UNIT 15: BUSINESS FORECASTING

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15.1 LEARNING OBJECTIVES

After going through this unit you will be able to

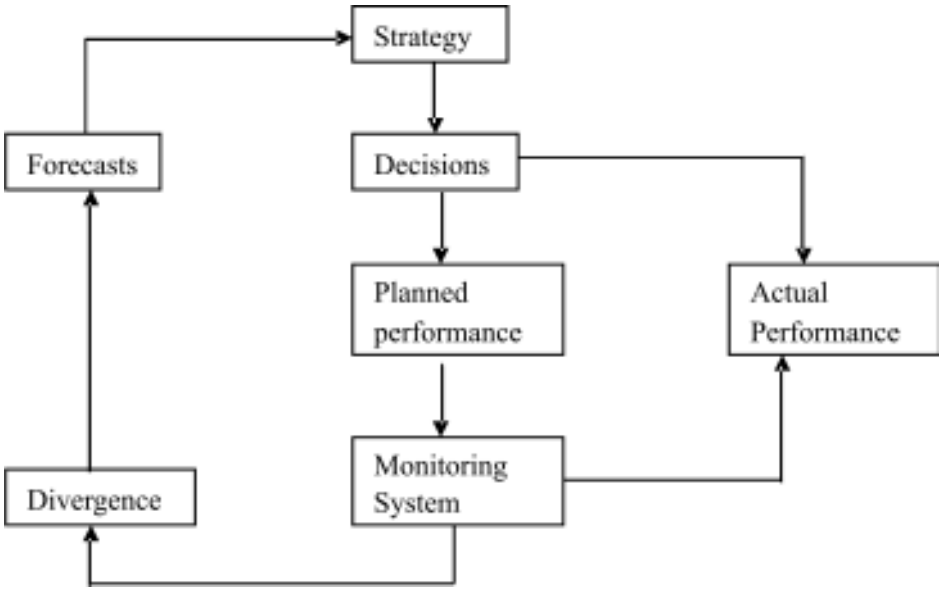
- Understand the pattern of the historical data and then extrapolate the pattern into the future.
- understand the utility as well as various methods of forecasting
- gain a general understanding of time-series forecasting techniques.

15.2 INTRODUCTION

In today's highly dynamic business environment, managers have to forecast the future and design strategies accordingly. The success of business depends mainly on future planning based on past and present experiences. The experiences may be based on quantitative and/or qualitative factors. Both these types of information help managers in business forecasting. Managers use forecasting (the art or science of

predicting the future) techniques to make strategic decisions about selling, buying, hiring, etc. every day. The past data are used by managers to make predictions about the future. For example, let us assume that a company wants to order raw material in advance for its production processes in the current year. The demand for the finished product is uncertain in the current year. In this situation, the company can take the help of forecasting techniques (with the help of past data) to order inventory for the current year.

Forecasting is essential in order to make reliable and accurate estimates of what will happen in the future in the face of uncertainty. A flow chart of forecasts and the decision-making process is shown below. In general, decisions are influenced by the chosen strategy with regard to an organization's future priorities and activities. Once decisions are taken, the consequences are measured in terms of expectation to achieve the desired products/services levels.



Decisions are also get influenced by the additional information obtained by using the forecasting method. Such information and the perceived accuracy of the forecasts may also affect the strategy formulation of an organization. Thus an organization needs to establish a monitoring system to compare

planned performance with the actual. Divergence, if any, and no matter what the cause of such divergence between the planned and actual performance, should be fed back into the forecasting process, to generate new forecasts.

Some of the objectives of forecasting are as follows:

(i) The creation of plans of action, because it is not possible to evolve a system of business control without an acceptable system of forecasting.

(ii) Monitoring of the continuing progress of action plans base on forecasts.

(iii) The forecast provides a warning system of the critical factors to be monitored regularly because they might drastically affect the performance of the plan.

Distinction among prediction, projection and forecasting: Prediction is a future estimate based on extrapolation. Hence, prediction is solely based on past data of the series under investigation. A projection is a prediction where an extrapolated value is subject to certain assumptions. For example, projections of number of births, deaths, etc. involve assumptions about changes in birth rate, death etc. A forecast is an estimate for some future point of time, partly based on past and present data and partly on subjective estimates arising out of the experience and judgment of the forecaster. Thus, forecasting involves using all our knowledge, from whatever source, about the situation.

15.4 STEPS IN BUSINESS FORECASTING

The following are the steps involved in business forecasting:

1. To know the causes of changes in the past: While attempting to forecast business fluctuations a clear understanding about the causes responsible for past changes is a must.

2. To measure the phases of business activity: Having known the causes of occurrences of fluctuations, certain phases of business activity needs to be computed so as to forecast the changes which are supposed to occur after the current level of activity.

3. Selection and compilation of data: The business barometers form the basis of statistical data available for measuring the fluctuations in business activity. One must have proper grasping regarding the fluctuations in business to select and compile data judiciously.

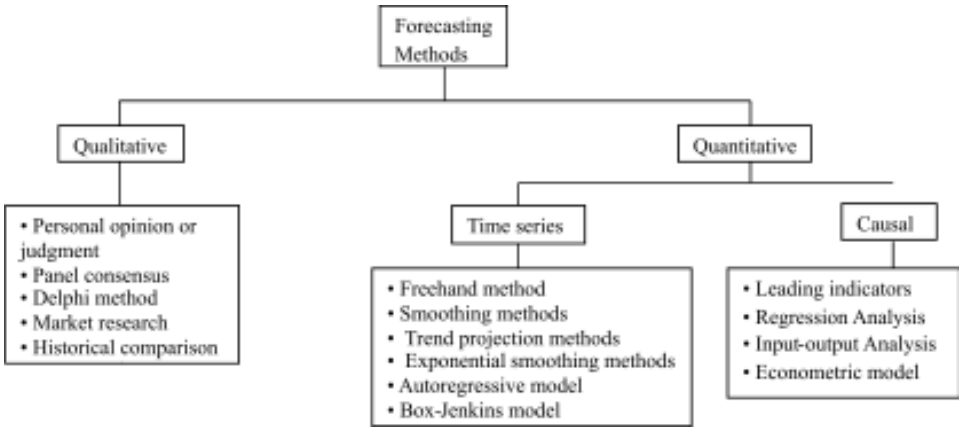
4. Analysis of data: The data needs to be analyzed in the light of one's understanding of the reasons why changes occur. If it is known that certain factors have resulted in a given change then these factors are to be computed statistically to draw conclusions about the future. The techniques with the help of which inferences can be drawn are called forecasting techniques.

15.5 METHODS OF BUSINESS FORECASTING

The methods of forecasting can be classified into two broad categories: (i) quantitative or objective and

(ii) qualitative or subjective. These can further be divided into several methods.

An overview of the types of forecasting methods is shown below:





CHECK YOUR PROGRESS

Q 1: State whether the following statements are true or false:

(i) Exponential smoothing is an example of a causal model.

(ii) Market research is an example of Qualitative method.

(iii) Time series method of forecasting includes personal opinion.

(iv) Quantitative methods of forecasting include smoothing approach.

15.5.1 QUALITATIVE FORECASTING METHODS

These methods consist of collecting the opinions and judgments of individuals who are expected to have the best knowledge of current activities or future plans of the organization. An important advantage of qualitative methods is that they are easily understood. Another advantage is that they can incorporate subjective experience as inputs along with objectives data. Again the cost involved in forecasting is quite low.

As against these advantages, these methods have some limitations also. One serious limitation is the varying perceptions of people involved in forecasting. As a result, intuitive forecasts are likely to differ from one individual to another and wide variance is found in forecasts. In fact these methods are suitable when forecasts are to be made for highly technical products which have a limited number of customers. A number of approaches fall under qualitative methods which are given below:

Personal opinion: Here an individual does some forecast which can be relatively reliable and accurate, of the future on the basis of his or her personal judgment without using a formal quantitative model. This approach is usually recommended when conditions in the past are not likely to hold in the future.

Panel Consensus: To reduce the prejudices and ignorance that may arise in the individual judgment, it is possible to develop consensus

among group of individuals. Such a panel of individuals is encouraged to share information, opinions, and assumptions (if any) to predict future value of some variable under study.

Delphi Method: This method is very similar to the Panel Consensus method. In the Delphi method, a group of experts who may be stationed at different locations and who do not interact with each other is constituted. After this, a questionnaire is sent to each expert to seek his opinion about the matter under investigation. A summary is prepared on the basis of the returned questionnaire. On the basis of this summary, a few more questions are to be included in the questionnaire and this modified questionnaire is again sent back to each expert. This process, which generally keeps them informed of each others' forecasts, is repeated until the desirable consensus is reached.

Market Research: The marketing research method is introduced in order to collect data and accordingly a well-designed questionnaire is prepared and distributed among respondents. On the basis of the response obtained, a summary is prepared and the survey result is developed.

Historical Comparison: Once the data are arranged chronologically, the time series approach facilitates comparison between one time period and the next. It provides a scientific basis to make comparisons by studying and isolating the effects of various influencing factors on the patterns of variable values. It also enables in making regional comparison amongst data collected on the basis of time.

15.5.2 QUANTITATIVE FORECASTING METHODS

These forecasting methods can be used under the following situations:

(i) Past information about the variable being forecast is available.

(ii) Available information can be expressed numerically

(iii) A reasonable assumption is that the pattern of the past will continue into the future.

The quantitative methods of forecasting are further classified into two broad categories, namely:

(1) Causal or Explanatory Methods and (2) Time Series forecasting

Now, we first focus on Causal or Explanatory methods:

(1) Causal or Explanatory methods: Causal methods are based on the cause and effect relationship between the two or more variables under study and regarded as the most sophisticated methods of forecasting. These methods produce realistic forecasts provided relevant data are available on the major variables influencing changes in sales. Some major advantages of this method are: (i) turning points in sales can be predicted more accurately by these methods than by time series methods. (ii) The use of these methods reduces the magnitude of the random component far more than it may be possible with the time series methods. (iii) The use of these methods provides greater insight into causal relationship.

The two causal methods, regression analysis and correlation analysis, have already been discussed in the Unit 10. Other causal methods are discussed below:

Leading Indicators: Sometimes one finds that changes in sales of a particular product or service are preceded by changes in one or more leading indicators. In such cases, it is necessary to identify leading indicators and to closely observe changes in them. For example, the demand for various household appliances is an example of a leading indicator which follows the construction of new houses. Likewise, the demand for many durables is preceded by an increase in disposable income. Similarly, number of births is another example of this approach. The demand for baby food and other goods for infants can be ascertained by the number of births in a territory. It may be possible to include leading indicators in regression models.

Regression Analysis: The regression approach is the most widely used and the most powerful method, amongst causal methods, to the solution of the forecasting problem. If there exists a functional relationship between two variables, then the knowledge of one variable leads to obtain an estimate of the other. For example, if we can formulate the functional relationship between advertising expenditure and sales of a company, then for a given advertising expenditure, we can forecast the probable increase in sales or vice versa. A regression model reflects the association among variables. The causal interpretation is done by the analyst on the basis of his understanding of such an association. As such, he should be extremely careful in selecting the variables so that a real causative relationship can be formulated among the variables selected.

Regression analysis involving two variables, one dependent and the other independent, is termed as simple regression. On the other hand, if there exists a functional relationship between the variable to be forecast and more than one independent variables then we have multiple regression. Statistical techniques that are used to fit the regression equations involve complex computations and hence are time consuming. But now-a-days many statistical packages are available with the help of which both simple and multiple regression equations can be quickly estimated.

Input-output Analysis: Here, the analyst takes into consideration a large number of factors, which affect the outputs he is trying to forecast. For this purpose, input-output table is prepared where the inputs are shown horizontally as the column headings and the outputs vertically as the stubs. It may be mentioned that by themselves input-output flows are of little direct use to the analyst. It is the application of an assumption as to how the output of an industry is related to its use of various inputs that makes an input-output analysis a good method of forecasting. The assumption states that as the level of an industry's output changes, the use of inputs will change proportionately, implying that there is no substitution in production among the various inputs. This may or may not hold good.

The use of input-output analysis in sales forecasting is appropriate for products sold to governmental, institutional and industrial markets as they have distinct patterns of usage. It is seldom used for consumer products and services. It would be most appropriate when the levels and kinds of inputs required to achieve certain levels of outputs need to be known.

A major limitation is that it needs extensive data for a large number of items which may not be easily available. Large business organizations may be in a position to collect such data on a continuing basis so that they can use input-output analysis for forecasting. However, this is not possible in case of small industrial organizations on account of excessive costs involved in the collection of comprehensive data.

Econometric Models: The term econometrics deals with the application of mathematical economic theory and statistical techniques to economic data in order to verify economic theorems and to establish quantitative results in economics. Econometric models involve a set of simultaneous equations. The values of the unknown constants in such equations are provided by a study of statistical time series, and a large number of equations may be necessary to produce an adequate model. It is to be noted that the development of an econometric demands sufficient data so that the correct relationships can be developed. Hence, when data are scarce—for example, when a new product is to be introduced in the market then this method cannot profitably be employed. Thus these are generally used at the macro level such as forecasting national income and its components and show how the economy or any of its specific segments operates. As compared to an ordinary regression equation, they bring out the causalities involved more distinctly.

Now we will turn our discussion to Time series forecasting.

(2) Time series forecasting: The time series methods are concerned with taking some observed historical pattern for some variable and projecting this pattern into the future using a mathematical formula. These methods fail to describe the cause effect relationship between

variables. This limitation of the time series approach can be overcome by using the causal method. Quantitative methods of time series forecasting include: free hand method, smoothing method, Exponential smoothing method, trend projection method, autoregressive model, Box-Jenkins method.

Free hand method: The free hand method is the simplest method of determining trend. It is obtained by plotting the values y_t against time t. Smoothing of the time series with the freehand curve eliminates the seasonal and irregular components. The forecast can be obtained simply by extending the trend line. A trend line fitted by the freehand method should conform to the following conditions:

(i) The trend line should be smooth—a straight line or mix of long gradual curves.

(ii) The sum of the vertical deviations of the observations above the trend line should equal the sum of the vertical deviations of the observations below the trend line.

(iii) The sum of squares of the vertical deviations of the observations from the trend line should be as less as possible.

(iv) The trend line should be drawn in such a way so that the trend line bisects the same area above and below a cycle.

Smoothing method: The main objective of the smoothing method is to "smooth out" the random variations due to the irregular fluctuation in the time series data. Various methods are available to smooth out the random variations due to irregular fluctuations, so that the resulting series may have a better overall impression of the pattern of movement in the data over a specified period. We have already discussed different methods of smoothing namely moving averages method, weighted moving averages and semi-averages method.

Trend Projection: A trend is the long-run general direction (upward, downward or constant) of a business climate over a period of several years. It is best represented by a straight line.

The trend projection method fits a trend line to a time series data and then projects medium-to-long-range forecasts. Several possible trend fits can be explored (such as exponential and quadratic), depending upon movement of time-series data. We have already discussed linear, quadratic and exponential trend models under the unit Time series analysis.

We now introduce the other three time series methods of forecasting which are being increasingly used in recent times. These are exponential smoothing method, Autoregressive model and Box-Jenkins model.

Exponential smoothing method: Exponential smoothing is another technique used to "smooth" a time series of its sharp variations. It is a type moving average forecasting technique which consists of a series of exponentially weighted moving averages. The exponential smoothing method weigh data from the previous time period with exponentially decreasing importance in the forecast. This method has a relative advantage over the methods of moving averages. First, this method focuses upon the most recent data. Second, during forecasting, this method takes into account all the observed values because each smoothing value is based upon the values observed previously. In this way, the values observed most recently receive the highest weight; the previously observed value receives the second highest weight and so on. This method is used for forecasting when there is no apparent trend or seasonal variation in the given values of a variable. However, this method is useful mostly for short-term forecasting like forecasting of sales, inventory, price etc.

In exponential smoothing method, forecasting is made up of the actual value for the present time period multiplied by a value, called the exponential smoothing constant, between 0 and 1. This exponential constant is denoted by α (not the same α as interpreted in Type I error in Testing of hypothesis). So, the resulting value is which is added to the product of the present time period forecast F_t and $(1-\alpha)$. Mathematically, the formula can be represented by the following functional relationship

$$F_{t+1} = \alpha . X_t + (1-\alpha) . F_t$$

Where F_{t+1} is the forecast for the next time period $(t+1)$, F_t is the forecast for the present time period (t), α the exponential smoothing constant and the actual value for the present time period (t).

The selection of exponential smoothing constant is a very critical step because it directly affects the result. The appropriate value of the exponential smoothing constant,, however, can make the difference between an accurate and an inaccurate forecast. The selection of the exponential smoothing constant should be such that we can obtain the most accurate forecast. From the formula stated above, we find that forecast for the next time period is a combination of the actual value for the present time period and the forecast for the present time period. If a forecaster selects less than 0.5, less weight is placed on the actual value for the present time period and greater weight is placed on the forecast for the present time period. If a forecaster wants to eliminate unwanted cyclical and irregular fluctuations then a small value of (closer to 0) is to be selected. In this situation, the overall long term tendencies of the series will be more apparent. If the objective is only forecasting then is assigned a high value (close to 1) and future short-term directions may be more accurately predicted.

The logic of using the word 'Exponential' for the smoothing technique is given below:

The formula for forecasting the value of the next time period () is again written as

$$F_{t+1} = \alpha . X_t + (1-\alpha) . F_t \qquad \text{.....(i)}$$

Next, the forecast for next period i.e., is expressed below in terms of the current values of actual and forecast namely, and the actual value of the variable at the next point of time

$$F_{t+2} = \alpha . X_{t+1} + (1-\alpha) . F_{t+1}$$

$$= \alpha . X_{t+1} + (1-\alpha).\{\alpha X_t + (1-\alpha)F_t\}$$

(Using equation (i))

$$= \alpha X_{t+1} + \alpha(1-\alpha)X_t + (1-\alpha)^2 F_t$$

Similarly, the forecast for the next i.e., is given by,

$$F_{t+3} = \alpha X_{t+2} + \alpha(1-\alpha)X_{t+1} + \alpha(1-\alpha)^2 X_t + (1-\alpha)^3 F_t$$

It may be mentioned that for ($\alpha < 1$), the coefficient of i.e., $\alpha(1-\alpha)$ is less than coefficient of X_{t+2} i.e., α. Further the coefficient of i.e., i.e., i $\alpha(1-\alpha)^2$ is less than the coefficient of X_{t+1} i.e., $\alpha(1-\alpha)$. Thus the coefficients or 'weights' of get reduced with time. This is known as the exponential property, and hence the word 'Exponential' is attached to the smoothing technique. Due to this property, the forecasts for any period of time yields maximum weight to the immediate past value and weights go on reducing as we go back in time.

X_{t+1}

Autoregressive model: Another approach to forecasting with annual time series data involves the fitting of an autoregressive model. Sometimes, the values of a time series data are highly correlated with the values that proceed and succeed them. In such situation an autoregressive model is applied for forecasting.

A first-order autocorrelation refers to the magnitude of the association between consecutive values while a second-order autocorrelation refers to the magnitude of the relationship between values which are two periods apart.

The first-order autoregressive model may be expressed as:

$$\hat{Y}_i = b_0 + b_1 Y_{i-1}$$

The second-order autoregressive model may be expressed as:

$$\hat{Y}_i = b_0 + b_1 Y_{i-1} + b_2 Y_{i-2}$$

It is observed from the above models that the first-order autoregressive model is similar to the simple linear regression, while the second-

order autoregressive model is similar to the multiple regression having two explanatory variables.

Similarly, we can have the p^{th} order autoregressive model which may be expressed as:

$$\hat{Y}_i = b_0 + b_1 Y_{i-1} + b_2 Y_{i-2} + ... + b_p Y_{i-p}$$

The p^{th} order autoregressive model deals with relationships between values up to periods apart.

A question may arise on the selection of the most appropriate model which is rather difficult. We must weigh the advantage of simplicity against the possibility of overlooking an important autocorrelation behavior that may exist in the data. On the other hand, we must be equally concerned with choosing a high order model estimation of several parameters, which may be unnecessary particularly when the total number of observations in the time series is not large. For example, if we select a second-order model, then there is a loss of first two observations. Each higher-order will involve a loss of one additional observation. In view of this, one should be careful in deciding the order of the model.

Box-Jenkins method: Another very difficult approach to forecasting is Box-Jenkins method. Here first of all, the analyst identifies a tentative model based on nature of the past data. This tentative model along with the data is entered in the computer. The Box-Jenkins programme then gives the values of the parameters included in the model. A diagnostic check is then performed to determine whether the model produce an adequate description of the data. If the model satisfies the analyst in this respect, then it is used to forecast. In case the model is not satisfactory, then the computer points out diagnostic information, which is then used by the analyst in revising the model. This process is continued until the analyst obtains an appropriate model, which is used for making forecasts.

The limitation of the method is that it requires at least 45 observations in the time series.

15.6 THEORIES OF BUSINESS FORECASTING

Several theories have been developed out of researches conducted by individuals or institutions on business forecasting. Amongst them some of the important theories are:

(1) Sequence or Time-lag Theory, (2) Action and Reaction Theory, (3) Economic Rhythm Theory, (4) Specific Historical Analogy, (5) Cross-Section analysis.

(1) Sequence or Time-lag Theory: It is one of the most important theories of business forecasting. The theory is based upon the conception that most of the business data have lead and lag relationship. Changes in business are successive and not simultaneous. There is a time lag between the different movements. For example, the expenditure on advertisement may not immediately lead to increase in sales. Similarly, when excise duties are increased by government then they will result in increase in prices which leads to higher demand for wages.

The reliability of the forecast depends in this case upon the accuracy with which time-lag is estimated. While forecasting, due allowance should be provided for the effects of the current economic conditions and other special factors.

(2) Action and Reaction Theory: This theory is based under two assumptions: (i) every action has a reaction, (ii) the magnitude of the original action influences the reaction. For example, when the price of wheat goes up above a certain level at a particular point of time, there is possibility that after some time, it will go down below the normal level. Thus, in the light of this theory a certain level of business activity is normal—sub-normal or abnormal conditions cannot remain fixed for ever— there is bound to be reaction to them. Thus we can conclude that a business cycle consists of four phases:

(a) Prosperity, (b) Decline, (c) Depression and (d) Improvement.

Since the theory regards a certain level of business activity as normal, the normal level must be very carefully estimated at the time of making forecasts. However, in practice, it is really difficult to define what constitutes 'Normality'.

(3) Economic Rhythm Theory: This theory is based on the assumption that "The History repeats itself". The exponents of this theory believe that cycles of nearly the same intensity and duration tend to recur. Thus the available historical data needs to be analysed into their component parts and different types of fluctuations influencing them have to be segregated. While projecting a series, its measurable components namely, secular trend, seasonal variations, and cyclical fluctuations may be projected independently for a given time period and then combine these projected values into a single forecast by the process of multiplication. The forecasts based on this method are applicable only for the individual firm for which the data are analysed .

This theory has some drawbacks. First business cycles are not strictly periodic and as such statistical extrapolation of cycles is not very satisfactory. Secondly, an error may be committed by an increase in either amplitude or duration of the cycles. Moreover, no subjective facts are taken into consideration in this theory.

(4) Specific Historical Analogy: This theory is based on a more realistic assumption, i.e., that all business cycles are not uniform in amplitude or duration and as such the use of history is made not by projecting any fancied economic rhythm into the future, but by selecting some specific previous situation which has many of the earmarks of the present and concluding that what happened in that previous situation will happen in the present one also.

What is done is that a time series relating to the data in question is thoroughly scrutinized and from it such period is selected in which conditions were similar to those prevailing at the time of making the forecasts. The course which events took in the past under similar circumstances is then studied which gives an idea of the likely course which the phenomenon in question would follow. For example, after World War II many persons forecast a depression because World War I had been followed by a depression.

(5) Cross-Section analysis: This theory is based on the knowledge and interpretation of current forces rather than projection of past trends. According to this theory the conditions which occurred in the past cannot be a guide for forecasting. Under this theory, factors like technological

advancement, government policies, supply-demand relationship, quantitative and qualitative changes in a population, availability of input and businessman's expectations which are concerned with the present economic activity are thoroughly analysed and an attempt is made to estimate the composite effect of all the variables. This method takes into account the views of the managerial staff, economists, consumers etc. prior to forecasting. Several organizations regularly conduct surveys in respect of executive opinions concerning future trends of general business conditions and selected series of business data. This method, however, is difficult in practice. To analyse each variable separately and to estimate the composite effect of all the variables for a forecast is an upheaval task.

15.7 UTILITY OF BUSINESS FORECASTING

The objective of business forecasting is to make analysis mainly based on definite statistical data to enable an executive to take advantage of future conditions to a great extent. Trade cycle is a characteristic of capitalist economy which is responsible for bringing depression and prosperity periods in industry, trade, agriculture, etc. Trade cycles are responsible for creating unemployment, discouraging capital formation, inducing speculation. Trade cycles increase the risk of business. Business forecasting reduces the risks associated with business cycles. Business forecasting helps knowing in advance whether a period of depression or prosperity is expected in near future. If it is known in advance that depression will occur in near future then precautionary measures can be taken to minimize the harmful effects of depression. Similarly, the businessmen can prepare themselves to take the maximum advantage of prosperity if it is expected beforehand.

A businessman has to forecast the future level of price and the extent of demand. No businessman can afford to base his decisions on a guess work. Forecasting reduces the areas of uncertainty that surround management decision making as far as costs, profits, sales, production etc. are concerned.

15.8 RELIABILITY OF BUSINESS FORECAST

Forecasts made from different forecasting techniques differ among themselves. Hence, forecast based on any one method should be checked and compared with forecasts based on other approaches. Because of various unforeseen causes future cannot be forecasted in the manner expected. The reliability of a forecast depends on the following factors:

(i) Range of forecast: The longer the range of the forecast, the lesser the possibility of the forecast being accurate.

(ii) Stability of the period: In general, if business stability prevails during the time period over which forecast is made then forecast is likely to be more accurate and reliable than the one made for a period characterized by uncertainties.

(iii) Nature of the product: Forecasts for all types of goods are not equally accurate and dependable. The demand pattern for non-durable industrial products is more stable than that for durable goods. Consequently forecasts made for non-durable goods industries are likely to be more reliable.



CHECK YOUR PROGRESS

Q 2: Write three different methods Quantitative methods of time series forecasting.

Q 3: Mention three theories of business forecasting.



15.9 LET US SUM UP

Forecasting is a technique that can aid in future planning. Time series is an important tool for prediction.

In general, there are two common ways of forecasting. These are: qualitative forecasting and quantitative forecasting techniques. personal opinion , panel consensus, delphi method, market research, historical comparison are some of the important methods of qualitative forecasting.

Quantitative method of forecasting can be broadly classified into two categories: time series analysis and causal analysis. Again, time series analysis can be of various types: free hand method, Smoothing methods, trend projection methods, exponential smoothing methods, autoregressive model and Box-Jenkins model.

On the other hand, various causal methods that we have discussed are: leading indicators, regression analysis, input-output analysis and econometric model etc. Again several theories have been developed out of researches conducted by individuals or institutions on business forecasting.

In this unit, we have learnt some important theories namely: (1) Sequence or Time-lag Theory, (2) Action and Reaction Theory, (3) Economic Rhythm Theory, (4) Specific Historical Analogy, (5) Cross-Section analysis.



15.10 FURTHER READINGS

1) Srivastava, T.N., Rego, S. (2008). Statistics for Management. New Delhi. Tata McGraw Hill Education Private Limited.
2) Sharma, J.K. (2007). Business Statistics. New Delhi. Pearson Education Ltd.
3) Hazarika, P.L. (2016). Essential Statistics For Economics And Business Studies. New Delhi. Akansha Publishing House.
4) Bajpai, N. (2014). Business Statistics. New Delhi. Pearson Education Ltd.



15.11 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q No 1: (i) False, (ii) True, (iii) False, (iv) True.

Ans. to Q No 2: Three different methods Quantitative methods of time series forecasting are: free hand method, smoothing method, Exponential smoothing method.

Ans. to Q No 3: Three theories of business forecasting are: (1) Sequence or Time-lag Theory, (2) Action and Reaction Theory, (3) Economic Rhythm Theory.



15.12 MODEL QUESTIONS

1. Define ‘business forecasting’? Write down the steps involved in business forecasting.
2. Distinguish among prediction, projection and forecasting.
3. Discuss the Quantitative method of time series forecasting method.
4. Write a note on Cross-section Analysis theory of business forecasting.
5. Discuss the utility of forecasting.

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References

- An introduction to commercial Mathematics and statistics - Prof. Ajanta Mazumder, Dr. (Mrs) Runjan Phookun. S. Chand and Company Lt. R New Delhi.
- Business Statistics - Dr. Nityananda Barman, Assam Book Depot.
- Elementary statistics, H.C. Saxena, S.Chand & Company Ltd., 2002.
- Basic Statistics, B.L. Agarwal, New Age International Publishers, 2009
- Biostatistics, P.N. Arora and Dr. P.K. Maihan,Himalaya Publishing House, 2010.
- Fundamental of Statistics volume -1, A.M. Gun, M.K. Gupta, V.K. Kapoor, Sultan chand & Sons, 2009.