

FORECASTING IN OPERATIONS RESEARCH

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ABSTRACT

Best use of available resources is the main aim of operation research. It uses advanced analytical techniques to improve decision making. Forecasting identify possible future development and help to make better decision in inventory control/production planning, investment policy, and economic policy in planning the future. Forecasting problems are classified as short, medium and long term on the basis of time scale involved in the forecast. The usual category varies according to the situation that is being studied. Different forecasting methods apply for different categories. The main aim of present paper is to focus on various forecasting methods: i.e. qualitative methods, regression methods, multiple equation methods, time series methods and their relative merits & criteria for choosing a suitable method to apply in a particular situation. Along with these the paper also focused on the concept of reliable forecasts with the help of suitable number examples.

KEYWORDS: Forecasting, reliable forecasts, time series analysis, regression analysis

1. INTRODUCTION

Now an organization whether in public or private sector will survive in global market only if it provides high quality products and services as and when required to the customers. Thus, careful planning and analysis is required at each stage in business to work effectively and efficiently. Operations research (OR) is like guide map that shows us path to achieve the target of optimality. It is nothing but a management function that makes use of advanced analytic technique from the field of mathematics and science to improve decision making. Experts from different fields sit together and chalk out plan to make best use of all resources available subjected to given constraints and try to optimize the profit. Today, both public and private sector management operate under condition of uncertainty or risk. It is very difficult to prepare proper strategies to deal with uncertainty of future. In long run, success of an organization depends on ability of management to foresee its future and work out efficient plan to deal with the future scenario. Minimization of risk factor and maximization of benefit are the two important objectives of any planning for the future and forecasting is the starting part of planning. It helps in budgeting all resources available and its objective is to reduce risk of decision making. It is an aid in approximating a number of factors like volume of production, labour hours required, cash requirement, inventory and financing need. But, it is very difficult to reveal the future. A crystal ball is required through which one can see future events, which is impossible. In forecasting methods we focus on extra-polating the future value of variable from present information using systematic forecasting rules, but major difficulty faced here is that future is uncertain. The uncertainties that are understood currently in terms of probability can be incorporated as a measure of forecast uncertainty. These regular persistent changes can be modeled as stochastic trends. Forecast performance in dealing with the anticipated outcome depends on the historical performance of a model. But those uncertain events we cannot understand currently are more serious are the major source of failure of forecasting. These structural breaks or mean sudden large changes are most of the time are unanticipated. Till date, no generic models for such breaks have evolved despite of considerable effort in the field of non-linear modeling. There are a number of forecasting methods which are broadly categorized as qualitative methods and quantitative methods.

2. QUALITATIVE METHODS

Qualitative forecasting is judgement forecasting. It is used in situations where there is no relevant past data is available on the variable of interest. Qualitative forecasting is based of human judgement and observations of existing trends. The advantages of these methods are that forecasting can be done in absence of past data ,systematic changes can be identify more quickly and interpret better effects of such changes on future even in absence of elaborate statistics. Some good qualitative methods are executive opinion, sales force polling, customer survey Delphi technique, etc.

2.1 Executive Opinion

Executive opinion forecasting is based on expectations of experts from different fields like administration, sale, production purchasing etc and the opinion of higher persons are aggregated to forecast about future sales. It is generally used in conjunction with quantitative method such as trend extrapolation. This method has disadvantage of biasness. It is a group thinks and powerful person in group may influence decision of others in the group.

2.2 Delphi methods

Panel of experts, physically separated from each other are asked to respond to series of questionnaires. Then a second questionnaire is prepared which incorporate information and opinion of all experts. Again each expert is asked to reconsider and revise his or her initial response and this process is continued until some degree of census reached among experts. Hence, we get a range of opinions in which major information lies. It is an attempt to reach at census. This type of method is quite useful for long range forecasting. As compared to executive opinion, this technique eliminates disadvantage of group think. Experts are not influenced by other and give their independent view. Main disadvantage of this method is lack of the census from the return. Also this method is low reliable as compare to former.

Sales force polling, customer survey are based on opinions of sales man and customer respectively.

3. QUANTITATIVE FORECASTING METHODS

Forecasting problems in which past information on variables of interest and other related variable is available, quantitative analytic technique are used to forecast about the variable. Time series is statistical representation past data of the variable. It has four components: seasonal component trend component, cyclical component and irregular component which helpful to understand random fluctuations and trends emerges due to one or more than one long term factors e.g. changes in size and demographic characteristics of population, variation in tastes and preferences of consumers etc. Professional forecasters often use straight line to represent a trend, an increasing trend is shown by an upward sloping line and a decreasing trend by a downward sloping line, but it does not applicable to every situation. In many situations, non linear trends may more accurately represent the true trend in the time series. Quantitative forecasting methods are divided into two broad categories: non casual forecasting methods, casual forecasting methods. In non casual forecasting methods we use the time series of a particular variable and related variables as base to forecast of about the variable. These techniques are also called time series methods. Quantitative casual forecasting techniques also uses past data in forecasting future values of a variable, but at the same time, the forecaster consider the cause-and-effect relationships of the variable with other relevant variables e.g. the level of consumer confidence with other relevant variables such changes disposable incomes of consumers, financial investment of consumer. The most popular causal method is the regression analysis, a statistical technique used to develop

mathematical relationship through linear and non linear curves which are used to estimate variable from the information regarding variable.

4. NON CASUAL /TIME SERIES METHODS OF FORECASTING

This category has further sub-categories described as follow:

4.1 Forecasting from trend projection

This method uses long-term trend of time series of variable of interest to forecast its future values. Suppose, a forecaster has data on sales of Indian- made autos in India for the last 25 years. The time series data on sales of auto can be plotted graphically. Most likely, time series of auto sale shows gradual growth in the sale, despite of small fluctuation from year to year. The emerging trend may be linear or non linear according as it represented by straight line or curve in time series graph respectively. Here it is important to note that if forecasters assume a linear trend when actually a nonlinear trend is present, then this misrepresentation can lead to gross inaccurate forecasts. Here we use mathematical techniques to find the straight line that shows trend in the time series on auto sales.

4.2 Smoothing methods

The moving averages method is most popular smoothing technique among all others forecasting techniques. It is based on idea of smoothing the time series. This method based on averaging of a fix number of adjoining data periods. This averaging process uses overlapping observations to generate averages. Suppose, a forecaster wants to generate three-year period moving averages. The forecaster calculates average of the first three observations of the time series. Then drop the first observation and calculate average of the next three observations and so on. This process continue till three-period averages are calculated all observations in time series. Here the forecaster moves either up or down the time series and pick observations and calculate an average of a fixed number of observations. Here we use the average of the most recent three observations of data in the time series to the forecast about the next period. Forecasted value for next year is in conjunction with the last two period observations in time series and it can be used as the forecast for further second period in the future. Length of period in moving averages forecast method will be chosen suitably to get highest accuracy in the forecasting.

4.3 Trend and seasonal component method

This method is expansion of the trend projection method. It makes use of the seasonal component of a time series along with the trend component and removes the seasonal effect or the seasonal component from the time series. This process is termed as de-seasonalizing the time series. Once a time series is de-seasonalized, we can identify a trend line that represents the time series data well. Then using this trend line, forecasts for future are generated. Finally, we reincorporate the seasonal component of time series using the seasonal index to adjust the forecasts based on trend alone. Thus, the forecasts generated in this manner, has both the trend and seasonal components. Forecast based on this method is more accurate as compare to the trend projection method.

5. CASUAL METHOD OF FORECASTING

The widely known causal method is called regression analysis. It is a statistical used to determine the nature of relationship a variable of interest (dependent or response variable) with one or more than one independent variable based on data values. A mathematical model showing how a set of variables is prepared and mathematical relationship in terms of curve (straight line, parabola, exponential curve) is used to generate forecasts. Independent variables are generally

called predictor variables. If there is only one predictor and relationship is represented by straight line than we use simple linear regression analysis and if number of predictors are more than one technique used here is multiple regression analysis. The key point in this method is to find the most accurate straight line. This is called line of best fit and it is found using method of least squares and will forecast future values of the dependent variable. Further, that the forecasts based on regression analysis method can be judged on the basis of forecast errors involved and can incorporated as measure of uncertainty of forecast.

6. MOST APPROPRIATE FORECASTING METHODS

Selection of an appropriate forecasting methods for a given problem depends on number of factors like purpose of forecasting (either long run or short run purpose), level of accuracy, how much data is available, level of error, cost of developing the forecasting method, complications in relationship that is being forecasted. Classification of forecasting problems depends upon timescale involved in the forecast. It may happen that a forecasting method which is most appropriate for forecasting sales next 15 days (a short-term forecast) may be totally inappropriate method for forecasting sales in five years time (a long-term forecast). Also choice of a forecasting technique largely depends on the stage of the product life cycle. In the beginning, relatively small expenditures are made for research and market investigation. As phase of product introduction starts, these expenditures start to increase. During growth stage high level of accuracy is required because considerable amounts of money are invested the decisions, when the product enter in the maturity stage, appropriate sales forecast technique provides an aid to chalk out plans for marketing and manufacturing.

7. SUMMARY

We have given just an overview of some important forecasting methods. It is necessary to understand the different forecasting methods and their relative merits and so be able to choose which method to apply in a particular situation. All quantitative forecasting methods involve tedious repetitive calculations and so are ideally suited to be done by a computer. Now-a-days, many interactive kind of forecasting packages are available in market.

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