product forecast.	Apply reference –class forecasting by examining similar business cases.
Planning Fallacy	Underestimating the time, money, and other resources needed to complete a major project.	Benchmark similar projects on budget, revenue, and cost elements, and put in place opportunities for company learning.
Post-Decision Audit	Overlooking the probabilistic/statistical nature of market research results.	Train personnel to understand probabilistic nature of new product forecasting.
Sunk Cost Fallacy	Unwilling to surrender the current course of activity, even if the costs are unrecoverable.	Have dispassionate experts and non-experts to examine the relevant aspects of the new product project.

Source: Kahn 2009

Organizational communication

Forecasts are usually used by several departments. For this reason, Kahn (2010) explains that cross-functional communication is vital in order to create forecast which incorporate all the necessary information. Also studies have shown that cooperation between departments can considerably improve forecast accuracy (Kahn & Mentzer 1994; Mentzer & Kahn 1997). One reason why forecast accuracy can be improved by cooperation is that it is one way to decrease the possibility of bias (Kahn 2010). Kahn (2010) argues that it is always better to have multiple stakeholders to provide their input in the forecasts since this makes the final forecasts more transparent, real, and objective.

3.4. Value of Early Sales Data

Previous studies (Cachon & Fisher 2000; Croson & Donohue 2003; Fisher et al. 2000; Rangunathan 2001) have identified the benefits of sharing consumer demand information in the supply chain. Sharing demand information provides companies some concrete knowledge of the upcoming demand hence they can be more confident in creating the forecasts and proving the expected demand information further along the supply chain. As mentioned earlier, due to the lack of historical demand information for new products, any prior knowledge of the upcoming demand is helpful. Fisher et al. (2000) explain the importance of using early sales data to establish more accurate forecasts for new products. Fisher et al. (2000) comment that using early sales data is particularly beneficial with products which have short life cycles such as fashion items. Companies can receive early sales data as POS (point of sale) data, distributor sell-through data, or distributor order data (Lehtonen et al. 2005). It depends largely on the industry which type of early sales data the company can attain and use.

Fisher et al. (2000) explains that one key element to increasing the accuracy of new product forecasts is to update the forecasts based on early sales data. A study conducted by Fisher et al. (2000) noted that many companies acknowledged the advantage of using early sales data to create more accurate forecasts however all the companies did not have a system in place to collect the data or if they attention was paid to early sales, the forecasts were not updated based on this information.

Bursa (2009) explains that POS data can provide an early indicator of which goods are selling therefore POS data is vital information for new products introductions. When using POS data, it is important to evaluate the reliability of the POS data. POS data can be inaccurate due to variety of reasons. For example, in apparel industry improper handling of returns is usually the cause of inaccurate POS data (Fisher et al. 2000).

All the different types of early sales data provide companies early indicator of overall product demand. Bursa (2009) also states that when a company has been successful in using POS data for

demand management processes, they have seen increased forecast accuracy, improved new product introductions, lower out-of-stocks, and total costs have decreased. The usage of POS data is usually feasible for companies which have short lead time since POS demand is not attained until products are sold to the end customer.

When companies are able to attain early sales data information when creating new product forecasts, the amount of predicting needed is less. Companies struggle with not knowing how to capture that data or how to use it (Fisher 2000).

3.5. Lead Time and the Bullwhip Effect

Lead time and the Bullwhip Effect are two factors which should be acknowledged and taken into consideration when creating forecasts. This section will briefly introduce these subjects and explain how they can affect NPF.

Globalization has opened up many doors for organizations to seek the best and most cost effective ways to offer products to their customers. Many companies have moved their manufacturing facilities to countries where manufacturing and labor costs are lower. This trend has increased the importance of supply-chain speed which is a critical factor of forecasting (Fisher et al. 2000). In NPF the lead times are already long due to planning and preparation times. Long planning and preparation times in addition to the long delivery lead time, is forcing many companies to create forecasts even a year ahead of time to the expected customer demand. Companies need to create the forecasts well in advance to provide their suppliers ample time to order the necessary materials and to reserve production capacity and to plan the production schedule. Long lead times make forecasting more inflexible since manufacturing capacity has to be reserved and/or materials have to be purchased. In many cases this means that the company already owns the products even though the product have not been manufactured (Fisher et al. 2000). Lead time is one main factor which causes companies to create their forecasts will before the expected demand occurs. As mentioned earlier some companies want their goods

manufactured in close proximity of the main market in order to have more flexibility and control of the manufacturing process and to have shorter lead time.

Bullwhip effect (also known as whiplash effect) is a phenomenon where the orders placed to the supplier have a greater variance than the sales to the customers and this variance is amplified upstream the supply chain (Chen et al. 2000; Lee et al. 1997). According to Lee et al. (1997) there are four causes for the bullwhip effect, the causes are; demand signal processing, the rationing game, order batching, and price variance. Lee et al. (1997) continues describing that bullwhip effect can create the following problems: inaccurate forecasts, low utilization of available capacity, higher inventory risks, and delivery problems.

Information sharing has been identified as one of the ways bullwhip effect can be decreased (Chen et al. 2000; Lee et al. 1997). Also creating transparency in the supply chain has definite advantages however in many companies creating transparency and utilizing the available information is a challenge (Chen et al. 2000). Bullwhip effect is well-known phenomenon for supply chain teams, having demand knowledge in both directions of the supply chain helps to possibility of this effect.

4. New Product Forecasting in the Textile Industry

“Textile-apparel companies have to deal with very competitive environment and have to manage consumers which become more demanding.” (Thomassey 2010)

The empirical research of the forecasting practices within organizations was conducted in companies which operate in the textile industry. The forecasting issues discussed in the literature review apply to all industries however the textile industry has also some unique characteristics. Time is critical element in the textile industry since it is so dynamic (Fisher & Raman 1996). This section will explain the textile industry characteristics when creating forecasts in section 4.1. and recommendations about handling the industry traits are provided in section 4.2.

4.1. Characteristics

Forecasting in textile industry very challenging task since the demand can be affected by factors which are beyond the control of the companies such as weather, fashion trends, and the economy (Fisher et al. 1994). These issues have to be acknowledged and addressed in order to minimize their effects. Thomassey (2010) summarizes the textile industry characteristics which provide specific challenges into four issues which companies operating in this industry should take into consideration. Mostard et al. (2011) explain that also globalization of sourcing and manufacturing creates challenges. These five characteristics are explained in more detail in the paragraphs below.

- Sales are usually seasonal
- Large number of stock keeping units (SKUs)
- Sales depend on fashion trends
- Many explanatory variables
- Globalization of sourcing and manufacturing

In the textile industry is **sales are usually seasonal** since the garments are often designed for specific weather conditions (Thomassey 2010). This factor causes the product life cycles to be quite short which makes accurate forecasting very important but difficult. Mostard et al. (2011) comment that due to the short product life cycle in-season replenishment opportunities are not possible or the possibility is very limited. This limited possibility of modifying forecasts greatly increases the risk of excess inventories or product obsolescence.

In order to provide products for a large customer group, companies in the textile industry have to offer the same products in various sizes and colors. This means that the company has to handle a **large number of SKUs**. This means that usually it is impossible to generate forecast on item level. For this reason in the textile industry forecasts are typically prepared at the product family level (Thomassey 2010).

Fashions come and go and it is important for companies in the textile industry to offer products which follow the current trends. Often in the textile industry **sales depend on fashion trends** which makes forecasting difficult since new products need to be continuously introduced and usually product characteristics change so much that historical sales data from previous seasons cannot be utilized. In the textile industry demand depends more on individual preference than customer need (Fisher & Raman, 1996). For this reason companies try to offer a variety of products to appeal to large consumer group.

Textile industry has to deal with **many explanatory variables** which cannot always be planned ahead of time. These can be events which involve an increase in purchase decision or events which change the store traffic (Little 1998). Examples of these kinds of explanatory variables are competition, calendar data such as holidays, purchasing power of customers, and end-of-season sales (Thomassey 2010).

Mostard et al. (2011) explain that usually majority of the textile product are manufactured in Asia due to low operation costs. Companies operating in the textile industry have had to cut costs since consumers are unfaithful and many of them make their purchase decisions according to

product price (Thomassey 2010). This **globalization of sourcing and manufacturing** is causing the lead times from manufacturers to be quite long. Fisher & Raman (1996) explain that due to the long lead time, forecasts, and production commitments for each style and color has to be made well in advance before of the selling season and before any customer demand information is available.

The factors explained above make forecasting in the textile industry a very challenging task. Thomassey (2010) comments that these challenges are also a reason why companies in this industry rarely use commercial forecasting systems. Companies want to be able to be in control of their forecasts therefore commercial systems are seldom used. Companies want to be in control because it is more critical to produce quality forecasts in this industry. The benefits achieved from accurate forecasts are more obvious due to the high volume of new products. In highly agile industries such as textile fashion industry the selling seasons are usually quite short and manufacturing capacity is constrained during the peak season hence at the end of the season over forecasted items must be sold at a discount and company will lose the sales for under forecasted items (Fisher et al. 1994, 83). This is because the selling season is usually too short to make additional orders. Companies have tried to solve these problems by using different production-scheduling systems such as quick response manufacturing and just-in-time (JIT) inventory systems (Fisher et al. 1994, 83). According to Fisher et al. (1994, 83-84) these are not proper solutions since their purpose is to allow flexible and quick changes to the production schedules and they do not address the problems of changing the orders which have already been placed.

Textile industry has its own set of forecasting challenges therefore the following section will provide some forecasting improvement recommendations which have been developed specifically for the textile industry.

4.2. Recommendations

One approach which has provided companies in the textile industry beneficial forecasting improvements is *accurate response*. According to Fisher et al. (1994) accurate response is a way to decrease the cost of forecasting errors. Fisher et al. (1994) explain that the key principle of accurate response is to find out which products are the most difficult to forecast and managers will delay the decision making regarding the demand of these products until they have more data such as early sales data available. Fisher et al. (1994) further explain that accurate response takes into consideration two aspects which other forecasting and scheduling systems are missing. Taking these factors into consideration helps companies to utilize the benefits of flexible manufacturing and shorter cycle times more effectively (Fisher et al. 1994).

- Accurate response takes into consideration missed sales opportunities and builds this factor into the planning phase
- Accurate response uses historical data and expert judgment to separate products which have predictable and unpredictable demand

As mentioned earlier, creating accurate forecasts is more crucial in highly agile industries such as textile industry due to the short product lifecycles. Industries which have long product life cycles accurate response is not necessary since forecast can be adjusted as needed and suppliers can react accordingly (Fisher et al. 1994). Accurate response is an approach which companies in the textile industry could consider implementing if current forecasting process does not provide expected forecast quality.

5. Theoretical Framework

Literature review provided general information and recommendations which could help companies to plan and organize their NPF activities in order to achieve increased forecast accuracy and financial benefits. This section will show and explain the framework used in this research. The framework has been constructed based on the information discovered in the literature review which covered sections 2, 3, and 4. According to Sekaran (2000) a theoretical framework is a conceptual model which explains the logical relationships of the important factors related to the research problem. The framework presented in this section will provide a logical presentation of the key issues which will help in providing answers to the research questions identified in section 1.3.

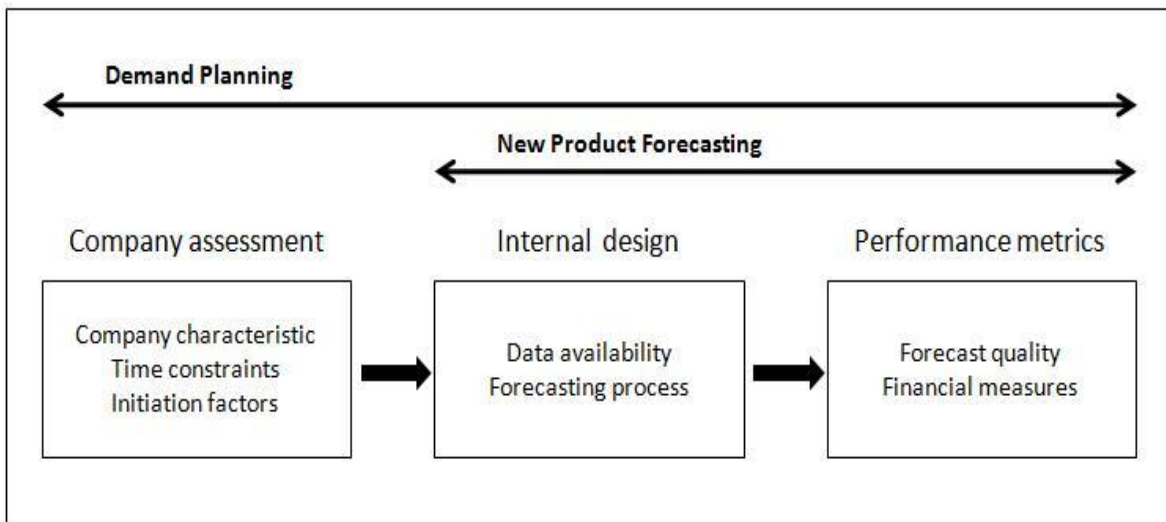
The following figure 5-1 shows the research framework which will be used to analyze the empirical research data. The framework provides a comprehensive picture of the key aspects of demand planning process created based on finding and recommendations provided by the literature. The framework divides the conducted research into three sections: company assessment, internal design, and performance metrics. Demand planning is an umbrella function for all these areas and in this framework NPF activities focus on internal design and performance metrics sections. All these sections are explained in more detail in the paragraphs below. As mentioned, this framework has been constructed based on the literature review sections. In the explanations below, the main sections where the specific issues were discussed are also mentioned.

Company assessment involves evaluating company characteristics, time constraints, and initiation factors. When making decisions regarding forecasting practices, *company characteristics* such as industry, company size, and future plans should be considered and assessed. (Company characteristics issues were discussed in sections 2.4., 3.1., 3.2., 3.3.2., 3.5., and 4.1.) The overall forecasting process should be built in a way that the company characteristics are integrated. Companies also have to evaluate the possibility of *time constraints* of the forecasts. (Time constraints issues were discussed in sections 2.4., 3.2., and 3.5.) This

involves creating and evaluating a timeframe in which the forecasts need to be created in order to provide all the interest groups the estimated quantities on time. One important factor to consider regarding time constraints is the supplier lead time. As mentioned previously, forecasts are usually created to estimate the product demand because of lead time since there usually is a time lag between upcoming need and the time the need occurs (Makridakis et al. 1998, 2). Time management is essential part of forecasting, as stated earlier it is possible to increase accuracy if more time is dedicated to analyzing the forecasts however management must balance acceptable forecast accuracy and the cost of attaining these forecasts. The final decision in the company assessment section is *initiation factors*. (Initiation factors were discussed in section 2.2.) Initiation factors involve making decisions regarding forecasting department, forecast level, horizon, interval and form.

The decisions made in the company assessment section will set the foundation for forecasting. The following sections, internal design and performance metrics, entail more specific subjects. Explanations of these sections will be provided below figure 5-1.

Figure 5-1 Theoretical Framework



Internal design involves important phases of NPF therefore a more detailed illustration of this section is provided below in figure 5-2. The first aspect in the internal design section is *data availability*. (Data availability issues were discussed in sections 3.1., 3.2., 3.3.2., 3.4.) This includes assessment of data availability regarding historical demand data, early sales data, and other demand estimates. This phase is aimed for the company to evaluate if any supporting information is available for the forecast creation.

The other phase of the internal design is *forecasting process*. (Forecasting process issues were discussed in sections 2.3. and 3.3.1.) The first step in the forecasting process creation is selecting the forecasting technique. As mentioned earlier, in most cases qualitative methods will be used in creating forecasts for new products. Quantitative techniques are feasible only in situations where some type of numerical data is available. The second step is to monitor and adjust forecast. This step involves watching the forecasts and adjusting them if new information which might have an effect the demand arises. Evaluating and integrating early sales data is critical in this step if that information is available. The third step, analyze forecast accuracy, is very important since this is the phase when the possible reasons causing inaccurate forecasts are examined. At this point it is imperative to calculate forecast error and also to evaluate if bias was a factor. The final step of the framework is to evaluate method success. This is the time to evaluate the whole NPF process. Does the current process create quality forecasts? Also it is vital to evaluate continuously how forecast quality could be increased.

Figure 5-2 Theoretical Framework: Internal design

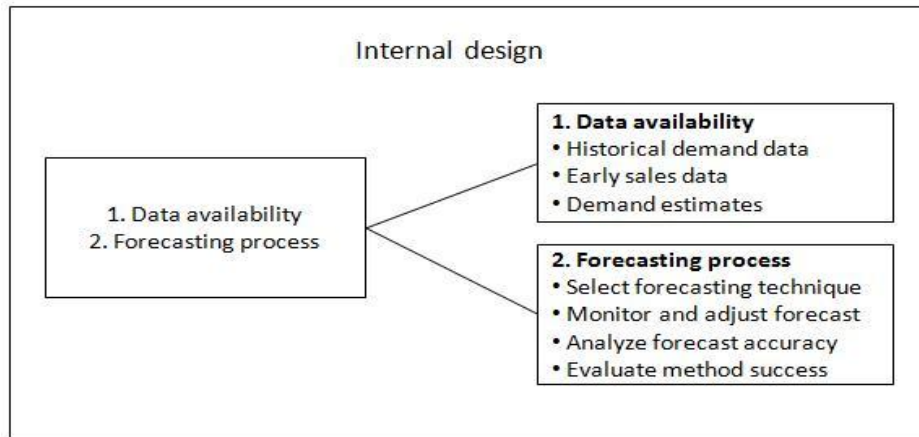


Figure 5-1 shows that the final section of the research framework is **performance metrics** which entails evaluation of forecast quality and financial benefits. *Forecast quality* is significant function of the forecasting process. (Forecast quality issues were discussed in sections 3.3.2. and 3.3.3.) As mentioned several times throughout this paper, calculating and recording forecast error is imperative for improving forecast quality. By doing this the company management can be more confident in the forecasts when there are concrete evidence of the forecast accuracy and credibility. Along with evaluating forecast accuracy also assessing *financial measures* should be part of the process. (Financial measures were discussed in sections 2.3. and 3.3.2.) Financial benefits of accurate forecasts can be quantified when records are maintained. Accurate forecasts provide clear financial benefits, such as decreased inventory costs and fewer clearance sales. Measuring negative financial impacts of the forecasts can be difficult to quantify. Negative financial impact occurs when a company has under-forecasted products and they cannot provide requested supply to their customer. This has a negative financial impact since in these cases the company loses potential sales.

This section has provided a comprehensive framework of the issues which were determined to be important when establishing a forecasting process and when aiming to create quality forecasts for new products. The following methodology section will provide information and validation of the research methods used to gather the information for the empirical research section.

6. Methodology

This section will provide the methodology of this research. Empirical research was conducted as a qualitative explanatory study and this section will explain and validate the used research method. This segment begins with section 6.1. which provides an explanation of the research design. Section 6.2. explains and validates the data collection method. This is followed by section 6.3. which provides details of the methods used to analyze the empirical research data. The final section 6.4. provides explanation and validation of the trustworthiness of this research. The final section is especially important since it explains that the research is valid and it provides real insights into actual forecasting schemes used in practice.

6.1. Research Design

The aim of the research was to discover the practices and attitudes of professionals who have in-depth knowledge of creating, evaluating, and managing NPF processes. Ghauri & Grønhaug (2005, 112) mention that qualitative research method is a way to investigate attitudes towards subjects such as trends and behavior. White (2002, 29) explains that qualitative research is a descriptive, non-numerical method to collect and analyze information of situations which happen in actual and everyday settings. Creswee (2003, 22) mentions that the aim of qualitative research is to increase the understanding in determined areas and this kind of research is explanatory. One form on qualitative research is case study. Yin (2003, 1) explains that case study as a research strategy is often used to add to our knowledge of individual, group, and organizational occurrences. Yin (2003, 2) summarizes saying that case study research allows the researcher to gain holistic and significant characteristics of real-life events such as organizational and managerial processes. Easton (1992, 1) states that the aim of case studies should be gaining knowledge by preset educational objectives in mind. The reasons above provide justification and clarification why qualitative case study research method was determined as the best research approach for this study.

The best case study method for this research was determined to be multiple-case study. Harriott & Firestone (1983) explain that multiple-case study is many times regarded as more convincing than single case study and this makes the study more robust. In this thesis the aim was to research forecasting habits within one industry sector therefore multiple-case study was more appropriate. Multiple-case studies also allow better generalization of the research results (Yin, 2003, 53). This section explained and provided justification for the qualitative multiple-case research design used in this research. The following section will explain how the research data was collected and documented.

6.2. Data Collection Method

Data collection method is critical task of the research methodology since it is the tool which is used to discover answers to the research questions. In this research semi-structured interviews were selected as the primary data collection method. Hirsjärvi & Hurme (2000, 48) comment that semi-structured interviews have the benefit of the interview being focused on certain themes. For this study semi-structured interviews allowed following a preset list of questions while at the same time the interview was considered to be a conversational communication about the subjects of demand planning and NPF. White (2002, 30) explains that one benefit of face-to-face interviews is that any misunderstanding between interviewer and interviewees can be clarified immediately. According to Timm (2005, 74) interviewees are encouraged to express matters which are important to them about the subjects of the semi-structured interviews.

White (2002, 30) also states that interviews have disadvantages and one of them is a possibility of bias on both the interviewee and interviewer side. Careful planning of the interview situation can decrease the possibility of bias on both sides (White 2002, 30-31) and in this research the possibility of bias was recognized and its effects were minimized by following the preset list of questions and maintaining objective attitude.

This type of data collection method is also considered to be an explanatory research because according to Yin (2003, 6) a study is an explanatory research if the aim is to find answers to

questions “how” and “why”. Yin (2003, 6) also mentions that this type of information needs usually lead to the usage of case studies. This also confirms that for this thesis semi-structured interviews were the best approach to discover answers to the research questions.

The companies which were approached for the interviews are Finnish companies operating in the textile industry. These companies sell high quality products which are unique and durable and the companies have well-known brands. The portion of sales attained from new products varies in these companies between 40-90% of total sales which is fairly high therefore NPF is a critical task. The selected companies provided rather interesting sample since the industry is the same however the companies have quite different goals and values. Hirsjärvi & Hurme (2000, 107) state that the structure of research interviews usually is that the interview starts with questions about boarder research areas and the questions will then move on to more specific ones. This is how the interview questions were formulated since the interview questions started with general questions about forecasting and then moving on to specific questions about NPF. According to literature review the subjects of the questions provide insights to the critical research areas and also help to discover answers to the research questions.

Semi-structured interviews of representatives of four companies were conducted between April 11th and May 5th 2011. Hirsjärvi & Hurme (2000, 74) comment that the best place for semi-structured interviews is a place where the interviewees feel relaxed and the place should be allow fluent communication flow. Three of the interviews were conducted at the company premises and one interview was conducted at a café, the interview situations were very comfortable and communications of the interviewees seemed fluent. The interviews were conducted in Finnish and the researcher translated the contents of the interviews in English according to researcher’s best ability. Each interview lasted approximately an hour and the interviewees answered the questions and provided clarification and additional details as needed. Details of the interviewee information are provided at the end of this thesis in the reference section. The following section will provide information of the way the empirical research data was analyzed.

6.3. Data Analysis

According to Yin (2003, 109) data analysis involves examining, categorizing, tabulating, testing, and exploring the evidence to try to explain the propositions of the research. The analysis strategy for this thesis is relying on theoretical propositions (Yin 2003, 111-112) which mean that the analysis of the data will follow the theoretical proposals of this research. The theoretical proposals were summarized in section 5 which presented the theoretical framework of this thesis. Ghauri & Grønhaug (2005) state the researcher can have prior assumptions and expectations about the main issues if the research is based on theoretical propositions. Therefore the analysis of the interview data will follow the structure of the theoretical framework which includes all the critical aspects of NPF thus providing insights to answering the research questions.

The interviews questions were prepared according to the subjects which seemed to have an important function in the process of creating quality forecasts. After the interview questions were created, the questions were sorted according to the theoretical framework. This allowed the analysis of the interviews fairly easily to follow the theoretical framework. During the interviews the interviewer asked many clarification questions and interviewees offered additional information and the subject deviated at time from the original questions. Therefore the interview notes and/or recordings were carefully sorted when reviewing the data in order to ensure that the information gathered from the interviews was analyzed in the right context of the framework.

This section provided clarification of the methods that were used to analyze the research data collected during the interviews. Careful explanation of the research process is one characteristic in providing objective and trustworthy research findings. The following section will explain other factors which validate the trustworthiness of this study.

6.4. Trustworthiness of the Study

Research conducted as interviews has many factors affecting the interpretations of the collected material. Hirsjärvi & Hurme (2000) explain that one factor impacting the research information

already during the collection phase is the researcher. For this reason it is important to explain in details the methods used to collect the data and to show that objectivity has been maintained and the quality of the study findings can be trusted. Yin (2003, 33-39) explains that in order to validate the quality of an empirical research usually the research has to pass four quality tests. These tests are: construct validity, internal validity, external validity, and reliability. The following paragraphs explain the ways these quality tests have been considered and fulfilled in this research.

Construct Validity

This test is about setting up the appropriate operational measures for the issues which are studied. In order for the validity to be constructed in a case study, the specific changes to be studied must be identified and also the measures used to evaluate the changes must reflect the change. This validity test has been met by having a preset list of interview question which identify the issues which are studied. The evaluation measures are the examination of the company practices comparisons to the recommendations discovered in the literature review. This is ensured by following the theoretical propositions constructed based on the literature review.

Internal Validity

Underlying relationship must be established in order for the research to have internal validity. It must be shown that the recommendations lead to the desired outcome. In this research the main goal is to find factors which help to create quality forecasts and factors which increase the forecast quality for new products. The interview questions were formulated in such a manner that the company representatives would be able to provide answers about the issues which in their organization help in creating quality forecasts and factors which possibly would increase the forecast quality. The literature review provides evidence that the recommendations will help companies to increase the quality of their new product forecasts. These issues help to establish internal validity for this study.

External Validity

External validity must be established by explaining whether the findings of the research can be generalized beyond the case studies conducted for the specific research. Critics claim that generalization in a single case study is rarely possible. In this research multiple-case study method has been utilized which increases the external validity of this research. By interviewing multiple companies, the researcher can be more confident in drawing conclusions to the issues which this research investigates. The conclusions from this research can be generalized fairly well since multiple companies have been interviewed and external validity has been established.

Reliability

In order to establish the reliability for a research, the investigator must show that the results of the study could be repeated with the same outcome. The aim of reliability is to confirm that the collected research information which does not contain errors or bias. Reliability of this research has been established by providing information of the individuals who were interviewed and also including the list of all the interview questions in appendix 1. These actions will help to strengthen the reliability of the study since by proving this information, the interviews conducted for this thesis could be replicated. The only variable which will affect the outcome of the research if the interviews would be repeated is the state of forecasting in these organizations. As mentioned forecasting is a very dynamic process hence it is constantly changing. This is a factor which diminishes the reliability of this study however it is a factor which cannot be controlled.

This section explained the factors increasing the trustworthiness of this research according to the criteria described by Yin (2003, 33-39). The researcher has been aware of the aspects which can affect the credibility of the research findings and has aimed to gather objective information from the literature review as well as from the empirical research interviews.

7. Empirical Research

Theoretical overview provided background of forecasting, new product forecasting, and forecasting in the textile industry. This section provides details of the empirical investigation by providing background information and analysis of the explanatory research. As mentioned earlier, the empirical research data was collected by conducting four semi-structured interviews. The interviewees are professionals whose jobs entail being part of demand planning and forecasting. The aim of the interviews was to discover what type of forecasting practices companies are using and to determine how the recommendations provided by the literature correspond to the practices used by the forecasting practitioners and also to provide answers to the research questions. As mentioned previously, the contents of the interviews will be analyzed according to the theoretical propositions hence the analysis structure will follow the theoretical framework presented in section 5.

The empirical section begins with section 7.1. which provides a brief introduction of the four companies whose representatives were interviewed. Section 7.2. provides details of the interviews finding in the context of the theoretical framework. The last section 7.3. presents conclusions of the analysis and recommendations.

7.1. Company Interviews

All the companies whose representatives were interviewed for this research are well-known Finnish textile companies which sell goods also in foreign markets. Finland offers quite small and limited market opportunities therefore companies wishing to expand usually seek growth opportunities abroad. According to Finatex (2011) textile and clothing imports have increased by 21% in 2010, this statement was also supported by the comments of the interviewees. Demand outside Finland is increasing and few of the interviewees commented that due to the increase in the volume of the products, more standardized forecasting processes would be helpful to provide easier control and enable taking advance of historical demand information. Established forecasting process allows better control of the product flows and easier sharing of the forecast

information. Below is brief introduction of the companies whose representatives were interviewed in alphabetical order: Finlayson Oy, Halti Oy, Marimekko, and Sasta Oy. The information provided here has been attained from the companies' websites.

Finlayson Oy has been in operation since 1820. The company manufactures and markets high quality home textiles. In 2004, Familon duvets, pillows, and mattresses were added to the product selection. In addition to home textiles, the company's product offering includes contract textiles and bed concepts. Company's production facilities are located in Finland which allows greater attention to product safety. (Finlayson 2011)

Halti Oy was started in 1976 and it designs and markets outdoor clothing collections which include accessories, footwear, and selected outdoor equipment for all seasons. The key product areas are winter and outdoor sports. Halti invests heavily in product development to meet the wishes and needs of demanding outdoor enthusiasts. The company sells goods through sporting goods retailers, department stores, and hypermarkets under 2 brands "Halti" and "Raiski". Currently the company has over 1400 sale points located in over 15 countries. The main market areas are Finland and the alpine countries in central Europe. (Halti 2011)

Marimekko OYJ is a Finnish textile and clothing design company established in 1951. The company designs and manufactures high-quality clothing, interior decoration textiles, bags, and other accessories. The company is especially well-known for its original prints and colours. (Marimekko 2011) Marimekko has all together 84 stores located in Finland and abroad. Out of these stores, 28 are Marimekko's own retail stores. In 2010 the largest countries for exporting were Japan, Sweden, the United States, Denmark, and Germany. (Marimekko 2011a, 6-8)

Sasta Oy is innovative Finnish family company. The company was established in 1969 and it designs and markets high-quality clothing and accessories appropriate for hunting, camping, and other outdoor activities in Finland and abroad. Sasta focuses on the high-quality, durability, and timelessness of their apparel. The company has licenses for Gore Tex- and Windstopper clothing which guarantees the utilization of new and high quality techniques. (Sasta 2011)

7.2. Analysis of Forecasting Practices

This section will provide a comprehensive explanation of the contents of the company interviews. Individual companies' answers are not provided in order not to protect companies' anonymity and also it is not necessary since the overall analysis of the information will provide a better picture of the general situation of NPF practices in these companies. These companies operate in the textile industry but they are different in many ways. The companies whose representatives were interviewed attain between 40-90% of their sales from new products. Some companies want to focus mainly on new products which are sold only during one season and few of the interviewees also commented that their company would like to increase the amount of seasonal products since those products usually have larger profit margins. Other companies want to focus on products which can have life cycles of several years hence the product selection and sales focus varies from one end to another.

This segment is divided into three subsections based on the theoretical framework which was constructed based on the literature review. Section 7.2.1. explains details of the company assessment factors. This is followed by section 7.2.2. which provides information about the internal design issues. The analysis of the forecasting practices is finalized by section 7.2.3. which explains the performance metrics portion.

7.2.1. Company Assessment

Company assessment factors involve overall demand planning decisions which should guide the general forecasting practices. These factors include evaluation of company characteristics, time constraints, and initiation factors.

Company characteristics

Company characteristics, such as industry, company size, and future plans, should be considered and integrated in the overall forecasting system in order to have a clear picture of the purpose and long-term goals of forecasting in the organizational context.

One characteristic which has a critical influence on the forecasting practices is the industry in which the company operates. As explained in the literature review, textile industry is very dynamic where frequent new product introductions and short product life cycles are common. It seemed in the interviews that overall forecasting practices in some of these companies were somewhat unstructured and this could be partly due to the industry they operate in. When the company is constantly involved in decision making process regarding new products majority of the time is consumed in planning for the future therefore the importance of recording, evaluating, and analyzing historical demand data can be overlooked. Systematical analysis and recording of the forecasts seemed to be areas which have been overlooked in some of these companies.

Another trait which could be tied to the industry is that only a few of the interviewed companies use some type of software to help with forecasting. In most cases forecasts were created just in spreadsheets. As mentioned in the literature review quite often companies in the textile industry do not use commercial forecasting software since the companies want to have better control of the forecasts. This could also be due to the large number of new product and frequency of new product introductions hence maintaining and building forecasts utilizing historical data is not seen very helpful. Only one of the interviewees explained that they have a comprehensive system in which historical demand data is maintained and they are able to retrieve statistics of their process from the system.

Also another company characteristics affecting in the decision to use forecasting programs is company size. In smaller companies product selection is usually more limited. Creating forecasts for a smaller quantity of products is often less time consuming and easier to maintain just in spreadsheet. Sometimes forecasting software can be seen as too laborious which needs and provides more information than necessary. One of the interviewees commented that due to the growth of the company and the growing number of stock-keeping units (SKU), their forecasting practices should be more organized and structured to enable better control of the forecasts, and better recordkeeping of historical demand data.

Organization's future goals should also influence forecasting practices. The factors described above, usage of forecasting software and product selection, are part of the future planning. If the company plans to expand their product selection, it makes forecasting more complex therefore usage of forecasting software and creating a structured forecasting process is recommended. As mentioned earlier this will help to maintain and archive historical records and make it easier to have overall control of the forecasts.

Industry, company size and company's future plans are company characteristics which influence forecasting practices. Many companies seem to have forecasting practices which work now but if and as the company grows, controlling all aspects of the process becomes more difficult. For this reason it is better to evaluate these factors now and make decisions which will help the companies to be ready and organized now and in the future.

Time constraints

Forecasting time constraints are issues which can cause great challenges for companies. It is important to create a timeframe which shows the timing of the need for the forecasts. As mentioned in the literature review, forecasts are predictions of the expected future demand and forecasts are created to have time to prepare for the upcoming demand. Time management is a critical factor since sharing estimated demand information with different interest groups late can cause delays in product deliveries and availability. Time constraints are one of the bottleneck areas which many companies aim to minimize.

The timing of forecast creation depends largely on the time it takes to manufacture and deliver the goods to the customers. The company representatives interviewed for this research said that the final forecasts had to be made 6-14 months ahead of the selling season. In most cases the forecast creation itself took only a few weeks but the time needed to purchase materials, to reserve manufacturing capacity, allow time for manufacturing, and delivery times cause the lead time to be so long. Lead times vary greatly and one of the aspects of lead time which companies actively try to shorten is the delivery lead time. Companies aim to streamline their product flows so that the delivery time of the materials to the supplier is at its minimum. Companies which

mainly manufacture goods in Asia the lead times are a much longer than for companies whose goods are manufactured in Europe. Long lead time often force companies to make demand estimates before any early orders from customers are received. As mentioned in the literature review, availability of early orders makes forecasting much easier. These factors show that selecting manufacturing locations can be one of the strategic decisions companies make.

Another factor in minimizing the effects of time constraints is smooth information sharing. One of the aids in this could be some type of Enterprise Resource Planning (ERP) system which provides a shared platform to provide immediate information to all the interest groups. Only one of the companies had ERP type of a system in use. Other companies had also systems which allowed information sharing but they were not as comprehensive. Systems which allow immediate information sharing make processes faster. For example, one of the interviewees commented that in their organization once the sales person receives an order and inputs it in the system, the information is immediately available to operations. This enables the planning for the manufacturing schedule to begin without any delays. The ideal situation is that the expected demand information and orders already placed are immediately available to everyone in the organization who needs to view the data and has to utilize it.

The interviewees commented that lead times are areas in which improvements could be made but it is very difficult since suppliers' prefer receiving forecasts as much ahead of time as possible and the companies and their customers wish they could delay forecasting decisions. The manufacturing locations for the companies involved in this research were mainly Asia and Europe. Some companies manufactured most of the goods in Asia in which cases the lead times could be 6-8 months or even longer and some of the companies manufacture a large portion of their goods in Finland or in other European countries and then the lead times can be as little as 3-6 months.

Time management of the forecasting process is very important in order to minimize the negative effects of time constraints. Time constraints, especially delivery lead time for many companies is

often a continuous area for improvement, unfortunately in many cases shortening lead times can be rather difficult.

Initiation factors

Initiation factors include decisions made regarding forecasting department, forecast level, horizon, interval, and form. These are the basic preliminary forecasting decisions which help to have an overall knowledge of the necessities.

Firstly determination about the forecasting department should be made and also it needs to be decided which departments should be involved in the process. As shown in the literature review, the department responsible for forecasting varies in organizations. Section 2.2. discussed and showed figure 2-1 of the departments responsible for forecasting. Operation/production was the leading unit and it was followed by sales and marketing. It was also mentioned in the literature review that a current trend has been to create an independent department for forecasting in order to minimize the effect of bias. It was interesting to discover that forecasts were mainly created by the sales personnel in the companies whose representatives were interviewed. Companies which introduce new products continuously, such as companies in the textile industry, it is understandable that sales people are strongly involved in the creation of the forecasts. One of the interviewees praised the sales personnel in their organization who are committed to the company and know their customers very well hence they are able to provide quite accurate forecasts. In some of these companies input for the forecasts was also received from one or more of the following departments: purchasing, operations, marketing, and company management. It is beneficial to share and discuss the forecast plans with all the departments which can have possible effects on the product availability and the upcoming demand. The interviewees commented that production is one of the departments which have been involved in forecasting. Production does not necessarily provide direct input about the forecast quantities but they often comment on the feasibility of the forecasted quantities for production and the expected timeframe for manufacturing those quantities. Another department which was mentioned in the interviews playing an important part in turning the forecasts into sales was marketing. Marketing department makes plans for increasing visibility of the products and they need to know which

products should be advertised. Marketing department will then make plans on how to create awareness and increase sales.

Forecasts level depends largely on the product type. All the interviewees commented that their organizations mostly create forecasts on stock-keeping unit (SKU) level. Some of the companies also create forecasts for some products at series level. In these cases, all the items in the series are created from the same material. Creating forecasts at SKU level means that the forecasts are created for each individual product. This is the lowest product level hence the amount of products for which forecasts need to be created is usually very large. Few of the interviewees commented that the forecasts must be created at this level because customers make their purchase decisions not only based on the style or fabric of the product but also according to color and size. For this reason forecasts are mostly created for each different product/fabric/color/size variation.

As mentioned in the literature review, forecast horizon often depends on the lead time. Companies need to make a choice how far into the future the forecasts should be made. Also forecast interval needs to be decided. Forecast interval is the timeframe which will be used to evaluate the forecast hence it should be a time period for which it is feasible to calculate forecast error. All the interviewees commented that forecasts are created for one season however in few of the companies this forecast is then divided for each month. The monthly forecasts also help to plan and distribute the product deliveries. These companies have 2-4 main seasons in a year and some of the companies also had few smaller product introductions throughout the year.

Companies need to also decide about the form in which the forecasts are provided to the different interest groups. Forecasts are usually viewed as product quantities for expected future sales. This is the main purpose of forecasting however some interest groups, usually management is more interested in the monetary amount that can be achieved if the forecast quantities are turned into sales. One of the interviewees stated that in their organization forecasting begins when the available budget for the upcoming season is decided hence the monetary amount is then allocated to the product selection which is expected to have demand.

Forecast accuracy can be increased by having input from departments which can affect the upcoming demand. In addition, interdepartmental collaboration and information sharing provides transparency and this provides all the interest groups information of the expected future sales. Decisions regarding these initiation factors will determine how the forecasts can provide the best possible benefits for the whole organization.

7.2.2. Internal Design

Internal design provides the core procedures of NPF. These areas should be properly planned and documented to provide the whole organization a clear picture of the main forecasting functions. Internal design factors include data availability, and forecasting process.

Data availability

Forecasting is easier when it is possible to base the expected demand decision on some quantitative data. Availability of supporting information for forecasting decision making varies greatly in different companies. As mentioned in the literature review, one of the difficulties in creating forecasts for new products is the lack or absence of supporting information. Examples of information that can help in forecast creation can be historical demand data, early sales data, and other demand estimates.

It is recommended that historical demand data is utilized with new product forecasts, when the company is introducing products which are similar to the ones they have sold before. This method, looks-like analysis, was explained in section 3.1.2. Most of the interviewees commented that their organization does not use historical demand data actively when creating forecasts for new products. Few of the interviewees commented that if similar products to past introductions were going to be introduced, then historical demand for these similar products were possibly used as reference and guidance but this was done at each sales person's own discretion. One of the companies used historical demand information to make forecasts however the interviewee commented that the market seems to be currently at a changing point which means that it is more

unreliable to use the past sales as a predictor of the future. A factor being partial cause for this change in the market dynamics and market demand is the price change of the materials.

Literature review highlighted the benefits of using early sales data to create forecasts for new products. All the interviewees commented that receiving orders or commitments from customers before the final forecasts have to be firmed makes forecasting much easier. As mentioned in the literature review and also the interviewees commented that receiving orders, especially in the retail industry, is often quite difficult. Retailers prefer making decisions regarding upcoming product selections as late as possible whereas the design companies usually have to order materials and plan for production before the retailers are ready to place their orders. Literature review discovered that often companies do not know a system is place to collect early sales data. This was not the case with the interviewed companies. All the interviewees commented that their organization benefits from receiving orders early and they urge their customers to place orders as early as possible. One of interviewees commented that their organization usually receives approximately 50% of the orders before the forecasts have to be firmed and the interviewee also commented that it is easier to obtain early orders from domestic customers. Another interviewee commented that the more orders they have received from their customers, the less they have to predict. Companies which have their manufacturing locations close to their main markets have an advantage regarding receiving early sales data since the lead time is rather short and the company can place their orders closer to the actual selling season. One of the interviewees commented that the first orders they place are very small quantities since usually they receive early orders before the second set of orders have to be placed.

Another factor that came up in the interviews when talking about availability of early orders information was minimum order quantities. All the companies had minimum order quantities which varied according to different products and manufacturing locations. Receiving early orders also helped to show which products have enough orders to cover the minimum order quantity. If an order quantity for some product was less than the minimum order quantity, then the company knew that if they order minimum, they are already taking some risk. If some products had very few orders or no orders at all, often the product is dropped from the new line introduction. In this

respect the order minimum helps companies also to evaluate the potential demand success of their products when they receive early orders.

Availability of some supporting data when forecast decisions are made is very beneficial. Historical demand data can be used as a reference for similar items and early sales data decreased the amount of predictions the company has to make and also early sales data provides indication of the products which the company should take risks in as they have then some confirmed orders for their new products.

Forecasting process

Literature review revealed that having a documented forecasting process is beneficial since it provides the whole organization an explanation of the steps involved in creating the forecasts. As mentioned earlier in the literature review forecasting process should include explanations of how the forecasts are created and how forecasting performance is measured and monitored. Most of the companies had clear steps how the forecasts are created however the follow-up of the forecasts performance seemed to be an area which could be improved in some of the companies.

All the interviewees commented on the importance of forecasting and how challenging it is. Some interviewees commented that their organization recognizes the lack of proper forecasting process and tools which hinders the company's ability to utilize all the available information effectively to produce more accurate forecasts and to keep control and records of the sales of their products. These companies saw the lack of proper forecasting process as a disadvantage and steps were being taken to correct the situation in order to provide more structure to the process. For one of the companies, the need for better forecasting process was also prompted by growth and internationalization. The company wanted better and uniform control over their products. The company was planning to develop a comprehensive forecasting process and also improve utilization of information technology for ongoing products and develop product development process for seasonal products. Another of the interviewees commented that they have to have documented forecasting process and system in place to provide them with continuous statistics of the complete situation otherwise it would be difficult to manage the process.

Having an outline of the forecasting process is a good idea since it shows the overall picture of all the phases. Most of the interviewed companies did not have a formal documented forecasting process description. In most of these cases the interviewees explained that forecasts are created by sales people for their own sales districts hence they need to predict each of their customers expected sales. The sales people usually utilized varying information to make their forecast decisions, information such as sales for the last corresponding season and monetary amounts the clients ordered previously. The forecast creator has to be able to explain what supporting information has been used to create the forecasts. After each sales person has made their forecasts, then the sales managers compile the total demand estimates hence the companies use sales force composite forecasting technique. In most cases this seemed to be a method which provides fairly satisfactory results. Literature review described that this is a bottoms-up approach which can be time consuming and the possibility for intentional bias is greater.

Step one of the forecasting process is selecting a forecasting technique. The methods used by these companies corresponded fairly well to sales force composite and jury of executive opinion. As forecasts were mainly created by the sales department the potential of bias exists and the interviewees recognized this. As mentioned earlier usually the sales person creating the forecasts had to be able to explain how the forecast was created and in all the cases several people viewed the forecasts which decreases the possible of biases. In few cases approval from the management team was required for the forecasts before the final orders were placed. This could be considered as a variation of the jury of executive opinion technique. Overall this seems like a good approach. Literature review discovered that forecast accuracy can be increased by using more than one forecasting technique. Also having several departments, such as sales and management involved in the decision making process minimizes the effects of possible bias.

The second step in the forecasting process is to monitor and adjust the forecast. Most of the interviewees commented that after the initial forecasts are created, usually there is a short time period, only few weeks, before the final order quantities have to be firmed. In some cases, during this time the company sometimes receives orders from their customers. They are hoping to receive as many orders as possible since it decreases the amount of predictions that have to be

made. The forecasts are always re-evaluated at least few times before the forecasts are firmed and orders are placed. In few of the companies orders were placed in phases, which allow more flexibility since orders for the last phases could possibly be modified after some early orders has been received.

After forecasting interval has ended, the forecasting process continues with analyzing forecast accuracy. This is a critical step to evaluate the success of the forecasts. Most of the companies did not calculate forecast errors after the forecasting interval. However as mentioned earlier, all the companies whose representatives were interviewed created forecasts for one season and all the companies had some type of review meetings after the season to discuss the overall success. One of the interviewees explained that their company also has monthly sales meetings where the quality of the forecasts is evaluated. Few of the interviewees commented that one important factor which is being monitored and which shows the accuracy of the forecasts is the amount of inventory that is left after the season. The companies determine whether the extra inventory is due to inaccurate forecasts or orders which were delivered.

The last step in the forecasting process is and evaluation of the process success. As mentioned in the literature review forecasting process should be dynamic which is under constant scrutiny. After analysis of the forecast accuracy has been completed, companies should evaluate if the accuracy is at acceptable level. If accuracy is lower than expected, then it is recommended to try to find ways to modify the process in order to increase the accuracy. One of the interviewees commented that the forecasting team in their company estimated demand for certain products rather high since all the team members felt that it is very likely that consumer would buy the product. They were wrong, the product did not sell as expected. Due to this experience, the company decided that they would like to have additional input about upcoming product introduction. The company decided to compile a small group of individuals from outside and inside the company, who could give their opinions about the attractiveness of the products to the customers. This shows one example of how low forecast accuracy prompted changes in the forecasting process.

Forecasting process is a simple but effective way to have a systematic approach to forecasting. Following the steps of the process ensures that all the important phases prior and after forecast intervals are completed and evaluated in order to make changes and improvements if necessary.

7.2.3. Performance Metrics

The final portion of the theoretical framework is performance metrics which includes forecast quality and financial benefits. This section will also provide explanation to the other question which should be answered when the forecasting process is defined: how the performance of forecasts is measured.

Forecast quality

Monitoring, recording, and improving forecast quality is a critical part of the overall forecasting process. This requires analysis of the forecasts after each forecasting period and it seems that consuming time to make analysis of the past performance is sometimes overlooked.

In most of these companies forecasts are not systematically recorded however the companies have general meetings where the success of the previous selling season is reviewed. The focus of the companies is to improve the quality of their forecast. As mentioned earlier, few organizations had a clear picture of the downfalls of their current process and they were working on improving them. One of the interviewees commented that their organization has in place all the necessary systems and tools to create accurate forecasts however as mentioned in the literature review – one certainty of forecasting is that the forecast are rarely accurate therefore even if forecasting process is in place, the interviewee said that the forecasts should be evaluated continuously in order to find ways to keep on improving the forecast accuracy. The company representative also added that finding ways to improve the forecast accuracy is a never ending challenge and the company is always looking for ways which would help them to meet the needs of their customers' better. Forecast quality can be also improved by listening to the customers. One of the interviewees commented that the feedback they receive from their customers about their products is important information source which helps to make better forecasts in the future.

Organizations want to create accurate and creditable forecasts. As mentioned previously, creating quality forecasts is a complicated task therefore it requires continuous effort.

Financial measures

Companies can attain clear financial benefits when they are able to meet the demand with accurate supply as explained in the literature review. For this reason it is also essential to analyze not only the forecast accuracy but also the financial impact of the forecasts.

When asked about monitoring supply chain performance indicators, most of the interviewees talked about inventory. Inventory turns, the amount of obsolete stock, and the amount of stock not delivered to fill customer orders were few of the measures which were monitored however here also most companies did not have systematic data collection procedures. These performance indicators were calculated and analyzed but the direction and guidance of when to calculate these and recordkeeping to allow easier comparison of different forecasting intervals was deficient. Holding goods in inventory is expensive and therefore companies plan and review forecasts carefully to try to make sure that goods do not stay in inventory. As mentioned previously, forecasting is a balancing act. The interviewees stated that holding inventory is expensive but also not having enough supply is also costly since it is a potential lost sale. When analyzing financial measures, inventory shows the product for which forecasts have been too high however looking at the inventory, it is difficult for companies to evaluate the financial impact of losing sales. This was also mentioned in the literature review. It is difficult to measure the financial losses of not having products available.

7.3. Discussion and Recommendations

The sections above explained detailed findings of the interviews following the theoretical propositions of this research. This section will provide an overall discussion of the empirical research and also provide recommendations for the companies. As mentioned earlier, the company interviews lasted only an hour which is a very short period to share information about the companies forecasting practices. The recommendations provided in this section are based on

the replies of the interviewees and the overall observations of the interviewer. Due to the time constraint, it is possible that the observations of the researcher are limited and do not reflect the complete state of forecasting practices at these companies.

It was discovered in the interviews that forecasting practices vary quite considerably in different companies from having a forecasting process and tools in place to starting a project to create forecasting process since the current way of forecasting is not providing satisfactory accuracy. Forecasting process guidelines provided in this research explain general recommendations of the issues which help in creating quality forecasts however one of the main factors to consider is company characteristics and making the process fit the company. Few of the companies whose representatives were interviewed had a forecasting system which currently provides fairly accurate forecasts. Forecasting needs change and the interviews also demonstrated that forecasting should be a dynamic task which evolves according to needs.

The aim of the primary research questions was to discover the main factors to aid the creation of quality forecasts and how forecast quality could be increased. As mentioned in the introduction section 1.3., the word “quality” means both accurate and creditable forecasts. Below are factors that were the interviewees’ opinions of the issues which can help in creating accurate and creditable forecasts and to help increase forecast accuracy. Most of these factors support the main issues discovered also in the literature review and were discussed in the empirical section of analysis of the forecasting practices which is section 7.2.

Factors that help to create quality forecasts

- Confidence in the products and knowledge about products
- Experienced sales staff
- Strong support from marketing
- Internal agreement of demand predictions
- Knowing and listening to the customers

Factors that can help to increase the quality of the forecasts

- Conducting market research
- Receiving early sales information
- Receiving forecasts from customers
- Collecting input and feedback from customers
- Using proper forecasting systems and tools
- Having knowledge and availability of historical sales data

When analyzing how well the forecasting practices in these four companies correspond with the recommendations discovered in the literature, it seems that the companies could benefit from having more systematical and documented forecasting process. In few of the companies the forecasting practice seemed to be very manual process which relied on data from several spreadsheets and information exchange and discussions were conducted via email. The problem with this type of process is the lack and absence of historical demand data or it is too difficult to retrieve this information. It is true that past is not always a good predictor of future but historical information combined with early sales data would provide these companies decision supporting network which could make forecasting easier and more reliable.

Conducting the interviews was very interesting and educating. Several commonalities were discovered regarding the forecasting practices but each interview also provided some unique observations. The overall evaluation of the companies revealed that forecasting is a vital task however in most cases it is not approached as a process which is systematically controlled. It seems that not having a systematical process is partly due to the textile industry characteristics and also due to the company size. Forecasts can be created and maintained to a certain point without a systematical approach however when product selection and sales quantities increase – handling and monitoring the forecasts without a standardized methods can become difficult. For this reason it is recommended that the companies which do not have a documented forecasting process should create one. This is a starting point in analyzing the overall forecasting structure and needs.

8. Conclusion

Theoretical review provided information about demand forecasting, new product forecasting, and forecasting in the textile industry. Empirical research analyzed forecasting practices of four Finnish companies which operate in the textile industry based on the theoretical framework and commonalities between the recommendations discovered in the literature to actual forecasting practices used in companies were explained. This conclusion section will summarize the main findings from both literature review and empirical research in section 8.1. Managerial implications are provided in section 8.2. and the thesis is concluded with section 8.3. which explains limitations of the research and provides suggestions for future research.

8.1. Summary of Key Findings

Forecasting is a very challenging task since most of the time the forecasts are not accurate. For this reason the aim to create quality forecast is a never ending task. This section will present summary of the key findings of this new product forecasting investigation. Research questions were explained in section 1.3. This section will provide answers to both primary research question and secondary research areas.

Primary research questions

1. What are the main factors that aid in creating quality forecasts for new products?
2. Which are the best methods to increase the quality of new product forecasts?

The purpose of the first primary research question was to discover factors which aid in creating quality forecasts for new products. According to the literature review, the key to creating quality forecasts is having a documented forecasting system in place. Forecasting process provides a structured and transparent platform which can be followed to complete all the beneficial steps both before and after forecasting intervals. Literature review also emphasized the benefit of utilizing historical and early sales data to create quality forecasts.

Empirical research highlighted the professional expertise of company employees as a factor in creating quality forecasts. Confidence and knowledge in the products, in addition to understanding and listening to the customers help to generate more accurate and creditable forecasts. Also agreeing internally within the forecasting team on the approximate demand predictions, helps the departments to work together to have the forecasted demand to be realized.

The second primary research question aimed to identify the ways forecast quality could be improved. Literature review revealed that analyzing the forecast success after each forecasting interval is a way to evaluate the forecasting performance and work on increasing it if necessary. The factors empirical research discovered for increasing forecast accuracy dealt with gathering information from customers before the forecasts have to be firmed to asking customer to provide feedback about how they felt after the sales season had ended. Also the benefits of forecasting system were discussed. All the companies which do not have a forecasting system should consider investing in one since it will help to keep all the data for easy reference and it can help companies to make forecast evaluations faster with less manual work.

Secondary research areas

1. To understand principles of demand forecasting.
2. To examine the phases of new product forecasting process.

The first secondary research area was to gain understanding of the principles of demand forecasting. Demand forecasting has few important principles which were indicated in the literature review. The first one is to understand that it is almost impossible to create completely accurate forecasts. This makes the task of forecasting very challenging but this also keeps the job very interesting since there is always room for improvement. Another demand planning principle that needs to be kept in mind is that the forecasting process should be under continuous change. The process should evolve according to market and company needs. The third demand forecasting principle is to understand the value of decision supporting information. Historical demand data and early sales data are both very beneficial when creating forecasts. The difficulty of this principle seems to be the absence of forecasting software which would enable easier

recording and analysis of historical demand data. The final principle is the importance of assessing the accuracy of the forecasts. The only way to make demand planning more efficient is to analyze what has happened in the past. After each forecast interval, forecast accuracy should be calculated to understand how well the demand was met.

The other secondary research area was to examine the phases of new product forecasting process. Literature review emphasized the importance of having a forecasting process. The process begins with the selection of the forecasting technique. It is beneficial to use more than one technique. The second step is to monitor and adjust the forecast. If new information regarding the upcoming demand is received, such as early sales numbers then the forecasts should be adjusted if still possible. The third step is to analyze forecast accuracy. As mentioned above as one of the demand planning principles, calculating, analyzing, and recording forecast accuracy is important. The final step in the forecasting process is to evaluate the forecasting method success. If the outcome of the forecasts was not what was expected, then changes need to be made. As also mentioned in the principles of demand planning, forecasting process should be dynamic which is being evaluated constantly and changes are made if the forecasts have not been close enough to the actual demand.

8.2. Managerial Implications

It is important for managers to understand that forecasting is a process which should be continuously monitored and evaluated in order to help the company to reach long-term success and to be able to obtain all the possible financial benefits effective forecasting practices can provide.

As mentioned in the literature review, in forecasting perfection is not possible therefore companies need to decide what the acceptable forecasting accuracy level is for them. This is an important management decision. In many cases, forecast accuracy and credibility can be improved by analyzing the market, past demand data, and gathering information about the upcoming demand. This can be very time consuming and therefore costly. Company

management has to determine the right balance between the costs it takes to create the forecasts and forecast accuracy level.

Management should also initiate the development of forecasting process if the company does not have one established yet. Having documented forecasting process provides the company more control and structure and potentially increased accuracy to forecasting. Increased accuracy enables also more accurate organizational planning since as explained in the literature review forecasts are used in short-, medium, and long-term planning.

8.3. Research Limitations

This research has provided a good understanding of the NPF process and what are the best practices recommended in the literature. The empirical research showed how the literature recommendations correspond to the actual forecasting practices and challenges. This research has few research limitations which are due to limited timeframe and lack of financial resources.

In order to be more confident in the research results, it would have been better to gather forecasting information from more than four companies. The number of companies interviewed for this research provides a fairly good picture of the forecasting practices companies are using however in order to have more confidence in generalizing the research findings it would be better to have information from larger sample of companies. The amount of interviews for this research was limited to four due to limited time availability and financial resources.

The selection of companies had to be limited to Helsinki and Lahti areas which limited the amount of possible companies for interviews. There would have been several other possible companies which operate in the textile industry however their main offices were located outside the Helsinki and Lahti region. The researcher was not available to travel to other destinations.

This research has provided a fairly good picture of the forecasting practices in Finnish textile companies in the context of this research. If more companies would have been interviewed for this research, it would have enabled more reliable generalization of the research results.

8.4. Suggestions for Future Research

This empirical research of this thesis has provided interesting details about NPF practices in Finnish textile companies. This research provided quite superficial study of the practices due to limited time resources. The research about NPF could be continued by investigating in more detail the practices companies use and possibly recording some forecasted and actual sales data to analyze the effectiveness of the used methods.

Another possible future research subject could be to investigate whether the practices and methods discovered in this research about the forecasting practices in these Finnish textile companies also apply in other industries. This research has shown that forecasting practices in companies operating in the textile industry are quite unique therefore it would be interesting to examine whether other industries have similar challenges.

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Appendices

Appendix I: Interview Questions

Company Interview: New product forecasting

General questions

1. Which department is responsible for forecast creation?
2. Does the organization use commercial forecasting system?
3. In what buckets are forecasts prepared? (Weekly, monthly, quarterly)
4. How long is the planning horizon for the forecasts?
5. At what level are the forecasts created?
6. Is demand forecasting a documented process?
 - a. What steps does the forecasting process contain?
7. How often are the forecast reviewed/updated? (Daily, weekly, monthly)
 - a. Are forecasts for new products reviewed/updated more frequently?
8. How are forecast monitored?
9. Does management review forecasts?
10. What is the average life cycle of your products?
 - a. Are most products seasonal?
11. Where are the manufacturing facilities located?
 - a. How long is the delivery lead time, for new and ongoing products?
 - b. Does the organization seek ways to reduce the delivery lead time?
12. What supply chain performance indicators are monitored?

For example: Forecast accuracy, inventory turns, inventory obsolescence, order fill rate
13. Are there any forecasting activities which the organization would like to improve?

New product forecasting questions

14. How often are new products introduced?
15. Who makes the decision which products will be manufactured?
16. Approximately what percent of overall sales come from new product?
17. How is the initial forecast for new products determined?

18. What forecasting techniques are used for new product forecasting?
19. Is bias in forecasts an issue which is considered?
 - a. What are the ways used to decrease the possibility of bias?
20. Does the organization receive early sales data?
 - a. Is this data used to evaluate/revise the new product forecasts?
21. Is forecast error calculated after each forecasting period?
 - a. Which forecast error calculation is used?
 - b. What steps are taken to reduce forecast error?
22. Does the new product forecasting process provide satisfactory forecasting accuracy?
23. What are the main criteria in creating accurate and credible forecast?
24. What are the factors most likely to increase forecast accuracy for new products?