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The Role of Forecasting and Its Potential for Functional Management: A Review from the Value-Chain Perspective

Dr. Cihat POLAT*

Abstract

The paper discusses the potential uses of forecasting as a managerial decision-making tool in the functional management of a company from value-chain perspective. The paper first establishes and discusses the link between the functional management and forecasting function. It then discusses the potential uses of it for each managerial activity in value-chain in detail. It is pointed out that forecasting is a central managerial activity in most of the decision-making processes within value chain and potentially it has a significant contribution to the value creation processes in companies.

Keywords: Forecasting, functional management, value-chain, decision-making, competition

Fonksiyonel Yönetimde Tahminin Rolü ve Potansiyeli: Değer Zinciri Perspektifinden Bir İnceleme

Özet

Bu çalışma, yönetsel bir karar alma aracı olarak ‘tahmin’in bir işletmenin fonksiyonel yönetimindeki potansiyel kullanımlarını ‘değer-zinciri’ bakış açısından tartışmaktadır. Çalışma ilk olarak fonksiyonel yönetim ile tahmin fonksiyonu arasındaki ilişkiyi ve daha sonra da ‘değer-zinciri’ndeki her bir yönetsel faaliyetteki potansiyel kullanımlarını detaylı olarak tartışmaktadır. Tahmin’in değer-zinciri içerisindeki karar-alma süreçlerinin çoğunda merkezi bir yönetsel faaliyet olduğuna ve potansiyel olarak işletmelerdeki değer yaratma süreçlerine olarak önemli bir katkısı olduğuna işaret edilmektedir.

Anahtar Kelimeler: Tahmin, fonksiyonel yönetim, değer zinciri, karar alma, rekabet

* Niğde Üniversitesi, İkt. ve İd. Bil. Fak., İşletme Bölümü, Merkez Kampüsü, 51100 Niğde, Tel: 0 (388) 225 20 55, E-posta: cpolat@nigde.edu.tr

1. Introduction

In today's world competition is getting more and more intensive in almost all markets. In such a competitive environment, only can the firms that are able to see and predict the future and those that are able to adapt themselves to new conditions achieve their goals. Those that are unable to manage reconditioning themselves to the new states may have to be either withdrawn from the market or continue their operations as a small company.

Managerial decisions form the basis for firms to direct their operations. For a successful company sound decision-making is one of the main factors and, thereby, for its ability to compete and, in essence, to survive in the market. Managers make decisions based on cases, assumptions, data, information, etc. It is important that the decision-makers have true, reliable, and up-to-date data and information on hand for the decisions they make. Forecasting can simply be described as an activity and process that produces the data and information needed by companies in a systematic approach and process for managerial decisions.

Most of the literature of forecasting has focused on how to obtain the data and information needed from the forecasting processes and how to improve the accuracy of forecasts obtained. However, comparatively little attention was given to how to use forecasting as a functional managerial tool or how effectively the forecasting function is used in companies in order to make effective operational decisions.

Additionally, the current literature of forecasting focuses mainly on the technical side of the issue. The research issues include, but not limited to, how to improve forecasting performance, which methods are better, whether there exists any specific method for specific forecasting problems and/or forecasting cases, if data issues increase forecasting performance, and new forecasting methods (Makridakis and Hibon, 2000; Makridakis et al., 1993, 1982).

The selection of an appropriate tool for decision-making, including forecasting, is something that mostly interests the manager(s) of specific position(s). However, it is within the interest area of researchers to apply, describe, and point out new application areas of forecasting so that managers' attention can be attracted to the issue. Surprisingly, the forecasting literature makes little emphasis on the utility areas of forecasting and for what kind of problems forecasting can be used to assist managerial decision-making. As forecasting can be used in a variety of problem situations both in service and manufacturing firms, this is not adequately emphasised in the literature. While the technical side of forecasting has been brought forward, the managerial side (or problem

solving capacity) mostly has been put aside. This study brings the issue to the attention of both practitioners and academicians in the context of 'value-chain'. The utility areas of forecasting are investigated in order to highlight its potential as a managerial decision tool and the likely benefits for functional management.

The purpose of this paper is to investigate how and if the forecasting processes, as an information and data production mechanism, such as market share forecasting, inventory forecasting, sales forecasting, cash flow forecasting, and cost forecasting can be used for functional decision-making. The paper makes a panoramic review of the utility areas of forecasting within the context of value-chain management. It contains four main parts. The second part discusses the value of forecasting as a decision tool in the functional management context. The third part discusses the contribution of forecasting to functional management in the context of 'value-chain'. Finally, the last part contains the summary and conclusion.

2. Forecasting and Functional Management

Forecasting simply refers to a 'process' of predicting the future. Functional management refers to the management of specific business functions (e.g. marketing, finance, and manufacturing) in a company. The functional level management is the main management unit through which the strategies are put into application. Therefore, there is a common ground between forecasting and functional management, the former one being an effective management tool. Almost all management levels from the lowest to the top (e.g. functional, business, and corporate level managers) need to base their decisions on data (and information). Thus, data (information) are the crucial input to professional decision-making.

Functional level management performs the basic task of collecting the data and information required which many decisions (including strategic ones) are based on. These data and information can best be observed and obtained in the functional level. Therefore, they are mostly produced at the functional level and transferred to the upper level management from there. As one of the main data (and information) producing mechanisms, forecasting also mostly operates at this level and helps management obtain the required data (information).

Management in any company is supposed to be interested in the future to form decisions concerning with it. Forecasting is a managerial function and process about the future. From this perspective forecasting is an activity within functional management and closely related to it. What makes the forecasting a valuable tool for management is the uncertainty in the future, which is almost always contained some degree of it. There lies one of the main roles of forecasting, which is to remove and, at least, to reduce it. Therefore, there is a

one-to-one connection between forecasting and management in terms of their purposes.

In such a frame, company management is expected to fully maximise the benefit from forecasting. To be able to do it, the forecasting system in a company should be integrated to, especially functional, management. This process has two basic dimensions: (1) the production of the desired forecasts when needed and (2) putting these forecasts into use properly. As with any other decision tools, a failure in utilizing this tool will make it difficult to achieve the desired plans, especially if a particular decision is heavily based on the information from the forecasting system (e.g. a decision regarding manufacturing capacity planning based on sales forecasts).

Forecasting process includes many activities such as data collection, data pre-processing and preliminary data analysis, forecasting method selection, which also involves model selection, model fitting, and diagnostic checking, and control in a forecasting system in use. This, 'process', feature of forecasting worth making emphasis on. In such a process, forecasting has lots of potentials for functional level managers such as revealing system dynamics, problem determination, monitoring, and control.

In terms of application areas, forecasting costs, market share, sales, inventory, cash flows, dividends, stock prices, and capacity requirements are only some of the internal utility areas besides interest rates, inflation rates, and growth rates of economy, which are some of the external utility areas.

There exists a significant set of forecasting techniques available to use. This offers managers the flexibility and capability to deal with various types of forecasting problems. It also increases the level of utilisation of forecasting function, which is directly related to the solutions offered for different decision domains. The forecasting literature is rich in forecasting methods at hand. These methods can be classified in various ways: Statistical and judgemental or quantitative, which includes time series analysis and casual methods, and qualitative, which includes sales force estimates, executive judgement, market research, and the Delphi method[1].

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[1] Qualitative techniques:

a) *Sales force estimates* are a method of forecasting based on compilation of periodic personnel estimates of future demands by the members of sales force in a company.

b) *Executive Judgement* summarizes the opinions of a group of executives to obtain a single forecast. The opinions are mostly based on executives' experience with similar products or services.

Time series analysis is a statistical approach that mainly relies on historical time series data, which are the data observed in regular time intervals, to predict the future.

Casual methods use historical data on independent variables, such as promotional campaigns, economic conditions, and competitors' actions, to predict the future behaviour of forecast subject. These are the methods such as the linear regression, which explains the relationship between the dependent variable and other internal and external independent variables (factors).

Qualitative techniques mostly rely on managerial judgement and experience and other sort of qualitative information to generate forecasts. This sort of techniques translates managerial judgement, expert opinion, and survey results into quantitative estimates. Some of the qualitative techniques are sales force estimates, executive judgement, marketing research, and the Delphi technique

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c) *Marketing Research* can be expressed as a systematic approach to creating and testing hypotheses about the market. The analyses are based on data, which are usually gathered by survey methods. That is why it may sometimes be an expensive method and may lead to faulty and 'difficult to interpret' conclusions, especially if the sample is not the representative of the population.

d) *Delphi Method* is a process of obtaining agreement from a group of experts, which generally includes several steps (panels) of consensus search. It is useful especially when there are no historical data to develop statistical models and when judgement or opinion based on experience and study of the market, industry, or scientific developments are the only bases for making forecast. The Delphi method might also be useful for long-range forecasts of product demand, sales estimates of new products, and technological forecasting (e.g. estimating the future of intelligent manufacturing systems). Delphi method can be preferred in estimating the changes and directions in environmental and social forces such as quality of life, governmental regulations, and competitors' actions. The results of such a process can provide direction for a firm's R&D activities.

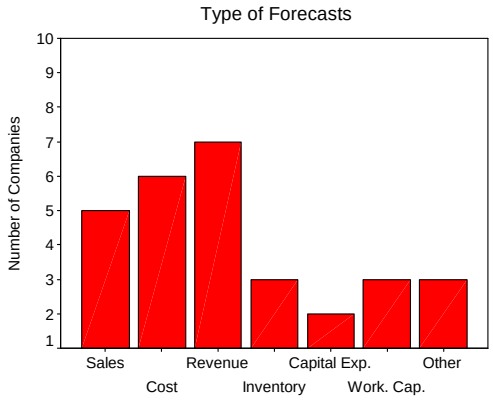

Figure 1: The type of forecasts that companies perform

There are several survey studies of forecasting (see Polat, 2002: Chapter 3; Pohlman et al., 1988; Watson, 1996; Duran and Flores, 1998; Fildes & Hastings, 1994; Dalrymple, 1987; and Mentzer & Cox, 1984). While the studies by Pohlman et al. and, partially, Polat are more specific to cash flow forecasting practices, those by Duran and Flores are more general. The others focused more on sales forecasting practices. For instance, Polat (2002) has examined the opinions of forecasting experts on some general forecasting issues, in addition to some specific ones concerning with cash flow forecasting, in British companies. The study has revealed that the surveyed companies perform variety of forecasts (e.g. sales, costs, revenue, inventory, capital expenditures, working capital forecasts) (see Figure 1) and do it for different purposes including financial, operational, and investment planning, general decision-making, monitoring, and control. The findings clearly highlight the importance and functionality of forecasting for managerial decision-making, where forecasting is related to many decision areas. The study has revealed that the people who are interested in and who directly or indirectly undertakes the forecasting task are mostly, in 8 of the 10 companies, upper level managers such as chief executive officer (CEO) (1), finance directors (3), and financial controllers (4), where the figures in the brackets show the number of companies. This can be taken as a clear indication of 'forecasting's potential for managers and its relevancy for decision-making.

Polat's (2002) study has also brought to light that, according to the experts, forecasting is a multi-purpose managerial tool. It has many potential uses in most of the functional management processes, explained below, although more in some of the areas than it is in others.

3. The Contribution of Forecasting to Functional Management and Value-Chain

One of the most apparent contributions of forecasting to functional management is that of to functional decision-making, whose one of the main purposes is to help create competitive advantage through value-creation. Even though the role of external factors of business cannot be ignored, the most of the contribution to creating 'competitive advantage' come from the internal and functional factors of business. Therefore, it is needed for any firm to concentrate on its functional strategies, which refer to the strategies determined by the individual functional areas (e.g. manufacturing, marketing, R&D, and human resources). Forecasting can bring about a major assistance to establishing those strategies in each of these areas, which are the leading factors in creating 'competitive advantages', the building blocks of competitive power in companies.

A company can create *distinctive competencies*[2] through its value-chain, whose elements are mentioned below. Each of the value-chain elements has significant contribution to the creation of distinctive competencies in companies. The purpose of utilising the forecasting function in these activities is to increase the efficiency of the value-chain elements and the contribution of them to the competitive power of the company.

The 'value-chain' consists of two main activity groups such as primary activities (manufacturing, marketing, and after-sale services) and support activities (materials management, research and development, human resource management, and information system support) in the process of value-creation in a company (Hill and Jones, 1992: 107-139), where the basic feature of the second type of activities is to provide input into the manufacturing and marketing functions.

3.1. Primary Activities and Forecasting

3.1.1. Manufacturing

The purpose of a company's manufacturing strategy should be to produce cost-competitive products that are sufficiently high in quality. The experience curve, the product-process life cycle, and the flexible manufacturing technologies are the three factors that require specific attention in achieving cost competitive production. Therefore, the link between forecasting and these factors, especially that and the last two, is the main issue here. The picture below simply depicts data and information interchange among the management, marketing

[2] "The term distinctive competence refers to a company strengths that competitors can not easily match or imitate. Distinctive competencies represent the unique strengths of a company." (Hill & Jones, 1992: 102).

department, forecasting system, and production system, which assumes a full integration among these departments.

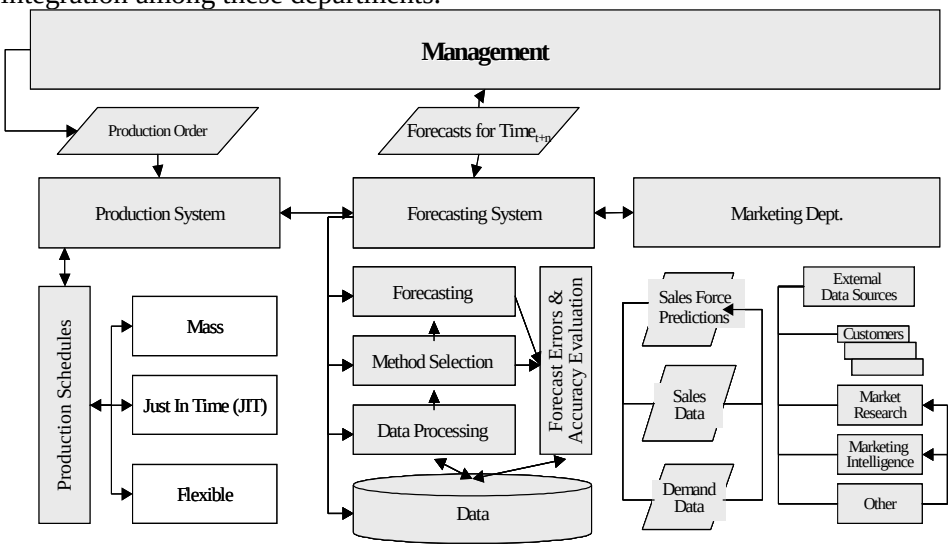

Figure 2: Data and information interchange among marketing and production functions and forecasting system under management

Firms may use any of the production systems including mass, Just-In-Time (JIT), or flexible production systems. Regardless of the production system in use, management has to base many of its production decisions on the information obtained from a forecasting activity, which might be of any kind, which also use the data from the marketing system. Therefore, forecasting function plays an intermediary role between the production department, management department, and the market (customers). It provides the flow of data continuously and closes the gap between the production time and the times of sales.

Flexible manufacturing[3] is, for instance, one of the production methods developed for reducing manufacturing costs. Forecasting goes into use in manufacturing processes in many aspects including *scheduling and capacity planning.* The companies that produce goods and services based on customer

[3] The term 'flexible manufacturing technology' refers to a collection of computer-based technologies that are designed to (1) increase the utilization of individual machines through better scheduling, (2) reduce set-up times, and (3) improve quality control at the manufacturing processes. Being different from the mass production schedule, the flexible manufacturing technologies allow companies to be highly responsive to unique customer demands and, at the same time, to compete on the basis of cost (Hill & Jones, 1992: 116).

order may need to forecast standard labour or machine hours required of each of the critical resources besides the number of units of products, based on historical data and patterns. For such companies, estimation of labour or machine hours may sometimes be crucially important to scheduling and capacity planning (Krajewski & Ritzman, 1993: 436) in meeting customers' demands.

The forecasts of the material requirements of each of the machines, operating times and labour requirements needed to complete specific manufacturing processes in each step of manufacturing processes may be needed for maximising the (automatic) distribution of materials and labour times among machines and, by doing so, it can significantly improve the efficiency of manufacturing processes and reduce the costs. Forecasting has lots to do especially in circumstances such as producing the estimates of the time and amount of specific customer demands so that it does not interrupt the usual manufacturing schedule of the company and helps in determining the patterns of unique customer demand. Also, for instance, the forecast errors can be utilised to be the cost determinant. Based on the state of the forecast errors, which correspond to over or under production based on the sales and demand, production schedule can easily be adjusted. In such a case, the maximum cost is directly related to the size of forecast errors. On the other hand, in "mass" production schedule, maximum cost is directly related to the amount of stocks ready for sale. In that case, the cost can be linked to the amount of stocks – amount of sales- because the production is made to stock.

Additionally, forecasts also determine the basic assumptions of financial projections related to production activities. For instance, financial budgets are variable based on different expense patterns for varying levels of production. A firm's production level is related to its sales amount. In order not to give any gap between the production schedule and the demand for its products, forecasts are the proper information needed in a company, on which the financial budget is based.

3.1.2. Marketing and Sales

Marketing is the second area in which forecasting makes significant contribution to functional decision-making. There are many decision areas and uses of forecasting within it: Sales forecasts, for instance, are the basis for many other functional decisions. It provides a point of start for assumptions used in various planning activities (Johnson et al., 1994: 191). Almost all functional areas of an organization have a planning task, and all their projections and future estimates depend upon the forecasting level of sales. Sales forecasting is the most important planning task within any company-large or small (Johnson et al.: 192).

Sales forecasts mainly refer to an estimate of company sales for a specified future period. Sales forecasting is an integral part of the marketing information system and helps many functional-area managers significantly in decision-making as well as sales managers. Sales forecasts are one of the most widely used information in marketing. The forecasting literature is also quite rich in this area. For instance, Watson (1996), Fildes and Hastings (1994), Dalrymple (1987), and Mentzer and Cox (1984) are some of the studies that review the sales forecasting practices in companies. Walsh (1998) discusses the difficulties and problems with sales forecasting in cyclical markets (in the aerospace industry, where there is a high degree of uncertainty and cyclicality), in which cases the support of forecasting function becomes highly significant for the future projections of production, marketing, human resources, and financial decisions (e.g. budgeting, financing, and investment planning).

There are many reasons for the wide use of forecasting in sales prediction. Each of the decision areas such as inventory, employment, capacity planning, production scheduling and distribution is directly related to the sales forecasts. Some of the decision areas closely related to sales forecasts are as follows:

1) setting of financial budgets, in which the expense patterns may differ based on varying levels of production,
2) setting of sales budgets, which is a management plan for expenditures to obtain sales goals.
3) establishing sales quotes, which are the sales goals sought by management, where sales forecast is one of the most reasonable foundation upon which quotes can be set,
4) projecting of staffing needs by human resources management,
5) using as aids in establishing and controlling operating and capital budgets by financial executives,
6) scheduling of purchasing and production activities,
7) controlling of inventories (Johnson et al., 1994: 192).

If the sales forecasts in a company are not good enough, it may have serious effects on the efficiency of each of the functional management areas. For instance, the following key decision areas are considered to be ‘central’ to functional and strategic marketing management and to the development of marketing competencies, where the forecasting function is of particular importance for each of these decision domains:

1) The selection of target market segments that determine where the company will compete,
2) The design of the marketing mix (price, promotion, product, place) that determines how the company will compete in these target markets,

3) Positioning[4] strategy,
4) Pricing: The prediction of the best suitable price for a specific product,
5) Advertising media selection: The prediction of the media to be used and their effectiveness and contribution to the sales of a company.

In this sense, the forecasting function in a company can be said to be a major tool that strengthens the marketing function in a company.

Additionally, forecasting, a process that includes analytical and informative procedures (e.g. data analysis), can be used to monitor the *product life cycle process*. The development of product life cycle procedures can be observed from the data collected step by step, from which the tendency of the product-process life cycle can be forecast with respect to the sales of a company. Through the investigation of product-process life cycle and consumer demand for the products in the market, the changes in consumer tastes and the direction of demand can be investigated and forecast.

Forecasting, especially sales forecasts, is also central to the *demand management*[5], which is a particularly important process in efficiently utilizing resources and production capacity (Krajewski & Ritzman, 1993: 434), which is based on the information about the timing and the amount of demand provided. One of the factors that drive the demand management is the likely higher costs associated with producing for peak consumer demand during the peak demand period. To reduce these costs, firms often use price incentives or advertising promotions to encourage customers to make purchases before or after traditional times of peak demand (Krajewski & Ritzman, 1993: 434). For instance, many telephone companies, including Turkish Telecom, encourage customers to make long distance calls after normal business hours by offering lower evening and weekend rates. Demand management is extremely important especially in such circumstances that a company has a limited capacity and that it cannot meet the demand. Thus, the existing capacity can be used efficiently and meeting customer demand at the same time. Such an application would prevent the company losing its market share, a result of customer dissatisfaction due to insufficient supply or poor service quality.

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[4] Based on two principles of marketing strategy: (1) the choice of target segments that a company decides to focus on and (2) the design of the marketing mix to create a differential advantage that defines how the company will compete with rivals in each segment.

[5] The term describes the process of influencing the timing and volume of demand or adopting to the undesirable effects of unchangeable demand patterns. (Krajewski & Ritzman, 1993: 434).

Forecasting function serves as a utility tool to regulate the capacity and demand irregularities like if there is a capacity insufficiency in some times and slack capacity in other times. Also, labor costs, inventory costs, and material costs are also some of the other factors that require forecasts in order to reduce the costs associated with them. Additionally, long-term planning for sales, profits, and capacity are also the areas in which forecasting has lots to do with.

3.1.3. After-Sale Services

After-sale services are another area that has a high potential use of forecasting. After-sale services mainly refer to the services delivered to the customers after the sale of products and services (e.g. warranties, the availability of service networks and spare parts). The importance of these services has increased considerably especially in the recent years due to the changes in the marketing concept, market conditions and competition which is getting more and more intensive. Especially, the establishment and maintenance of a service network can be a very costly operation and the after-sale service costs can sum up to a considerable amount, sometimes much higher than what is estimated, due to intensive competition in some industries (e.g. household appliances). Company managers have to pay attention to after-sale services for two main reasons: (1) To maintain customer satisfaction and (2) to minimise the cost of these services. Forecasting can be used as a very effective tool in increasing the service quality. For instance, a household appliances company can increase the service quality with a better scheduling based on the estimates of the number of calls and their timings from customers for service and with the estimates of the number of spare-parts to be used in its after-sale services (e.g. within warranty period), labour hours and personnel for service, and the number of service stations needed in a specific region, which minimises the storage costs of spare-parts, financial expenses tied to these parts and the overhead costs of service points.

3.2. Support Activities and Forecasting

3.2.1. Materials Management

Forecasting function also has a major contribution to support activities in value creation, which includes materials management, research and development, human resources management, and information system management. Materials management[6] deals with purchasing, inventories, production plans, staffing plans, schedules, and distribution (Krajewski & Ritzman, 1993: 521).

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[6] According to materials management approach, purchasing, production, and distribution are not separate activities but three aspects of one basic task. It controls the flow of materials and products from sources of supply through manufacturing and channels of distribution and into the hands of customers; in order words, through the

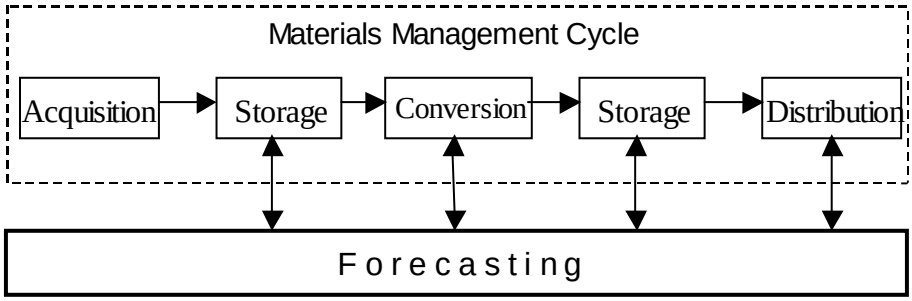

Figure 3: Materials Management and Forecasting System Connection

The role of materials management is to oversee purchasing, production planning and control, and distribution, which is also referred to as logistic management. An efficient materials management can significantly reduce its costs and increase product quality. The figure above represents the materials management cycle and the relationship between forecasting system and the procedures (and/or functions) within it. As the figure puts it clearly, forecasting has potential uses in most of the procedures. Since it is explained under the relevant titles in detail, it is not mentioned here again to avoid repetition.

The costs that can be saved from a function or procedure is, besides other factors, directly related to the size of spending for that function. How important is forecasting in material management and how much can it contribute to it? Forecasting is involved in most of these managerial procedures, although more heavily in some (e.g. inventory management) than in others. Inventory management is an essential part of materials management. Inventory is a stock of materials held to satisfy some eventual demand and requirement. However, demand is rarely constant in most of the times and it sometimes may fluctuate highly, which refers to 'uncertainty'. Demand uncertainty can lead to ordering too much or too little, which can result in a cost or customer service penalties (Krajewski & Ritzman, 1993: 563). Holding inventory is not free of costs, which sometimes sums up to a very high amount of money. Holding (carrying) costs may vary between 20-40 percent of the inventory's value in a year (Krajewski & Ritzman: 506).

The utilisation of forecasting techniques for inventory control is very intensive and a great amount of academic efforts have been spent to developing specific

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value chain. Coordination and control of the material flow give a company the opportunity to take advantage of cost savings, inventory reductions, and performance improvement opportunities, which would be unavailable without materials-management function (Hill & Jones: 124).

forecasting techniques in order to ease inventory management. The current literature of forecasting in inventory control shows that the gain from forecasting might be considerable in many cases and there are lots of potential to develop, too. The search of the forecasting methods that may provide the highest potential gain and that may give the highest contribution to the inventory management has still been going on for several decades (see Gardner and Diaz-Saiz, 2002), one of the early examples of which is the development of exponential smoothing method by Brown (1963). The latest examples of these efforts are either in form of developing new forecasting techniques or improving the existing ones (see Synder et al., 2002).

For instance, consider a supermarket chain that sells thousands of items, where the company has to invest a few hundred thousands or millions of dollars for the purchase of even a single product in the inventory. If it is thought the number of products that the company sells, the amount of money to be tied up with inventory can easily be estimated. In such a company, forecasting can contribute to the release of lots of money tied up with the inventory by reducing the amount of it (e.g. reducing storage costs of products and raw material and the costs of financial resources tied up).

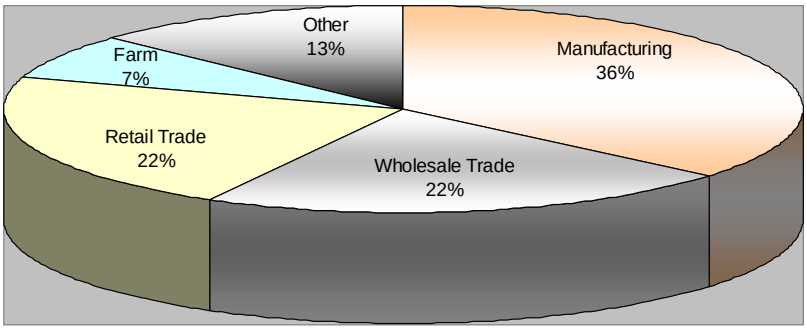
Another role that forecasting plays with inventory forecasting is to help maintain and secure an inventory level that meets the customer demand, protect the firm from losing the company's loyalty and losing customer. It is particularly important in cases where the moving (selling) speed of different products in a firm's product line differs substantially. Analysis and monitoring of the moving speed of products is needed and helpful for detecting which products should be included and excluded from the product line so that, for instance, new shelf spaces are opened for new products in the market.

For a more concrete example, consider a car manufacturer that assembles thousands of parts in its assembly line. It may have to store millions of parts in its inventory, where obtaining some parts may require longer time than the others. The company needs to make forecasts of, say, next several months to 1 or 2 years market demand (under various economic conditions) for its production so that it can manage its material requirements for its inventory. The number of parts to be used during production is based on *production schedule*, which is directly related to the demand forecasts or sales forecasts. Therefore, there is no need to store parts to be used later. In such a case, the use of forecasting is expected to reduce the costs of inventory, protect the company from losing sales and, in turn, its market share, and give opportunity and time to plan and adjust its production schedule besides some other benefits.

Inventory is also formed for the purpose of meeting customer demands, which requires accurate prediction of the demand patterns in order to be able to decrease the associated costs. In cases where inventory is centralized rather

than regionalized, called 'pooling effect', demand is less volatile and, that is why, more predictable (Krajewski & Ritzman, 1993: 499). If inventory is regionalized, it may show different regional characters and volatility features based on regions. In such instances, inventory is as predictable as it is in centralized inventory but the need for inventory forecasts increases for a better and more efficient inventory management.

In order to put it more clearly, let us consider the following quotes about the importance and the size and weight of the materials management functions. "The typical U.S. manufacturer spent 40 percent of its total income from sales on purchased materials and services in 1945. The proportion rose to 50 percent in 1960 and stands at more than 60 percent today." "In 1990 more than $ 1 trillion in inventory were held in the U.S. economy. This inventory total is 2.7 times larger than the economy's monthly sales to final consumers." (Krajewski & Ritzman, 1993: 489). A more specific and detailed distribution of inventories is expressed in the figure below.



Source: Economic Report of the President, 1991

Figure 4: The distribution of inventories

All these quotes and figures show that any contribution from forecasting directed at establishing an efficient materials management function so as to reduce materials management costs has a significant value. Although there are some inventory systems (e.g. Just-In-Time, JIT[7], inventory systems and flexible production schemes) developed to reduce the inventory costs and it provided significant savings in many companies, the applicability of these systems may

[7] Just-In-Time (JIT) Inventory System: Inputs are shipped from suppliers to manufacturers at the last possible moment. JIT requires that a company enter into a close relationship with its suppliers, which includes the establishment of computer link between suppliers and the company to facilitate coordination and scheduling. The major cost saving comes from increasing inventory turnover, which reduces inventory-holding costs such as warehousing and storage costs (Hill & Jones: 122). The drawback of JIT systems is that they leave a company without a buffet stock of inventory.

be limited to specific type of companies, especially if a company's number of suppliers is high.

Another area in which forecasting has a very major potential role is *the quality control*, which is a sub-area of materials management. The quality of input materials is particularly important in the production of higher quality products. The number of defect parts that are likely to go into manufacturing process can significantly be reduced to a certain level through quality control methods before they go through the manufacturing process. The utilisation of sophisticated statistical quality-control procedures can significantly reduce the number of defects in finished products and, thereby, the cost of manufacturing and after-sale costs.

Statistical quality control has been an active research field for about a century (Ramjee, Crato, and Rey, 2002: 291). In most of the quality control processes the observations are taken in time series format. Statistical properties of control charts (e.g. stationarity, nonstationarity, independence of observations, and the presence of autocorrelation between the observations) have been very much a concern for many researchers. Time series methods such as ARMA and ARIMA have already been in use widely concerning the performance of control charts. Among many, Montgomery and Mastrangelo (1991) and Wardell, Moskowitz, and Plante (1992) have applied time series methods such as Exponentially Weighted Moving Averages (EWMA) to statistical quality control and found them to be very effective for monitoring stationary processes.

For the sake of simplification, let us consider the monitoring of a manufacturing process that yields defect parts. In order to determine if the defects are generated by a random or a specific process (e.g. linear or non-linear), the mechanism can be investigated and analysed through statistical forecasting procedures. For instance, assume that it was determined from the graph of the quality control data that every 5^{th} part of the bulk of 50 parts comes defected. In such a case it is apparent that there exist some problems and these can, most of the times, be detected with simple statistical procedures. Additionally, the forecast of defect parts can be used to analyse if and how the cost structure of manufacturing changes or is affected.

The figure below shows a simple *hypothetical* example of the number of defect parts detected from a manufacturing process, which each is generated by a linear and a random mechanism. In linear processes, it is much easier to detect the problem that causes the defect parts, compared to a problem created in a random process. Nevertheless, there should be little worry about it, if the process is a random one because it may rather refer to an unsystematic problem.

Forecasting function visualises the data generated by a specific process. A visualised data set would make it easier to detect the problems appeared in the data generation mechanism so that the necessary measures are taken as early as possible. Forecasting function can also visualise the tendency of the defect parts produced so that the estimates of the number of future defects are made under specific circumstances.

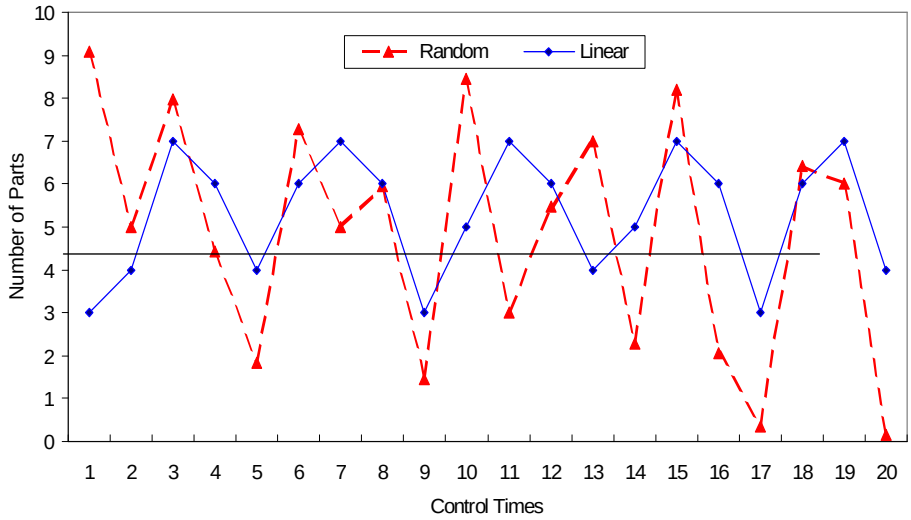


Figure 5: The graph of number of defect parts generated by linear and random processes

A further area with a very potential use of forecasting is *the distribution and collection management*. The distribution function is related to the management of flow of materials from manufacturers to customers (or from customers to firms, especially, in service firms), involving storage and transportation of products, materials, and/or services. Distribution function is important both for manufacturing and service firms. Manufacturing firms may need to distribute hundreds or, sometimes, thousands of items to distribute to variety of places. The service firms such as Federal Express, TNT, Yurtiçi Kargo and Aras Kargo also have many potential uses of forecasting. They can use forecasting for planning the quantity of products (deliveries) to be distributed (or collected from various collection points for service companies), work force, distribution vehicles, etc. based on different regional areas. The benefits expected from forecasting function would generally be proportional to the alternative costs born from forecast subject. For instance, an increase in the delivery times may cause the company to deliver poor quality of services, which, in turn, lose its market share. Another example is such that, assume, the number of calls that reaches to the customer service of a (mobile) phone company to report service demands. In such a case, forecasting can be used to predict the number of calls

that reach to the centre so that services can be scheduled, man-power requirements can be estimated and the necessary scheduling activities for the job can be performed.

As an overall statement, it can be said forecasting to have a central role in the distribution and collection functions such as the estimation of the amount of products that are demanded (or supplied) in specific distribution centres. It may play a very efficient role especially in scheduling, routing, and carrier selection. For instance, a central post office or cargo company that forecasts its collection and distribution centre locations and loads can schedule and route its distribution and collection schemes and, thus, can increase the efficiency of its distribution (collection) function.

3.2.2. Research and Development

Research & Development (R&D) function is crucial for many firms, especially the ones that operate in an industry where a high competition is observed and/or those that operate in a high-tech industry. These costs may form a very high amount of money. Nevertheless, "only about 12 to 20 percent of R&D-based projects actually generate profit when they get to the marketplace. The remaining 80 to 88 percent fail." (Hill & Jones, 1992: 125). Some major reasons are as follows:

1) *Uncertainty:* Developing a new product is a risky business. No one can really predict what the demand for it would be. Although a good market research can reduce the risk of failure, it cannot eradicate them completely. Forecasting has a potential to reduce this uncertainty (with the utilisation of judgemental or statistical methods).
2) *Poor commercialisation:* It refers to the case that when there is an intrinsic demand for a new technology but the technology is not well adapted to consumer needs. Forecasting function (e.g. with the help of marketing research) can predict the consumer needs properly and then commercialise.
3) *Marketing mistakes:* If marketing function incorrectly estimates the demand for a product, service, or technology when there is no sufficient demand, prices too high (e.g. due to higher costs), or determines a wrong marketing mix for a product, a new product may fail. Forecasting function can contribute to avoiding such mistakes substantially through predicting the cost of production and, in turn, the demand for a specific price range.
4) *The speed of introducing a product to market:* It may deeply affect the success. The time plays a critical role and forecasting may become a very major part of the decision-making process in estimating different requirements. The longer the time between initial development and

final marketing becomes, the more likely it is that someone else will beat a company to market and gain a first-mover advantage. Forecasting function can provide estimates for the competitors' position and predicts the time that it takes to develop and market the products and services that a company produce.

As a concluding remark, it is highly beneficial to integrate the R&D and marketing functions in a company. Forecasting can help in leading R&D activities to a specific direction by predicting consumer needs.

3.2.3. Human Resources

A high quality of personnel is one of the most valued resources in a company. Maintaining the required number of skilful personnel may be crucial for those companies that operate especially in industries where high quality of labour force is required (e.g. when there is a faster growth in an industry) and the labour supply is limited or it takes long time to obtain or train people for such a high-quality skills (e.g. information technology). In such circumstances companies have to make labour-force estimates in order not to allow their operations to be interrupted or disturbed. Companies may have to make the analysis of supply and demand for human resources in order to formulate alternative approaches to head off human-resource imbalances.

3.2.4. Information Systems

As already pointed out, forecasting has many potential uses in most of the business functions either directly or indirectly. However, the information system (IS) function, especially a well-developed one, in a company forms the basic infrastructure of forecasting activities. In a wide-range of forecasting activities, from data gathering and collection to forecast evaluation, IS performs a basic support. In other words, IS plays an important role in obtaining healthy and accurate forecasts that may affect most of the major operational decisions. As the success of forecasting activities depends on the existence and efficient use of IS, the contribution of it to the firm functional management can be considered as the building bricks of the forecasting function and activities.

On the other hand, the developments in the information technology have made forecasting activities much easier. As regard to the difficult process of modelling phase and time consuming phase of data preparation, many forecasting software presented to the market in the recent years have provided automatic modelling (e.g. Forecast Pro) (see Stellwagen and Goodrich, 1997) and direct data input from the Internet (see http://www.rer.com) and data pre-processing capabilities with hundreds of variables to forecast at a time (e.g. in Forecast Pro Batch version). This has made many complex forecasting methods such as ARIMA class procedures, which normally may require quite experienced forecasters for modelling, available to use, even for hundreds (or

thousands) of items, for many non-experts. Consequently, all these developments can be expected to affect the use of forecasting more positively and provide the support of forecasting for managerial decision-making in companies.

3.2.5. Company Infrastructure

Company infrastructure consists of a number of activities such as general management, planning, finance, and legal and government affairs. Forecasting is a central activity in many of the decision areas defined in the company infrastructure.

For instance, financial management is one of the most widely used areas of forecasting. Financial decisions (e.g. investment decisions) often require decision-making in that a high amount of money is included. Financial managers have to base their decisions on good and reliable forecasts; otherwise, it may lead a company to severe positions or, at least, the company may have to bear high financial costs.

Let us consider cash flow management. It is a sub-financial area in which forecasting is of high functional use. Cash flow is one of the most important financial concepts for a company and cash flow projection is the most important financial planning tool available to any company (Sidford, 1997: 18). It basically refers to the surplus of internally generated funds over expenditures or "the difference in the cash balances of a company on two dates" (Casey & Bartczak, 1984: 63). There are three types of cash flows: Cash flow from operations, cash flow from investments, and cash flow from financial activities. The first type of cash flow formed between 60 to 80 % of the cash flows generated in the UK, Dutch, and German companies (Webb et al., 1991:17,21-27) in median terms and half of the companies raised at least 61% of their finance from operational cash flows (Webb et al.: 11). Therefore, forecasting cash flows from operations is vital for many companies for variety of reasons (e.g. meeting its payments in time and raising funds for financing). The importance of forecasting flow of cash in a company comes from the fact that, most of the times, the timing and amount of cash outflows and cash inflows do not match each other. In case there are big differences between cash inflow and cash outflow in a specific time point and the company attempts to close the gap with a credit from a financial institution, it has to incur a cost for this financing activity. Cash flow forecasting helps financial managers to understand their cash inflow and outflow dynamics and to foresee their future cash positions so that they can have time in order to adjust their cash balances.

Due to the particular significance of it, cash management has attracted an increasing attention of both academicians and practitioners (see Srinivasan and Kim, 1986 for a comprehensive review of the studies on cash management

including cash flow forecasting (CFF)). For instance, while some introduce and/or propose (new) forecasting techniques and approaches for estimating cash flows (see Quillen, 1993; Paté-Cornell et al., 1990; Sokol, 1990; Stone and Miller, 1987; Miller and Stone, 1985; Anvari, 1983; Boyd and Mabert, 1977; Stone and Wood, 1977), others propose new system for forecasting cash flows (Scott et al., 1979). On the other hand, it still continues the need to point out the importance of an effective CFF and suggestion for an efficient CFF system (see Bennet and Eklund, 1994; Sidford, 1997).

Forecasting is a proper tool to capture the patterns of account receivables (see Stone, 1976; Lewellen and Edmister, 1973; Lewellen and Johnson,1972), disbursement requirements (see Stone and Miller, 1983; Maier et al., 1981), and the properties of daily cash flow (see Emery, 1981). Also, consumer payment patterns through lockboxes[8] is also detectable and the future payments from customers can thus be forecast.

Cash flow forecasting helps in estimating cash inflows and outflows from financing and investment activities of a firm, too. One of the main characteristics of this sort of cash flows is that they are in bigger lumps compared to the first type of cash flows. Even though their timing and amounts are, in general, comparably well known in advance, the forecast of cash flows from this sort of activities is also still significant for the future projections. Some other decision-making areas within financial management where forecasting can be/are used extensively are stock returns, stock prices, and dividends.

Forecasting can be used as a performance evaluation measure for *monitoring and control purposes*. It provides with company management continuous control over firms' activities (e.g. the level of sales) and the easy comparison over if the firm's goals are achieved in a specified operational area such as the development of short-term financial control systems (Johnson et al., 1994: 191). In short, forecasting helps company functional managers to have more effective managerial decisions and thus to have more effective operational activities.

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[8] Lockbox is the location of regional collection points. "Lockboxes increase the amount of funds available for investment by reducing the delay between the time the customer mails the check and the time funds are credited to the firm's account." A lockbox is generally in form of a post office box rented in different geographical areas of a country, from where a company's bank officer may collect them in order to credit the company's account. If it is thought that clearing a check takes, average, 5 to 7 days, a company can release a considerable amount of money by shortening the time to cash thousands of checks from its customers. In USA, for instance, where the rate of check use is considerably much higher compared to many European countries, the use of lockbox is quite widespread (see Maier and Weide, 1983 for more explanation).

4. Summary and Conclusion

The paper has reviewed and discussed some of the functional areas in which forecasting – as a managerial decision-making tool- has the potential capability. It approached to the subject from the value-chain perspective. Besides establishing a connection between the forecasting function and functional management, the paper discussed the contribution of forecasting to functional management. The discussions have pointed out that forecasting function has the applicability in many of the functional decision-areas both in primary activities and support activities in the value-chain. In each of these decision areas, variety of forecasts are needed (e.g. the number of products demanded, the number of machine hours required, the amount of raw material, the number and timing of customers who demand service, etc.) for different managerial decisions. Even though forecasting is central to many major managerial decisions, the state of current literature in Turkey makes little implication that the value and positive contribution of forecasting to functional decision-making is understood adequately. Maybe, that is why, forecasting did not find as sufficient application areas as it should have been. The paper finally underlines the fact that forecasting has a wide range of applicability and use in practice for decision makers.

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