Table of Contents

1. Introduction

1.1 Background

Production environments are flexible systems which are always changing. Over time, there have been two extremes in the way that production operations were managed. Historically, the craftsmanship was the first method used. This was a period in which one craftsman processed raw material and then forwarded the product or component to the next representative in the production process, and this went on until the product was completed (Bellgran & Säfsten, 2008). In addition, the craftsman owned all the tools and had control over the entire production process (Berner, 1999). After a while the demand increased, and with the industrial revolution the craftsmanship became inefficient, requiring new methods. In such a context Ford, by using the scientific management methodology combined with the idea of continuous flow as well as inter-changeable parts, introduced the mass production concept (Bellgran & Säfsten, 2008). Mass production is a very popular research subject since the 1920s (Tolliday, 1998a) and appeared to be a solution for the inefficiency problems related to previous methods. Concerning the costs, the mass production led to enormous reductions in terms of unit cost due to higher production volumes. Consequently, Ford was able to sell its products at extremely low prices which, in turn, led to an enormous market share (Tolliday, 1998b). However, this method required large batch sizes and the system was based on anticipated sales (Tolliday, 1998b), which led both to serious problems for Ford as well as the financial crisis of the 1920s. Big business and farmers assumed that the crisis was a consequence of overproduction and consumers and union bodies thought that the depression was a result of low purchasing power (Nyland & Heenan, 2005). Although those two perspectives are rather different, they do show that the crisis of the 1920s was characterized by an overproduction and low market demands. It is questioned that if demand forecast methods were applied the consequences might have been softer.

Now-a-days, however, the situation on the global market has changed and pure mass production is no longer suitable. Globalization had not just linked people from different places but also increased the competition. In the 1960s and 1970s the call was always for improving productivity (Lines, 1996), but after many technological innovations the production capacity overrun the customer's demand (Lines, 1996). Consequently, this led to the fact that the customer's requirements increased and that, for instance, lead times had to be reduced (Lines, 1996). In order to fulfil these demands organizations started to build inventories, planning and forecasting activities became more important (Lines, 1996; Fildes, 1988). Within manufacturing areas it is common to build short term forecasts (usually up to six months) in order to define what to manufacture, ship and stock. (Lines, 1996). Because of the costs related to these aspects, improved demand forecasting accuracy can lead to significant monetary savings. In addition to that it can also lead to greater competitiveness, enhanced channel relationships, customer satisfaction (Moon, Mentzer, & Smith, 2003) and, consequently, higher sales figures. This has shown the importance of the relationship between costs and forecasting, but personally we also think that the relation with price management can be interesting for many organizations. Like mentioned by Frontistis and Apostolidis (1987), the multiplicity of company

endeavours to gain customers, to search for new products and to anticipate the actions of competitors makes forecasting a must (Frontistis & Apostolidis, 1987). Although this does not clarify how forecasts and price management are related, it shows that it is clearly connected.

It is assumed that the lack of knowledge about the relationship between forecasting, cost- and price management, leads to inefficiencies in the decision making process for many organizations. Although sometimes all the knowledge is available, it is usually not centralized. This report aims at fulfilling this demand by investigating the subject and creating a comprehensive framework that can be used by management.

1.2 Purpose and Aims

Forecasting, cost management and pricing policies are topics which have been deeply investigated over time. In general, managers who are involved with shop floor activities have limited knowledge about how a forecasting method can affect the cost management and price policies. Often, it is assumed that those three subjects are correlated to each other, but there is still a lack of research on these interfaces. In the report this assumption will be tested and, as an outcome, the company-wide knowledge about these subjects will be combined in a framework that can be used by management.

1.3 Delimits

Pricing, forecasting and costing are three different subjects which are all widely explored. Sometimes the border of each subject is unclear and overlapping with other research fields. In order to clarify the use of these terms and to guide the research project, some delimits were defined.

First of all, the report is written with an organisation as a point in the middle. When the terms price or pricing are used, this means that it is the price that the company (in which the manager works) set. In other words, it is *not* the price for product bought and this is considered as a cost.

Secondly, when forecasting is being described it discusses *demand* forecasts. Although other kinds of forecasts can be interesting as well, they are excluded from this research and left to other researchers.

Finally, the costing methods investigated are based on an accounting perspective. Often, managers base their decision on accounting report or on accounting information and therefore other kind of perspectives about cost, like economical, will be excluded.

1.4 Outline

The following report is divided in a set of chapters in order to provide a clear and rational explanation about the main subject.

Chapter 1 - The first chapter aims to describe the current situations (background), to introduce a problematic issue to be investigated (the research problem), state consistent reasons for investigating such area, and set the research limits.

Chapter 2 – This chapter concerns to the theoretical background. The main pricing, costing and forecasting concepts are presented in order to provide a better understanding about the analysis performed and the conclusions reached. At first, the most used terms are brought up and then the main methods used nowadays are explained. A decision making part was also included due to its relevance when it comes to the analysis of those the subjects.

Chapter 3 – The research methodology employed in this studied is elucidated in this chapter. It explains the research methodology adopted in order to provide a scientific credibility and validity for this work.

Chapter 4 – The cost and price relationships are analysed in this chapter. At first it addressed two important questions (Are those methods related? If so, How related are they?). This chapter aims to answer those questions by analysing the relationship in two different perspectives; organizational and supply chain.

Chapter 5 – The costing and forecasting relationships are analysed in this chapter. Following the same structure used in the previous chapter, two questions are addressed (Are those methods related? If so, How related are they?), and this chapter aims to answer those questions by analysing the relationship in the same way (organizational and supply chain perspective).

Chapter 6 - The price and forecasting relationships are analysed in this chapter. Following the same structure used in the previous chapter, two questions are addressed (Are those methods related? If so, How related are they?), and this chapter aims to answer those questions by analysing the relationship in the same way (organizational and supply chain perspective).

Chapter 7 – This chapter analyses the links among the core research subjects: pricing, costing and forecasting.

Chapter 8 – In this last chapter the researchers present their finding and conclusions about the topic. In addition, topics for further researches are suggested.

2. Theoretical Background

2.1 Decision Making Process

The theory about the decision making process is an interesting subject. Every manager is in fact some kind of decision maker and usually the performance is formed by (the results of) the choices made (Vroom, 1973). Decisions are made all the time, although sometimes unconsciously. It is a subject that is relevant for many business areas and, in this situation, it can be used to define the optimal way of defining new policies concerning forecasting, cost and price management.

2.1.1 Decisions in Organisations

In order to be able to help management in making decisions concerning forecasting, cost and price management it is essential to define what a management decision actually is. In the literature, several definitions have been used, but for the purpose of this report Ofstad's version is of great relevance:

"To say that a person has made a decision may mean:(a) that he has started a series of behavioral reactions in favor of something, or it may mean (b) that he has made up his mind to do certain action, which he has no doubts that he ought to do. But perhaps the most common use of the term is this: 'to make a decision'. (c) To make a judgement regarding what one ought to do in a certain situation after having deliberated on some alternative courses of action."
(Ofstad, 1961)

This means that decisions by management should be made in a systematic and logical way, have clear objectives and should analyze several alternatives that could fulfil the requirements. However, the decision makers of today face problems that are increasingly complex and that are often interrelated (Diehl & Sterman, 1995; Moxnes, 2000; Sterman, 1989). The task of management is to analyze the situation and to make the right decision at the right time.

This kind of decisions can usually be divided into different categories. One possible way of characterizing decisions is, for instance, by dividing them into decisions that deal with the short term and those that affect the long term aspects (Vaught & Walker, 1986). Short-term decisions usually relate to the day-to-day businesses and operations, while long-term decisions generally concern those activities that affect the organization's destiny by, for instance, setting up new policies (Vaught & Walker, 1986). Another method of categorising them is by their occurrence. Decisions that are recurring or that are routines are considered to be of one kind, while the ones that are non-recurring can be considered of a second category. Those recurring decisions are usually made by lower management, while the non-recurring are typically made by middle and upper management (Harrison & Pelletier, 2000).

There are also two different ways of decision making, namely individually or within groups (Wright & Goodwin, 2008); although there are also several sub-levels in between, like can be seen in the next figure (Kessler, 1995).

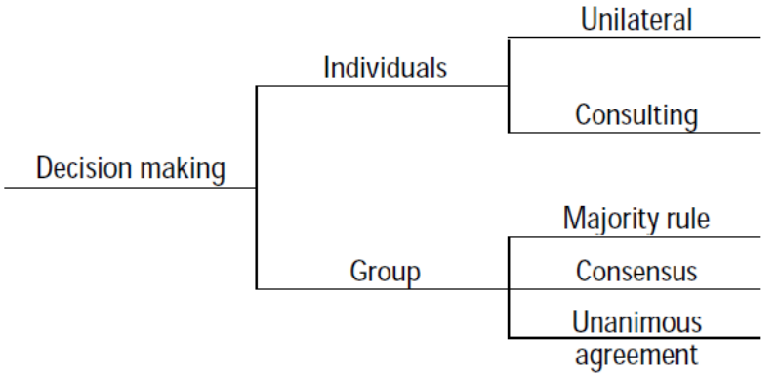


Figure 1: Decision Making (Kessler, 1995)

It can be said that, in the figure above, the decision that will be made moves down from a situation in which there is just one decision maker to a situation in which an entire team makes it unanimously. Generally, it can also be said that decisions are stronger when there are more people involved in the process (Kessler, 1995). This means that the willingness, under e.g. personnel, to follow the outcome of a decision is the highest when many persons feel like they contributed to it. For managers it is therefore recommendable to include many employees in decision making processes. In order to make a decision, it is required that the decision makers have the right amount of power and authorities and are able to make sure that resources are allocated as required (Hayes, 2007; Osland, Kolb, & Rubin, 2001). In other words, this means that the decision making team should have the right power/authority, responsibility and budget to make the desired decision.

The effectiveness of decisions can usually be defined by: 1) the quality of the decision, 2) the time required to make it, and 3) the commitment of subordinates in executing it (Vroom, 1973). This is partly confirmed by Harrison and Pelletier (2000) who say that the success of the decision can be measured by the acceptance of the external environment.

2.1.2 Decision Making Processes

At the moment, most persons who work with decision making use mainly simple hierarchic structures consisting of a goal, criteria, and alternatives (Saaty & Vargas, 2006). Although this fulfils all the criteria that Ofstad included in his definition, it raises the question about what the most effective method actually is. According to Rausch there is no comprehensive framework or collection of guidelines, that is widely understood and accepted, which can be used to make managerial decisions (Rausch, 1996). However, since one of the main purposes of this report is to guide management in making decisions, it is still advisable to use one systematic methodology. Therefore, two possible methods are described further down in this section.

The managerial decision-making process

"The managerial decision-making process" (Harrison & Pelletier, 2000; Harrison, 1996) is a model that describes the different phases in a decision making process. As it describes, the model from figure 1 consists out of six different areas that are all interrelated and form a dynamic process.

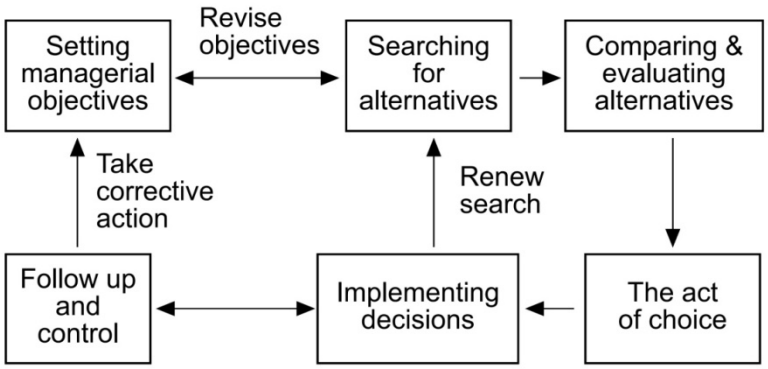


Figure 2: The managerial decision-making process (Harrison, 1996; Harrison & Pelletier, 2000)

Hereby the decision making process starts with setting the managerial objectives. This managerial objective is within definitive time and cost constraints and usually originates from an external need or opportunity (Harrison & Pelletier, 2000). Afterwards, the manager usually starts to search for alternatives, compares and evaluates the different alternatives and then creates an action plan for implementing it. The evaluation and comparison of the different alternatives is greatly influenced by the personal characteristics of the person or the team that is in control. A clear characteristic that affects the final decision is given by Harrison and Pelletier (2000) who explain that the risk acceptance or avoidance of a person or (project) team is often the most important decisive factor. After the decision is made and a plan of action has been formed, the decision should be actually implemented and followed up and controlled.

Since the managerial decision making process is a dynamic procedure, it is also possible to go back several times. This means that after analysing the results of a step, the decision maker can go back and try to get to a better input for that particular part of the process.

The Rational Decision-Making Process

A second approach that can be used to make strategic decisions, consists out of the following ten different steps.

1. Recognize and define the problem.
2. Identify the objective of the decision and the decision criteria.
3. Allocate weights to the criteria.
4. List and develop the alternatives.
5. Evaluate the alternatives.
6. Select the best alternative.
7. Implement the decision.
8. Evaluate the decision.

(Osland, Kolb, & Rubin, 2001)

Based upon this theory, Herbert Simon won a Nobel Prize for his theory of bounded rationality (Osland, Kolb, & Rubin, 2001). Although it is often questioned (Kerr, 2007), bounded rationality is still a popular research subject. The concept is based on the idea that, like the name already suggests, there are bounds on the rationality of persons. In the economics the main idea is often that persons will try to make the optimal decision (Brown, 2004). However, Simon's theory objects that by giving a philosophy that suggests that managers

'sacrifice' rather than 'maximise' while making decisions (Simon, 2002; Brown, 2004; Osland, Kolb, & Rubin, 2001). This means that managers can only make decisions with the knowledge and information which is available for them, and the decision will be made as soon as the expected result is 'acceptable'. Osland, Kolb and Rubin (2001) explain this with an example about internet. As they describe it, it is usually impossible to find an optimal website, so persons stop searching as soon as their result 'satisfies' their needs or purposes.

Simon (2002) gives hereby several procedures to transform an intractable decision into a tractable one, which say that managers should "look at satisfactory choices instead of optimal ones", "replace abstract, global goals with tangible sub-goals, whose achievement can be observed and measured", and split up the work between different specialists and coordinate their work instead (Simon, 2002). All of this is included in his bounded rationality theory.

2.2 Demand Forecasting Methods

Predicting the future is always a challenging task. Through the years people have been aiming to foresee future events in order to clarify their main doubts. Who is going to be the next president and which team is going to be the next champion are examples of questions addressed nowadays. In fact the uncertainty by itself affects people's life and for that reason there is an increasing attempt to improve the forecasting methods.

The following chapter is dedicated to present the main demand forecasting methods used in enterprises nowadays. At first, a brief elucidation about demand instability will be presented in order to provide a better understanding about the subject. Afterwards, the main demand forecasting methods will be presented in combination with their advantages, disadvantages, accuracy and feasibility.

2.2.1 Demand

The demand concept is extensively explored in the microeconomics literature. Generally demand is analyzed together with supply because there are strong connections among those subjects. Depken (2005) says that the demand of a product is related to its price at a given period of time. At a glance such relationship seems simple and easy to understand, but there is a big difference between the theory of microeconomics and the practice. To analyze demand (and other aspects of the economy), economists assume that everything in the economy is held fixed. However, in practice, just a few factors are truly fixed, which makes economy analysis a difficult task to perform (Depken, 2005).

In order to understand the complexity of demand, and consequently their relationship to supply, it is important to mention the elasticity concept. According to Depken (2005) elasticity measures the relative change in one variable in response to a relative change in another variable. There are two important elasticity concepts: price elasticity and demand elasticity. Demand elasticity is rarely discussed in the literature (Case & Fair, 2003), it assumes that the product's price may drop as the demand for it arises. For instance, the oil and steel industries are heavily affected by this phenomenon. According to Schotamus, Telgen and Boer (2009) it can be explained by increases in economy of scale and/or transaction costs. Price elasticity, on the other hand, is about the variation in demand when the price is changed (Kotler, Wong, Saunders, & Armstrong, 2005). Simply, it "measures *the sensitivity of demand or supply of goods to percentage changes in the price of those goods (price elasticity)*" (Harding & Long, 1998).

Demand is a complex subject because it can be affected by many factors. Krajewski and Ritzman (2002) categorize those factors in two main groups: external and internal factors. External factors are those which are beyond the managers' control such as governmental policies, change in customers' requirements, expansion or contraction of market share and so forth. Internal factors, on the other hand, are those related to internal decisions and therefore it is under managers' control. For instance, price settings and advertising promotions are probably set by the marketing department and it can affect the sales figures. Krajewski and Ritzman's explanation is quite simplistic; in order to get a better idea about demand complexity it is necessary to look through microeconomics theory. According to microeconomics, demand can be changed

by price setting, disposal income of customers, expected future prices, the number of demanders and suppliers and, finally, the customer's preferences (Depken, 2005).

By observing the demand figures for a specific period of time it is possible to identify some basic patterns:

- *Horizontal* - fluctuation of data around a constant mean;
- *Trend* - consistent changes in the mean of the series over time;
- *Seasonal* – repeatable pattern of change in demand depending on the time of the day;
- *Cyclical* - or less predictable gradual increases or decreases in demand over longer periods of time (year or decades);
- *Random* –variation in demand which is not possible to forecast.

(Krajewski & Ritzman, 2002)

Those patterns are called times series and can be useful in understanding future trends.

Before choosing a forecasting method some important factors have to be taken into consideration. Krajewski & Ritzman (2002) mention three important decision criteria concerning forecasting:

- *Level of aggregation* - By clustering several similar products or services in a process called aggregation, companies can obtain more accurate forecasts;
- *Units of measurement* - It can vary depending on the aim (volume demanded, expected earning in sales, expected cost, and so forth);
- *Forecasting horizon* - Short (0-3months), Medium (3months- 2years), Long (More than 2 years).

Asides the level of aggregation, the unit of measurement and the forecasting horizon (Krajewski & Ritzman, 2002), some other factors also have to be taken into consideration, such as: the stage of the product's life cycle (Chamber, Mullick, & Smith, 1971), the availability of data (Baines, 1992), the accuracy desired (Barron & Targett, 1986), and the application for the forecasting method (Chamber, Mullick, & Smith, 1971). Jenkins (1976) summarized all factors which have to be considered and developed a 9 steps systematic procedure to guide users in their forecasting selection:

1. Analyse the decision-taking system — this involves describing all decisions affected directly or indirectly by the forecasts, so that it is clear what is required of the forecasts;
2. Define the type and timing of the forecasts in the light of knowledge about the decision system collected at stage 1;
3. Consider what factors influence the forecasts and should therefore be reflected in the forecasting technique; in other words construct a conceptual model of how the forecasts should be made;
4. Check the quality and availability of data — the forecasting technique may be limited by scarcity of data;
5. Decide the technique(s) that are to be used — this is sometimes thought to be all that forecasting consists of;

6. Appraise the likely accuracy of the forecasts — this is elaborated below in the section on recognising good and bad forecasts.
7. Decide how judgment is to be incorporated — this is described in greater detail below;
8. Implement the system — again there is more detail on this below, and
9. Set up a method for monitoring forecasts as they are used — this is done with the aim of making improvements in the light of experience.

2.2.2 Forecast methods

There is a wide range of forecasting methods that can be used (Chamber, Mullick, & Smith, 1971), each has its advantages and disadvantages which makes them feasible for particular situations. Generally, they are divided in two groups: qualitative and quantitative methods. A prerequisite for quantitative methods is the historical data. With historical data on hands it is possible to identify demand patterns and consequently estimate future demands. The qualitative methods are used when historical data are lacking, and it relies in several sources of information in order to generate forecasts (Krajewski & Ritzman, 2002).

A common mistake among forecasters is the focus on the current product portfolio and new product ideas already generated. However, one aspect which is usually not considered is the concept of customer expectations. In many situations it is more interesting to figure out what is value to the customer rather than just forecasting demand for the current situation. Knowledge gained from this kind of forecasting can, for instance, be used in new product development and to gain a higher customer satisfaction. Most of the forecasting methods described later on can be used for both purposes of forecasting.

Qualitative methods

Qualitative forecasting methods are always used in situations where data is scarce. For instance, when a new product is introduced to the market qualitative forecasting methods might be the only possible alternative due to the lack of historical data. According to Chamber, Mullick and Smith (1971), qualitative methods aim to bring together all information available and judge it in a logical and systematic way in order to avoid biased judgments. The most cited qualitative methods in the literature are: Sales-force estimate, Execute (or expert) opinion, Market research and Delphi method.

Sales-force estimates: Sales personnel are the members of the company who are in constant contact with customers and therefore an important source of information. Sales personnel can be involved in forecasting because they probably are the persons within the company who know most about the customers' behaviour. According to Krajewski and Ritzman (2002), the main advantages are:

- Sales is the group which is most likely to know which products or services customers will buy in the near future, and in what quantities;
- The information given is broken down in a way that can be useful for inventory management, distribution, and sales-force staffing purpose;

- The forecasts of individual sales force members can be easily combined to get regional and national sales.

However such approach has also disadvantages. According to Krajewski and Ritzman (2002) the main disadvantages are:

- Individual biases of the salespeople may taint the forecast; moreover, some people are naturally optimistic, others more cautious.
- Salespeople may not always be able to detect the differences between what a customer "wants" (expectations) and what the customers "needs" (requirements).
- If sales figures are used to measure sales performance, then sales personnel may underestimate their forecast.

Executive opinion: There are some situations in which forecasting a future demand requires a certain degree of expertise which is not internally available. For instance, estimating the demand of a new product for the market can be a challenging task due to the lack of a database. In such situation hiring an "Expert" can be an option. In doing so, the opinion, the experience, and technical knowledge of one or more executives are used to overcome problems related to lack of internal expertise (Krajewski & Ritzman, 2002). Those kinds of professionals are in better position than the company to prepare forecasts because they have more data available and forecast expertise (Kotler, Wong, Saunders, & Armstrong, 2005). The main advantage of this method is the easy access to this kind of professionals. On the other hand, hiring an "expert" can be very costly (Krajewski & Ritzman, 2002). Cost and forecast accuracy is a trade-off since highly skilled and experienced executives require high wages. At last, the accuracy for short, medium and long terms forecast depend on how skilled and experienced the executives are.

Market research: Is an approach in which a range of techniques is applied in order to get valuable information about customers' behaviour, and consequently it can be used for forecasting purpose. The main idea behind market research is to obtain information directly from the customer, and the most used method for obtaining such data is the survey. Surveys are used when the purpose is to determine extent, dispersion, and relation between variables in a population (Williamson, 2000). Krajewski and Ritzman (2002) give us a hint of how to carry out a survey:

1. Design a questionnaire that requests economic and geographical information from each person interviewed and ask whether the interviewee would be interested in the product or service;
2. Decide how to administer the survey: by phone polling, mailings, or personal interviews;
3. Select a representative sample of households to survey. This should include a random selection within the market area of the proposed product or service;
4. Analyze the information using judgment and statistical tools to interpret the responses, determine their adequacy, make allowance for economic or competitive factors not included in the questionnaire, and analyse whether the survey represents a random example of potential market.

Market research has several advantages: it is a good method to identify turning points and it does not require any special computerized calculations (Chamber, Mullick, & Smith, 1971). In addition, the information gathered is so detailed that it can be used to identify and define marketing opportunities and problems. Moreover, market research enhances the communication within the company. However such tool has also disadvantages. It is a complex procedure which involves analytical techniques. If it is used incorrectly it may not provide usable information (Birn, 2004). Besides that, it can be costly and time consuming process (Chamber, Mullick, & Smith, 1971).

Market research can be used for short, medium and long-term forecasting, but according to Krajewski and Ritzman (2002) the accuracy decreases when the forecast horizon increases. At last, market research can be advocated to forecast long-range and new products sales (Chamber, Mullick, & Smith, 1971).

Delphi Method: In order to reach a high degree of accuracy the forecasting method requires several sources of information. Sometimes those sources are contradicting which might become a problematic issue within the company. Delphi is a research method to solve problems of divergence by reaching a consensus through several repeated rounds of questions (Williamson, 2000). So far it is the most well known method of eliciting and synthesizing expert opinion (Cooke, 1991). First of all, a monitoring group defines the main questions to be addressed and selects the group of experts who will be involved in the process. The respondents are just known by the monitoring group and the responses are kept anonymously. Secondly, the problem is presented in a questionnaire form and the group of specialists are requested to answer. Thirdly, the set of responses is gathered in a panel and then sent back to the respondents; together with the median answer and the inter quartile range (Cooke, 1991). Consequently, the participants are requested to answer the same question, but now considering the given answers. The second and third steps are repeated until the consensus is reached. (Williamson, 2000).The respondents whose answer were outside the inter quartile are asked to justify (Cooke, 1991).

According to Kahn (2006) the successive rounds is an advantage over other forecasting methods because it provides consolidated feedback to the respondents and also increases the consensus among the experts. An additional advantage is the anonymity aspect which minimizes the effects of social pressure to agree with the majority, ego pressure to stick with your original choice, the influence of repetitive argument, or the influence of dominant individuals (Kahn, 2006; Munier, 2004). On the other hand, such method also has disadvantages. Delphi method is time consuming since it requires several rounds and each round might takes weeks to complete (Kahn, 2006; Krajewski & Ritzman, 2002). Furthermore, the responses may be less meaningful than the response from a situation in which barely experts were involved (Krajewski & Ritzman, 2002).

In practice, Delphi is advocated for developing long-range forecasts of product demand, new-product sales projection, and technological forecasting (Krajewski & Ritzman, 2002). The accuracy provided is almost the same for short, medium and long term forecasts, and it can also be used to identify turning points (Chamber, Mullick, & Smith, 1971).

Quantitative Methods

The quantitative methods are divided in two groups: time series analysis and causal models.

Time series Methods: "Time series analysis is the analysis of past behaviour or events across a number of (generally) even time periods in order to predict behaviour or events by extrapolation across the next few time periods" (Baines, 1992). For control and audit issues companies have to register and store quantitative information. Through the years such information, if managed properly, can be an important source of information to help managers in their decision making process. However, pure quantitative information by itself is useless without being processed (Chamber, Mullick, & Smith, 1971). Time series method is the process of analysing past behaviour or events across a number of (generally) even time periods in order to predict behaviour or events by extrapolation across the next few time periods (Baines, 1992). According to Chamber, Mullick and Smith (1971) time series analysis helps to identify and explain:

- Any regulatory or systematic variation in the series of data which is due to season ability - the "seasonal";
- Cyclical patterns that repeat any two or three years or more;
- Trends in the data;
- Grow rates of these trends.

Naive forecast: Is a time series method whereby the demand for the current period is used as a base for estimating the demand for the next period. If the demand changed between two last periods, the trend (the demand difference) is taken into account while calculating the next demand. For instance, if the demand two months ago was 98 units and last month it was 104, the demand forecast for next month is 104+(104-98)= 110 units.

The main advantages are the low cost and simplicity. Such method works well when the horizontal, trend, or seasonal patterns are stable and random variation is small (Krajewski & Ritzman, 2002). However, the naive forecast requires a consistent demand database in order to check the patterns' stability, which might be a problematic issue. In addition, it fails to foresee random events as well as identify the reasons behind changes in the patterns (Wacker & Lummus, 2002). Consequently, it is not efficient for identifying turning points. At last naive forecast is fairly accurate for short term forecasting and it is feasible for controlling inventory of low volume items (Chamber, Mullick, & Smith, 1971).

Simple moving average: Is a method to estimate the demand by summing the demand of *n* periods and dividing the sum by number of periods (*n*). The number of *n* depends on the stability of the demand series, so large values of *n*'s are advocated when the series is stable and small when the demand series is instable (Krajewski & Ritzman, 2002). The accuracy decreases while the forecasting term increases, so it is fair to good for short term, poor for medium term, and very poor for long term forecasting (Chamber, Mullick, & Smith, 1971). In order to reach a fairly good accuracy the demand has no pronounced trend or seasonal influences (Krajewski & Ritzman, 2002). An evident advantage is the easy calculation procedure, however a minimum of 2 years of sales history is needed (Chamber, Mullick, & Smith, 1971). In addition, such method has a very low cost due to its simplicity. On the other hand, simple moving average is

very poor when it comes to predicting turning points. Chamber et al (1971) advocated the simple moving average for inventory control of low-volume items.

Weighted moving average: Is very similar to the previous forecasting method, but the difference is that weights are given for each period depending on its importance (Krajewski & Ritzman, 2002). In such method forecast demand is calculated using the following equation:

$$F_{t+1} = \frac{\alpha D_t + \beta D_{t-1} + \gamma D_{t-2} + \cdots + \delta D_{t-n-1}}{n}$$

Where:

- F $t+1$= Forecast
- t = period of time
- D = demand
- $\alpha, \beta, \delta, \ldots.$ = weights for each period
- n = number of periods

The number of periods (n) taken into the consideration and the weight for each period can vary depending on the time series. The most challenging task in such approach is to set the number of periods (n) as well as the weight for each period. By choosing the right number of periods and the weight for each period, the forecast error is minimized. Setting those parameters might be a time consuming task but it can be easily performed.

While dealing with weights two common terms are used in weighted moving average; front-weighted average confers higher weights for the most recent and current data, while the back-weighted average puts more value on the older part of the data (Larson, 2001). Weighted moving average is simple and inexpensive to perform, however it requires a consistent demand database and it is inefficient to forecast demand turning points (Chamber, Mullick, & Smith, 1971). Finally, the accuracy is fair for short term, poor for medium term and very poor for long terms forecasting and it is advocated for inventory control of low volume items.

Exponential smoothing: Is a sophisticated weighted moving average method that calculates the average of a time series by giving recent demands more weight than earlier demand (Krajewski & Ritzman, 2002). A period before the forecast is weighted with the highest value, which decreases exponentially as we move to earlier periods (Kazmier, 2003). In another words, the forecast demand is composed by the forecast of the previous period plus a forecast error. Mathematically exponential smoothing can be expressed in the following way:

$$F = Ft + \alpha(Dt - Ft)$$

Where:

- F= Forecast this period
- Ft=Forecast last period
- α =smoothing parameter

Exponential moving average has the advantage of simplicity and minimal data required, it just requires two periods (Henderson & Morton, 2000). Consequently, it is inexpensive to use and very attractive to firms that make thousands of forecasts each time. However, it can be only used to forecast short term

forecasts, since it only provide demand figures for the next period in the time series (Kazmier, 2003). In addition, as all time series methods, this one is not good for identifying turning points (Chamber, Mullick, & Smith, 1971). Finally, exponential moving average is advocated for production and inventory control (Chamber, Mullick, & Smith, 1971).

Box-Jenkins: Box-Jenkins is a complete and iterative technique in which a time-series is fitted in a mathematical model aiming at minimizing the forecast error. It is complete because it combines trend, seasonality, smooth autoregressive and spiked forecast-error terms (Hanssens, Parsons, & Schultz, 2001). It is iterative because it requires several attempts to fit the time-series in a model (Waddell & Sohal, 1994). Autocorrelation is defined by Salvatore and Reagle (2002) as a correlation of errors in different periods. For instance, first-order autocorrelation is when a error in a specific period is positively correlated to the previous period. The models range from Univariate (modelling a time series condition of its past) to multi-equation (modelling more than one time series as a function of all other series in the equation) (Henderson & Morton, 2000).

Box-Jenkins shares almost the same advantages as the exponential smoothing method; it is inexpensive and simple (Chamber, Mullick, & Smith, 1971).Although the underlying model is complex due to its composition, it is easy to interpret conceptually (Hanssens, Parsons, & Schultz, 2001). The main difference while compared with other forecasting methods is the use of autocorrelation to improve accuracy (Waddell & Sohal, 1994). Autocorrelation provides useful information to identify data patterns which is helpful to understand the demand behaviour. In addition, autocorrelation is useful to diagnose whether the model is adequate or not (Henderson & Morton, 2000). However, such approach might demand a certain degree of expertise for building and maintaining the model (Hanssens, Parsons, & Schultz, 2001). Furthermore, box-Jenkins demands a consistent database for building and updating the existing model (Chamber, Mullick, & Smith, 1971). At last, the accuracy is high for short-terms forecasting and it decreases while the forecasting term is increased, and such approach is advocated for short term forecast of cash balance as well as production and inventory control for large volume items (Chamber, Mullick, & Smith, 1971).

Causal Models

Causal model are sophisticated forecasting tools which express in mathematical terms, through models, the relationship among the variables. By knowing the cause-effect relationships, it is possible to reduce the uncertainty and therefore take more confident decisions (Wacker & Lummus, 2002). However, causal models are iterative which means that it needs to be revised constantly. There are a wide range of causal models, each one with its advantages, disadvantages and feasibility. Due to the fact that our research focus is demand forecasting, just linear regression and econometric models will be considered.

Linear regression: Is the most famous and used casual method (Krajewski & Ritzman, 2002). In such approach one variable (the dependent) is related to one or more independent variable by a linear equation expressed below.

$$Y = a + bX$$

Where:

Y= dependent variable
X= independent variable
a= Y-intercept of the line
b= slope of the line

In forecasting, linear regression can be used to identify the relationship between demand (dependent variable) and an independent variable such as price, advertising expenditures, disposal income of customers and so forth. Computer programs are generally used to calculate the values of **a** and **b** as well as the forecast accuracy.

The main advantage of linear regression over others casual model methods is the low cost. In addition, such method is very efficient for identifying turning points. Moreover, the accuracy achieved is generally very good for a forecast horizon shorter than 6 months and poor for long terms. However, the accuracy depends on the ability to identify relationships and an historical of several years is necessary to obtain good and meaningful relationships. Finally, linear regression is advocated for forecast the sales by product classes (Chamber, Mullick, & Smith, 1971).

Econometric Models: Linking theory and reality is a common problem in economics. Due to the high degree of dynamism and complexity inherent to reality, there is a need to build and test theories constantly. Econometrics is an approach which combines economic theory, mathematics and statistical techniques to test hypotheses and formulate new theories (Salvatore & Reagle, 2002). More than a theory builder tool, econometrics can also be used to estimate numerical coefficients of economic relationships, which is essential in decision making, and forecast events (Salvatore & Reagle, 2002).

Concerning to the methodology, econometrics is a stepwise and iterative process. It starts building a mathematical model based on the economic theory. The model is composed by an explicit stochastic equation which connects an economic variable (the dependent variable) to one or more independent variables (Salvatore & Reagle, 2002). Then, a systematic data collection is carried out in order to build a quantitative database for testing the model. Finally, the proposed model is tested using regression analysis. Economical and statistical aspects are taken into consideration in this step. Econometric criteria are taken into consideration in this stage (Salvatore & Reagle, 2002). As a possible outcome the model can be accepted or rejected. If the model is rejected, a new model has to be built and submitted to the same process again until it reaches a desired acceptance (Henderson & Morton, 2000).

The main advantage of this method is that it provides cause-effect explanations of how related the variables are (Salvatore & Reagle, 2002). Such cause-effect relationships are extremely valuable for understanding what affects the outcome and consequently foresee future events. In addition, econometrics is excellent for identifying turning points, which is a differential while compared with the time series methods. However, the advantages gained by the method may well compensate for the extra costs incurred (Henderson & Morton, 2000). Econometrics is very costly because it requires a specialist to analyse the quantitative information and incorporate expert judgment (Allen & Fildes, 2001). In addition, it is a time consuming process (Chamber, Mullick, & Smith, 1971).

As it was stated previously, it is an iterative process which might take several rolls and months until reaches a desired accuracy. In general, econometrics has a good accuracy; especially for medium terms forecasting when the accuracy achieved is higher. At last, econometrics is advocated for forecasting of sales by product classes (Chamber, Mullick, & Smith, 1971).

2.3 Costing Methods

Costing is an extensively studied subject which has taken the attention of economists, engineers, and marketers. Through the years, both academics and professionals of those areas have been striving to understand the mechanisms that affect the cost behaviour. So far, a lot of scientific work has been done, relevant conclusions have been reached but still this subject is not totally understood. Based on the idea that managers take cost information into account in the decision making process (Hansen & Mowen, 1995; Kaplan & Cooper, 1998), understanding the cost behaviour is a must. This following section aims to present the fundamental knowledge necessary to understand the costing methods relationship with pricing and forecasting. The main costing methods found in the text books are presented, as well as its advantages, disadvantages, and feasibility. In order to provide a better understanding about the subject, some terms will be introduced on beforehand.

2.3.1 Definitions in Costing

Due to its multidisciplinary aspect, cost is defined in many ways. Economists, for instance, use the concepts of economic, sunk and marginal cost. The first one is the value of the best alternative use of resources (Perloff, 2009). The next concept refers to the expenditures that cannot be recovered (Pindyck & Rubinfeld, 2009). Marginal cost, at last, is the increment in cost that results from producing one extra unit of output and tells us how much it will cost to expand output by one unit (Pindyck & Rubinfeld, 2009). In fact, economists have a much wider perspective about cost than engineers. However, even for economists, the concept of costs is sometimes a source of complexity. Accountants, on the other hand, are more focused on allocating cost to the product and to write financial reports. Therefore they use mainly costing terms that also sound familiar to managers.

Engineers, especially those involved in production activities, are focused at the sources of costs rather than at cost allocation. The main sources of cost as well as some examples are displayed in the following table.

Cost types	Examples
Labour costs	Wages
	Salaries
Imputed costs	Depreciations
	Interest charges
Material costs	Raw materials
	Indirect materials
Costs of external services	Transportation
	Repairing
Costs of society	Taxes
	Contributions

Table 1: Cost types (Zulch & Brinkmeier, 1996)

Labour cost refers to the expenditures in workforce necessary to complete a particular task. Impute costs are those related to assets; it is not the money spent but a cost assigned for that. Material costs are the expenditures with purchase of materials (raw materials and consumables). Costs of external

services are those related to outsourcing. Finally, costs of society are expenditures related to obligated governmental agencies and additional non-obligation expenditures, like charity and sponsorships.

A definition which is given from an accounting perspective says that cost is a cash or cash equivalent value sacrificed for goods, and services that are expected to bring a current or future benefit to the organization (Hansen & Mowen, 1995). Allocating cost to cost objects (products and services) is not an easy task to perform. Those which are easily and accurate allocated to the objects are called direct cost (e.g. direct material and direct labour). Indirect costs, on the other hand, are those which are neither easily nor accurately allocated (Hansen & Mowen, 1995). It is often known as overhead costs. In addition, accountants also classify the cost in terms of behaviour. Variable costs are those which change in proportion to changes in the related level of total activity or volume (e.g. direct material). Fixed costs, on the other hand, are those which remain unchanged in total for a given time period (e.g. salaries) (Horngren, Forster, & Datar, 2000).

2.3.2 Cost allocation methods

Job Order Costing: Costing allocation is, always a problematic issue. Although direct material and direct labour hour can easily be allocated, overhead cost requires allocation criteria. In the Job Order Costing approach overhead is distributed using an allocation base. In order to allocate the overhead cost it is necessary: to define the cost objects at first, then to identify the indirect costs, to choose an allocation base, and finally to allocate indirect cost based by use of the allocation base. According to Hansen and Mowen (1995) the allocation rate is generally the direct labour hours, but a different allotment base can also be adopted. Armstrong (2006) give some examples of overhead allocation cost bases commonly used, namely: machine hours, floor space and power consumed.

In general, Job Order Costing has the following characteristics:

1. The method require detailed postings of material requisitions, direct labour time tickets to many separate cost sheets, and a distribution of indirect manufacturing costs over several jobs (Crowningshield, 1969; Garrison, 1979);
2. It supplies more accurate and theoretically correct cost data, making costs for specific jobs more exact. Its clerical burden can be significantly reduced by the use of computers (Rushinek, 1983);
3. It provides management with two types of information: The cost of a particular job and the overall cost-effective information. The first one helps the manager to determine the price that should be charged, as well as the duration of the job. The second one determines the conformity of actual costs with budgeted standards (Copeland & Dascher, 1978).

When allocating costs with this method it is important to keep all relevant costs, including an overhead allocation, with a particular job until it is completed and sold. If the actual manufacturing overhead and applied manufacturing overhead are not equal, a year-end-adjustment is required (Webster, 2003). In Job Order Costing, similar products which were produced in the same way might have different cost (Rushinek, 1983).

Job Order Costing systems are mainly used when the company produces several different products, usually simultaneous, in each period (Berry, 2005). The cost object is usually a small quantity of heterogeneous products or services that can be produced as a single unit or even in batches (Garrison, 1979). The product is specially designed according to particular customer's specifications, giving the product a high degree of customization (Berry, 2005). Consequently, it is largely confined to industries that make a product after a customer has placed an order which has certain specifications (Arnstein & Frenk, 1980). Examples of industries using Job Order Costing include machine tool manufacturing, furniture manufacturing, shipbuilding, machinery products, printing, health-care service, aircraft industry, and construction. However, Job Order Costing is also becoming more common in manufacturing industries like electronics, due to an increasing demand for customized products (Horngren, Harrison Jr, & Bamber, 2002).

Job Order Costing systems have the advantage of apparent cost absorption, which means that all the cost is allocated, including the overhead. According to Armstrong (2006) lowering prices to reach volumes sales might be a risky decision and there is a need to consider the fixed cost behaviour in a long term too. On the other hand, this method has disadvantages which have to be considered while working with it. An allocation method based on a singular base can provide an inappropriate unit cost estimation if the allocation base is not properly chosen (Hansen & Mowen, 1995). In addition, such method requires a great amount of clerical work, which can demand a considerable effort (Rushinek, 1983).

Process costing method: The idea of how process costing works is straightforwardly connected to the company's operational characteristics. Berry (2005) and Warren et all (2002) present evidences which link the company characteristics to the costing method. In order to better understand how the Process Costing method works, it is relevant to describe the environment in which such method is applied. In general, process costing is adopted by companies which produce a large number of identical units that pass through a series of uniform production steps (processes) until its completion (Horngren, Harrison Jr, & Bamber, 2002). Companies working with process costing can produce a single or a variety of products using separate or even the same facilities (Rushinek, 1983). Foods, beverage and pharmaceutical industries are some examples of sectors that normally work with process costing method.

Regarding to the method, the cost flow in a process costing system reflects the physical material flow (Warren, Reeve, & Fess, 2002). Direct material, direct labour and overhead costs are assigned to each step in a production process. In addition, there is a separate work in process inventory account for each process. The product incorporates its cost share in each process after being submitted to a transformation. Consequently, the product accumulates the cost as it moves through the processes until its completion (Horngren, Harrison Jr, & Bamber, 2002). Understanding the logic behind such method is not a difficult task to perform but accounting the unit cost might be very demanding. The reason for this difficulty, according to Berry (2005), is that in the various processes or departments there can be units in various stages of completion before and after the accounting period ends. More specifically, a manufacturing company may have to deal with one or more of the following situations:

- Units could be started and fully completed during the period;
- Units could be started during the current period but not completed until the next period;
- Units could have been started during the previous period completed this period.

An important source of information for accounting the cost is the production report (Warren, Reeve, & Fess, 2002). The production report is a document that mainly provides information about cost incurred (direct labour, direct material cost and overhead) and material used. Besides that such report provides estimates of completion for each inventory category mentioned previously. The process cost system calculates the unit cost by adding the unit conversion cost to the unit material cost (Hansen & Mowen, Cost Management: Accounting and Control, 1995). The unit conversion cost is calculated by combining direct labour cost and overhead together and then dividing the sum by the total units converted. Additionally, the material unit cost is computed by dividing the direct material cost by the total of units processed.

While calculating the unit cost there are several approaches which vary regarding to cost allocation but the most used approaches are: First-in-First-out (FIFO) and weighted moved average. FIFO assigns the conversion cost based on the degree of completion, considering uncompleted and completed units as different entities. The advantage of such method is that managers can use these current costs per unit to measure the efficiency of production during the month (Horngren, Harrison Jr, & Bamber, 2002). On the other hand, weighted average method costs all equivalent units of work with weighted average of that period's and the previous period's per equivalent unit (Horngren, Harrison Jr, & Bamber, 2002).

Hybrid Systems: There are some situations where the production process has characteristics that neither the Process Costing nor the Job Order Costing system is suitable to assign costs properly. For instance a particular footwear company produces batches of similar shoes with different materials for different markets. In this particular case the process costing method might be feasible to assign the conversion cost properly but not the material cost. In such situation a possible solutions for the allocation problem is to combine different costing systems in a single one: a hybrid system.

Hybrid costing systems combine characteristics of different costing systems in order to adapt the costing system to the production process characteristics. Hybrid costing systems are advocated for companies which produce batch of homogeneous products with different materials requirements (Hansen & Mowen, 1995). Wearing companies such as clothing, textiles, and footwear is an example of a sector which has batch production processes and adopts hybrid costing methods. In batch production process each unit of product is treated the same but different materials are required, thus moving it closer to a custom job order (Webster, 2003). The products might be visually identical but manufactured with different materials. Consequently, the conversion cost might be identical but the material cost differs from batches. So, Process Costing method is used to assign conversion cost and Job Order method to assign material cost (Berry, 2005).

Joint Product Costing: Joint Product costing method is an approach designed especially for assigning cost to joint products. Joint products, according to Hansen and Mowen (1995), are products made from the same raw material,

which is divided in two or more products during the production process. A butchering process is an example of Joint Product process. The raw meat is cut in different pieces which have different market value. Food industry, especially the ones related to meat packing and milk derivates, petroleum refining, chemical industry, and agricultural industry are other examples of companies that applies Joint Product Costing.

An important issue concerning to joint products is the concept of by-products. By-product is defined as a secondary product recovered in the course of manufacturing a primary product and that has a relative minor sales value while compared to the main product. According to Hansen and Mowen (1995) by-products have the following characteristics, while compared to the main product:

1. By-product resulting from scrap, trimming, and so forth, of the main products in essentially non-joint-product types of undertaking;
2. Scrap and other residue from essentially joint-product types of processes;
3. A minor joint product situation.

Concerning to the costing method Joint Product Costing is basically used for accounting reasons. It has little or no use for decision making or cost control (Hansen & Mowen, 1995). Such method is applied because Joint Product companies are requested to present financial reports often and also because income tax law requires it.

Cost allocation is a difficult task to be done, and with Joint Product Costing is not different. Allocation cost requires an allocation base which is generally chosen in an arbitrary way. However, while dealing with Joint Product Costing, allocation for main products and by-products are done differently.

Activity- Based Cost (ABC): A typical characteristic of traditional costing methods is the use of a single allocation base. One allocation base has the advantage of simplicity and easiness. On the other hand, a single base allocation might provide unrealistic cost information, because it can underprice low volume, custom products and overcost high-volume, standard products (O'Guin, 1991). It points to the conclusion that a single allocating base is insufficient in the competitive environment nowadays; in most companies no single factor drives all indirect costs (Horngren, Harrison Jr, & Bamber, 2002). Since cost information is an important input for decision making, a more accurate costing method is required in competitive environments

ABC is a unique costing approach that allocates cost in a rational and efficient way. More than just allocating cost, ABC is a costing system designed to provide information for decision making. Similarly to the methods mentioned previously, direct materials and direct labour are allocated in the same way. The difference is that ABC makes more effort to allocate indirect costs (Horngren, Harrison Jr, & Bamber, 2002). Organizational processes are first broken down into discrete processes and then into discrete activities and finally each activity is measured in term of cost and performance (Webster, 2003). The "breaking" process described previously is a necessary step for gathering corporative information required for setting the cost drivers. Cost drivers are the link between the cost and the object, therefore they are very important to understand ABC (Bengt & Loevingsson, 2005).

According to Berry (2005) the ABC allocation process can be divided in 7 steps:

1. Identify the activities that consume resources;
2. Identify and trace all direct cost to cost objects;
3. Identify the resource drivers for allocating overhead pools to each activity;
4. Identify the activity drivers to assign activity cost to cost objects;
5. Identify and allocate all overhead costs to activity;
6. Compute the total activity cost allocated to the cost object;
7. Use activity cost in decision making.

The first step is the most important; it aims to gather information which is essential for a proper cost allocation. The data collection can be carried out in different ways: through interviews, surveys, and flow charting (Berry, 2005). If the information collected is not accurate, it will affect the allocation output. Additionally, this step is time and resource consuming, therefore requires additional attention.

According to Kaplan and Cooper (1998) ABC application is guided by two simple rules: The Willie Sutton and the right diversity. The first one refers to the proportion of indirect cost over the total cost. Companies which have a high proportion of indirect costs might face problems with allocating cost. So, in this case ABC might be a solution to provide a better cost estimation. The second rule, "The right diversity", is about the context's degree of complexity in which the company is involved. The number of customers, the variety of products or services offered and the processes' characteristics are aspects which affect the complexity of a enterprise. So, ABC cost is advocated for companies which face complexity in one or all those aspects mentioned previously.

ABC has the advantage of more accurate cost information for product costing, improved cost control (Clarke, Hill, & Stevens, 1999; Hussain, Gunasekaran, & Laitinen, 1998), more accurate allocation of indirect costs (Hussain, Gunasekaran, & Laitinen, 1998), improved operational efficiency (Tayles & Drury, 2001), more accurate cost information for pricing (Clarke, Hill, & Stevens, 1999; Tayles & Drury, 2001), preparation of relevant budgets (Tayles & Drury, 2001), modernization of cost accounting system in order to better depict costs (Hussain, Gunasekaran, & Laitinen, 1998) and improved business processes (Tayles & Drury, 2001). On the other hand, ABC also has the disadvantage of difficulties in identifying and selecting activities or cost drivers (Clarke, Hill, & Stevens, 1999; Hussain, Gunasekaran, & Laitinen, 1998), problems in accumulating cost data for the new system (Hussain, Gunasekaran, & Laitinen, 1998; Tayles & Drury, 2001), time and resource consuming implementation process (Gunasekaran, Marri, & Yusuf, 1999) prolongation of the time schedule of the adoption process and overrun of cost budgets (Tayles & Drury, 2001; Hussain, Gunasekaran, & Laitinen, 1998).

2.4 Pricing Strategies

"*Pricing is an art, a game played for high stakes; for marketing strategists, it is the moment of truth – all of marketing comes to focus in the pricing decision"* (Corey, 1983).

Price management is a popular research as well practical area within the field of marketing. Besides product, promotion and place/distribution management, pricing is one of the original four areas of the marketing mix (Kotler, Wong, Saunders, & Armstrong, 2005; Ivy, 2008; Lilien, Kotler, & Moorthy, 1992; Nagle & Holden, 1995). It is often considered to be one of the oldest fields within the marketing (Cannon & Morgan, 1991), and still has a large impact on the entire subject. Pricing is also one of the most flexible elements of the marketing mix and it can be changed rather quickly, this in contradiction to e.g. product features and channel commitments (Kotler, Wong, Saunders, & Armstrong, 2005). Finally, it is the only element from the marketing mix that actually generates revenues (Rao, 1984).

The price of products has large consequences on the entire organisation. Setting a price that is too low might also lower the company's, brand's or product's reputation, while a price which is too high will lead to lower sales figures. According to Nagle and Holden (1995) it is about "harvesting your profit potential", which clearly shows why it is an important subject for organisations. Although it is a key subject for organisations, many companies do not handle their pricing well (Kotler, Wong, Saunders, & Armstrong, 2005).

The problem faced by managers of these firms is how to use their market power most efficiently. They must decide how to set prices, choose quantities of factors inputs, and determine output in both the short and long run to maximize profits (Pindyck & Rubinfeld, 2009).

2.4.1 What is price?

Price is the part of the marketing mix that generates revenues, where the other elements just create costs. In the narrowest sense it can be seen as "the amount of money charged for a product or service". In broader terms it can also be seen as "the sum of the values that consumers exchange for the benefits of having or using the product or service" (Kotler, Wong, Saunders, & Armstrong, 2005).

When one takes a look at these definitions, one can make several conclusions about the concept 'price'. It is an amount that a consumer exchanges in order to be able to own or use the product or service. Usually, this amount is considered to be paid with money, but according to the broader definition this is not necessarily required. This means that the price is clearly distinguished from costs due to the fact that it is exactly what the consumer pays and therefore also included profits.

In daily life there are many other words that can be used with the same meaning as price. In many situations one pays e.g. a rent, honorarium, salary or fee. Often, this is considered to be something different from a 'normal price', but after analysing the definitions mentioned before one can say that all of those words refer to prices too.

The pricing strategy is, thus, the decision that has been made in order to set the price for a particular product in a particular situation. So;

"a pricing strategy *is a reasoned choice from a set of alternative prices (or price schedules) that aim at profit maximization within a planning period in response to a given scenario*" (Tellis, 1986).

Buyer's perspective

In order to make the best decisions about setting a price or choosing a pricing strategy, it is useful to know the customer's perspective about the subject. What a seller might call the price can be different from how the buyer sees it. In the literature, it is often said that the value for the customer is crucial in setting prices (Nagle & Holden, 1995; Rue & Abarbanel, 1997). This, however, creates a difficult situation due to the vagueness of the concept. Nagle and Holden (1995) say that value often is described as "the total savings or satisfaction that the customer receives from the product". Baker (2000) uses a definition of value that describes it as: "1: a fair return or equivalent in goods, services or money for something exchanged, 2: the monetary worth of something: marketable price". In addition to that, Reilly (2003) describes it as a combination of the sales price of the product, the total life-cycle costs for maintaining the product and the impact that the product has for the customer. It is hereby important to realise that something is only value when the customer considers it to be value (Reilly, 2003). It is the customer's perception that is the key issue (Christopher M. , 1982). Christopher (2005) combines this in the following formula: $\text{Customer value} = \frac{\text{Quality} \times \text{Service}}{\text{Cost} \times \text{Time}}$, where the quality represents the functionality, performance and specifications. The service represents the availability, the support and the commitment to the customer. The cost is both the customer's price and life cycle costs. And, finally, the time is the time that was required to respond to the customer's requirements (Christopher, 2005). Nevertheless, it can also be said that, from a customer's point of view, the product does not have a real value. It is the functionality or purpose of the product that creates the value. A customer usually does not want to buy a product, but they want to have a solution for their needs or problems (Christopher M. , 1982). After analysing those different definitions, it can be concluded that the value of a product consists out of several aspects. First of all, it is customer oriented in such a way that only the customer knows how important the product is. This also means that value a subjective concept is and can differ per buyer. Secondly, the value of a product can be expressed as the monetary amount that it is worth. Although, it should be understood that this does not mean that the sales price is automatically the value for the customer.

For the purpose of pricing products it is essential to realise what creates this kind of value for customers. Reilly (2003) describes an investigation, under 1000 American industrial organisations, which concluded that 76 percent of the perceived value added comes from knowledge related activities. His research places knowledge in many situations higher in the customer's priority list than the product's price. This would mean that organisations are able to charge higher prices if they present themselves in the right way.

Nagle and Holden (1995) describe several factors that influence the price sensitivity of the customer concerning a product or service. As they see it there are ten main reasons which make it more difficult or easier for a customer to

accept a certain price. First of all, the *'perceived substitutes'* effect states that customers are more sensitive to prices when the price difference between one product and that of a substitute is bigger. Secondly, the *'unique value effect'* describes that customers are less price sensitive if a product highly differentiates itself from possible substitute products. The *'switching cost effect'* describes that customers are less sensitive to prices if it is expensive for them to switch between suppliers. Furthermore, the *'difficult comparison effect'* explains the situation in which it is difficult for customers to evaluate the differences between all the products on the market. When this is the case, the buyer is most likely less sensitive to prices and goes for the product which he or she trusts the most. In addition to that Nagle and Holden (1995) also describe the *'price-quality effect'* which, as they describe it, explains that buyers are less sensitive to higher prices when the price itself represents a part of the quality. This is the case for a small amount of products and these can be considered as either image products, exclusive products or products that show any other quality characteristics to the buyer. Another aspect that influences a buyer in the buying decision is the *'expenditure effect'*. This effect assumes that a buyer who has a larger budget is more likely to be less sensitive to a higher price than a buyer with a smaller budget. This is both valid in business-to-business and business-to-consumer markets. Besides of this effect, these authors also describe the *'end-benefit effect'.* This effect is slightly related to the previous one and describes two different things. It says that a buyer is more price sensitive if the end-consumer is that as well. It also says that a buyer is more price sensitive if the product plays a major role in the customer's costs. The *'shared-cost effect'* is also similar to the previous two. In some occasions the buyer himself is not fully responsible for all the costs involved in the buying decision. When the buyer pays, for instance, only a small percentage, he will be less price sensitive. Another concept that might influence buying decisions and that can be important for customers is related to fair prices. Nagle and Holden (1995) describe that customers will be more price sensitive the further the price asked is out of the range that they consider to be fair. This is called the *'fairness effect'*. Finally, there is also the *'inventory effect'*. This is another factor that influences the price sensitivity of buyers in cases where the buyer is able to keep an inventory of a product. If a buyer is capable of storing a product for later use, then they will probably be more sensitive for temporarily differentiations in the price.

An interesting example about a possible buyer's point of view at prices, is given by Ratchford & Ford (1976) and Christopher (1982). By bringing up an IBM case, they show that a purchasing decision consists out of more than just the price. In this case, IBM has computers that are qualitatively not better than those of the competition, but they are still asking a much higher price. The history has shown that their clients were still willing to pay this higher price, which means that customers are also willing to pay for non-hardware aspects that differentiated IBM from its competition. More generally, it can be said that the price sensitivity of products is the lowest with the highest or lowest priced products (Nagle & Holden, 1995).

2.4.2 Different pricing strategies

There exist several different pricing strategies which are suitable in different kind of situations. These decisions about setting a price for a product or a service are usually affected by both internal and external/environmental factors (Kotler,

Wong, Saunders, & Armstrong, 2005). Choosing the optimal approach is therefore a complex process which has a massive impact on e.g. the profitability of the product (range) and the organisation.

Different pricing policies can usually be divided into *fixed-pricing strategies* or into *dynamic pricing strategies*. Fixed-pricing strategies are pricing methods that have one price for each product without being affected by different customers or markets. In the contrary, the dynamic pricing strategies charge "different prices depending on individual customers and situations" (Kotler, Wong, Saunders, & Armstrong, 2005). In the remaining part of this section several methods are given for each of those two categories. The decision about which is the most effective strategy depends on the organisation's preferred objectives, like: profit, customer satisfaction, competitive vulnerability, strategic consistency and simplicity (Cannon & Morgan, 1991).

Fixed pricing strategies

Like described before, fixed-pricing strategies have one price for each product and does not take any individual demands into account.

Cost-plus pricing

Cost-plus pricing is probably the simplest pricing method that exists. It is a methods that uses the costs of the product and adds a certain mark-up as a profit. It is possible to add the mark-up to the total costs of the product or on the variable costs (Monden, 1995). It can also be said that, the mark-up can be seen as "the difference between selling price and cost as a percentage of selling price or cost" (Kotler, Wong, Saunders, & Armstrong, 2005; Cannon & Morgan, 1991). The selling price can then be calculated as:

$$\text{Mark-up price} = \frac{\text{variable cost} + (\text{fixed costs} / \text{unit sales})}{1.0 - \text{desired return on sales}}$$

(Kotler, Wong, Saunders, & Armstrong, 2005)

Like it can be concluded from the formula, the cost-plus pricing method is strongly based on the (expected) unit sales. As soon as this amounts lowers, the total costs raise and the desired mark-up percentage will not be reached. In addition to this disadvantage, the cost-plus pricing method does not take the competitors' prices into account either. On the other hand, when the entire market uses this pricing methodology the prices are usually more fair to both buyers and sellers, and the prices will be more similar between different competitors (Kotler, Wong, Saunders, & Armstrong, 2005; Cannon & Morgan, 1991).

Target-profit pricing

Target-profit pricing is a variation on another strategy that is called break-even pricing or cost-volume-profit analysis (CVP) (Kotler, Wong, Saunders, & Armstrong, 2005; Harding & Long, 1998). A break-even analysis is a marginal costing technique which is used to identify how total costs, revenues and profits are related to sales volume (Harding & Long, 1998). In break-even pricing the company tries to determine its fixed, variable and total costs at different sales figures, for a certain price, and this figure will then be compared with the revenues of the corresponding sales level. As soon as the total revenues are equal to the total costs, the break-even-point has been reached (Harding & Long,

1998; Kotler, Wong, Saunders, & Armstrong, 2005). This can be summarized with the following formula:

$$\text{Break-even volume} = \frac{\text{Fixed cost}}{\text{Price} - \text{Variable cost}}$$

(Kotler, Wong, Saunders, & Armstrong, 2005)

Target-profit pricing is a variation on this principle, with the difference that it aims at reaching a specific profit (Cannon & Morgan, 1991; Kotler, Wong, Saunders, & Armstrong, 2005). So, in order to use the target-profit pricing strategy the company needs to make a demand forecast to calculate the estimated profit level and to figure out if the target profit will be reached (Rich, 1983; Cannon & Morgan, 1991). "A firm that practices target-profit pricing might gouge consumers who have inelastic demand in order to meet profit objectives during times of slack." (Cannon & Morgan, 1991).

The advantage of the target-profit pricing is that this method does not require much knowledge about the price elasticity. All knowledge required is that the demand will be relatively inelastic for the prices considered (Cannon & Morgan, 1991). However, this approach is based on the assumption that the variable and fixed costs are constant and that costs will only rise by the marginal (variable) cost of production and sales for the corresponding unit (Harding & Long, 1998). In the more complex business situations, this might create a perspective of the current situation that is too simplistic or that is not accurate enough.

Perceived value pricing

Perceived value based pricing, or just value based pricing, is a demand oriented approach which is based on the assumption that a firm can determine what people are willing to pay for a product and its various forms (Cannon & Morgan, 1991). In other words, "value-based pricing uses buyers' perceptions of value, not the seller's cost, as the key to pricing" (Kotler, Wong, Saunders, & Armstrong, 2005). A lean-manufacturing method that is similar to the perceived value pricing is target costing. An organisation that uses target costing starts with analysing the demand and features of the new product, and the prices that the competition uses on the market. Afterwards, it sets its own price for the new product and defines a desired profit margin. Based on these data the desired cost is set and the actual development process can start (Helms, Ettkin, Baxter, & Gordon, 2005; Ax, Greve, & Nilsson, 2008; Cooper & Slagmulder, 1997). Target costing can be defined as: "*a structured approach to determine the lifecycle cost at which a proposed product with specified functionality and quality must be produced to generate the desired level of profitability over its life cycle when sold at its anticipated selling price*" (Cooper & Chew, 1996). However, e.g. Monden sees it as "*the system to support the cost reduction process in the developing and designing phase of an entirely new model, a full model change or a minor model change."* (Monden, 2000).

This means that the perceived value based pricing, or target costing, is more a market or demand based approach than a cost-based approach (Kotler, Wong, Saunders, & Armstrong, 2005; Cannon & Morgan, 1991). According to Kotler, Wong, Saunders and Armstrong (2005), the cost-orientated approaches start with designing the product, setting the cost and price, and then giving value to the customers. These methods, however, turn this process around. They start with the customer, and its value, and set a price based on this data. Afterwards,

the cost can be set and consequently the product, and production, can be developed.

Over the last few years many companies have adapted value-based pricing methods, with Ikea and Wal-Mart as famous examples (Kotler, Wong, Saunders, & Armstrong, 2005). This kind of pricing strategy usually leads to a fair price for the right quality level (Kotler, Wong, Saunders, & Armstrong, 2005). Especially in markets with a high product commonality, it might be difficult for organisations to gain pricing power (Kotler, Wong, Saunders, & Armstrong, 2005). In order to escape pricing competition it is required to improve the value for the buyer (Kotler, Wong, Saunders, & Armstrong, 2005; Porter, 1985). This can be done by lowering the buyer's cost or by raising the buyer's performance (Porter, 1985).

Going rate pricing
Going rate pricing is a method which sets the price based on the price level that the competition uses. It is a method that puts the competition over the own costs of the organisation (Cannon & Morgan, 1991; Kotler, Wong, Saunders, & Armstrong, 2005). Usually, higher differentiated organisations will try to charge their price above the market price, while the less differentiated organisations will try to price below the common market price (Cannon & Morgan, 1991; Kotler, Wong, Saunders, & Armstrong, 2005; Porter, 1985). Organisations that use this kind of pricing strategy usually feel that the market price represents "the collective wisdom of the industry as to the price that would yield a fair return and not disturb industrial harmony" (Kotler, 1984).

Dynamic pricing strategies
Like described before, the term dynamic pricing relates to pricing strategies that are customer oriented. This category is often also known as *price discrimination* (Pindyck & Rubinfeld, 2009).

Sealed-bid pricing
Sealed bid pricing is a strategy that exists in several forms and that has been modernised over time. The different forms all have in common that firms use assumptions about how their competitors will price rather than their own cost or demand (Kotler, Wong, Saunders, & Armstrong, 2005; Cannon & Morgan, 1991). This method gains its profit from a particular bidding strategy (Paranka, 1969) in which "*potential buyers submit sealed bids, and the item is awarded to the buyer who offers the best price*" (Kotler, Wong, Saunders, & Armstrong, 2005). It "*is unique in that the buyer rather than the seller determines the approach. It is considered a pricing strategy because a company might (1) seek out customers who request sealed bids or (2) encourage its customers to take a sealed-bid approach"* (Cannon & Morgan, 1991).

Like described before, there exist different variants within this kind of pricing strategy. Especially since the introduction of internet, and in particular auction sites like E-bay, this pricing method has been renewed. The following five methods are often applied, as being described by Kotler, Wong, Saunders and Armstrong (2005):

- *English auction* – The price is raised successively until only one bidder remains;
- *Dutch auction* – Prices start high and are lowered successively until someone buys;

- *Collective buying* – An increasing number of customers agree to buy as prices are lowered to the final bargain price;
- *Reverse auction* – Customers name the price that they are willing to pay for an item and seek a company willing to sell;
- *Second-price-sealed bid* – Sealed bids are submitted but the contender placing the best bid pays only the price equal to the second best bid. (Kotler, Wong, Saunders, & Armstrong, 2005)

Negotiated pricing
Where all the previous pricing methods were being described in Kotler (1984) and Kotler, Wong, Saunders and Armstrong (2005), the negotiated pricing method is not being mentioned by them. Cannon and Morgan (1991) consider this to be a pricing strategy as well. Like the name already describes, it is a method in which the buyer and seller negotiate, on a case-by-case basis, in order to achieve the optimal price for both of the parties (Cannon & Morgan, 1991).

Product Life Cycle Pricing
Where prices are related to products it is crucial to understand that products can be in several phases. Based on the stage of the product, there are different aspects to consider when setting a price. The first stage that a product will be in is the development phase. Here is the demand for the product usually rather low and stable. Afterwards, the product will go into the growth phase and the demand often starts to rise rapidly. Empirical studies indicate that the demand does not start to rise until two to five percent of the potential buyers have bought the product (Rogers & Shoemaker, 1971). For a large part this is due to word of mouth marketing process which has to be started (Nagle & Holden, 1995). After this phase, the product comes in the maturity phase which means that the demand stabilises. This is then often a signal that the decline phase is about to come and demand will decrease. Finally, the product is usually brought to an end. This all is shown in Figure 3:

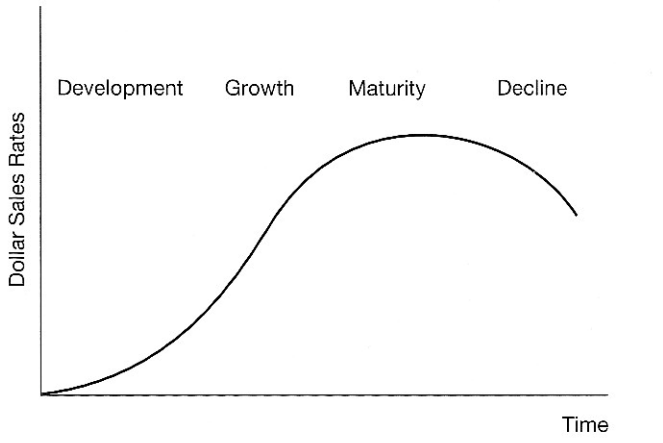


Figure 3: Product Life Cycle (Nagle & Holden, 1995)

Like described before, there are different aspects to consider concerning prices within the different phases of the product. In the first phases, for instance, the growth needs to be stimulated. On the other hand, in the last phases this might no longer be relevant. Even though there are four different market phases, it is especially interesting to look at new products and products that are already at

the end of the life cycle. In the stages in between it is usually possible to use one of the other methods described in this chapter.

New-product pricing
Prices usually change as the product passes through the product life-cycle (Kotler, Wong, Saunders, & Armstrong, 2005). In the introduction phase different strategies can be used, also depending on the current competition at the market or market segment. It is often considered that there are two main strategies for new-product pricing, namely:

- *Market-penetration pricing* – The purpose of market-penetration pricing is to price the new product against a low, initial price. The idea of this method is to quickly gain a large market share. The aim is that the low price leads to high sales figures and, consequently, to lower costs due to economies of scale. The requirements for this method are that the market should be highly price sensitive, the price should keep out the competition and the production/distribution should profit from higher sales volumes.
- *Market-skimming pricing* – The initial price is set high and over time the price is reduced layer by layer. This means that the high demanding customers pay the highest price, while the more price sensitive customers have to wait. The advantage of this method is that high prices are asked at the moment that the (production) costs are the highest.

  (Rao, 1984; Cannon & Morgan, 1991; Kotler, Wong, Saunders, & Armstrong, 2005).

In the case of those new products it should be noted that the most buyers are rather price insensitive. This is due to the fact that buyers tend to use the price as an indicator for the product's quality, because alternative products are usually not available at those moments. Those two strategies are suitable for new, innovative and patent-protected products (Kotler, Wong, Saunders, & Armstrong, 2005), there are, however, other strategies for new imitative products. According to Kotler, Wong, Saunders and Armstrong (2005), there are four different possibilities:

- *Premium strategy* – A high price is asked for a high-quality product;
- *Good-value strategy* – A low price is asked for a high-quality product;
- *Overcharging strategy* – A high price is asked for a low-quality product;
- *Economy strategy* – A low price is asked for a low-quality product.

According to Kotler, Wong, Saunders and Armstrong (2005), the premium and economy strategies can be used besides each other as long as the market consists out of two different groups of buyers.

End of the life cycle pricing
When to decide about pricing in a declining market, there are several aspects to consider. When a organisation has high variable costs, it is usually able to adapt quickly to the changing demand and to keep the prices relatively steady. However, when the organisation has high fixed costs then it depends on the difficulty of redirecting them. Where the facilities can be easily moved to other products, it is often possible to maintain the current price level. On the other hand, in markets where this is not that easy it is often common that price wars become to exists (Nagle & Holden, 1995).

According to Nagle and Holden (1995) organisations have three different strategies which they can use when a market or a product comes to the end of its life cycle, namely: retrenchment, harvesting, or consolidation. These methods differ in their purpose, vision and resources required.

- *Retrenchment strategy* – The weakest assets are liquidated and the firm withdraws from those kind of markets, so the company becomes leaner but more defensible. It is a strategic decision and not a reaction to a crisis;
- *Harvesting strategy* – "A harvesting strategy is a phased withdrawal from the industry. It begins like a retrenchment strategy with abandonment of the weakest links. However the goal of harvesting is not a smaller, more defensible competitive position but a withdrawal from the industry." (Nagle & Holden, 1995). The price is hereby not set to keep the firm's market share, but to optimise the revenue for a short period of time. The company can still make some short term investments, but long term investments will no longer be made. The organisation tries to take what it can get and then leaves the industry;
- *Consolidation strategy* – This strategy can only be used by organisations which have a remarkably strong financial position before the market starts to decline. The basic idea of the concept is that an organisation starts to invest more when the market starts to decline. By doing so it attempts to increase its product quality and lower the prices at the same time. The final purpose is to 'push' the competition out of the market and end up with a stronger market position.
  (Nagle & Holden, 1995)

However besides the aspects mentioned by Nagle and Holden (1995) there are also other things to consider. In the literature there is not much described about the industrial perspective about pricing in the maturity phases of the product life cycle (PLC) (Haley & Goldberg, 2008). "When a company decides to withdraw a product from the market, it faces further decisions: to re-sell the product to another company, or to simply liquidate it?" (Szozda, 2004). Another option that firms often use at the end of a product's life cycle is to use a markdown or sale to dispose this excess of inventory (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). The only question in this case is if the sales of the discounted product affect the sales, and holding costs, of other similar products of the company or that of a product which will be developed. In such a case it might be recommendable to just terminate the product and stop selling it (Sezen, 2004).

Other pricing methods

The pricing methods described above are a few common approaches. However, there are also other methods, strategies or aspects that should be considered when pricing a product. These aspects are sometimes less relevant for directly setting a price, but they can be used to e.g. adopt the price for discounts or to price products with a high similarity. Those different aspects, methods and strategies are described in this part.

Product-mix pricing

Kotler, Wong, Saunders and Armstrong (2005) describe also five different strategies that can be used when the product concerned is part of a larger product mix. In those kind of situations the "pricing is difficult because the

various products have related demand and costs, and face different degrees of competition" (Kotler, Wong, Saunders, & Armstrong, 2005). As they describe it, the five strategies are:

- *Product line pricing* – Setting price steps between product line items;
- *Optional-product pricing* – Pricing optional or accessory products sold with the main product;
- *Captive-product pricing* – Pricing products that must be used with the main product;
- *By-product pricing* – Pricing low-value by-products to get rid of them. By-products can be seen as items produced as a result of the main factory process such as waste and reject items;
- *Product-bundle pricing* – Pricing bundles of products sold together.

(Kotler, Wong, Saunders, & Armstrong, 2005)

Two-part-pricing
Two-part-pricing is a method, in the field of marketing, that is described by Kotler, Wong, Saunders and Armstrong (2005) as "a strategy for pricing services in which price is broken into a fixed fee plus a variable usage rate". In the subject of microeconomics it is also known as *two-part tariff* and it is described by Pindyck and Rubinfeld (2009) as a "form of pricing in which consumers are charged both an entry and an usage fee". For the company, the difficulty with this method is to decide if they want to set a high entry fee and a lower usage cost, or a low entry fee and higher usage costs (Pindyck & Rubinfeld, 2009). Clear examples of this method are amusement parks in which you pay for the entrance and for certain attractions, or telephone contracts in which you pay a monthly fee and a certain amount per minute (Kotler, Wong, Saunders, & Armstrong, 2005). Although, this can also include less obvious situations like with sales of safety razors. Here ones pays for the razor and 'consumes' the blades (Pindyck & Rubinfeld, 2009). This means that it can be seen as a part of the *captive-product pricing* strategy, like described before.

Peak-load pricing
Peak-load pricing is the "practice of charging higher prices during peak periods when capacity constraints cause marginal costs to be high" (Pindyck & Rubinfeld, 2009). Seasonal discounts (Kotler, Wong, Saunders, & Armstrong, 2005) can also be seen as a way of peak-load pricing.

Quantity discrimination
Quantity discrimination is another aspect that should be considered when pricing a product. It is the theory of lowering or raising the price of a product according to the amount bought (Kotler, Wong, Saunders, & Armstrong, 2005; Pindyck & Rubinfeld, 2009).

Other discounts
According to Kotler, Wong, Saunders and Armstrong (2005) and others there are also other ways of discounting products. Common ways of doing so is by:

- *Trade-in allowance* – The customer gets a discount when an old item is being returned (Kotler, Wong, Saunders, & Armstrong, 2005);

- *Functional/Trade discount* – A discount to a channel member that performance certain services or functions (Kotler, Wong, Saunders, & Armstrong, 2005);
- *Promotions* – Discounts after a promotional campaign (Kotler, Wong, Saunders, & Armstrong, 2005; Perloff, 2009; Pindyck & Rubinfeld, 2009)
- *Segmented pricing* – Different prices for different customers, times, locations and/or product forms. The differences in price are not based upon a difference in cost (Kotler, Wong, Saunders, & Armstrong, 2005).

2.4.3 Decision making within price management

Like described before, decision making is a difficult subject. Like the model of Harrison (1996) and Harrison & Pelletier (2000) explains, decision making starts with setting up managerial objectives, it continues then with defining, comparing and evaluating different alternatives and finally it ends with making an action plan about how to implement the decision which has been made. The same is valid in the field of price management.

Prerequisites

While making decisions about setting prices, it is crucial to consider the importance of the product's costs (Nagle & Holden, 1995). No matter which of the preceding pricing strategies will be chosen, the ultimate target is to make profit and therefore a financial analysis is inevitable. However, plain knowledge about the cost levels is not enough for decisions about choosing a pricing strategy or setting a price. As Nagle and Holden (1995) describe it: "*Managers who really understand their costs know more than their levels; they know how their costs will change with the changes in sales that result from pricing decisions*". For decisions in general, and therefore also for pricing decisions, it is key to isolate and consider only the costs that directly affect the profitability of the decision that has to be made (Nagle & Holden, 1995). However, the comprehensive relationship between costs and pricing management will be described and analysed further down in this report.

Nagle and Holden (1995) also state that "effective pricing cannot be done in steps". As they see it, the process should be approached holistically and each trade-off which affects e.g. higher costs, higher prices and cutting gross profit in order to lower expenses, should be analysed in such a holistic matter. Nagle and Holden (1995) also state that it is recommendable to develop a separate managerial costing system that works independently from the systems that are used for accounting purposes. This is due to the fact that financial systems tend to include data, like historical investments, which might be misleading for pricing decisions.

Another aspect that is important within the process about choosing the right pricing strategy is the commitment from top-management (Rich, 1983). This is due to the fact that pricing strategies affect the profitability of the total organisation in such a high matter and due to legal issues that might be involved (Rich, 1983). Knowledge about these legal matters is then also another prerequisite for setting a price or pricing strategy.

Finally, the product sold is usually a combination of different functions, characteristics and/or benefits. At first this seems to be sold as just one product, but for the pricing decision it is essential to split this bundle up in order to

"identify the individual benefit components which together constitute the totality" (Christopher M. , 1982).

Setting the price

There are several aspects which can affect the decision about choosing a pricing strategy and setting a price. Kotler, Wong, Saunders and Armstrom (2005) presented this in the following model.

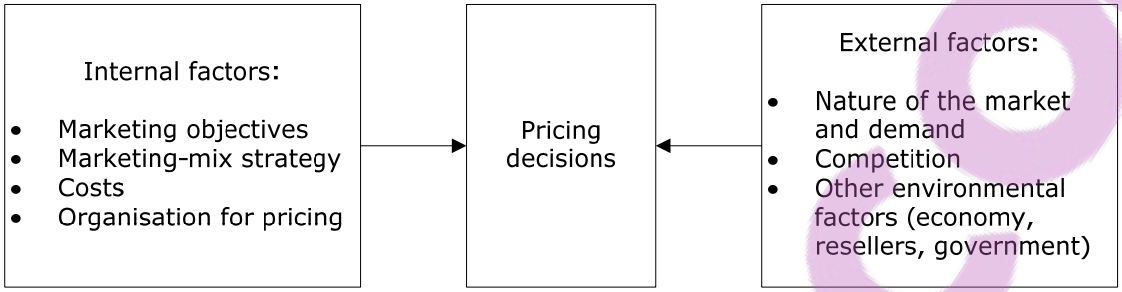


Figure 4: Factors affecting price decisions (Kotler, Wong, Saunders, & Armstrong, 2005)

According to Nagle and Holden (1995) a price should always be market based, however cost-based pricing approaches have historically always been the most common method (Nagle & Holden, 1995; Christopher M. , 1982). On the other hand, it can be questioned whether the cost-based approaches are still applicable in today's situation.

According to Rich (1983) the decision about which pricing approach to choose depends on the state of the market that is being served. It can be said that cost-based methods are most suitable in markets that are not competitive or when it is a seller's market and the organisation's product is clearly superior or distinct from competitor's products (Monden, 1995; Kaplan & Cooper, 1998). Market-based approaches, on the other hand, are most appropriate when; a) there are no major distinctions between the company's and competing products, b) short product life cycles bring rapidly new generations of competing products, or c) the market has matured to the point that is has become a buyer's market (Monden, 1995).

A clear framework to help with pricing decisions has been developed by Cannon and Morgan (1991). They compare the first six pricing strategies (fixed and dynamic pricing strategies), which were described before, based on the following six different rules. These rules can be seen as questions which the company can use in order to analyse their situation at the market:

1. *Scale rule* – This rule questions the size of orders. If purchases are too small, sealed-bid and negotiated pricing are not appropriate;
2. *Consumer knowledge rule* – This rule wonders whether customers are able, or can they be enabled through promotion, to evaluate the monetary value of a product? (Kotler, 1984). If not, perceived-value pricing is not suitable, because customers cannot recognise the differences in value which are required for different prices;
3. *Demand rule* – This question concerns the importance of price in the customer's decision making. When the price does not play an important rule in the customer's purchasing decision, target-profit pricing is not useful for the organisation;

4. *Information rule* – This rule questions the ability of the company to determine price/value evaluations and the levels of demand. If they are not able to do so, target-profit pricing and perceived-value pricing are not applicable. Target-profit pricing requires, namely, an accurate estimate of demand and perceived-value pricing requires a specific approximation about how the market will respond on different price-product combinations;
5. *Competitive substitute rule* – This rule relates to competitive products that are on the market. If some substitutes exist, the product's price can be set according to these products. However, if those substitutes do not exists, the going rate pricing strategy is not applicable;
6. *Patronage rule* – This rule relates to other non-quality or non-price reasons that might be involved. One can think about interpersonal ties, mutual agreements or the firm's reputation or size that might affect purchasing decisions (Arndt, 1979). If those issues are present in the firm's market, then the negotiated pricing strategy is most likely not suitable, due to the fact that the organisation would not get a fair possibility from the buyer. However, this rule is weaker than the other five and includes also other issues than plain pricing strategies.

(Cannon & Morgan, 1991)

Nagle and Holden (1995) have a slightly different framework which they use in making pricing decisions. As they state it, the first step in making profitable pricing decisions is data collection. Information about costs, customers and competitors is, obviously, required in order to make well considered decisions. Secondly, an strategic analysis process should be started in which the financial situation should be analysed and trade-offs should be made. Hereby the (desired) market segmentation should also be analysed as well as the competition. Finally, this should be combined into a clear strategy formulation about the price setting. This process is schematically described in the two figures below.

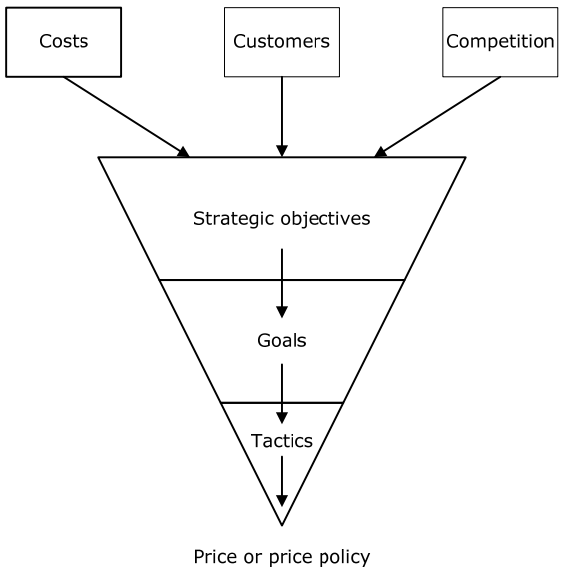


Figure 5: Developing an Effective Pricing Strategy (Nagle & Holden, 1995)

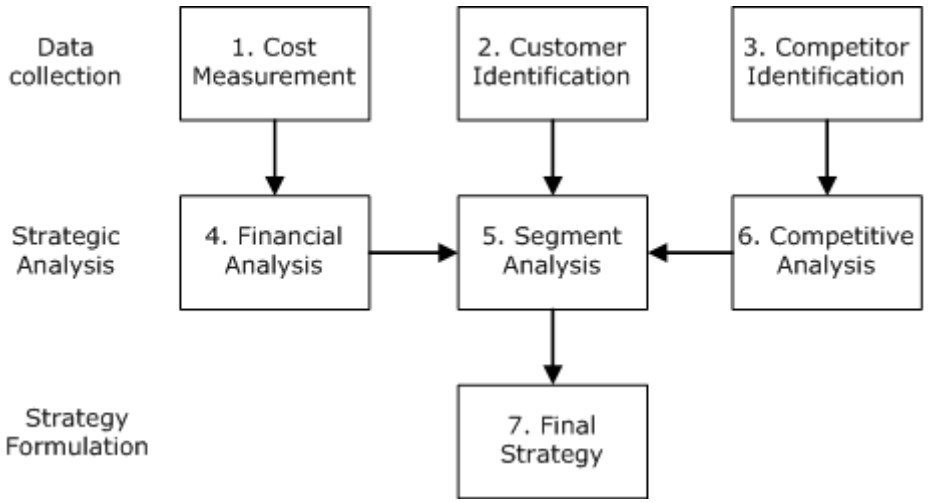


Figure 6: Steps to More Profitable Pricing (Nagle & Holden, 1995)

Looking at those different perspectives, it can be said that there are several factors included in the decision making process for choosing a pricing strategy and setting prices. First of all, relevant data should be collected referring to market characteristics and costs. Those market characteristics consist, for instance, out of price sensitivities per segment and the level of competition. As Nagle and Holden (1995) describe it, "the formulation of every pricing strategy should begin with a managerial analysis of price sensitivity". Obviously, additional external influences, like laws, should be considered as well. Afterwards, this information should be compared with internal information, objectives and strategies about the marketing mix, the product's state and the organisation's general policies, and then the final decision upon the pricing strategy can be made. The different possibilities for those strategies depend on the fact if the new product is innovative, imitative or just differentiated from the competition. Finally, it is recommendable to test the pricing assumptions, for instance, at a test market and then the decision can be implemented (Rao, 1984).

3. Research Methodology

Research is in important aspect in the society, since it is the process which leads to new knowledge. "Research is the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested" (Leedy & Ormrod, 2001). In this chapter the chosen research methodology as well as the data inquiry approaches are presented. In addition, the reason for choosing this will be motivated in combination with support from existing literature.

In order to perform a research project, a systematic way of working is required in combination with a theoretical foundation and a thorough analysis and discussion. This means that the entire research project is all about gaining knowledge (Eriksson & Wiedersheim-Paul, 2001). Knowing this, it can be assumed that the desired outcome – the kind of knowledge that wants to be learned – determines the research methodology which is most effective. In this research project it was assumed that the areas of forecasting, costing and pricing are related to each other. The purpose of the report is to test this assumption and to deliver useful information to managers who want to make decisions concerning (one of) these subjects. Since it was assumed that these three main subjects are related to each other, it has been decided to use a qualitative, interpretive research design (or in other words, a flexible design).

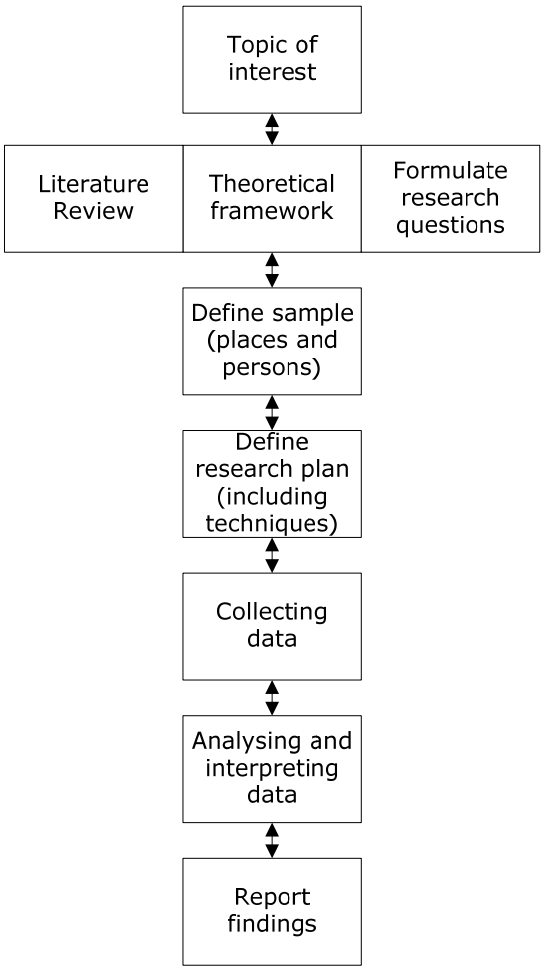


Figure 7: Qualitative research design (Williamson, 2000)

Like it is shown in Figure 7, an interpretive design is a stepwise process in which a researcher is able to return to previous step when it is considered interesting to do so. For this project this is very desired, because while analysing the results new knowledge about the separate subjects might be required.

However, every research project starts with defining a topic of interest. For this report this has been done in the end of January 2009 by performing several brainstorm sessions between the researchers. At first, different ideas were generated without limitations. Afterwards, several items were combined and three personal favourites were selected. Finally, a brief literature review was performed to find existing literature about the subjects. It was realised that there exists a lot of scientific material on costing, forecasting and pricing, but there is a lack of research about the interrelationship between the concepts. Since it was assumed that this was a important subject for many organisations and that those areas could be related, it was decided to start a research project to test this hypothesis.

The first part of the actual research project, after defining a topic of interest, was to develop a concrete time plan to guide the researchers in their process. This planning discussed all the tasks which had to be performed and formed the main tool during the research process. This tool was adapted several times after new information was gained, but the investigation was continuously monitored by comparing the current state to the one of the planning. After developing the planning, the first step was to develop the theoretical background. "*The theoretical framework is the foundation on which the entire research project is based. It is a logically developed, described and elaborated network of associations among variables that have been identified through such processes as interviews, observations, and the literature survey*" (Sekaran, 1992). This means that the theoretical background is very important in a research project. "*It 'informs' the research process and helps to direct it*" (Williamson, 2000).In this report the research areas are in the fields of costing, forecasting and pricing. As a theoretical background, a literature review was first performed on these three subjects separately. There exist two different reasons for this. First of all, it gives a brief overview for managers who are concerned with making a decision in one or more of these fields. Secondly, in order to investigate the interfaces between the three different areas it is key to understand what the three different concepts discuss. To gain information about the different subjects, it has been decided to use several different sources, namely: books, scientific journals/articles, material used for lectures and previously written theses. To improve the reliability from the information gained, it was chosen that the data should come which analyse the phenomena from different perspectives. In this report it was tried to find information from the following (research) areas: accounting, marketing, operations management, supply chain management, micro-economics, decision making and research theory.

While analysing this theoretical background it was concluded that knowledge about decision making was lacking. It was decided that this also had to be included in the literature review, because a clear understanding of managerial decision making is crucial when developing (or reading) a framework which aims at helping management at making decision.

After performing a literature review and developing a theoretical background on the three different research fields separately, it was decided to analyse interfaces between two of the interfaces at a time.

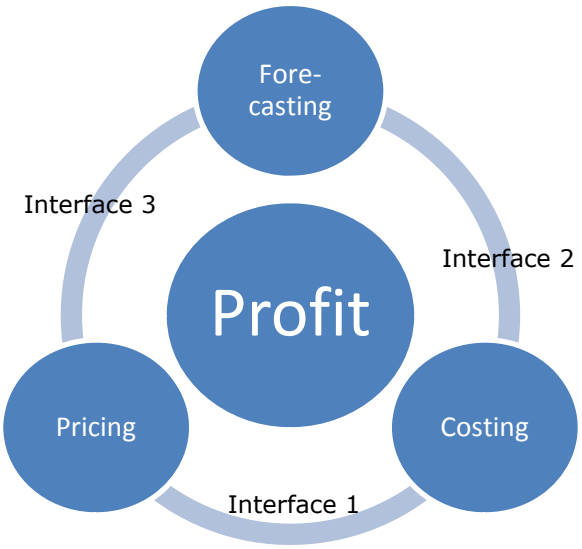


Figure 8: Project model

Because the literature review showed that besides the forecasting, costing and pricing methods also their outcomes – demand forecasts, products costs and prices – were interesting to investigate, it was decided to include both of these perspectives in the analysis.

Even though there exists literature about the pricing-costing, costing-forecasting and pricing-forecasting interfaces, the current literature does not cover all the relevant aspects. However, there exists more literature about these subjects than about the total relationship. In addition to that it was assumed that a relationship between all three of the phenomena can never exists when there is no interface between just two of the concepts. This are the reasons why it was decided to investigate three sub-questions before answering the main question. In these questions the terms pricing, costing and forecasting can relatively be changed in prices, costs and (demand) forecasts. Besides that it has been decided that those questions will be studied from both the single organisation as well as from the supply chain point of view:

1. What are the relationships between pricing and costing?
2. What are the relationships between costing and forecasting?
3. What are the relationships between pricing and forecasting?

After the analysis of these separate parts the total relationship has been analysed. This has been done by comparing the results gained before and by adding new information found. Finally, the conclusions have been made and the results were written down in the decision making framework.

During this entire process there have been many discussions to talk the subject through. Several times, approximately every third week, there has been a meeting with a supervisor in order to make sure that everything was on track and several new perspectives were brought up during those meetings. In the end of the project, the results have also been discussed at Fagerhult AB in Habo,

Sweden in order to get a 'second opinion'. As described by Williamson (2000), "*the advantage of triangulation is that conclusions are likely to be more reliable if data are collected by more than one method and from the perspective of more than one sources* ". Another purpose of this company visit was therefore to test the results gained in reality, and to improve the reliability of this investigation.

4. Cost-Price Relationships

Contradicting to common beliefs, understanding the cost-price relationships is not as simple as it seems. A possible explanation for such complexity might be rooted in the multidisciplinary aspect of such relationships. Cost and price are subjects studied by economists, marketers, accountants, engineers, academics and practitioners. Although those subjects have been widely explored during the years, they are still not totally understood. When it comes to price–cost interface analysis there are two basic questions to be addressed. First of all, are cost and price related? If so, how related are they? This section aims at analysing price and cost relationships by answering those two questions. Such analysis will be carried out in two perspectives, namely from an organizational and a supply chain point-of-view.

Concerning to the first question; are cost and price related? , there are numerous evidences connecting cost and prices. The profit concept; price minus cost, is a strong evidence. Like described before; "*Managers who really understand their costs know more than their levels; they know how their costs will change with the changes in sales that result from pricing decisions*" (Nagle & Holden, 1995). Pricing decisions, in theory, might not consider or involve cost information. As it was observed in the theoretical review, there are plenty of pricing strategies which do not take cost into consideration while setting prices (e.g. sealed-bid pricing). However, the theoretical field is rather contradicting since they also consider cost as an important factor while setting prices. According to the *Theory of the Optimal Marketing Mix,* when the brand's price is the only factor affecting unit sale, and it only affects current unit sale, then the only other phenomenon influencing performance is the nature of the production unit cost function (Hanssens, Parsons, & Schultz, 2001). Considering the fact that theories are "attempts" to represent the reality, it is definitively a naive behaviour to think that price and cost are not related. Corporations that set prices, without considering the current expenditures incurred have a high probability to end up in bankrupt.

4.1 Costs and Prices within a single organisation

The relationship between costs and prices can be seen from two different perspectives, i.e. from a (single) organisational and from a supply chain point of view. With a change in perspective, the focus of a decision maker changes as well. From a pure organisational point of view, the company is a closed system and only the different pricing and costing methods should be considered. Nevertheless, this perspective also considers marketing and purchasing efforts.

According to the following authors, among others, pricing methods can be considered to be either cost or market-based (Horngren, Forster, & Datar, 2000; Kotler, Wong, Saunders, & Armstrong, 2005; Nagle & Holden, 1995; Cannon & Morgan, 1991). When looking at the six main pricing methods, only cost-plus pricing and target-profit pricing are considered to be cost-based methods. The others can be considered to be market-based, although the two variants of market and cost-based approaches can be considered to be just extremes and sometimes overlapping.

4.1.1 Theoretical cost and price behaviour

Before analysing how cost and market-based pricing methods are related to costs it is important to know how the cost and the price behave theoretically. As it was mentioned before, researchers have not reached a consensus regarding the relationship among price and cost. On one side researchers in the field of marketing present pricing policies which do not take cost into consideration (Kotler, Wong, Saunders, & Armstrong, 2005). On another side, still in the theoretical field, researchers like Nagle and Holden (1995) highlight the importance of cost information in price setting. In order to understand the cost and price relationships it is essential to analyse those entities separately. By carrying out a separated analysis it is possible to find similarities, differences and consequently draw conclusions.

The parameter which better describes the price behaviour is price elasticity. As it was mentioned, before price elasticity measures the variation in price after an intentional change in the quantity demanded (Kotler, Wong, Saunders, & Armstrong, 2005). As a possible outcome, demand can change considerably (elastic) or slightly (inelastic). The quantity demanded is expected to be reduces significantly when the price is (intentionally) increased. What it is important to point out is that price elasticity is a complex concept and that it can be affected by wide range of factors such as market characteristics and product features (Kotler, Wong, Saunders, & Armstrong, 2005).

The elasticity concept can also be applied to describe the cost behaviour. Cost elasticity measures the sensibility between the cost and the output (Belkaoui, 1991), which is in this case the quantity produced. This can be calculated using the following equation:

$$e_{TC} = \frac{\frac{\Delta TC}{\Delta X}}{\frac{TC}{X}} = \frac{X \Delta TC}{TC \Delta X} = \frac{MC}{UC}$$

(Belkaoui, 1991)

Where:
e_{TC} = Cost elasticity;
TC = Total Cost;
ΔTC = Variation in the Total Cost;
X = Quantity of Output;
ΔX = Variation in the Quantity of Output;
UC = Unit cost;
MC = Marginal cost.

A possible way to increase the profits without changing the price is by decreasing the costs. It can be done by different ways including improving the production efficiency, improving the existing product design or by taking the advantage of large quantities produced. The last approach mentioned is called economies of scale and it is achieved if the production cost falls as the output expands (Perloff, 2009) . Economies of scale were extensively adopted by Ford in the beginning of the 20th century (Bellgran & Säfsten, 2008), and it is still used nowadays. According to Belkaoui (1991)the main reasons for economies of scale are:

- A large scale enables individual employees to work on more highly specialized tasks, increasing their proficiency and reducing the time lost changing tasks;
- Incremental fixed costs, such as those involved in product design, are lower per unit when they can be spread over more units;
- More efficient production processes (for example, assembly lines) are practical only when employed on a large scale;
- Large sizes of capital equipment can often be built for less than a proportional increase in cost.

Through the years it raised a common belief that increasing the quantity produced is the primary condition to enjoy the economies of scale's benefits. However, the overproductions crises which took place in the end of the 1920's (Bellgran & Säfsten, 2008) proved the opposite. Economies of scale are just possible if the marked absorbs the quantity produced (Nagle & Holden, 1995). However there is a second *cine qua non* condition which is barely taken into consideration. The marginal cost (MC), which is the cost of producing an extra unit, might decrease with an increment in produced quantity. However, due to capacity constraints, the marginal cost will increase if the company decides to produce more than they are capable of. The cost and revenue behaviour can be observed in the following graphic; marginal analysis.

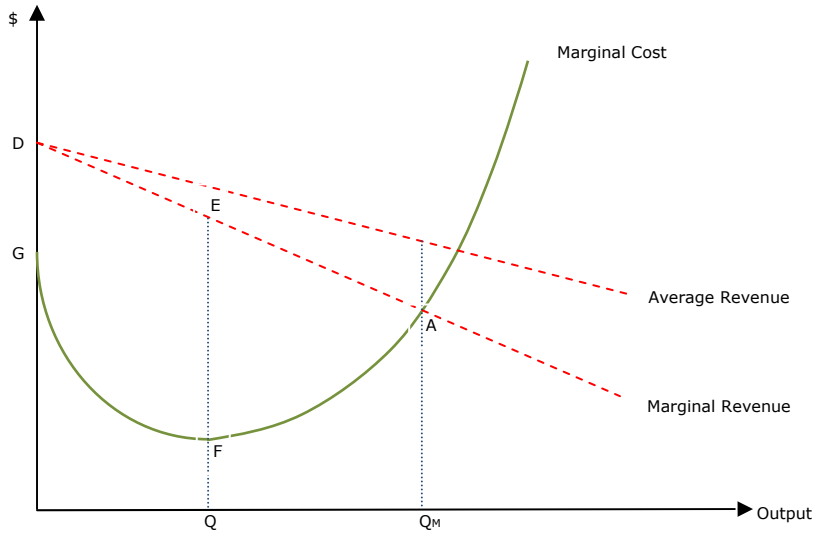


Figure 9: Graphic Presentation of Marginal Analysis (Belkaoui, 1991)

By mathematical explanations it is proved that marginal cost (MC) has a behaviour similar to a parabolic function $Y = \alpha x^2 + \beta x + \gamma$ (Belkaoui, 1991). Initially, when the quantity produced is zero, the marginal cost is represented by the letter G. Such initial marginal cost might be the expenses involved in developing the product and/or building a production line. As long as the quantity produced increases, the marginal cost decreases until the point F, which represents the vertex of the parabola and the minimum marginal cost. Such reduction represents the economies of scale mentioned previously. From F, if the quantity produced increases, the marginal cost will also increase. The marginal revenue, on the other hand, has a linear function $Y = \beta x + \gamma$ (Belkaoui, 1991) and β represents the price elasticity. Marginal revenue (MR) can be calculated by multiplying the price with the quantity at a particular time. The initial demanded price is D, and as expected demanded quantity increases the price decrease, as

it is expected. The point A represents equality between the marginal cost (MC) and the marginal revenue and Qm the quantity to reach to reach the maximum profit. The area below the parabola and above the x axis (Output) represents the total cost. At the same time, the total revenue is the area below the straight line with smooth negative declivity and above the x axis. Consequently, the profit, which is the marginal revenue minus the marginal cost, is the area below the straight $Y = \beta x + \gamma$ and above the parabola. Qm is the quantity that maximize the profits.

4.1.2 Cost-based pricing methods

In section 2.4 it described how the different cost-based pricing methods work. Generally, it can be said that both methods use the product cost in combination with a mark-up to set the price. The simplest form of setting the price is therefore to calculate the cost and then to add a margin which has been set on before hand. The more complex method does also include forecasts and the desired profit, and the margin is calculated based on this information.

This latter method, target-profit pricing, includes the use of a break even analysis to define the margin. This break even analysis is another evidence which connects price and cost. It is an approach to calculate the minimum quantity necessary to equalize revenue and expenditures. It is used to identify how total costs, revenues and profits are related to sales volume (Harding & Long, 1998).

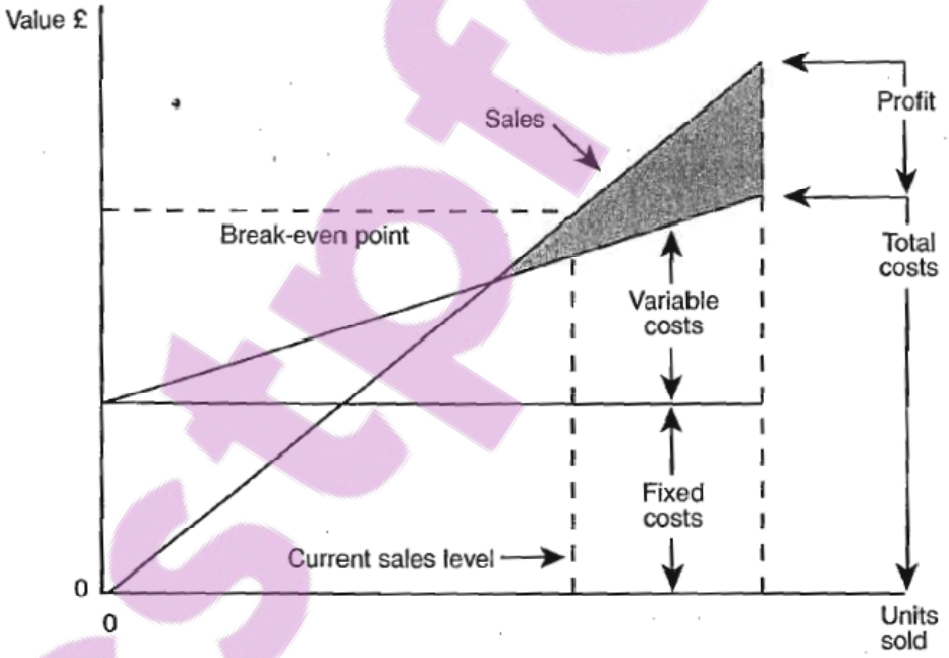


Figure 10: Break-Even Analysis (Harding & Long, 1998)

Break even analysis has a valuable use for academic purpose, specially for teaching what affects the profits; cost, volume, and revenue. However, such analysis is based on the assumption that fixed cost, variable costs and revenues are kept constant, (Harding & Long, 1998), and in reality it generally does not happen. According to Atrill, McLaney and Harvery (2000) there are three basic reasons for such unfeasibility. First of all, the relationships between fixed cost, variable cost, revenue and quantity are not linear in the real life. Secondly, fixed

cost might be kept constant in a specific period of time, but in a long term they tend to be "stepped", which means that it changes and stays constant for a specific period until the next change. At last, break even analysis is feasible for a single product, but when it comes to the corporative reality, which is characterized by a multi product environment, such analysis is impossible to perform.

However, in both cost-based pricing situations it is required to have concrete information about the product's cost level. In (pricing) theory it has been said that cost-plus pricing is the easiest pricing method (Kotler, Wong, Saunders, & Armstrong, 2005), although this does not take the difficulties of cost allocation into consideration. In section 2.3 it has been explained that this can also be a difficult process. In order to set a right, accurate price it is required that accurate cost information is available, and well divided between the different products. Obviously, this is a both a time-consuming and difficult process, but it has huge consequences for setting prices when a cost-based pricing methods is being used.

Based on the basic idea behind cost-based pricing methods – price is the product's cost plus a margin – it can be said that even minor changes in cost allocation have direct consequences for the price asked. There are different ways for allocating costs and the final results, a product cost, are not necessarily equal. The direct costs are easily dividable, but the indirect costs can cause problems. One way of allocating those is, for instance, by dividing the total indirect costs by the total number of products. However, it is also possible to take the direct costs into consideration and divide the indirect costs accordingly to these values. This is, obviously, only of any concern when the organisation has several products or product variants, but the product cost – and therefore the price as well – will probably be completely different.

Another example of problems with allocating costs for pricing decisions is given by O'Guin. As he describes it, most companies in today's manufacturing environment rely on traditional labour based costing systems to establish a cost-based price. Therefore, each company has its costs systematically skewed in the same direction – underpricing low volume, custom products and overcosting high-volume, standard products. This distortion, no doubt, influences pricing (O'Guin, 1991).

4.1.3 Market-based pricing methods

Where the cost-based pricing methods were directly related to costs, there is a different situation in the case of market-based pricing methods. In theory in sounds like the market-based methods do not include costs while making decisions, but for companies that use this kind of pricing method this is of course rather unlikely. Based on the assumption that organisations want to make profit – or at least break even – it is necessary that cost information is available. The main difference between cost-based and market-based is therefore the moment when the cost information is included in the decision making process. Nagle and Holden (1995) explain this with a model, which is also used by Kotler, Wong, Saunders and Armstrong (2005).

They explain the difference between cost and market-based pricing by taking the product development process into consideration. In cost based systems the entire process starts with developing a product and ends at the market. In a

market-based approach this process is turned around and starts at the customer and ends, consequently, with developing the product.

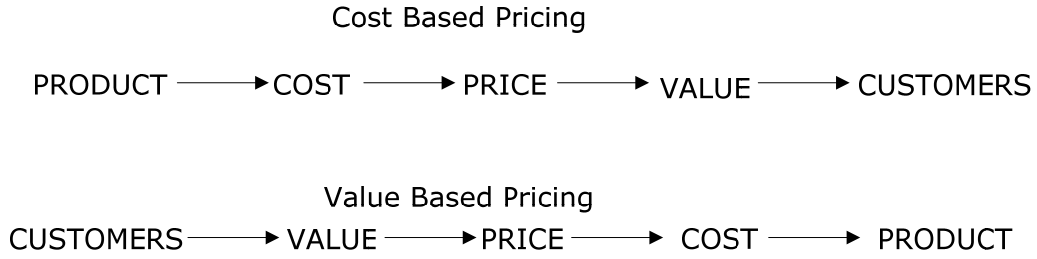


Figure 11: Role of Pricing Product Development (Nagle & Holden, 1995)

Here, value based pricing is a synonym for market based pricing. Like it can be seen in the model, this method also uses cost information, but it is placed later in the process. It can be said that it is more a target price then a measured value.

This leads to one of the main approaches in market based pricing, namely perceived value pricing or target costing. With this method there is a clear connection between cost and price. Target costing is a costing estimation procedure used for developing products which takes the market price and the expected demand for that particular product into account. A product cost is computed by subtracting the firm's desired profit margin from the product's market price (Kee & Matherly, 2006). Based on the allowed cost, designers and engineers create the product. In addition, current researches indicate that the majority of a product's unit cost (up to 85%) is defined during the development stage (Maccarrone, 1998; Kee & Matherly, 2006). By combining both statements mentioned previously let the conclusion that product development is not only important to estimate the unit cost but also to set the price.

The other market-based pricing methods use cost in a slightly different way. Negotiated pricing discusses the price with the customer and usually it takes hereby the cost into consideration. Going rate pricing adopts the price that has been set by the competition, and is therefore rather independent concerning costs. The same is valid for sealed-bid pricing, where the customer actually sets the price. For both of these methods it is, of course, still required to keep tracking the costs in order to stay profitable as an organisation. The problem with sealed-bid (i.e. auctions) is, however, that sometimes agreements about selling are made before the price is defined. In such a situation the company/person accepts the risk of loosing some money if the possible customers are not willing to pay a price above the cost. Nevertheless, this is a rare situation and in many situations avoidable, if wanted.

It gets more interesting with the new, innovative product pricing strategies, since those pricing strategies handle the cost in a special way. Market penetration pricing is a method which requires a market or market segment with high price sensitivity. It sets the introduction price at a very low level in order to gain a large market share and to keep the competition from entering the market. In other words, the firm tries to get large sales volumes by using low prices from the beginning. Afterwards, the organisation is able to lower the costs of building the product by taking advantage of economies of scale, like explained in the first

section of this chapter. One idea of this concept is that this process of lowering prices and costs can carry on continuously due to the idea that the costs tend to decrease over time.

The other pricing method which exists for new product pricing is price skimming. This method leads to lower sales, but "the high price indicates the product's uniqueness and special properties, and allows quicker recovery of development costs" (Kotler, Wong, Saunders, & Armstrong, 2005). So to explain it a bit further, market-skimming pricing makes use of the principle of life cycle costs.

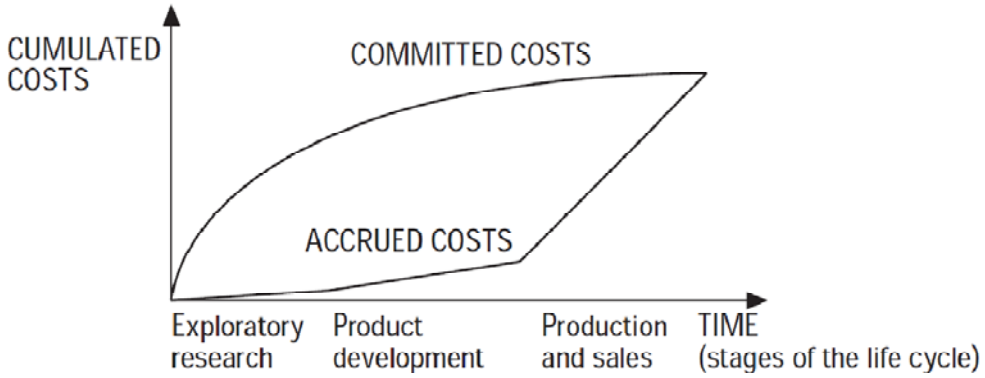
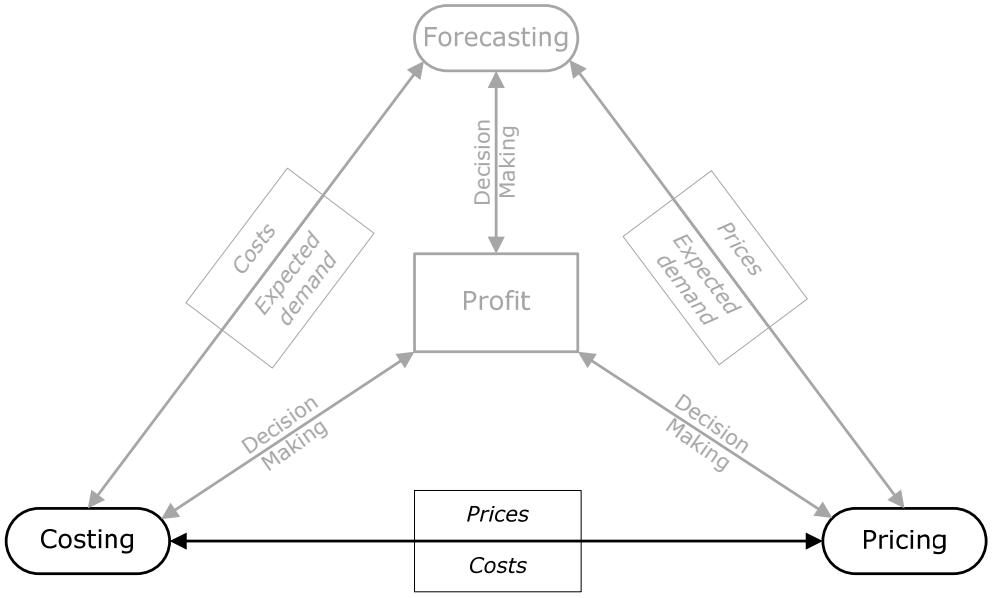


Figure 12: Life Cycle Costs (Maccarrone, 1998)

According to the principle of life cycle costs, up to 85 percent of the costs or committed before the actual production starts (like described before). However, the actual product costs are mainly built up as soon as the production starts, like this figure shows. Obviously, the committed and the accrued costs end up at the same value (Maccarrone, 1998). The idea of market-skimming pricing is to gain the quickest return on the investments and aims at collecting this mainly from the customers who are most willing to obtain the new product. This is again a field where cost and price are clearly connected.

4.1.4 Research model

The following model summarises the interface between pricing and costs. It shows the inputs and outputs related to each method, and it shows the importance of prices and costs in relationship to costing and pricing.



Input factors
- Costs (direct, overhead)
- Number of units
- Costing method
- Cost drivers

Input factors
- Stage of the life cycle
- Costs
- Level of competition
- Corporate/marketing strategies
- Demand

Figure 13: Price-Cost model

4.2 Cost and Prices within the Supply Chain

The field of Supply Chain Management (SCM) is one area in which cost and price are clearly related to each other. It is a rising concept that aims at gaining benefits for all organisations in a specific market chain. Typical supply chains start with the sales/procurement of raw materials and go through different distribution and production steps to the end consumer. The relationships between the different parties in SCM are much stronger than a 'normal' supplier-customer relationship due to the fact that the different firms have a common goal. SCM can be described as:

> *"The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole"*
> (Christopher, 2005)

Or,

> *"Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize systemwide costs while satisfying service level requirements."*
> (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008)

The difference between traditional logistics and supply chain management is, thus, the fact that logistics just deals with the organisation's internal processes

and marketing channels, where SCM aims at the relationships between the chains (Christopher, 2005). Like it is described in these definitions, lowering the costs through the entire chain is a main purpose of the SCM concept. According to Simchi-Levi, Kaminsky and Simchi-Levi (2008) a common and effective way of doing so is by creating supply contracts between the different parties. In such a supply contract, buyers and suppliers usually agree on:

- Pricing and volume discounts;
- Minimum and maximum purchase quantities;
- Delivery lead times;
- Product or material quality;
- Product return policies.

(Simchi-Levi, Kaminsky, & Simchi-Levi, 2008)

The first point mentioned here, pricing and volume discounts, in combination with the purpose of lowering costs shows that price and costs are connected in the field of supply chain management. There are several kinds of supply contracts which all aim at reducing the total costs for the supply chain. All those methods have one thing in common; they try to reduce the uncertainty for organisations, or that they try to lower the consequences/risks. Therefore, the concept of risk and uncertainty within firms and supply chains will be explained first. Afterwards, the different supply contracts which affect pricing decisions will be described and analysed.

4.2.1 Uncertainty and risks in organisations

Risk is a happening that is always present. In the broadest sense, it is something that is unavoidable and people and organisations are therefore always at risk. When someone walks on the street he or she has, for instance, already the risk of getting involved in a car accident. Hereby, there is usually a difference between the risk that people observe, the subjective risk, and the actual risk being present, the objective risk. Obviously, the term 'risk' is quite vague in this way, and therefore it can be defined as:

$$\text{Supply chain risk} = \text{Probability of disruption} \times \text{Impact}$$ (Christopher, 2005)

After analysing this formula, it can be concluded that both the probability and the consequences involved define the (objective) risk. Due to the high number of customers, the impact of loosing one is very low for a large supermarket. On the other hand, the impact of loosing an entire market segment has a much bigger impact. The same is valid for the probability of disruption. In this first example, the probability is quite high, but the total risk is probably rather low. In the second example, the probability is lower while the risk is most likely still relatively low. The probability of disruption, however, is a difficult concept. It is the basis of the existence of the concept of 'subjective risks', due to the fact that persons tend to estimate the chance that something happens higher or lower than the real probability of occurrence. The problem with this situation is that the probability of disruption is usually not clearly defined, or in other words, it is an uncertainty.

There are many factors in organisations that increase the uncertainty. One can think, for instance, about uncertainties in demand forecasts or machine breakdowns. This leads to the fact that uncertainty and risk are present in every supply chain (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008), and in its turn, this leads again to major costs for companies and higher risk.

Organisation have generally several approaches which they use to deal with the (results of) uncertainty and risks, however this will be described in chapter 5. In the next part of this section different methods which are related to pricing and that can be used within SCM will be analysed.

4.2.2 Supply contracts which affect pricing decisions

Supply contracts is a method which is described by Simchi-Levi, Kaminsky and Simchi-Levi (2008) as a important way to optimise supply chain performance. They describe a traditional supplier-customer supply chain as a situation in which both the buyer and seller are separated entities. The buyer places an order and the seller produces and/or delivers. The seller uses hereby forecasts to predict the demand for their products (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008).

In such a situation, there can be different kinds of pricing methods, like fixed and dynamic strategies. However, generally, it can be said that the seller will try to make a certain profit on its product or services. This profit is based on the difference between the sales prices and the organisation's internal product costs. This is applicable in cost-based pricing methods as well as in market-based approaches, due to the basic profit = price – cost philosophy.

This means that decisions are made for each entity separately. "Obviously, this cannot be an effective strategy for supply chain partners since it does not identify what's best for the entire supply chain" (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). Supply contracts are based on the idea of risk sharing between the different parties of the supply chain (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). A supply contract can then be described as "an agreement between a buyer and a supplier that stimulates the terms of the purchase in an environment of incomplete information and possible reaction alternatives" (Sethi, Yan, & Zhang, 2005). By lowering the risk for buyers, they are most likely more willing to order larger amounts, which in its turn lowers the risk of out of stocks, and therefore both parties get a higher probability of getting higher profits (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008).

There are several kinds of supply contracts that are based on this principle. Like said before, some are more related to pricing than others. Simchi-Levi, Kaminsky and Simchi-Levi give the following types of strategic supply contracts:

Contract	Characteristics
1. Buy-back	Partial refund for all unsold goods
2. Revenue-sharing	Buyer shares revenue with supplier for discount wholesale price
3. Quantity-flexibility	Full refund for a limited number of unsold goods
4. Sales rebate	Incentives for meeting target sales

Table 2: Contracts for strategic components (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008)

These are four different contracts for strategic components. Due to the costs and time efforts involved it is sometimes difficult to apply them for each product.

Out of these four strategies, the second strategy has the biggest relevance to pricing. This method aims at lowering the total supply chain costs by lowering the price for the buyer, which in its turn returns a part of its revenues to the

supplier. By doing so the required investment for the buyer gets lower and this applies for his risk as well. Yet this does also includes an advantage for the supplier. When the risk for the buyer is reduced, he is expected to order larger quantities. For the supplier this leads, consequently, to economies of scale and therefore to lower costs. Finally, this method does also increase the administration costs of the different parties, since those need to be measured and shared (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). There exist more types of supply contracts, both for strategic and non-strategic components, which are based on the same principle of risk sharing. For the purpose of this report this is however less relevant and therefore it will not be expounded. The interested reader is advised to read Simchi-Levi, Kaminsky, & Simchi-Levi's book "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies".

5. Costing-Forecasting Relationships

Cost and forecasting are two wide explored topics in the academic literature. While dealing with the cost side, there are two different concepts that need to be clarified; the costing method, and the output of the costing allocation method. Concerning to the first concept its importance lies on the fact that it can influence the second factor; the cost as a value. Cost allocation can be a complex task to perform, and if not performed properly it might lead to inaccurate costs. Due to the fact that cost information is used in decision making, inaccurate cost information can drive decision makers to wrong decisions (Kaplan & Cooper, 1998). Similarly to cost, forecasting is also a concept which needs to be understood in terms of process (forecasting), and value (forecast). This following section aims to explain the cost –forecasting relationship by answering the same two questions addressed in the previous chapter: Are those two topics related? If so, how related are they?

Regarding to the first question (Are those topics related?) there are strong evidences pointing out for a positive answer. As it was mentioned before each forecasting method has its own operational cost. While comparing the forecasting method the Time series methods are cheaper to perform while compared with causal models and qualitative methods (Chamber, Mullick, & Smith, 1971). Another evidence of cost-forecasting relationship is the forecast error. Current studies have found that forecast error, the different between the forecast and the actual demand, has a considerable impact on the organizational cost (Biggs & Campion, 1982). "When forecasts are inadequate, planning becomes haphazard, there are frequent costly revisions to the plan and inventory increases (Vollman, Berry, & Whybark, 1992)".

The second question, on the other hand, is not easy to answer. In order to answer it both, cost and forecasting concepts, will be studied in terms of method and output. First of all, the analysis will be carried out in an organizational and then in a supply chain perspective.

5.1 Forecasts and Costs within a Single Organisation

Nowadays companies are facing difficulties to fulfil their purpose. There is a pressure to optimise the use of resources and to improve the operational efficiency at the same time. Such pressure is triggered by an increasing competition, and according to Kalchschnidt, Verganti and Zotteri (2006) it is partly explained by an increasing attention to customers. *"Customers are critical not only because they directly influence the success of specific products or firms, but also because they play a fundamental role in many internal processes"* (Kalchschmidt, Verganti, & Zotteri, 2006). The excessive focus on customers has, somehow, affected the demand behaviour, and consequently the demand uncertainty faced. In a highly competitive market customers can easily shift from one supplier to another, and a loss of customers has a considerable impact on profits.

Managing demand uncertainty has created significant problems industries in general. After studying 1380 manufacturing and retail companies, KPMG Peat Marwick, concluded that many companies worldwide do not know exactly the

amount of goods they need to manufacture, transport and store (Helms, Ettkin, & Chapman, 2000). Uncertainty increases decision making difficulty, working in a highly uncertainty environment might lead managers to costly decisions. A widely solution used to deal with demand uncertainty is build inventories of finish items (Helms, Ettkin, & Chapman, 2000). By building inventories it is possible to provide an expected service level which fulfils the customers' needs. However, if not managed properly, safety stocks can impact heavily in the operational cost (Baker K. , 1986).

Forecasting is an alternative approach to deal with the uncertainty issue. Such subject has been widely explored by academics and professionals; however companies, in general, are still facing problems while working with forecasting. Most companies know that a forecast is inaccurate, but they do not know how to overcome those problems. A possible explanation for such degree of inaccuracy is the lack of an interdepartmental forecast system (Helms, Ettkin, & Chapman, 2000). The marketing department which is generally responsible for forecasting might focus on the future sales in terms of monetary units and at the same time finance might carry out a parallel forecast which better fits with their needs; budgeting. Sales personnel, on the other hand, might adapt the marketing's forecast based on sales quotas, while purchasing may possibly adjust a forecast to reflect their points of view and experience to create what they consider to be a better forecast. At last, production might not use any of those different contradicting forecasts and overspend the production resources. According to Helms, Ettkin and Chapman (2000), operating from many plans is a handicap that creates misinformation, excess inventory, lack of accountability and results in the creation of a cycle of poor forecast credibility that is difficult to break.

As it could be observed, forecasting has two impacts on the cost; a direct impact on the operational forecasting cost, also known as cost of forecast accuracy, and the indirect impact of forecast uncertainty which is also known as cost of error.

5.1.1 Cost of forecast accuracy

The relationship between forecast accuracy and cost is undeniable. Generally, the most accurate forecasting methods are also the most costly. By comparing different forecasting methods it is possible to state a cost-accuracy relationship. Time series methods are generally inexpensive, since they are easy to perform but the accuracy provided is fairly good, but just for short terms (Lines, 1996). The problem with using only historical data to foresee the future is that it assumes that in the future the same past patterns will occur (Helms, Ettkin, & Chapman, 2000). Causal methods, on the other hand, provide a very accurate forecast for short, medium and long terms. However those models have operational difficulties; they are costly, hard to understand, and demand a considerable effort to implement and maintain (Armstrong J. , 1984). At last, quantitative methods are also costly and the accuracy depends on the forecasters expertise. In general, those methods are accurate for short, medium and long term forecasting (Chamber, Mullick, & Smith, 1971), but what makes them attractive is the possibility of performing them without historical data. At a glance, the cost benefit analysis might lead the erroneous conclusion that high accuracy is just achieved by using sophisticated methods such as Box-Jenkins and econometrics models. In fact sophisticated methods are more accurate in theory, but in practice there are some aspects to be considered. Sophisticated

methods are generally more difficult to understand, and they are costly in terms of development, implementation and maintenance (Armstrong J. , 1984).

The choice of a forecasting method has a significant impact on cost. By choosing the right forecast approach, it is possible to achieve a desired accuracy at a low cost. However, in practice, selecting a forecast method is not an easy task to perform. It depends on many factors such as; the relevance and availability of historical data (Chamber, Mullick, & Smith, 1971; Krajewski & Ritzman, 2002), the degree of accuracy desirable, forecast horizon (Krajewski & Ritzman, 2002), the time available for making analyses (Chamber, Mullick, & Smith, 1971), the cost/benefit of the forecast (Armstrong J. , 1984; Chamber, Mullick, & Smith, 1971).

A possible alternative to improve accuracy without heavy expenditures in complex and sophisticated solutions is combining different forecast methods. The current literature provides substantial evidences regarding the benefits of combined forecasts (Makridakis, 1989). Morris achieved an error reduction of 50 percent by combining forecasts from two different extrapolation models (Armstrong J. , 1984). After interviewing 900 senior Canadian marketing executives West (1997) found out that the number of methods involved affects the forecast accuracy. However, combining a forecast combination is not an easy task to perform. Because there is a considerable amount of forecasting techniques available, this increases the chances of failure. Some specialists suggest starting with the most well known forecasting methods, however, Armstrong (1984) recommend considering the least expensive at first.

5.1.2 Cost of forecast error

"The forecasting of future product demand, for example, is the basis of a whole series of decisions relating to capacity planning, inventory management, purchasing control, plant investment decisions and so on. Many of these decisions illustrate the fact that predicting the future involves a significant degree of risk" (Baines, 1992).

"Managers make resource allocation decisions based on the forecast, only to find that in the increasingly competitive world product configuration changes" (Wacker & Lummus, 2002).

"Many decisional processes, such as inventory management, product development, production and supply chain planning, require forecasts" (Kalchschmidt, Verganti, & Zotteri, 2006).

Forecasting is a key driver for many organizations. As it is observed above, important decisions concerning to investments, planning and development require certain estimations. Managers in general need accurate predictions to make the right decisions. However the competitive and instable environment has, somehow, increased the degree of uncertainty faced by those managers. Today, forecasting accuracy is more important than ever. The impact forecasting accuracy has on the organizational cost is being extensively studied during the years; however less attention has been given to the indirect impact of the forecast error. The impact of forecast error on the organizational cost was studied for the first time by Holt, Modigliani, and Simon (1955), who were mainly focused on quantifying the over costs related to labour force (regular payroll,

overtime, hiring, training and firing expenses) and inventory costs. Later on, Biggs and Campion (1982) investigate the relevance of bias decisions on the forecasting cost. Lee and Adam (1986) evaluate the forecasting error in Material Requirements Planning (MRP), focusing on lot sizing settings. After all those studies the impact of forecast error on organizational cost were quantified between 10 to 30%, which indicate that forecast errors, in fact, can increase the cost (Sanders & Graman, 2006).

Although those studies were focused on proving the impact of inaccuracy on cost, and little attention has been given to the managerial side (Wacker & Lummus, 2002). It is evident that a forecast has always some degree of inaccuracy, but by knowing the limitation of the method it is still possible to minimize the cost related to forecast inaccuracy. Concerning to the implications of forecasting limitations on decision making Wacker and Lummus (2002) gave a significant contributions to the managerial side in their article; *"Sales forecasting for strategic resource planning"*. He provided significant suggestions such as; relate specific resource decisions to specific time frames, agree on one organizational forecast, and combine models with managerial judgment in forecasting. However, the most significant contribution for the costing aspect concerns to the timing issue."*The most important managerial decisions a company can make are based on the least accurate forecast*" (Wacker & Lummus, 2002). Here the timing issue is related to the forecasting horizon. The forecasting accuracy is tied with the horizon; long term forecasts are, in general, less accurate than the ones with short ones (Chamber, Mullick, & Smith, 1971). At the same time the most important managerial decisions, such as plant investments and capacity planning, are based on long term forecasting (Baines, 1992). Considering the fact that such decisions require a considerable amount of money, it is possible to conclude that the decision which has the most impact on cost are based on the least accurate forecast.

5.1.3 Trade-off: cost of accuracy and forecasting error

As it was observed previously, both forecast accuracy and error have a cost. The relationship between cost and forecast accuracy is straightforward, highly accurate methods such as causal and econometric models are generally expensive methods (Chamber, Mullick, & Smith, 1971). On the other hand, simple statistical models are cheaper to perform but the accuracy provided is far less than that of the sophisticated methods (Chamber, Mullick, & Smith, 1971). Contrary to forecasting accuracy, forecasting error has an indirect relationship with cost. The error does not necessary lead to costly decisions, but it increases the uncertainty which might result in a costly decision. Some empirical studies have shown that well run organizations develop capabilities to manage the problems related to uncertainty (Wacker & Lummus, 2002).

The trade-off between forecast accuracy and error is a relevant aspect to consider. The lack of accuracy leads to costly decisions, however a highly accurate forecast is also costly. So, while dealing with those two aspects it is important to reach a balance between the cost of error and the cost of accuracy. Chamber, Mullick and Smith (1971) provide a diagram which helps to understand such trade-off.

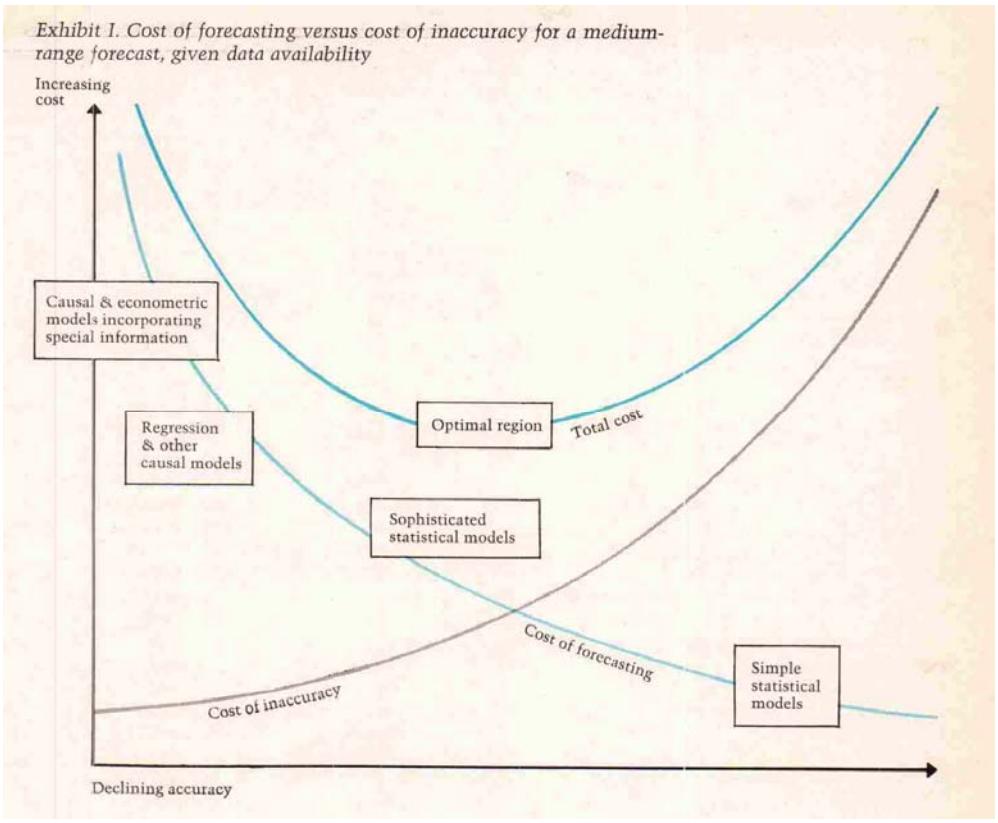


Figure 14: Cost of forecasting versus cost of inaccuracy (Chamber, Mullick, & Smith, 1971)

5.1.4 Research model

The following model summarises the interface between costs and forecasts. It shows the inputs and outputs related to each methods, and it shows the importance of prices and costs in relationship to costing and forecasting.

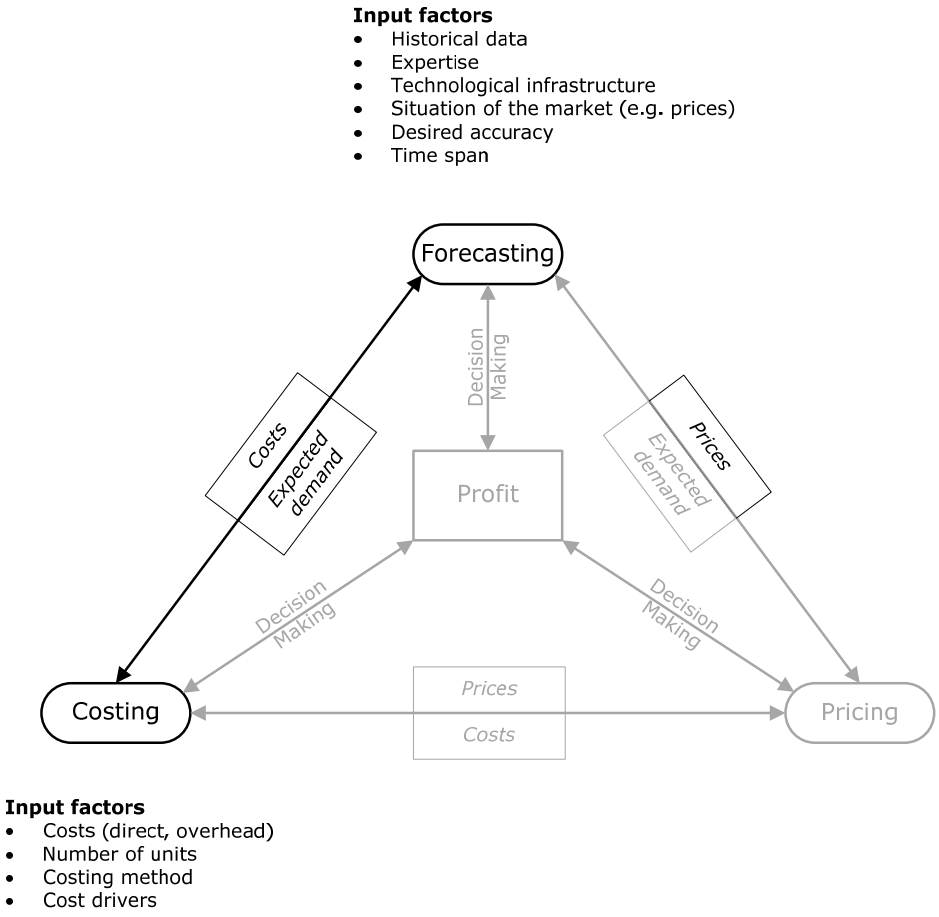


Figure 15: Forecast-Cost model

5.2 Forecasts and Costs within the Supply Chain

"The goal of supply chain management is to meet the needs of the final consumer by supplying the right product at the right place, time and price. The supply chain management approach allows companies to meet this goal while also achieving competitive advantages. There are countless success stories in which companies have used supply chain management to "replace inventory with information'', squeeze out costs, and improve efficiency and customer service" (Helms, Ettkin, & Chapman, 2000).

The importance of forecasting in supply chain management is obvious (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008; Kalchschmidt, Verganti, & Zotteri, 2006; Helms, Ettkin, & Chapman, 2000; Sethi, Yan, & Zhang, 2005; Sanders & Graman, 2006). Predicting the future can be a challenging task to perform depending on the situations. Managing the forecasting process in a single

organization can be a demanding task, but when it comes to a supply chain it is even more difficult. What it is often disregarded by most of the organizations is the fact that supply chain structure has an impact on demand variability (Kalchschmidt, Verganti, & Zotteri, 2006). In order to maximize their profits companies constantly change their orders, which results in a increasing degree of uncertainty for the next member in the chain (e.g. wholesaler, distributor, manufacture, supplier). Consequently, those members have to take protective decisions which might affect their operational cost.

"Supply chain performance is typically related to metrics reflecting cost, tied-up capital and customer service. The supplier might need to use internal actions to compensate for poor customer service. Corrective actions, such as rush orders and overtime, are mainly related to costs for the supplier. Preventive actions, for example, safety stocks and extra capacity, are mainly related to tied-up capital, but also to costs" (Forslund & Jonsson, 2007).

The problem described previously can be easily solved by sharing information and forecasting is a useful tool to enhance the overall supply chain performance. Studies have found that by improving one percent of the forecasting accuracy a millions of dollars can be saved (Helms, Ettkin, & Chapman, 2000).

The following section aims to present the cost-forecast relationship in a supply chain perspective. The previous conclusions applied in the organizational perspective can also be applied in the supply chain but there are more aspects to be considered with it come to a wide are as Supply Chain is.

5.2.1 Level of aggregated demand

When it comes to aggregate demand a possible term that might arise is Risk pooling. It is a used simplistic technique to reduce the demand variability by aggregating demand from different locations. In doing so, a high demand from one customer will probably be offset by lower demand from another (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). Risk pooling is a useful managerial tool but its benefits can be increased by using it together with forecasting tools. By forecasting the demand aggregated significant it is possible to improve the forecasting accuracy without making considerable investments in forecasting techniques.

"*Forecasting the demand for a particular brand or model or component within a market is generally a far more hazardous task than forecasting the development of the market itself, because markets tend to move more slowly and less erratically than the individual products within them*" (Davis, 1970).

Forecasting the aggregated demand has advantages as it is described above. However when it comes to heterogeneous customers, forecasting the aggregate demand can be a wrong decision. Bartezzaghi, Verganti and Zotteri (1999) found out that costumer heterogeneity increases demand variability and traditional forecasting techniques, such as risk pooling, became inefficient. Kalchschmidt, Verganti and Zotteri (2006) achieved significant improvement in forecasting accuracy by forecasting different group of customers. The advantage of forecasting demand from heterogeneous is evident, however such process might be also costly. Again, it is necessary to balance the proper cost of forecasting

with the forecasting accuracy taken into consideration the level of demand aggregated.

5.2.2 Sharing forecasting

Collaborative forecasting is a new research area in the field of supply chain management. Now-a-days, companies are realizing that by sharing the same forecasting information it is possible to reach significant operational improvements, which might result in cost savings. In a study conducted with approximately 500 companies, Mentzer and Kahn (1997) concluded that the companies which have already adopted some degree of shared forecasting are generally satisfied with the gains. The improvement achieved can be expressed in different forms, but they can be quantified in terms of cost reduction:

"Supply chain cost savings come in the form of lower inventory levels, lower production costs, lower incidence of transhipment (which occurs when product is originally shipped to one location and demanded at another), and lower incidence of product obsolescence (because the shelf-life expired)" (Mentzer, Moon, Kent, & Smith, 1997).

Collaborative forecasting is more a managerial oriented tool rather than a technical. Every company in the supply chain has an expert which meets with the other experts in order to agree upon the forecasting (Helms, Ettkin, & Chapman, 2000). When it comes to reaching consensus a possible problem that might arise is the dominance of a particular opinion (Williamson, 2000). Therefore, there is a need to employ Delphi method in a collaborative forecasting. A managerial benefit by applying such concept is the cross-organizational communication (Helms, Ettkin, & Chapman, 2000). By sharing information the uncertainty can be decreased and consequently the costs can be reduced. Concerning to the technical side, collaborative forecasting reduces the reliance on historical data, due to the fact that it is supplemented by current knowledge about specific trends, events and other relevant aspects. (Helms, Ettkin, & Chapman, 2000). By decreasing the need for historical data, the company might reduce also the cost of gathering data. The amount of information collected has a direct impact on the accuracy and an indirect impact on the organizational costs (Kalchschmidt, Verganti, & Zotteri, 2006). In addition, it has also a direct impact on cost due to the fact that gathering data is a resource consuming process.

At last, there is a reasonable number of studies proving the cost gains in a single organization perspective (Mentzer, Moon, Kent, & Smith, 1997). However, when it comes to quantifying the cost savings of using collaborative forecast in a supply chain perspective there is no enough research about it. A possible explanation might be rooted in the fact that it is a new topic.

6. Price-Forecasting Relationships

6.1 Price and Forecasts within a Single Organisation

One aspect that evidently proves the relationship between demand and prices is the concept of price/demand elasticity. This moment calculates how the demand and price are related to each other, like it was explained in section 2.2 Demand Forecasting Methods. The elasticity shows how one correlates to the other, e.g. how the demand rises when the price is lowered.

6.1.1 The use of Forecasts in Cost-based pricing methods

There exist two different kinds of cost-based pricing methods, like described in chapter 2. Cost-plus pricing is the main cost-based pricing method and this one is based on the idea of product cost plus a fixed margin is the product's price. A slightly more complex method is target-profit pricing, a method which is also known as break-even pricing or cost-volume-profit analysis (CVP). This is a method which shares the same concept as cost-plus pricing, but with the difference that it defines the margin based on a desired profit level.

Target-profit-pricing is a methods which uses the outcome of forecasting – a estimated demand – as the main tool to define a price. By dividing the total cost plus margin by the estimated demand, the sales price will be calculated (Kotler, Wong, Saunders, & Armstrong, 2005; Peter & Donnelly, 1998). Thus, the forecaster estimates a sales figure for a certain time period without taking the price into consideration. This has been criticised because of the lack of demand and competition considerations (Peter & Donnelly, 1998), but it is still a method which is regularly used and that clearly connects pricing and forecasts. This kind of pricing method can use all different kinds of forecasting methods due to the simplicity of the method. Obviously, the outcome of the forecast has to be quantitative instead of descriptive.

6.1.2 The use of Forecasts in Market-based pricing methods

Market-based pricing methods deal with demand in several ways. Competitor-based methods can take the demand into consideration, but the price stays more or less the same; at the competitor's level. For the forecasting process, a competitor-based price has a bigger influence and depends on the state of the market.

Perceived-value pricing, which is almost similar to target-costing, is another market-based pricing method. It uses forecasts to estimate their future cost level and to test if a certain product is expected to become profitable. Obviously, in further stages, when the product is already developed, forecasts can still be used for planning and development purposes, but this is no longer firmly related to the pricing method. It can therefore be concluded that the relationship between market-based pricing and forecasting is the strongest with value-based prices, but the relationship is (from the market-based pricing perspective) present but relatively weak.

6.1.3 Forecast and price relationships in the Product Life Cycle

The importance of product life cycle on organizational strategy is emphasized in the literature (Chamber, Mullick, & Smith, 1971; Simchi-Levi, Kaminsky, & Simchi-Levi, 2008; Kotler, Wong, Saunders, & Armstrong, 2005). Considering that demand behaves differently in each lifecycle stage (Chamber, Mullick, & Smith, 1971), managers should be aware of the impact of the uncertainty in the organizational performance. An efficient approach to decrease demand uncertainty is by employing the right forecasting technique in the right time (Wacker & Lummus, 2002). In order to take advantage of the low uncertainty and maximize the profits, a suitable pricing policy has to be adopted. Based on those arguments it is possible to conclude that there is a need to employ costing methods and pricing policies to different stages in the lifecycle. The works *"Types of decisions made over a product's life cycle, with related forecasting technique"* from Chamber, Mulick and Smith (1971) and *"Marketing strategy implications of the product life cycle"* of Churchill and Peter (1995) were combined in order to provide a better idea of which methods and policies are used in each stage:

	Product development	**Marketing & early introduction**	**Grow**	**Maturity**	**Decline**
Traditional decisions	Amount of development effort Product design Business strategies	Optimun facility size Marketing strategies including distribution and pricing	Facility expansion Marketing strategies Production Planning	Pricing Production planning Promotions	
Forecasting techniques	Delphi method Historical analysis of comparable products Priority pattern analysis Panel consensus	Consumer surveys Traking and warning systems Market tests Experimental designs	Market survey Statistical techniques for identifying turning points	Time series analysis Causal and economic models Market surveys: tracking & warning Life cycle analysis	
Pricing strategies		Often high to recover development costs; sometimes low build demand rapidly	Somewhat high because of heavy demand	Low, reflecting heavy competition	Low to sell of maintain inventory or high to serve a niche market

Table 3: Price and forecast in a life cycle

During the "product development" stage the company has done a considerable investment in developing the product, the production process, structuring the supply chain and setting the market strategy (Chamber, Mullick, & Smith, 1971). Although the expenditures are expressive, the sales period has not started yet and consequently there are no revenues. In such situation the only forecast approach possible is the qualitative one, due to the lacks of historical data (Krajewski & Ritzman, 2002).The pricing policy is just performed in the following stage; marketing and early introduction.

In the "marketing and early introduction" period part of the process is already committed due to decision already taken based on the forecast performed in the previous stage. Product design and production facilities are already built, but there are still decisions to be made such as choosing the launching price and the amount of units to be produced. Concerning to the pricing strategies Peter and

Donnelly (1998) advocates for setting the price as high as possible (even though this can be at a relatively low market penetration price), in order to recover the investments in development. Similarly to the previous period, the forecasting approach in this stage has to be a qualitative method, due to the same reasons mentioned in the previous stage (Krajewski & Ritzman, 2002).

The "grow" period is characterized by an increase rate in product demanded. During this stage the use of production capacity increases, products are being sold resulting in revenues to the corporation. The product is new to the market and therefore the company has to take advantage of the situation and charge a high price in order to capture the amount of money that the customer is willing to pay in the beginning (Cannon & Morgan, 1991). In addition, at this point the resources are even more committed, and the forecast information is more useful for the purpose of setting prices than for resource allocation. Due to the fact that quantitative data is available at this point, statistical forecasting approaches such as time series methods can be used (Chamber, Mullick, & Smith, 1971).

In the following stage; "maturity" the organization might be working in full capacity, the demand variability has achieved a considerable degree of stability, and the company might have already recovered the investments performed in the development stage. Considering the stability achieved, the best demand forecasting approach to be used might be the time series methods, due to cost issues (Chamber, Mullick, & Smith, 1971). In addition, a suitable pricing strategy according to Peter and Donnelly (1998) is lowering the price in order to keep a certain level of competitiveness.

At last, the "decline" stage is characterized by a demand retraction, the company might have already developed another product and there are not many decisions left to be made. The decisions made are basically related to what to do with the existing product. If they decided to keep it, the managers could add a new feature, find a new use of it or introduce in a new market (Peter & Donnelly, 1998). If they want to end with production, the decision might lie in how to deal with the existing inventory. In this situation setting a price has an important impact on profits. Therefore a possible pricing approach might be to lower the price in order to get rid of the units left (Peter & Donnelly, 1998).

6.1.4 Causal methods

Causal models can be an evidence of a direct relationship between price and forecasting. An important characteristic present in causal models is the attempt to describe the complex cause-effect relationships which affects the demand. As demand can be affected by different factors (Krajewski & Ritzman, 2002), the causal models aims to bring those relevant factors into consideration (Baines, 1992). In a very competitive market the product price can affect the demand of that particular product. Based on the concept of substitute goods (Depken, 2005) a particular customer might switch to another supplier which offers a product with the same functionality. For instance let's consider an open market environment, with oligopoly characteristics; in order to be competitive a particular seller might base their product price on their competitor's. A causal model can take the price into consideration of one or several companies, depending on the relevance of the price aspect. After analysing all those relevant aspects it is possible to conclude that there is a relationship between the method (forecasting), and an input (price). Of course, causal models can also be used to

forecast future prices (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008), but due to the fact forecasting prices is out of the scope of this project it will not be considered.

6.1.5 Research model

The following model summarises the interface between prices and forecasts. It shows the inputs and outputs related to each methods, and it shows the importance of prices and costs in relationship to pricing and forecasting.

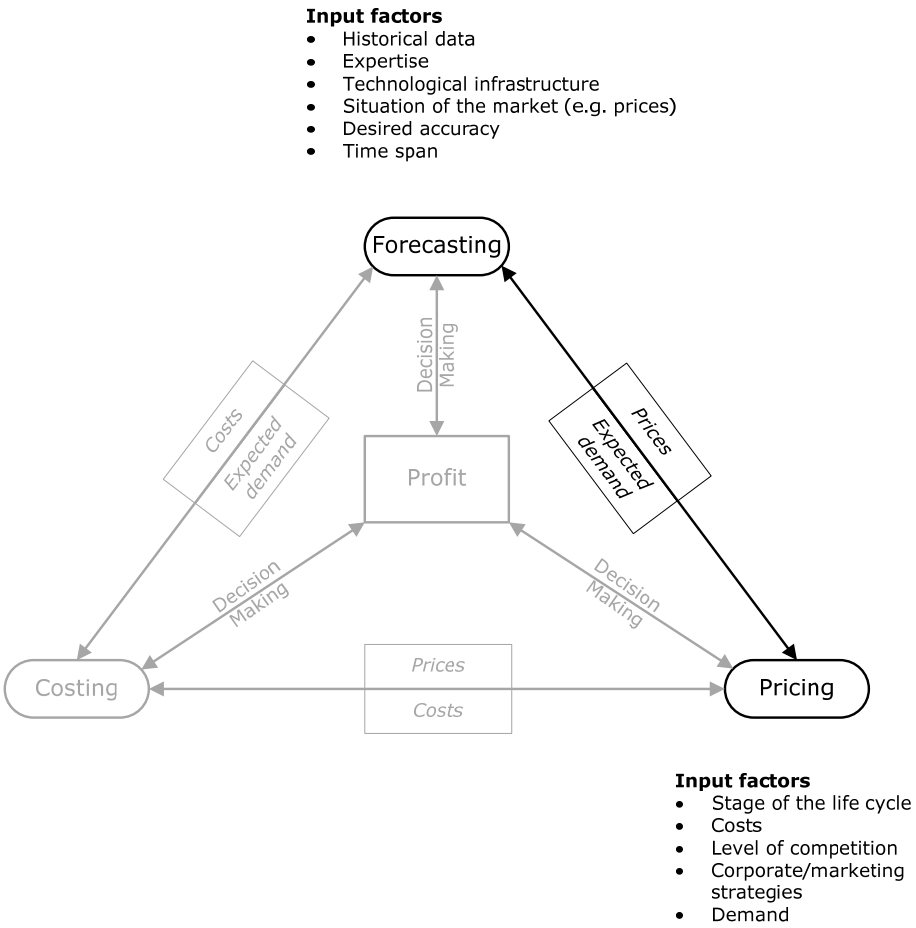


Figure 16: Price-Forecast model

6.2 Price and Forecasts within the supply chain

"*The goal of supply chain management is to meet the needs of the final consumer by supplying the right product at the right place, time and price*" (Helms, Ettkin, & Chapman, 2000). In order to find those requirements organisations often use forecasting either in a single organisational or supply chain context. Usually, the chain which is the closest to the consumer has the most accurate forecast information (Forslund & Jonsson, 2007). Since a demand forecast does not necessarily result in a quantitative result, the other players of

the supply chain can use the data to define what the (customer's perspective of the) value of their product is.

One other aspect where forecasts relate to prices is when forecasts are made for the entire supply chain. In this case, it is possible to aggregate them in order to increase the accuracy and lower the uncertainty of the chains. Theoretically, it is then also possible to lower the prices of the different products in the chain (for the buyer this might be a cost, for the seller it is a price). The margins that organisations add on their costs, in both market and cost-based pricing systems, are partly meant to deal with unforeseen events. When aggregated forecasts are used, which come from the closest point to the end user, the organisation can assume that there will be less of those unforeseen happenings (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008) and the price can, thus, be lower.

In addition to that there exist also situations where price fluctuations in the supply chain affect the total demand. In the example of the supply contracts from section 4.1.2, and then the one about revenue-sharing in particular, the combination of buyer and seller agree upon lowering the price in return for a higher amount of sales (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). Another advantage here is that "price formation is a key decision made by firms which affects not only their own product prices, but the factor input prices of other firms downstream and perhaps even the aggregate price level" (Cebryk, 1997). Cooperating in the supply chain can help to reduce the uncertainty of price fluctuations by creating pricing contracts that attenuate the fluctuations. When price is an input factor for forecasting, the price fluctuations over the entire supply chain have to be considered instead of just those of the own organisation.

7. The links between prices, costs and forecasts

The literature about forecasting, pricing and costing is extensively explored when it comes to those topics separately. The interfaces between two of them are also explored, although in a lower degree. However, the relationship between all of those three subjects has never been investigated. In the previous sections, the relationship between two of the research topics were analysed. The data about pricing, forecasting, and costing was relatively easy to find, although sometimes there existed some gaps and conflicts. Concerning the interfaces the data available was less wide-spread. In this chapter, the links between all of the three subjects will be clarified. Now it is the time to analyse the common aspects and interdependences concerning to pricing, forecasting, and costing. The aggregation of the models given before, shows how the three subjects are linked.

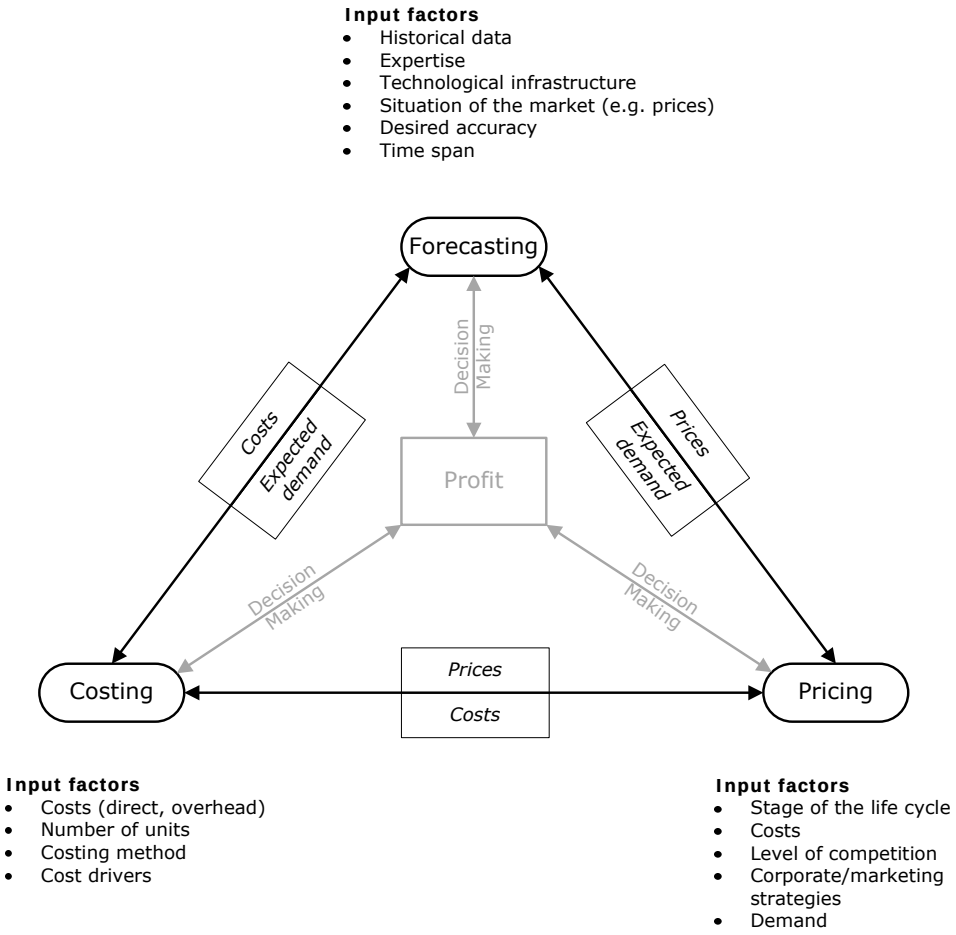


Figure 17: Forecast-Cost-Price model

One of the purposes of this report is to guide the management in building a profitable company. In today's competitive environments profit is, more than ever, a must for industrial organizations. Profit is one of the aspects which give the firm a reason to exist. The basic idea behind the profit concept is easy to understand; the revenues have to be higher than the costs. However when one

looks more closely at the concept, then one can see that there is more than a simple mathematical expression.

Profit = revenues – cost =
*(demand * price) – (demand * variable costs) - fixed costs*

Price affects demand (Pindyck & Rubinfeld, 2009), demand affects cost (Kaplan & Cooper, 1998) and consequently cost affects price (Nagle & Holden, 1995). However, this is just a mathematical view of the reality, and there are also other aspects that can increase the complexity about the subject. One can think hereby, for instance, about the consequences of advertisements (Hanssens, Parsons, & Schultz, 2001). One of the problems of the formula is the uncertainty related to the future demand and explains the importance of forecasting. Demand forecasts relate directly to profit because it is an attempt to estimate a future demand (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). After saying this, it can be concluded that the forecast also relates indirectly to the price and costs. It might use price as an input for estimating the future demand and the forecasting output has a direct and an indirect impact on costs.

Still, concerning to forecasting, the analysis of different future scenarios requires estimations of price, cost and demand. Setting prices and allocating cost are activities which are under the company's control; however demand is the source of uncertainty. The demand uncertainty has a significant impact on profits, and therefore the analysis of different scenarios requires a probabilistic forecasting. Probabilistic forecasting connects the future demand and the probability that it occurs (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). With probabilistic forecast in hand together with cost and price information, it is possible to make the most profitable decisions.

One of the most important aspects concerning forecasting, in relationship to cost and prices, is the forecast accuracy. As it was mentioned before forecast accuracy has a cost; generally high accurate forecasts implies investments in technology, expertise and infrastructure. Besides that, the forecast error has an impact on the organizational cost. Inaccurate demand estimations leads to more inventories and others costly implications. This leads to the conclusion that forecasting is related to costs, but the question is if this is also valid for prices. Causal models are a forecasting approach which aim to describe a theory by building a model that establish cause-effect relationships (Wacker & Lummus, 2002). Causal models might involve prices consequently it is possible to state an input-method (price-forecasting) relationship. However, forecasting also has an indirect impact on price setting. It can be said that "costs set the lower limit of prices, the market and demand set the upper limit" (Kotler, Wong, Saunders, & Armstrong, 2005). Since price affects demand and vice-versa, uncertainty of demand might affect pricing decisions (Pindyck & Rubinfeld, 2009).

Based on this statement, it can be assumed that pricing decisions also affect demand. The problem in price and demand relationships lies in calculating the degree of correlation between those two subjects. Pricing decision might also take cost information into consideration, however the use of this depends on the pricing policy chosen. Target-profit pricing uses a forecasted demand in combination with the product's cost to set the price. In addition, value-based pricing methods estimate a total costs for a new product. In order to calculate the product cost a future demand needs to be forecasted at the chosen price level. Finally, in competitor-based pricing policies it sounds like the organisation

does not have much of a choice concerning their pricing flexibility; however the decision about pricing just above or underneath the market-level should still be considered. Often, this trade-off will be made based on the company's position at the market. The estimated demand, or forecast, influences hereby directly the pricing decision. Obviously, cost information is also crucial in order to make the right, most profitable decision.

The way overhead cost is allocated is vital to understand cost information. Direct labour and direct material can be easily assigned to the product; however the overhead cost allocation requires an allocation base which is generally subjective. The forecasting cost and the forecast uncertainty – relatively the cost of accuracy and the cost of the error - are included in the overhead cost. The subjective allocation base is the reason why cost could be assessed in different ways even though it concerns the same product. The traditional costing systems – based on a single cost driver – are easy to perform but the unit cost might not be accurate. On the other hand, sophisticated costing systems like ABC provides a reliable unit cost, but it is considerably complex to perform. The question is how the product cost allocation method affects pricing decisions. An possible answer might be rooted in the relationship between price and cost discussed previously.

To clarify the explanations presented previously, it will be explained once more from a different perspective, namely with seasonal patterns. When an organisation phases a market with different seasonal patterns (where the sales and production season can differ), all three research topics need to be considered in the decision making. For instance, a flower store might lower their prices in the end of the day. The product is no longer useful the next day, so throwing them away is a high cost. However, the discounted products of today might affect the demand of the next day. This is also an aspect that should be included in the forecasting process. Luckily, there exist several specific forecasting methods for situations like this that can be used, like time-series methods. Hereby it can be interesting to realise that in seasons with a high demand, the total cost within the organisation might be higher due to the variable costs (again, the production and sales season might differ). However, the overhead cost can be divided over more products, so the total product cost might be lower.

Finally, the case below is about an organisation in which all three subjects are connected. The firm which combines the subjects is Zara. This is a company which operations have been widely recognised because of their speed in reacting to trend changes (Kaipia & Holmström, 2007). Inditex, Zara's mother company, described Zara as:

> *"Zara is a high-fashion concept offering apparel, footwear and accessories for women, men and children, from new-borns to adults aged 45. Zara stores offer a compelling blend of fashion, quality and price offered in attractive stores in prime locations on premier commercial streets in upscale shopping centers. Our in-house design and production capabilities enables us to offer fresh designs at our Zara stores twice a week throughout the year."*
> (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008)

In Zara's kind of industry, it is common to set prices by adding a target margin on top of the product costs (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008); so they often use target-profit pricing. Zara, however, uses a method where they charge different prices based on the location of the retail store as well as the costs involved. The demand data is gathered directly at the point-of-sale (POS)

and the store personnel is often in contact with the product managers to talk about the latest trends (Kaipia & Holmström, 2007).

Zara creates here a way of working that is not very common in today's industry. They include several processes into bigger multifunctional processes. In product development, for instance, all kind of information is used. The designers are in contact with the store managers who bring in new ideas. The possible rate of success of those ideas is immediately forecasted based on certain price levels, which can differ per location. This is then again compared with cost information to estimate the profitability of those popular concepts.

8. Conclusions and Discussions

After analysing the problem for this investigation, several conclusion have been made. In general, managers who are involved with shop floor activities have limited knowledge about how a forecasting method can affect cost management and price policies. It was assumed that those three subjects are correlated to each other, and in the report this assumption was tested by using a system analysis. This was done by adapting a qualitative, interpretive research design. The research process was mainly done by a literature review in both the single subjects and in the interfaces between two out of three research subjects. At first, just the pricing, costing and forecasting methods were investigated, but further on it was decided that it was more interesting to include the subjects of prices, costs and demand as well.

In order to understand the interfaces between the subjects, it is vital to know the difference between a relation and a correlation. Where a relationship shows that two or more entities are linked, the correlation shows that the entities are affecting each other too. At first the assumption was that the methods were related, however it was uncertain to what extent. Nevertheless, after investigating the subject described before, it can be concluded that the three different methods are not directly related. From all the relationships investigated, none affected another method. Based on inductive reasoning (Williamson, 2000) it can be concluded that there are no relationships between them.

One the other hand, every method is related to the outcomes of either one or two of the other methods. The qualitative study based on previous investigations has given several examples of how this is related. These can be found in chapter 4 to 7.

In addition to that, it can be concluded that the main outcomes of the different methods are directly related. The examples given before can be used to prove that these outcomes are linked, and often even affect each other's value. The model below shows how this connects:

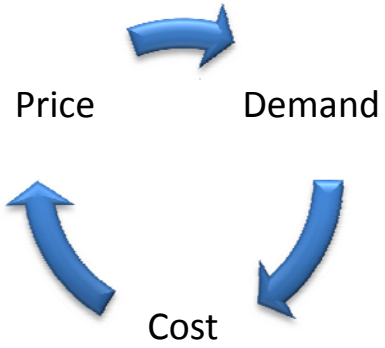


Figure 18: Price, demand and cost relationships

As it is observed, price, demand, and cost are related in a continuous process. Where the price elasticity shows that the demand is affected by the price, economies of scale show this between cost and demand. Finally, the link between price and cost is rather obvious and widely investigated and can be associated to the principle of profit. The cyclical relationship that connect those three topics highlights the direct and indirect impact of decisions. For instance a particular

choice in price affect directly demand and indirectly the cost. Consequently, the price can also be reconsidered and it provides a feedback about the price decision made before. The conclusions about Figure 18 have also been discussed at Fagerhult AB and were confirmed.

Generally, it can be said that cost, forecast and price are affected by internal and external factors. Here the internal factors that are in the company's control and the external factors that are not. It is interesting to mention that the situation is not entirely black and white, so there exists several degrees in between. The costs, prices and demand can all be seen as an output from the corresponding method, and as an input for the other methods. From a system or black box perspective, this is valid for all of the subjects. And when this is taken into account it is possible to state that cost information, demand forecasts and the uncertainty involved (such as the forecast accuracy) are inputs for decision making; such as pricing.

Finally, it is also interesting to discuss the timing aspect in those research topics. The cost is usually high in the beginning, but as soon as experience is gained the cost decreases. At the same time, the forecast starts with qualitative methods, but over time this moves to time-series , and later on causal models are suitable to use. The price start high (concerning time, not the market) and gets lower at each step. Therefore it can be recommended to take time into consideration every time a strategic decision has to be made. It is the best to make the decision as late as possible, so that it is close to the results (Wacker & Lummus, 2002). Hereby it can be concluded that the product life cycle also plays an important role for each decision (Chamber, Mullick, & Smith, 1971; Churchill & Peter, 1995).

To summarise all of this; the methods are not directly related, but the outcomes are. For management it is important to take the demand, the cost and the price into consideration when they make a decision concerning to either pricing, costing or forecasting. This model, on the following page, might help management not to forget crucial aspects during their decision making process.

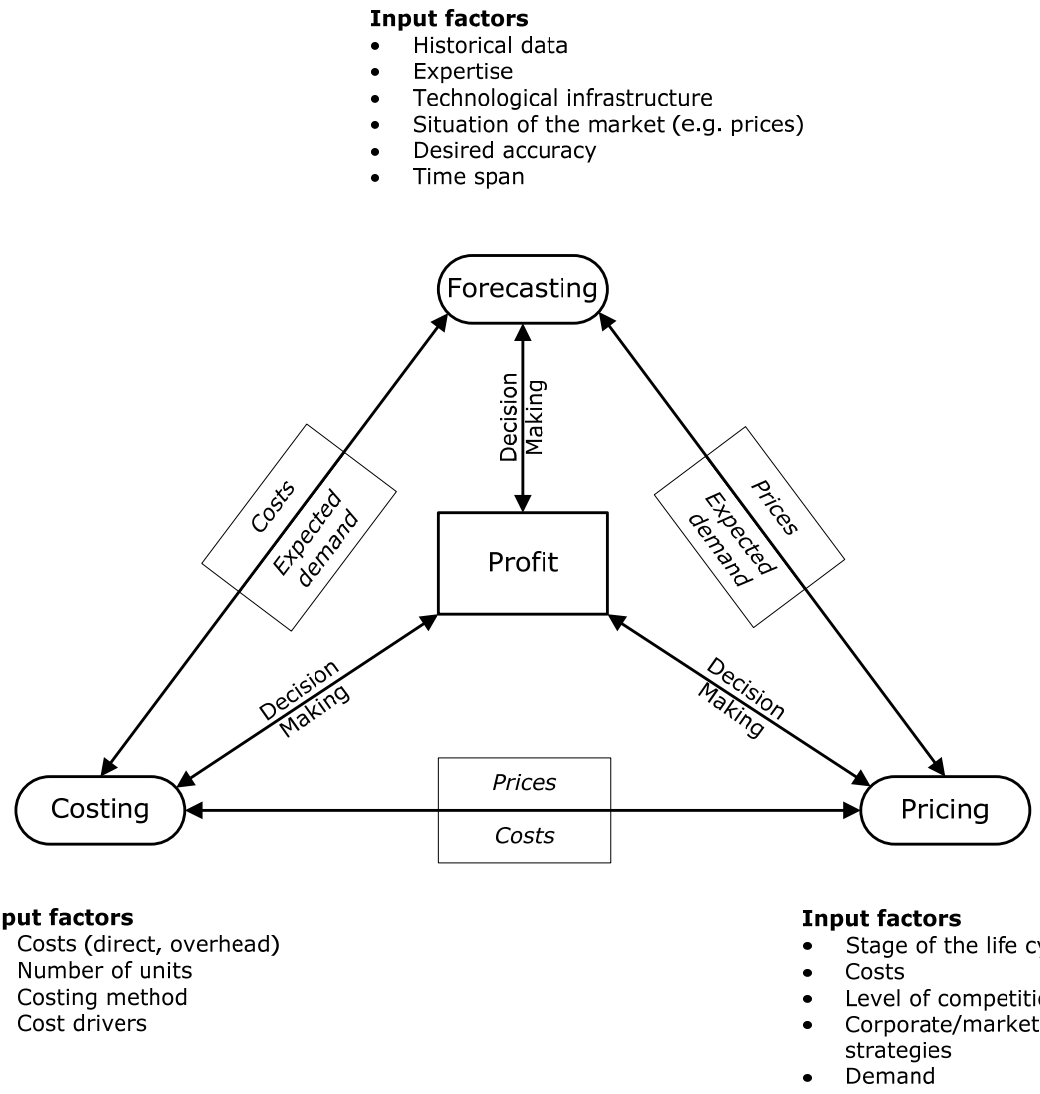


Figure 19: Interdependencies model

This model has also been discussed at Fagerhult AB and it was found that the total model seemed to reflect the reality. However, the interviewees did not work with pricing, so the two interfaces which include pricing were taken less into consideration. The interface between costing and forecasting, on the other hand, seemed to be true. Although it was mentioned that customer satisfaction, support from management and contact between different departments are crucial for success. It was also said that the number of quotations to (possible) customers can be used as an input factor for forecasting.

At last, it is also important to reflect upon the work done, and the results achieved. In the opinion of the researchers it was an interesting topic to investigate. There existed no previous academic research in the corresponding topic area, and therefore the study becomes valuable as a starting point for further research. Due to the research methodology, the work is rather dependent on the work of other studies. Consequently, the reliability of the work does also depend on previous scientific investigations in the corresponding fields. Usually it

can be said that scientific work is quite reliable and by using many different sources, the reliability of this investigation has been increased.

This however leads also to the limitations of this scientific work. The model presented has not been tested in practical situations, which is required to give it a solid base and a scientific acceptance. Unfortunately this was not possible due to time constraints, but this could be an interesting subject for further research. Also, the report has a risk of generalisation. Due to the research methodology adopted, the analysis and conclusions achieved are considerably generalized and they might not be feasible in particular situations. However, if the model will be further investigated, this will be brought up.

9. References

Allen, P., & Fildes, R. (2001). Econometric Forecasting. In J. Armstrong, *Principles of Forecasting. A Handbook for Researchers and Practitioners.* Norwell, MA: Kluwer Academic Publishers .

Armstrong, J. (1984). Forecasting by Extrapolation: Conclusions from 25 years of research. *Interfaces* , 52-65.

Armstrong, M. (2006). *Handbook of Management Techniques: A Comprehensive Guide to Achieve Managerial Excellence and Improved decision Making (Revised 3rd Edition).* London: Kogan Page Limited.

Arndt, J. (1979). Toward a Concept of Domesticated Markets. *Journal of Marketing , Volume 43*, 69-75.

Arnstein, W., & Frenk, G. (1980). Direct Costing. *AMACONS* , 17-28 and 261-264.

Atrill, P., McLaney, E., & Harvey, D. (2000). *Accounting.* Frenchs Forest: Pearson Education.

Ax, C., Greve, J., & Nilsson, U. (2008). The impact of competition and uncertainty on the adoption of target costing. *International Journal of Production Economics , Volume 115*, 92-103.

Baines, A. (1992). Management Forecasting. *Work Study* , 6-9.

Baker, K. (1986). Component Buffer Stocks for Uncertainty in Product Mix. *International Journal of Operations & Production Management* , 63-71.

Baker, R. (2000). *The Professional's Guide to Value Pricing.* USA: Harcourt Professional Publishing.

Barron, M., & Targett, D. (1986). Forecasting and the Manager. *Market inteligence and planning* , 4-13.

Bartezzaghi, E., Verganti, R., & Zotteri, G. (1999). A simulation framework for forecasting uncertain lumpy demand. *International Journal of Production Research* , 499-510.

Belkaoui, A. (1991). *Handbook of cost accounting theory and techniques.* New York: Quorum Books.

Bellgran, M., & Säfsten, K. (2008). *Production Development: Development and operation of production systems.* Jönköping: Studentlitteratur.

Bengt, K., & Loevingsson, F. (2005). *A to Z of Management Concepts and Models.* Thorogood.

Berner, B. (1999). *Perpetuum mobile?: teknikens utmaningar och tidens gång.* Lund: Pandoraserien, Arkiv.

Berry, E. (2005). *Management Accounting Demystified.* McGraw-Hill Companies.

Biggs, J., & Campion, W. (1982). The effect and cost of forecast error bias for multiple stage production-inventory systems. *Decision Sciences* , 570-84.

Birn, R. (2004). *Effective Use of Market Research : How to Drive and Focus Better Business Decisions.* London: Kogan Page Limited.

Brown, R. (2004). Consideration of the origin of Herbert Simon's theory of "satisficing" (1933-1947). *Management Decision , Volume 42 - No. 10*, 1240-1256.

Cannon, H., & Morgan, F. (1991). A Strategic Pricing Framework. *The Journal of Business and Industrial Marketing , Volume 3 - No. 3/4*, 59-70.

Case, K., & Fair, R. (2003). *Principles of economics.* Prentice-Hall.

Cebryk, N. (1997). *Industrial Price Formation and Industry Concentration in Canadian Manufacturing Industries.* Ottawa: National Library of Canada.

Chamber, J., Mullick, S., & Smith, D. (1971). How to chose the right forecasting technique. *Havard Business Review , 49*, 45-71.

Christopher, M. (2005). *Logistics and Supply Chain Management: Creating Value-Adding Networks.* Harlow, UK: Pearson Education Limited.

Christopher, M. (1982). Value-In-Use Pricing. *European Journal of Marketing , Volume 16 - No. 5*, 35-46.

Churchill, G., & Peter, J. (1995). *Marketing: Creating Value For Customers.* Burr Ridge: Richard D. Irwin.

Clarke, P., Hill, N., & Stevens, K. (1999). Activity based costing in Ireland: barriers to, and opportunities, for change. *Critical Perspectives on Accounting* , 443-468.

Cooke, R. (1991). *Experts in Uncertainty : Opinion and Subjective Probability in Science.* Oxford: Oxford University Press, Incorporated .

Cooper, R., & Chew, B. (1996). Control Tomorrow's Costs Through Today's Designs. *Harvard Business Review , Volume 74*, 88-97.

Cooper, R., & Slagmulder, R. (1997). *Target Costing and Value Engineering.* Portland, USA: Productivity Press.

Copeland, R., & Dascher, P. (1978). *Managerial Accounitng.* John Wiley and Sons, Inc.

Corey, E. (1983). *Industrial Marketing: Cases and Concepts.* Englewood Cliffs, NJ, USA: Prentice-Hall, Inc.

Crowningshield, G. (1969). *Cost Accounting Principles and Managerial Applications.* Boston: Houghton Mifflin Co.

Davis, J. (1970). Techniques in Marketing Forecasting. *Management classics* , 62-70.

Depken, C. (2005). *Microeconomics Demystified.* McGraw-Hill.

Diehl, E., & Sterman, J. (1995). Effects of feedback complexity on dynamic decision making. *Organizational Behavior and Human Decision Processes , Volume 62 - No. 2*, 198-215.

Eriksson, L., & Wiedersheim-Paul, F. (2001). *Att utreda, forska och rapportera.* Stockholm, Sweden: Liber AB.

Fildes, R. (1988). Research issues in business forecasting. *Management Research News , Volume 11 - Number 4/5*.

Forslund, H., & Jonsson, P. (2007). The impact of forecast information quality on supply chain performance. *International Journal of Operations & Production Management* , 90-107.

Forslund, H., & Jonsson, P. (2007). The impact of forecast information quality on supply chain performance. *International Journal of Operations & Production Management* , 90-107.

Frontistis, T., & Apostolidis, P. (1987). Forecasting Applications in Marketing and Small Business. *Marketing Intelligence & Planning , Volume 5 - Number 2*.

Garrison, R. (1979). *Managerial Accounting: Concepts for Planning.* Control and Decision Making Business Publication Inc.

Gunasekaran, A., Marri, H., & Yusuf, Y. (1999). Application of activity based costing: some case experiences. *Managerial Auditing Journal* , 286-293.

Haley, G., & Goldberg, S. (2008). Reciprocally derived demand and pricing strategy for mature industrial products. *Management Decision , Volume 46 - No. 7*, 1066-1080.

Hansen, D., & Mowen, M. (1995). *Cost Management: Accounting and Control.* Ohio: South-Western College Publication.

Hanssens, D., Parsons, L., & Schultz, R. (2001). *Market Response Models : Econometric and Time Series Analysis (2nd Edition).* Kluwer Academic Publishers.

Harding, S., & Long, T. (1998). *MBA Management Models.* Hampshire, England: Gower Publishing Limited.

Harrison, E. (1996). A process perspective on strategic decision making. *Management Decision , Volume 34 - No. 1*, 4-53.

Harrison, E., & Pelletier, M. (2000). The Essence of Management Decision. *Management Decision , Volume 38 - No. 7*, 462-469.

Hayes, J. (2007). *The Theory and Practice of Change Management.* UK & USA: Palgrave Macmillan.

Helms, M., Ettkin, L., & Chapman, S. (2000). Supply chain forecasting: Collaborative forecasting supports supply chain management. *Business Process Management , 6* (5), 392-407.

Helms, M., Ettkin, L., Baxter, J., & Gordon, M. (2005). Managerial Implication of Target Costing. *Competitiveness Review: An International Business Journal incorporating Journal of Global Competitiveness , Volume 15 - No. 1*, 49-56.

Henderson, B., & Morton, G. (2000). *Scientific Financial Management : Advances in Financial Intelligence Capabilities for Corporate Valuation and Risk Assessment.* New York: AMACON.

Holt, C., Modigliani, F., & Simon, H. (1955). A Linear Decision Rule for Production and Employment Scheduling. *Management sciences* , 1-30.

Horngren, C., Forster, G., & Datar, S. (2000). *Cost Accounting: A managerial emphasis.* New Jersey: Prentice Hall.

Horngren, C., Harrison Jr, W., & Bamber, L. (2002). *Accounting.* New Jersey: Prentice Hall.

Hussain, M., Gunasekaran, A., & Laitinen, E. (1998). Management accounting systems in Finnish service firms. *Technovation* , 57-67.

Ivy, J. (2008). A new higher education marketing mix: the 7 Ps for MBA marketing. *International Journal of Educational Management , Volume 22 - No. 8*, 288-299.

Jenkins, G. (1976). *Practical experiences with modelling and forecasting time series.* Jersey: Channel Islands.

Kahn, K. (2006). *New Product Forecasting : An Applied Perspective.* New York: M.E.Sharoe, Inc.

Kaipia, R., & Holmström, J. (2007). Selecting the right planning approach for a product. *Supply Chain Management: An International Journal , Volume 7 - No. 1*, 3-13.

Kalchschmidt, M., Verganti, R., & Zotteri, G. (2006). Forecasting demand from heterogeneous customers. *International Journal of Operations & production management* , 619-638.

Kaplan, R., & Cooper, R. (1998). *Cost & Effect.* Boston: Harvard Business School Press.

Kazmier, L. (2003). *Schaum's Easy Outline : Busines Statistics.* Whitby: McGraw-Hill Trade.

Kee, R., & Matherly, M. (2006). Decision control of products development using target costing. *Advances in Management Accounting* , 267-292.

Kerr, G. (2007). The development history and philosophical sources of Herbert Simon's Administrative Behavior. *Journal of Management History , Volume 13 - No. 3*, 255-268.

Kessler, F. (1995). Team Decision Making: Pitfalls and Procedures. *Management Development Review , Volume 8 - No. 5*, 38-40.

Kotler, P. (1984). *Marketing Management: Analysis, Planning and Control.* London, UK: Prentice-Hall International, Inc.

Kotler, P., Wong, V., Saunders, J., & Armstrong, G. (2005). *Principles of Marketing.* Essex: Pearson Education Limited.

Krajewski, L., & Ritzman, L. (2002). *Operations Management: Strategy and Analysis.* New Jersey, USA: Prentice Hall.

Larson, M. (2001). *Technical Charting for profits.* Frederiksberg : John Wiley & Sons.

Lee, T., & Adam, E. (1986). Forecasting Error Evaluation in Material Requirements Planning (MRP) Production-Inventory Systems. *Management Science* , 1186-1205.

Leedy, P., & Ormrod, J. (2001). *Practical Research-Planning and Design.* Upper Saddle River, NJ, USA: Prentice-Hall, Inc.

Lilien, G., Kotler, P., & Moorthy, K. (1992). *Marketing Models.* New Jersey, USA: Prentice-Hall.

Lines, A. (1996). Forecasting – key to good service at low cost. *Logistics Information Management , Volume 9 - number 4*, 24-27.

Maccarrone, P. (1998). Activity-based management and the product development process. *European Journal of Innovation Management , Volume 1 - No. 3*, 148–156.

Makridakis, S. (1989). Why combining works? *International Journal of Forecasting* , 601-603.

Mentzer, J., Moon, M., Kent, J., & Smith, C. (1997). The need for forecasting champion. *The Journal of Business Forecasting* , 3-8.

Monden, Y. (1995). *Cost Reduction Systems: Target Costing and Kaizen Costing.* Portland, USA: Productivity Press.

Monden, Y. (2000). *Japanese Cost Management.* London, UK: Imperial College Press.

Moon, M., Mentzer, J., & Smith, C. (2003). Conducting a sales forecasting audit. *International Journal of Forecasting , Volume 19*, 5-25.

Moxnes, E. (2000). Not only the tragedy of the commons: Misperceptions of feedback and policies for sustainable development. *System Dynamics Review , Volume 16 - No. 4*, 325-348.

Munier, N. (2004). *Multicriteria Environmental Assessment : A Practical Guide.* Kluwer Acadamic Rublishers.

Nagle, T., & Holden, R. (1995). *The Strategies and Tactics of Pricing: A Guide to Profitable Decision Making.* Englewood Cliffs, NJ, USA: Prentice-Hall.

Nyland, C., & Heenan, T. (2005). Mary van Kleeck, Taylorism and the control of management knowledge. *Management Decision , Vol. 43 - No. 10*, 1358-1374.

Ofstad, H. (1961). *An inquiry into the freedom of decision.* Oslo, Norway: Norwegian Universities Press.

O'Guin, M. (1991). *The complete guide to activity-based costing.* Englewood Cliffs, N.J., USA: Prentice Hall.

Osland, J., Kolb, D., & Rubin, I. (2001). *Organizational Behavior: An Experiential Approach.* Upper Saddle River, NJ, USA: Prentice-Hall, Inc.

Paranka, S. (1969). The Pay-Off Concept in Competitive Bidding. *Business Horizons* (Volume 12), 77-81.

Perloff, J. (2009). *Microeconomics.* Boston, USA: Pearson Education, Inc.

Peter, J., & Donnelly, J. J. (1998). *Marketing Management: Knowledge and Skills.* Madison, Wisconsin, USA: The McGraw-Hill Companies, Inc.

Pindyck, R., & Rubinfeld, D. (2009). *Microeconomics.* New Jersey: Pearson Education Inc.

Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance.* New York, USA: The Free Press.

Rao, V. (1984). Pricing Research in Marketing: The State of the Art. *Journal of Business , Volume 57 - No. 1*, S39-S60.

Ratchford, B., & Ford, G. (1976). A study of prices and market shares in the computer mainframe industry. *Journal of Business , Volume 49 - No. 2*, 194-218.

Rausch, E. (1996). Appropriate techniques in decision making - Part I. *Management Development Review , Volume 9 - No 2*, 35-39.

Reilly, T. (2003). *Value-Added Selling.* USA: McGraw-Hill.

Rich, S. (1983). Price Leadership in the Paper Industry. *Industrial Marketing Management , Volume 12 - No. 2*, 101-104.

Rogers, E., & Shoemaker, F. (1971). *Communications of Innovations.* New York, USA: The Free Press.

Rue, W., & Abarbanel, K. (1997). *The dollar bill knows no sex: Lessons in life and money.* USA: McGraw-Hill.

Rushinek, A. (1983). Cost Accumulation for Different Costing Systems and their computer application. *Managerial Finance* , 19-22.

Saaty, T., & Vargas, L. (2006). *Decision Making with the Analytic Network Process: Economic, Political, Social and Technological Applications with Benefits, Opportunities, Costs and Risks.* Boston: Springer US.

Salvatore, D., & Reagle, D. (2002). *Schaum's Outlines Statistics and Econometrics (2nd Edition).* McGraw-Hill Professional .

Sanders, N., & Graman, G. (2006). Quantifying costs of forecast errors:A case study of the warehouse environment. *The international journal of management science* , 116 – 125.

Schotanus, F., Telgen, J., & Boer, L. (2009). Unraveling quantity discounts. *The international Journal of Management Sciences* , 510-521.

Sekaran, U. (1992). *Research methods for business.* New York, USA: Wiley.

Sethi, S., Yan, H., & Zhang, H. (2005). *Inventory and supply chain management with forecast updates.* New York, USA: Springer Science + Business Media, Inc.

Sezen, B. (2004). Expected profit approach used in discount pricing decisions for perishable products. *International Journal of Retail & Distribution Management , Volume 32 - No. 4*, 223–229.

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2008). *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies.* New York, USA: McGraw-Hill.

Simon, H. (2002). Rational Decision Making in Business Organizations. In R. Langois, T. Yu, & P. Robertson, *Alternative Theories of the Firm - Volume II* (pp. 600-620). USA & UK: Edward Elgar Publishing.

Sterman, J. (1989). Misperceptions of feedback in dynamic decision making. *Organizational Behavior and Human Decision Processes , Volume 43*, 301-335.

Szozda, N. (2004). End of product life cycle forecasting. *Sborník vědeckých prací Vysoké školy báňské* (Volume 47 - No. 1), 139-142.

Tayles, M., & Drury, C. (2001). *Autopsy of a stalling ABC system: a case study of activity based cost management and performance improvemen.* Athens: 24th Annual Congress of the European Accounting Association.

Tellis, G. (1986). Beyond the Many Faces of Price: An Integration of Pricing Strategies. *Journal of Marketing , Volume 50 - No. 4*, 146-160.

Tolliday, S. (1998a). *The rise and fall of mass production - Volume I.* Cheltenham, UK & Northampton, USA: Edward Elgar Publishing.

Tolliday, S. (1998b). *The rise and fall of mass production - Volume II.* Cheltenham, UK & Northampton, USA: Edward Elgar Publishing.

Vaught, B., & Walker, W. (1986). Decision Making and the Project Team: A Model for Increasing Productivity. *Industrial Management & Data Systems , Volume 86 - No. 1/2*, 22-26.

Vollman, T., Berry, T., & Whybark, W. (1992). *Manufacturing Planning and Control.* Homewood: Richard D. Irwin Corp.

Vroom, V. (1973). A New Look at Managerial Decision Making. *Organizational Dynamics , Volume 1 - No. 4*, 66-80.

Wacker, J., & Lummus, R. (2002). Sales forecasting for strategic resource planning. *International Journal of Operrations & Production management* , 1014-1031.

Waddell, D., & Sohal, A. (1994). Forecasting: the key to managerial decision making. *Managerial Decision* , 41-49.

Warren, C., Reeve, J., & Fess, P. (2002). *Accounting.* Cincinnati: South-Western Thompson Learning.

Webster, W. (2003). *Accounting for Managers.* New York: McGraw - Hill Trade.

West, D. (1997). Managing Sales Forecasting. *Management Research News* , 1-10.

Williamson, K. (2000). *Research methods for students and professionals.* Wagga Wagga NSW: Centre for information studies.

Wright, G., & Goodwin, P. (2008). Structuring the Decision Process: An Evaluation of Methods. In G. Hodgkinson, & W. Starbuck, *The Oxford Handbook of Organizational Decision Making* (pp. 534-551). New York: Oxford University Pres.

Zulch, G., & Brinkmeier, B. (1996). Simulation of activity costs for the reengineering of production systems. *International journal of production economics , 56-57*, 711-722.

10. Search Words