DEMAND FORCASTING MODEL FOR A MANUFACTURING COMPANY

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Abstract

One of the most important decisions about production is the one that addresses how a manufacturing company can produce goods and services at the right number. In this paper, we focus on demand forecasting as a tool for determining the right number of goods and services to be produced. We have developed a web based demand forecasting system based on three widely and commonly used models namely; least square model, simple moving average and exponential weighted moving average. This demand forecasting system has been deployed using ASP.NET 2.0 web technology model and Visual C# programming language. The system is dynamic, flexible and easily accessible and has the ability to analyze very large volume of data.

In a manufacturing environment, decision makers are responsible for the planning and control of production systems to reach the objectives of the company. In this situation where decision makers of manufacturing companies need to make the right decision concerning the right quantity of goods to produce then demand forecasting model technique becomes a useful tool to solve such problems.

Manufacturing companies are often faced with choices such as "What new product should be developed from the choices available?", "What is the timing of this production?", "what quantity of products should be produce? Such choices are not easy to make and managers needing to make such choices could benefit from a decision model. In both the manufacturing and services sector new products are constantly being developed.

In this research work a stand alone decision support system will be developed that will integrate the expert knowledge in production and analysis model that will aid in the decision making for manufacturers. Models are formal representations of decision problems (Krishnan, & Chari 2000).

The research problem therefore includes the finding of a management or decision support method that will be able to simultaneously deal with both qualitative and quantitative data and be able to provide inputs at the different stages in the product development cycle. A fast and cost-efficient Product Decision Model can be a decisive factor in competitive markets. A relentless product development and a constantly changing manufacturing landscape demand responsiveness from today's manufacturers.

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Production decision in any manufacturing company is regarded as a top-level human mental process. This research uses the term – "production decision model" more restrictively, to focus on decision-making as the process of determining information related to planning and scheduling for activities within an enterprise. It includes not only planning and scheduling, but also the associated processes that create and manage information for those purposes.

It is argued that manufacturing management decisions are hard and therefore requires decision making support model. The reasons while production decision are hard to make include: complexity of the problem, because of inherent uncertainty in the situation, because the decision maker may be

interested in working towards multiple objectives but progress in one direction impede progress in others, and because different perspectives lead to different conclusions. New product development is characterised by a tremendous degree of complexity and uncertainty and involves choosing between different products competing for the same funding. Given this it can therefore be said that product development decision are hard and therefore in need of decision models. Any model supporting production decision making must therefore allow for subjective inputs. In this research a modelling approach is used. This approach provides a graphical representation of the situation. From a decision analysis perspective such models have a key advantage in that they allow for analysis which can indicate a "preferred" alternative. The model is a predictive model in nature such a model is an effective modelling framework for the following reasons: it captures the structural aspects of the decision, it serves as a framework for and efficient quantitative analysis, allows sufficient representation and exploitation of conditional independence in a decision model, and has proven to be an effective tool for communicating decision models (among decision analysts and decision makers, and between the analyst and the computer (Bozarth & Handfield 2006).

Models

The noun model means "a miniature representation of something; *or* a pattern of something to be made". In science Models are physical, mathematical, or logical representation of a system of entities, phenomena, or processes. Basically a model is a simplified abstract view of the complex reality. A model is an abstraction of reality or a representation of a real object or situation. In other words, a model presents a simplified version of something. A model airplane may be assembled and glued together from a kit by a child, or it actually may contain an engine and a rotating propeller that allows it to fly like a real airplane (Sharma 2008).

The notation of the models can be graphical, textual or mixed, *Model-driven DSM* emphasizes access to and manipulation of a model. They use data and parameters provided by decision-makers to aid them in analyzing a situation, but they are not usually very data intensive. Models are simplified representations of systems or problems (Turban et al, 2001).

Decision Models

Decision modeling refers to the use of mathematical or scientific methods to determine an allocation of scarce resources that improves or optimizes the performance of a system. Decision models make use of decision modeling process as illustrated in figure 2.1 below.

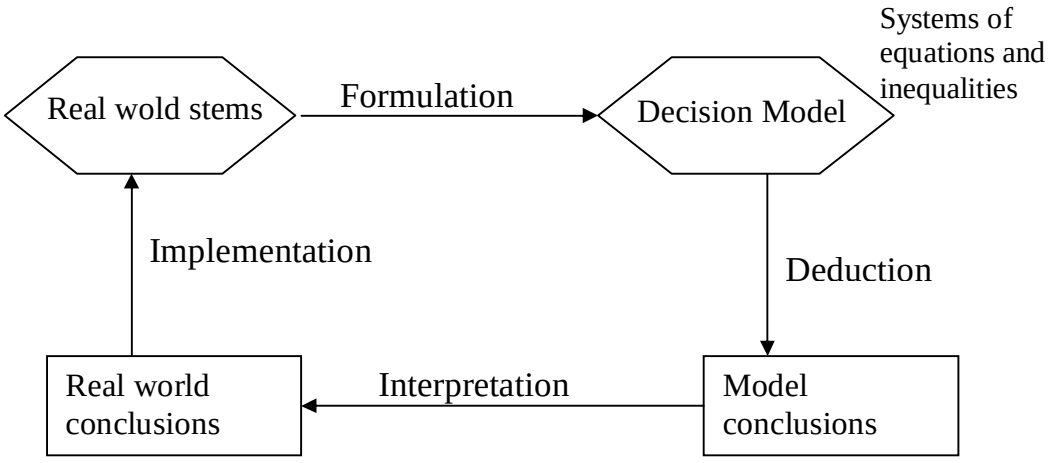


Fig 2.1: Decision Modeling Process

Demand Forecasting: A Tool for Production Decision

Demand forecasting is the activity of estimating the quantity of a product or service that consumers will purchase. Demand forecasting involves techniques including both informal methods, such as educated guesses, and quantitative methods, such as the use of historical sales data or current

data from test markets. Demand forecasting may be used in making pricing decisions, in assessing future capacity requirements, or in making decisions on whether to enter a new market.

Often forecasting demand is confused with forecasting sales. But, failing to forecast demand ignores two important phenomena. There is a lot of debate in the demand planning literature as how to measure and represent historical demand, since the historical demand forms the basis of forecasting. Should we use the history of outbound shipments or customer orders or a combination of the two to proxy for demand (web1 2010).

Methodology

The Structured Systems Analysis and Design Methodology (SSADM), was once a very popular methodology but it has lost favor as a methodology. As Whitten (2004) had rightly pointed out, "the practice of structured analysis for software design has greatly diminished in favour of object-oriented methods".

While model- driven methodology emphasizes the drawing of pictorial system models that represent either a current reality or a target vision of the system, rapid application development emphasizes extensive user involvement in the rapid and evolutionary construction of a working prototype of a system to accelerate the system development process.

The data flow diagram presented below represents a simple model for demand forecasting in the present system is shown in figure 3.1.

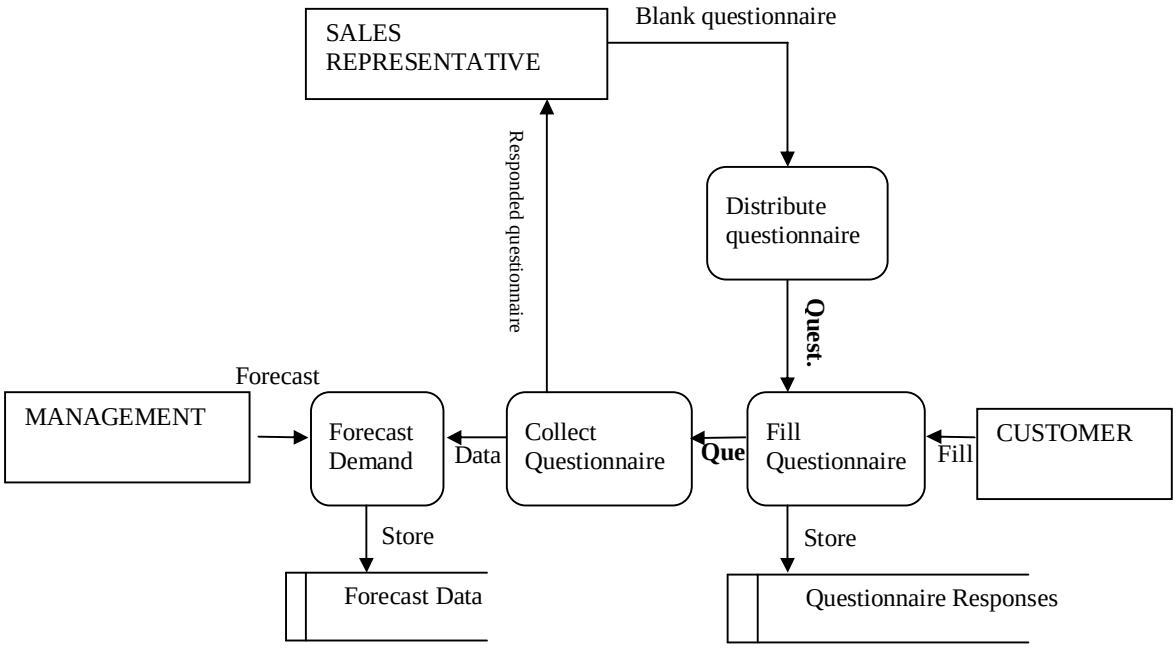


Fig 3-1. Model of the present system

Weakness of the Present System

There are many weaknesses of the present system. Most of these weaknesses and problems stems from the fact that demand forecast is not only done manually but that it is based on judgmental techniques. Some of these weaknesses are presented below:

1. This is heavy reliance on the past experience of the person and skill.

2. It is cumbersome and time consuming.
3. It is biased and subjective as it is not backed by any scientific method or statistical data.
4. The accuracy of the predicted demand depends upon the skill, expertise and *experience of the person making the forecast.
5. If the data required is large, then this approach may be very costly produce the materials and assemble the experts that will make sound judgments.
6. Data are not easily defensible as being representative of populations due to potential subjectivity of researcher

High Level Model of the Proposed Solution

In this research, we did not focus much on drawing models of the proposed system due to the large nature of the data, processes and interfaces that is involved in the system.
To address this problem, this research study has chosen to use discovery prototyping to analysis, document and validate the requirements of the present system. This approach is anchored on the philosophy that users will recognize their requirements when they see them.
In fact, as rightly pointed out by Whitten (2004), prototyping is an alternative to system modelling. This is because according to him, users sometimes find it difficult to state or visualize their business requirements. In such a situation, a complementary approach to system modelling is to build discovery prototype.

However, we will present two simple models that depict a high level model of the proposed system.

The next model is called a functional Decomposition Diagram. A decomposition diagram shows the top-down functional decomposition or structure of a system. It also provides us with the beginnings of an outline for drawing our data flow diagrams as shown in figure below.

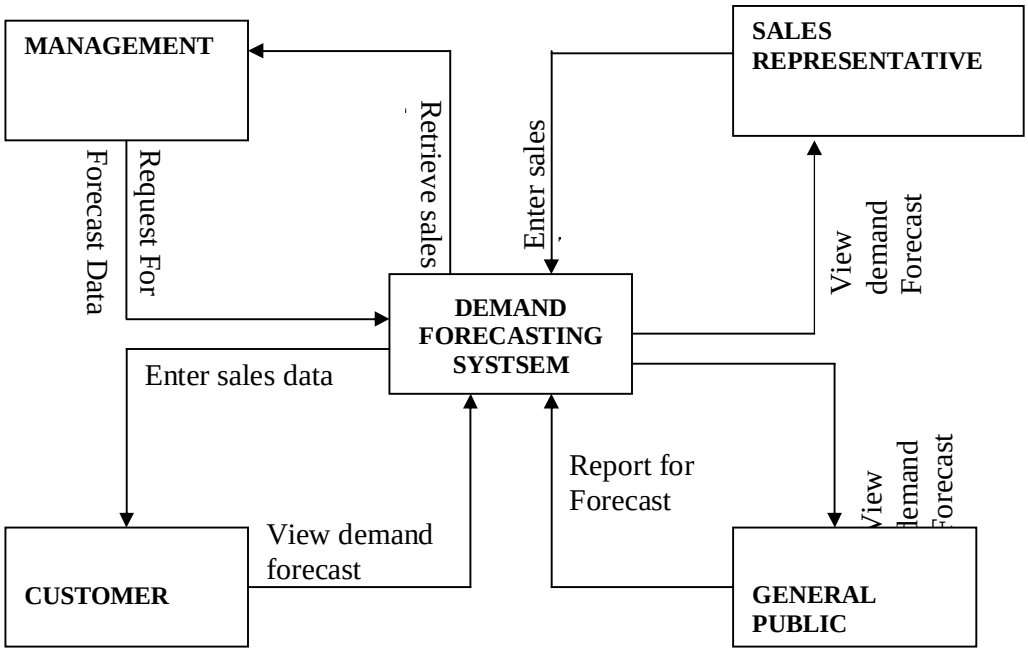


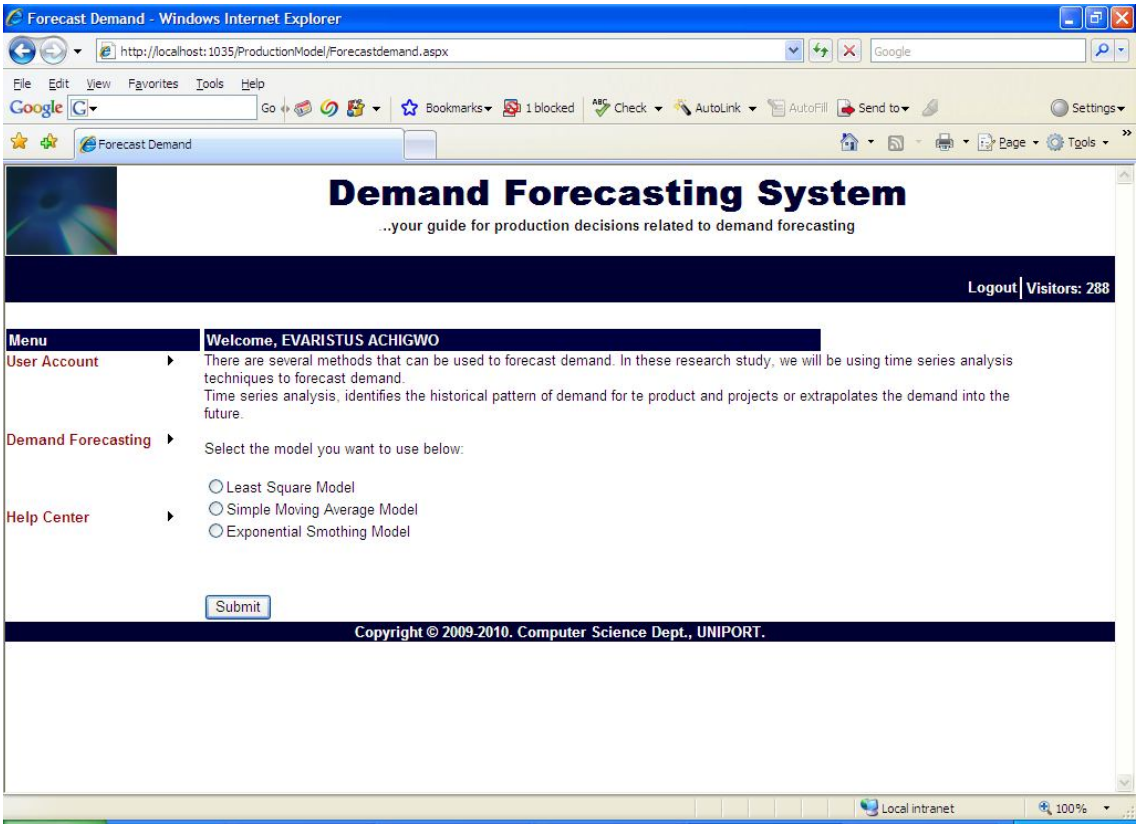
Fig. 3-2: The Context Data Flow Diagram of Demand Forecasting

Summary

Forecasting plays a crucial role in the development of plans for the future. It is an important component of strategic and operational planning. It establishes the link between planning and controlling. There is s great need for demand forecasting for industries that are involved in production because majorities of the activities of these industries depend upon the future sales.

Results

This research has been able to focus on demand forecasting model for a manufacturing company. This model which is based on the following least square method, simple moving average and exponential method has been analyzed and used in designing the system. This system can handle large volume data and will follow the trend in forecasting the sales in a company for a period of time. This demand forecasting system will guide manufacturing companies in production decision.



Conclusion

A web database application is an application that can be accessed through the web browser. The software and database reside on a central server rather than being installed on the desktop computer system and is accessed over a network.

In this research, we have gone through a simplified system development process: system analysis, system design, system implementation, and system maintenance.

We first started by analysis the current manual system of collecting past demand data and then using them to compute future demand data. After that, we proceeded to the design of the application system by taking into consideration three simple and widely used forecasting models- least square method, simple moving average and exponentially weighted smoothing average. Thereafter, we developed and implemented a web-based demand forecasting system using ASP.NET web technology model. Finally, we have discusses how we documented the entire process and also made recommendations on how to properly install, test, deliver the system into production and then maintain the system when it is under use.

Although, there were some constraints in developing this demand forecasting system, this system has been tested at the level of the design and it has been found to be effective and reliable. This application can handle a very large number of past sales or historical data

Web based applications are the ultimate way to take advantage of today's technology to enhance your organizations productivity and efficiency. Web based application gives you an opportunity to access

your business information from anywhere in the world at anytime. It also helps you to save time and money and improve the interactivity with your customers and partners.

Recommendations

For this demand forecasting system to function effectively and continue to meet the needs of the production firms and the general public, it has to be properly installed, operated and maintained. It is recommended that the computer system that would be used to set-up this application system should have the same general features and capabilities as the local machine that was used in developing the application.

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