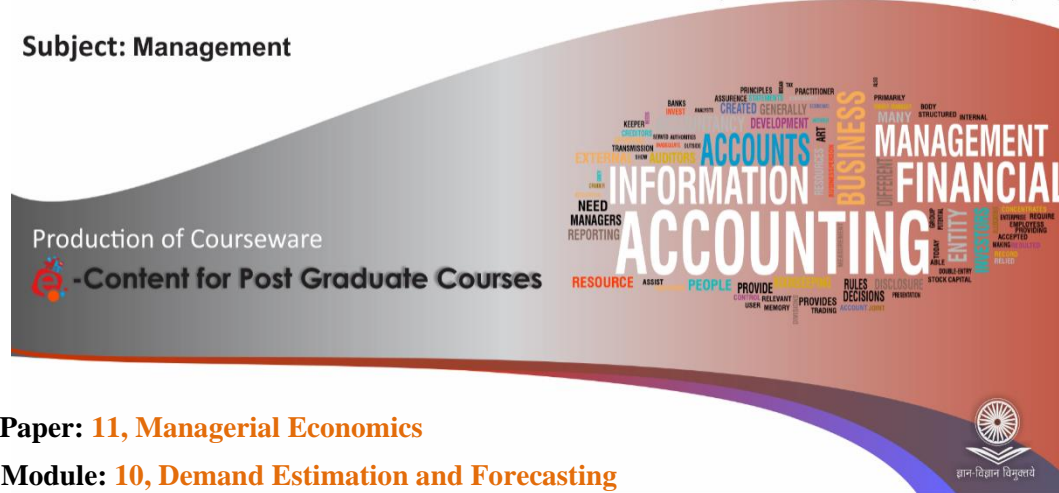


Subject: Management



Paper: 11, Managerial Economics

Module: 10, Demand Estimation and Forecasting



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Items	Description of Module
Subject Name	Management
Paper Name	Managerial Economics
Module Title	Demand Estimation and Forecasting
Module Id	Module No.-10
Pre- Requisites	Basic understanding of Demands, Demand Function, Business Statistics
Objectives	To enable learners to understand concept of meaning, significance, level and process of Demand Estimation and Forecasting. Various methods that can be adopted in forecasting the most likely future demand of a product or service.
Keywords	Demand Estimation, Demand Forecasting, Trend Projection, Sample Survey, Collective Opinion and Delphi Method

QUADRANT-I

Module 10: Demand Estimation and Demand Forecasting	
1.	Learning Outcome
2.	Demand Estimation and Demand Forecasting
3.	Features of Demand Forecasting
4.	Why Demand Forecasting
5.	Demand Forecasting Process
6.	Determinants of Demand Forecasting
7.	Methods of Demand Forecasting
8.	Summary

1. Learning Outcome:

After completing this module the learner will be able to:

- Understand the various concepts of Demand Estimation and Demand Forecasting.
- Various methods that can be used for Estimation and Forecasting of Demand of a product.

1.0 Introduction

Estimating the future demand for products, either existing or new is a significant aspect of demand analysis. A manager needs to have information about likely future demand of its product to enable the firm to produce the required quantities of a product at the right time and arrange well in advance for the various inputs (like labor, raw material, machines etc.) as well as to pursue optimal pricing strategies. Demand estimation and forecasting means predicting future demand for the product under given conditions and helped the manager in making decisions with regard to production, sales, investment, expansion, employment of manpower etc., both in the short run as well as in the long run. In this unit attempt has been made to discuss the concept of demand.

1.1 Demand Estimation and Demand Forecasting

In **Demand estimating** manager attempts to quantify the links or relationship between the level of demand and the variables which are determinants to it and is generally used in designing pricing strategy of the firm. In demand estimation manager analyse the impact of future change in price on the quantity demanded. Firm can charge a price that the market will ready to wear to sell its product. Over estimation of demand may lead to an excessive price and lost sales whereas under estimates may lead to setting of low price resulting in reduced profits. In demand estimation data is collected for short period usually a year or less and analysed in relation to various variables to know the impact of each variables mainly the price on the demand behaviour of the customers. It is for a short period.

In **Demand forecasting** mangers forecast the most likely future demand of a product so that he can make necessary arrangement for the various factor of production i.e labor, raw material, machines, money etc. Demand forecasting tells the expected level of demand at some future date on the basis of past and present information. It helped in production planning, new product development, capacity enhancement or new schemes etc. Demand forecasting is generally used for short term estimation as well as long term forecasting.

Thus, demand estimation and forecasting means when, how, where, by whom and how much will be the demand for a product or service in near future. The process of demand estimation/forecasting can be broken into two parts i.e. analysis of the past conditions and analysis of current conditions with reference to a probable future trend. It helps in estimating the most likely demand of a good or service under given business conditions.

1.2 Features of Demand Forecasting

The main features of the demand forecasting are;

1. Demand Forecasting is a process to investigate and measure the forces that determine sales for existing and new products.
2. It is an estimation of most likely future demand for a product under given business conditions.
3. It is basically an educated and well thought out guesswork in terms of specific quantities
4. Demand Forecasting is done in an uncertain business environment.
5. Demand Forecasting is done for a specific period of time (i.e. the sufficient time required to take a decision and put it into action).
6. It is based on historical and present information and data.
7. It tells us only the approximate expected future demand for a product based on certain assumptions and cannot be 100% precise.

1.3 Why Demand Forecasting

As business is done in an uncertain and risky business environment and managers have to take decisions under uncertain and risky conditions. Demand forecasting help the managers in forecasting the most likely future sale of their products, accordingly manager plan their production, arrange various inputs like labour, material, capital and techniques etc. prepare future budgets and formulate various marketing and supply chain strategies or policies to achieve the budgeted targets. This will help up to certain extent in managing the future risks caused due to varied business conditions as well as in optimum utilization of available business resources.

In short run demand forecasting helps in determining the optimum level of output at various periods to avoid under or over production. It helps in better inventory management, of buying inputs and control its inventory level which cuts down overall cost of production. A balanced pricing policy can be formulated to suit short run and seasonal variations in demand. It helps the company to set realistic sales targets for each individual salesman and for the firm as a whole. It helps in advance financial planning required for achieving the budgeted production and sales and to raise the required funds well in advance at reasonable cost. It also helps the firm in evolving a suitable labour policy and to determine the exact number of workers to be employed in the short run.

In long run, the demand for a product of a firm is forecasted generally for a period of 4 to 6 or 10 years and it helped in taking capital expenditure decisions relating business expansion, capacity enhancement or setting up a new production unit, modification and up gradation of technology as

it involves large scale production as well as long gestation period. Accordingly firms can plan long run financial requirements, capital structure and investment programs by floating shares, bond and debentures in the open domestic as well as foreign capital markets at reasonable costs.

Trained and skilled labour and business managers may be needed in long run thus demand forecasting also helps in preparing long term man power planning for imparting training to the existing staff and recruit skilled and efficient labour force and executives for its long run growth.

Demand forecasting can play a significant role in controlling over total costs and revenues of a company and determining the value and volume of business, estimating future profits of the firm and regulating business effectively to meet the challenges of the market. The speed at which the company can grow, stability in firm's performance and interdependence of different industries can be adjudged with the help of demand forecasting.

1.4 Demand Forecasting Process

To have efficient, accurate and reliable demand forecasting a manager must take the following steps;

1. Specifying the objective of Demand Forecasting

While forecasting demand one may have different objectives like quantity and composition of demand, price to be quoted, production planning, inventory planning or capital budgeting, short or long term demand, firm's market share etc. Thus, the objective for which demand is to be estimated must be clearly defined at first stage.

2. Determining the nature of goods

The next step in demand forecasting is identification of type of goods as different type of goods such as consumer goods, capital goods, industrial goods, durable and nondurable goods; perishable or seasonal goods have different type of demand pattern. This will help in applying write approach to demand estimation process.

3. Determining the time perspective

Depending upon the nature of goods and firm's objective, the demand can be forecasted for short term as well as for long term. In short term many of the determinants of demand may remain constant or not to be change significantly but in long run these determinants may change significantly. Thus, while forecasting demand one has to define the time span for the forecast. The time period is normally divided into short run up to 3 to 6 months, medium term up to 2 or 3 years and long term beyond 3 or 5 years.

4. Determining the level of forecasting;

Demand forecasting may be undertaken at micro or firm level, industry level, macro level or international level. It may be done for product line forecasting, general or specific purpose or for established or new products. There are different factors that influence the demand at different level of forecasting. Thus one must specify the level of forecasting beforehand.

5. Selection of proper method or technique of forecasting

Economists have developed different methods or techniques for forecasting. However, these methods are not suitable for all type of demand forecasting due to the type or objectives of forecasting, data requirement, availability of data and time frame. One has to select an appropriate method for demand forecasting to achieve stated objectives. It also depends upon the purpose, knowledge and experience of the forecaster.

6. Data Collection and modification

Depending upon the objective and method of forecasting next step in demand forecasting is to collect the required data. There are different method of collection of primary data like observation, interview, survey or questionnaire, focus group discussion methods etc. Data can also be collected from various secondary sources but, this data required modification as it may not be available in the required mode.

7. Data analysis and estimations

Once the data has been collected and method of data analysis has been finalised the next step in demand forecasting is analysis of data and interpretations of results. The Efficiency of estimation depends upon the efficiency with which it has been analysed and interpretive. Sometimes, estimation required support from background factors which has not been used in estimation process. One must frequently revised the estimates depending upon the changed business conditions.

1.5 Determinants of Demand Forecasting

Different type of goods has different determinants. Broadly goods can be classified as Capital goods, Durable and Non durable consumer goods and factors that determine the demand of these goods are discussed below;

Capital Goods i.e. factory building, machinery, equipment, tools etc., have derived demand as demand of these goods depend upon demand of consumer goods industry growth rate, level of capacity utilization, wage rate and size of the market. The demand for these goods comprises of replacement demand and new demand and one should consider Growth potential of the Industry, per unit consumption norms and velocity of their use in estimating the demand of capital goods.

Demand for Consumer Durable goods i.e. residential building, car, refrigerators, furniture, readymade garments, TV, Computer etc. depend upon social status, prestige, level of money income, obsolescence rate, maintenance costs, availability of road, petrol, supply of electricity, family size, age-sex distribution and credit facilities. One should consider the trends of these factors while estimating the demand of consumer durables.

Non durable consumer goods are consumed once only i. e. milk, food, vegetables, fruits, medicines etc. and their demand is affected by disposable income or purchasing power of the household,

price elasticity (own price or price of substitute and complimentary goods) and demographic variables.

1.6 Methods of Demand Forecasting

Demand forecasting methods can be broadly classified into two categories i.e. 1.Survey methods and 2 Statistical methods. Different methods of demand estimation have been presented below;

1. Survey Methods

Survey methods are generally used in short run and estimating the demand for new products. In survey methods information about the future purchase plans of potential buyers are collected through direct interview of potential consumers or experts opinions. The different approaches under survey methods are

A. Consumers' Survey method

Under this method, efforts are made to collect the relevant information directly from the consumers with regard to their future purchase plans. It is one of the oldest methods of demand forecasting. It is also called as "Opinion surveys". Under this method, the intentions of the consumer are recorded by trained, reliable and experienced investigators, through personal interviews, e-mail or post surveys and telephonic interviews. A well structure questionnaire is designed with regards to preferences and willingness about particular products, reaction to price change or a change in other variables such as quality, sales promotion, advertisement, channel of distributions, packing, color etc. and consumers are asked to reveal their 'future purchase plans with respect to specific items. There are two type of consumer survey, namely: (i) Complete enumeration survey and (ii) Sample survey.

- i) Under **Complete Enumeration Method** all potential customers are contacted in the market are surveyed. Since all potential consumers are interviewed in this method, there is a greater degree of accuracy, is more useful in introducing new products, for bulky or costly products or products having few consumers. This method is expensive, time consuming and is not suitable in case of large scattered consumers.
- ii) In Sample survey method different cross sections of customers that make up the bulk of the market are carefully chosen. Only such selected consumers from the relevant market through some sampling method are interviewed or surveyed and average demand is calculated on the basis of the consumers interviewed. This average demand is multiplied by the total number of consumers to find the aggregate demand of the product. As compared to Complete Enumeration this method is less costly and time consuming and more information can be collected to make forecasting more reliable.

B. Collective Opinion Method (Sale Force Opinion or Reaction Survey Method)

Another variant of the survey method is Collective Opinion Method also known as “Sales – force polling” or “Opinion poll method” or “Reaction Survey Method”. In this method, instead of customers, salesmen, marketing manager, production manager, professional experts and the market consultants and others are asked to express their considered opinions about the volume of sales expected in the future. It is very simple method and does not involve the use of any statistical techniques and take advantage of collective wisdom of salesmen and managers.

C. Experts Opinion Method or Delphi Method

It is a variant of opinion poll and survey method of demand forecasting. Under this method, outside experts are appointed. They are supplied with all kinds of information, statistical data and posed questions relating to an underlying forecasting problem. The management requests the experts to express their considered opinions and views about the expected future sales of the company. Then, an independent party seeks to form a consensus forecast by providing feedback to the various experts in a manner that prevents identification of individual positions. The process goes on until some sort of unanimity is arrived at among all the experts.

This method was originally developed at Rand Corporation in the late 1940's by Olaf Helmer, Dalkey and Gordon and was used to predict future technological changes and has been proved more useful and popular in forecasting non– economic rather than economical variables. This method is best suited in case where intractable changes are occurring. The method is also less time consuming and cheap but the effectiveness of this method is sensitive to the expertise of the independent party chosen.

D. Market Studies and Experiments

Another way of collecting present and future market information of a product is to conduct market and experimental study to investigate consumer behaviour under given environment. Under this method, companies first select some markets or cities having similar features i.e population, income culture, social or religious factors etc., then carry out the market experiments by changing prices, quality, packing, advertisement expenditure or other controllable demand determinants under the assumption that other things remain constant.

2. Statistical Methods

In statistical methods historical or cross sectional data are used to forecast the future probable demand of a particular product by applying statistical models and mathematical, equations. These methods are considered to be superior techniques of demand estimation. The important statistical methods used in demand estimation are;

A. Trend Projection Method

In trend analysis past data about the dependent and independent variables is used to project the sales in the coming years assuming that factors responsible for the past trends will continue to behave in similar manner in future also as they did in the past in determining the magnitude and trend of sales of a product. In this method a data set of past sales are taken at specified time, generally at equal intervals to depict the historical pattern under normal conditions. On the basis of derived historical pattern, the future sales of a company are project. The main aspect of this method lies in the use of time series and changes in time series occur due to following reasons:-

1. **Secular Trend:** Secular Trend also known as long term trend indicate the general tendency and direction in which graph of a time series move in relatively over a long period of time. This can be upward or downward trend, depending upon the behaviour.
2. **Seasonal Trends:** This trend reflects the changes in sales a company due to change in various seasons or climates or due to festival season or sales clearance season etc. These changes are repetitive in nature and related to twelve months period.
3. **Cyclical Trends:** These trends reflect the change in the demand for a product during diverse phases of a business cycle i.e growth, boom, maturity, depression, revival, etc.
4. **Random or irregular trends:** These changes arise randomly or irregularly due to unforeseen events such as famines, earth quakes, floods, natural calamities, strikes, elections and crises. These changes take place only in the short run and have their own impact on the sales of a firm. These trends cannot be predicted.

In trend projection method real problem is to separate and measure each of these trends separately. In order to estimate the future demand of the product the impact of seasonal, cyclical and irregular trends are eliminated from the data and only secular trend is used.

The trend in the time series can be eliminated by using any of the following method;

- I. Graphical Method,
- II. The method of semi average,
- III. Moving average method and
- IV. The least square method

I. Graphical Method

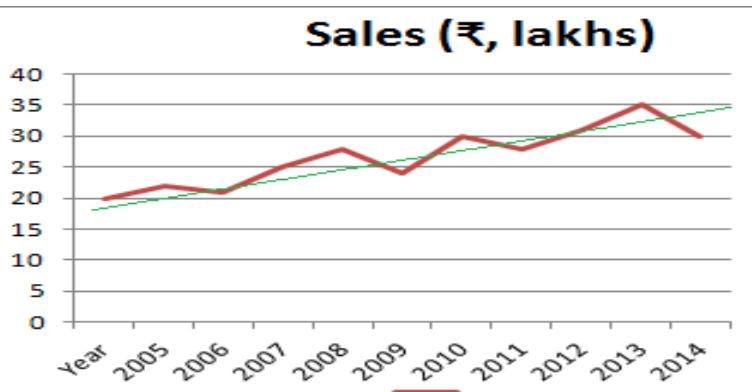
It is simplest method of trend projection. In this method periodical sales data is plotted on a graph paper and a line is drawn through the plotted points. Then a free hand line is drawn passing through as many points as possible. The direction of this free hand line or curve will reflect the

general trends whereas the actual trend line will show the seasonal, cyclical and irregular trend. This has been illustrated with the help of table-1 and figure-1.

Table-1
Sales data of XYZ Company

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sales (₹, lakhs)	20	22	21	25	28	24	30	28	31	35	30

Figure-1
Trend Projection Sales of XYZ Company



II. The Semi average method

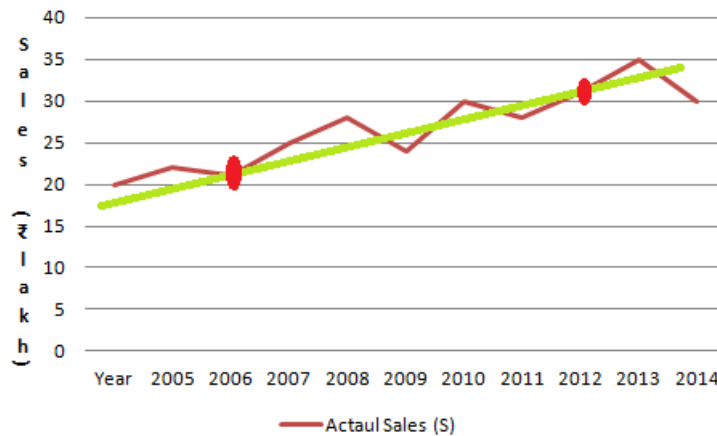
In this method, first of all time series data of sale is divided into two equal parts and thereafter, separate average sale is calculated for each half. The two values of averages are plotted on graph corresponding to the time period. A straight line is then drawn by joining these two points. This line become the trend line and is used to forecast future sale. It has been explained with following example;

In the table -3, we have given time series sales data for 11 years (odd years) so in order to divide the series into two equal parts the sale of the middle year (i.e 2010) has been eliminated for fitting the trend. The average sale of first half i.e. 2005 to 2009 is ₹23.2 lakhs for the next half it is ₹30.8 lakhs. These two points have been plotted and joined with straight line to find the trend of the sale.

Table-2
Sales data of XYZ Company (₹, lakhs)

Year	Sales (S)	Average sale
2005	20	First half $(20+22+21+25+28)/5$ $=23.2$
2006	22	
2007	21	
2008	25	
2009	28	
2010	24	---
2011	30	$(30+28+31+35+30)/5$ $=30.8$
2012	28	
2013	31	
2014	35	
2015	30	

Figure-2
Trend Projection Sales of XYZ Company



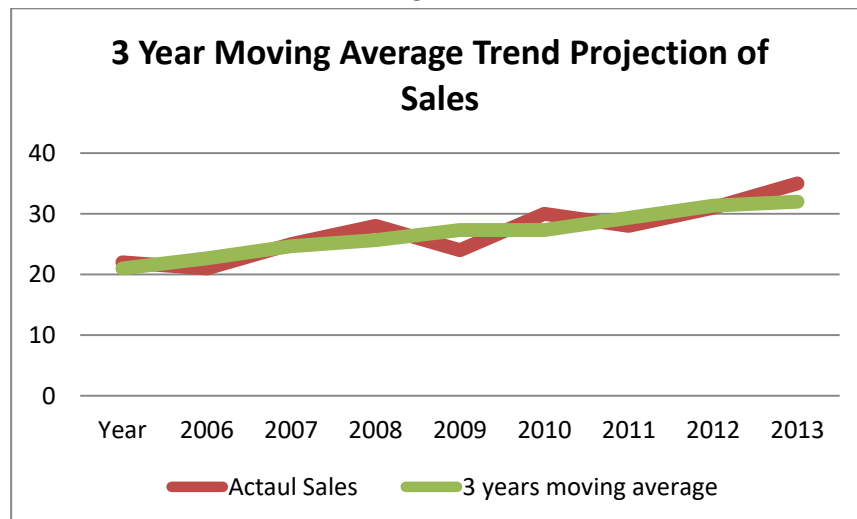
III. Moving average Method

Moving average method is very widely used in practice. Under this method, moving average is calculated. One has to decide what moving year average – 3year or 5year or 7year should be taken up and it depends upon the periodicity of the data. It is determined by plotting the data on the graph paper and noticing the average time interval of successive peaks or trough. After deciding the moving year average, moving average of the given sales data is calculated and these averages are plotted on the graph paper to fit the trend. It has been explained with help of following example;

Table-3
Sales data of XYZ Company (₹, lakhs)

Year	Sales (S)	3 years moving average
2005	20	-
2006	22	$(20+22+21)/3 = 21.00$
2007	21	$(22+21+25)/3 = 22.67$
2008	25	$(21+25+28)/3 = 24.67$
2009	28	$(25+28+24)/3 = 25.67$
2010	24	$(28+24+30)/3 = 27.33$
2011	30	$(24+30+28)/3 = 27.33$
2012	28	$(30+28+31)/3 = 29.33$
2013	31	$(28+31+35)/3 = 31.33$
2014	35	$(31+35+30)/3 = 32.00$
2015	30	-

Figure-3



IV. The least square method

Fitting trend equation or popularly known as least square method is a scientific, formal and popular method of projecting the trend line. In this method a trend line is fitted with the help of straight line regression equation i.e

$$S = a + bT$$

where S = annual sales, T = Time, a and b are constants. The coefficients a and b are calculated by solving following two equations;

i) $\Sigma S = Na + \Sigma T$

ii) $\Sigma ST = a \Sigma T + b \Sigma T^2$

Where,

ΣS = Sum of the original sales of N years (S)

N= Number of years

ΣT = Sum of deviations of the years taken from a central period

ΣT^2 = Sum of the squared deviations of T values

ΣST = Sum of the product of the deviation and corresponding sale

Taking the data given in table-4 given below, the regression equation i) and ii) are given below;

i) $294 = 11a + 0$

ii) $148 = a*0 + 110b$ by solving these two equation we get;

$S = 28.73 + 1.345T$

With the help of this equation, it is quite easy to forecast the sale for any future year i.e for the years 2018, 2020 or 2022 by taking T as the deviation from the base year (2010) and t in this case will be 8th, 10th, and 12th year. It can be calculates as follow;

2018 $S_{2018} = 28.73 + 1.345(8) = ₹39.50$ lakhs

2020 $S_{2020} = 28.73 + 1.345(10) = ₹42.18$ lakhs

2022 $S_{2022} = 28.73 + 1.345(12) = ₹44.87$ lakhs

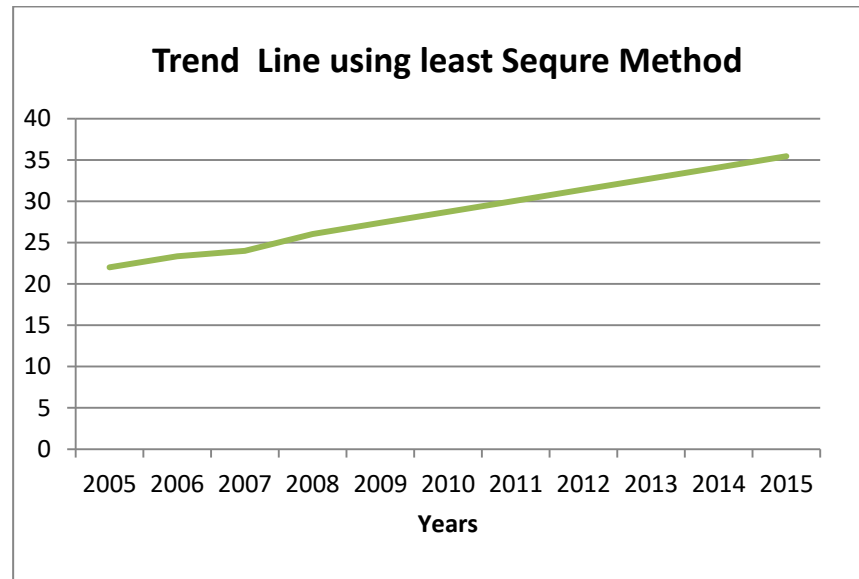
In order to fit the trend line the computed sales value (S_c) are to be plotted on the graph paper as given in the figure-4

Table-4
Sales data of XYZ Company (₹, lakhs)

Year	Sales (S)	T	T ²	ST	S _c (Computed Sales value)
2005	20	-5	25	-100	$28.73 + 1.345(-5) = 22.01$
2006	22	-4	16	-88	$28.73 + 1.345(-4) = 23.35$
2007	21	-3	09	-63	$28.73 + 1.345(-3) = 24.70$
2008	25	-2	04	-50	$28.73 + 1.345(-2) = 26.04$
2009	28	-1	01	-28	$28.73 + 1.345(-1) = 27.39$
2010	24	0	00	0	$28.73 + 1.345(0) = 28.73$
2011	30	1	01	30	$28.73 + 1.345(1) = 30.08$
2012	28	2	04	56	$28.73 + 1.345(2) = 31.42$
2013	31	3	09	93	$28.73 + 1.345(3) = 32.77$
2014	35	4	16	140	$28.73 + 1.345(4) = 34.11$
2015	30	5	25	150	$28.73 + 1.345(5) = 35.46$
	$\Sigma S = 294$	$\Sigma T = 0$	$\Sigma T^2 = 110$	$\Sigma ST = 148$	

The least square method is very popular method used in demand forecasting because it is very easy and less expensive method.

Figure-4
Trend Projection Sales of XYZ Company



Thus, Trend projection method requires simple working knowledge of statistics, quite inexpensive and yields fairly reliable estimates of future course of demand.

B. Barometric or Economic Indicators Method

Economic indicators as a method of demand forecasting are developed recently. In this method forecasting follows the method adopted by meteorologists in weather forecasting and a few economic indicators become the basis for forecasting the sales of a company. An economic indicator indicates change in the magnitude of an economic variable. It gives the signal about the direction of change in an economic variable.

Demand Forecasting For a New Product

Demand forecasting in case of new products is not easy as in case of established products. In case new product the firms will not have any past experience or past data for this purpose. It requires an intensive research of the economic and competitive features of the product should be made to make efficient forecasts.

Professor Joel Dean, however, has suggested a few guidelines to make forecasting of demand for new products.

a. Evolutionary approach

The demand for the new product may be considered as an outgrowth of an existing product. For e.g., Demand for new **Tata Indica**, which is a modified version of Old Indica can most effectively be

projected based on the sales of the old Indica, the demand for new Pulsor can be forecasted based on the sales of the old Pulsor. Thus when a new product is evolved from the old product, the demand conditions of the old product can be taken as a basis for forecasting the demand for the new product.

b. Substitute approach

If the new product developed serves as substitute for the existing product, the demand for the new product may be worked out on the basis of a 'market share'. The growths of demand for all the products have to be worked out on the basis of intelligent forecasts for independent variables that influence the demand for the substitutes. After that, a portion of the market can be sliced out for the new product. For e.g., A moped as a substitute for a scooter, a cell phone as a substitute for a land line. In some cases price plays an important role in shaping future demand for the product.

c. **Opinion Poll approach**

Under this approach the potential buyers are directly contacted, or through the use of samples of the new product and their responses are found out. These are finally blown up to forecast the demand for the new product.

d. **Sales experience approach**

Offer the new product for sale in a sample market; say supermarkets or big bazaars in big cities, which are also big marketing centers. The product may be offered for sale through one super market and the estimate of sales obtained may be 'blown up' to arrive at estimated demand for the product.

e. **Growth Curve approach**

According to this, the rate of growth and the ultimate level of demand for the new product are estimated on the basis of the pattern of growth of established products. For e.g., An Automobile Co., while introducing a new version of a car will study the level of demand for the existing car.

f. **Vicarious approach**

A firm will survey consumers' reactions to a new product indirectly through getting in touch with some specialized and informed dealers who have good knowledge about the market, about the different varieties of the product already available in the market, the consumers' preferences etc. This helps in making a more efficient estimation of future demand.

These methods are not mutually exclusive. The management can use a combination of several of them supplement and cross check each other.

Executive Summary

An important feature of demand analysis from the manager point of view is demand forecasting for established as well as for new products. Demand forecasting is the process to estimate most likely future demand of product under given conditions. These forecasts help the manager in the short run in production planning, formulating optimum purchase policy, pricing policy, inventory policy, short run financial requirements, reducing the dependence on chances, evolving suitable labor policy etc. In the long run demand forecasting help in taking capital expenditure decisions relating business expansion, capacity enhancement or setting up a new production unit, modification and up gradation of technology, planning long run financial requirements, capital structure and investment programs, man power planning etc.

Demand forecasts are done at micro level, industry level and macro level. A good demand forecasting method must be accurate, simple, economical, and achievable and permit changes in the demand relationships on an up-to-date basis.

Broadly there are two methods of demand forecasting i.e. i), Survey Methods or primary method and ii) Statistical Methods based on secondary data. Under the survey methods manager may apply Consumers' Survey either completes enumeration or sample survey, Collective Opinion Method (Sales Force Opinion or Reaction Survey Method), Experts Opinion Method or Delphi Method and Market Studies and Experiments methods. Demand forecasting is done either by conducting a survey of consumers through questionnaire or by interviewing directly either all the prospective consumers residing in an area or by forming a panel of consumers i.e. sample survey. Under the collective opinion method forecasts are made on the basis of the information gathered from the sales men and market experts regarding the future demand for the product. In case of expert opinion method assistance of external experts is suited to forecast future demand.

Statistical methods like trend projection and Barometric or Economic Indicators Method indicators are normally applied in making long term projection of demand. Under the trend projection method, historical data of sales is used to fit the trend either through Graphical Method, The least square method, the method of semi average and Moving average method. Under Barometric Method, changes in the extent of the economic indicators are considered to measure the change in consumer buying behaviour by applying sophisticated statistical techniques.

In case newly developed product, demand forecasting become a tedious job due to non availability of past sales data hence evolutionary approach or substitute approach or Opinion Poll approach or Sales experience approach or Growth Curve approach or vicarious approach serve the purpose individually or collectively.

Thus a manager has different methods that can be applied while estimating the most likely future demand of a product or service depending upon the nature and objective of forecasting. Accurate and efficient demand forecasting is of great importance in managing business affairs, optimum utilization of

available business resources effectively as well managing the future risks caused due to varied business conditions.

Management

Managerial Economics

Demand Estimation and Forecasting