UNIT 3 MARKET AND DEMAND ANALYSIS

Objectives

Study of this unit, will enable you to understand:

- importance of market and demand analysis in project management
- aligning all capital expenditure to serve and satisfy the customers' needs
- different methods of demand analysis, their comparative advantages and disadvantages
- increasing emphasis on accuracy in forecasting demands in the backdrop of fierce competition and changing customer preferences
- impact of errors in forecast and relationship between operating costs of forecasts and their accuracy.

Structure

3.1 Introduction
3.2 Forecast versus Prediction
3.3 Time Horizon of Demand Forecasting
3.4 Need for Demand Forecasting
3.5 Uncertainties in Demand Forecasting
3.6 Levels of Demand Forecasting
3.7 Determinants of Demand for capital Goods
3.8 Criteria for a Good Forecasting Method
3.9 Methods of Forecasting Demands
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3.12 Self-Assessment Exercises
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3.1 INTRODUCTION

Emerging competition in market place is propelling managements to hear the voice of their customers. To survive in the market, management have to be forward-looking and carry out market and demand analyses of products and develop strategic business policies. However when it comes to working out methods and methodologies of demand forecasting, it presents a strange dilemma. Demand Burke had said that, "You can never plan the future by the past", whereas Patrick Henry opines that, "I know of no way of judging the future but by the past".

As an essential part of project formulation and appraisal, market and demand analysis is vital so that capacity and facility location can be planned and implemented in line with the market requirements. A major error in demand forecast can throw painstaking capita expenditure on plant capacity and other hardware facility totally out of gear. Such decisions are not easily reversible. Metal Box of India, a premier company in the field of metal, plastic and cardboard packaging became kick owing to ill-timed diversification into manufacture of bearings.

3.2 FORECAST VERSUS PREDICTION

Forecast is an estimate of future events and trends and is arrived at by systematically combining past data and projecting it forward in a predetermined manner.

Prediction is an estimate of future events and trends in a subjective manner without
taking into account the past data. The subjective considerations may not emerge from any predetermined analysis or approach.

3.3 TIME HORIZON OF DEMAND FORECASTING

Market and demand analysis of various types are undertaken to meet specific requirements of planning and decision making. For example, short-term decisions in production planning, distribution etc and selling individual products would require short-term forecast, upto one year time horizon, which must he fairly accurate for specific product items. For long-term planning, time horizon being four to five years, information required from demand analysis would be for broad product groups for facilitating choice of technology, machine tools and other hardwares and their location. Various time horizons and corresponding information requirements are as below:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Types of Decisions</th>
<th>Time Horizon</th>
<th>Types of Data/Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Short-term planning decisions</td>
<td>One Year</td>
<td>Specific items and their demand</td>
</tr>
<tr>
<td>ii</td>
<td>Medium-term planning decisions</td>
<td>Two to Three Year</td>
<td>Aggregate demand of technology and site selection</td>
</tr>
<tr>
<td>iii</td>
<td>Long-term and site selection</td>
<td>Four to Five Year</td>
<td>Broad data on technology</td>
</tr>
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</table>

Longer-term forecasting is also undertaken to determine trends in technology development so as to choose the technology for backing up and funding its research and development.

3.4 NEED FOR DEMAND FORECASTING

All business planning starts with forecasting Capital investment, like procurement of raw materials and production planning, has to relate to demand forecasting. High volume high technology mass production systems have further high-lighted the importance of accurate demand forecasts. Even in a batch type production, any major mismatch between forecast and manufacture will lead to higher capital tied up in finished products which are slow in selling.

3.5 UNCERTAINTIES IN DEMAND FORECASTING

Demand forecasting is the estimate of future demand. As the future is always uncertain, forecasting cannot be completely fool proof and correct. However, the very process of forecasting demand in future involves evaluating various forces and factors which influence demand. This exercise is very rewarding in itself as it enables the personnel to know about various market forces, currents, cross-currents and under-currents relevant to the demand behavior.

3.6 LEVELS OF DEMAND FORECASTING

Demand forecasting can be at the level of a firm or an industry or at the national or national or international level:
a) **Firm Level**

If the exercise aims at forecasting demand of firm’s products locally at state, region or national level, it is a micro-level of demand forecasting. Sometimes, forecasts are required for company’s products in specific industry or market segment.

b) **Industry Level**

Such a demand forecasting exercise focuses on an industry as a whole for the region and/or national level. These forecasts may be undertaken by a group of companies or by industry/trade associations.

c) **National Level**

Demand forecasts at national level include parameters like national income, expenditure, index of industrial and/or agricultural production etc. Estimating aggregate demand of products at national level facilitates governmental decisions for imports, exports, pricing policy etc.

d) **International Level**

Companies operating in multinational markets would require similar forecasting of demands for its products, trends in consumption etc at international level

Managerial Economists play a leading role in masterminding these forecasts at firm, industry, national and international levels. Time horizon of these demand forecasts usually varies from 1 to 5 years and in rare instances up to 10 years.

### 3.7 DETERMINANTS OF DEMAND FOR CAPITAL GOODS

Capital goods are man-made equipment for the production of goods and services. Demand of consumer goods is autonomous and is forecast by direct measurements. However, demand forecast for capital goods is indirect and derived. Their demand is dependent upon profitability of the industries using these equipment and the ratio for production to installed capacity (also called occupacity). For example, demand for cement manufacturing machinery will depend not only on the profitability of cement industry by also on the current surplus capacity in the industry. If surplus capacity is low or negligible, one can expect major expansion of existing cement manufacturing units. Similarly, demand for commercial vehicles is dependent upon:

- growth of Indian economy
- growth pattern of different modes of transport-rail, river, air and sea
- availability of bank finance for leasing etc
- growth of replacement market of commercial vehicles

### 3.8 CRITERIA FOR A GOOD FORECASTING METHOD

A good forecasting method should have the following attributes:

a) **Accuracy in forecast**

Accuracy in forecast is measured in terms of past forecasts against current sales and by the percentage of deviation from actual demand. It is important to not only check the accuracy of past forecasts but also the validity of assumptions in practice. Forecasts being future-oriented, cannot be always accurate although accuracy is the most important criterion.
b) Plausibility of forecasts

Forecasts of demand must be reasonable, consistent and plausible. Assumptions made should stand scrutiny and techniques adopted must be commensurate. Explanatory note on these aspects must be available in the write-up on methods and methodology employed in forecasting.

c) Economy of forecasts

Forecasting exercise should not be expensive in terms of efforts and costs. Additional costs of ways and means for improving the accuracy of forecasts should not exceed the extra gain expected.

d) Quick Results

Method of forecasting chosen should be capable of yielding quick and useful results. If method selected takes fat too long a time to yield accurate forecast, it may not be conducive for taking quick and effective decisions. Always remember not to make best enemy of `good'.

e) Availability and Timeliness

Methodology of forecasting should be such that it can easily be updated when changes occur in the demand relationships.

f) Durability

Demand forecasts should not be changed frequently. Durability of forecast is subject to the followings:

i) Simple and reasonable relationship between price and demand, advertisement and sales, level of income and volume of sales etc

ii) Stability of relationship between the above variables

g) Flexibility

Flexibility of forecast is an added advantage. It is desirable to be able to adjust `co-efficient' of variables from time to time to cope with the changing conditions.

3.9 METHODS OF FORECASTING- DEMAND

To facilitate proper and reliable appraisal of investment proposal, we require a reasonably accurate forecast of demand. Starting with qualitative methods like survey of collective opinions, buyers' intention, Delphi approach and its variant, a number of quantitative methods are used for compiling and computing demand forecasts as detailed below:

a) Collective Opinion Survey

Sales personnel are closest to the customers and have an intimate feel of the market. Thus they are most suited to assess consumers reaction to company's products. Herein each salesperson makes an estimate of the expected sales in their respective area, territory, state and/or region. These estimates are collated, reviewed and revised to take into account changes in design/features of products, changes in selling prices, projected advertising and sales promotion campaigns and anticipated changes in competitors :marketing policies covering product, people, price, promotion and place. Opinions of all managers involved at various levels of sales organisation are also included in the survey. Thus "collective opinion survey forms the basic of market analysis and demand forecasting.

Although this method is simple, direct, first hand and most acceptable, it suffers from following weaknesses:

i) Estimates are based n personal judgement which may not be free from bias

ii) Adding together demand estimates of individual salespersons to obtain total demand of the country maybe risky as each person has knowledge about a small portion of market only
iii) Salesperson may not prepare the demand estimates with the requisite seriousness and care

iv) Owing to limited experience, usually in their employment, salesperson may not have the requisite knowledge and experience

This method may be useful for long-term forecasts. It is also used for new products or new variants of existing products.

b) Survey of Customers Intention

Another method of demand forecasting is to carry out a survey of what consumers prefer and intend to buy. If the product is sold to a few large industrial buyers, survey would involve interviewing them. If it is a consumer durable product, a sample survey is carried out for questioning a few representative consumers about what they are planning or intending to buy. It is neither realistic nor desirable to query all consumers either through direct contact or through printed questionnaire by mail. These surveys serve useful purpose in establishing relationships between:

- demand and price
- demand and income of consumers
- demand and expenditure on advertisement etc

This method is preferred when bulk of the sales is to institutions and industrial buyers and only a few of them have to be contacted.

Disadvantages are that customers may not know total requirements; in some cases they are not certain about quantity to be purchased. Besides during shortages there is a tendency to inflate their requirements. Survey method is not useful for households - interviewing them is not only difficult but also expensive. They are not able to give precise idea about their intentions particularly when alternative products are available in the market.

c) Delphi Method of Demand Forecasting

Delphi method is a group process and aims at achieving a `consensus of the members. Herein experts in the field of marketing research and demand forecasting are engaged in

- analyzing economic conditions
- carrying out sample surveys of market
- conducting opinion polls

Based on the above, demand forecast is worked out in following steps:

i) Co-ordinator sends out a set of questions in writing to all the experts co-opted on the panel who are requested to write back a brief prediction.

ii) Written predictions of experts are collated, edited and summarized together by the Co-ordinator.

iii) Based on the summary, Co-ordinator designs a new set of questions and gives them to the same experts who answer back again in writing.

iv) Co-ordinator repeats the process of collating, editing and summarizing the responses.

v) Steps 3 and 4 are repeated by the Co-ordinator to experts with diverse backgrounds until consensus is reached.

If there is divergence of opinions and hence conclusions, Co-ordinator has to sort it out through mutual discussions. Co-ordinator has to have the necessary experience and background as he plays a key role in designing structured questionnaires and synthesising the data.

Direct interaction among experts is avoided nor their identity is disclosed. Procedure also avoids inter-personnel conflicts nor strong-willed experts are able to dominate the group. This method is also used for technology forecasting.

d) Nominal Group Technique

This is a further modification of Delphi method of forecasting. A panel of seven to ten
experts is formed and allowed to interact, discuss and rank all the suggestions in descending order as per the following procedure:

i) Experts sit around a table in full view of one another and are asked to speak to each other.

ii) Facilitator hands over copies of questionnaire needing a forecast and each expert is expected to write down a list of ideas about the questions.

iii) After everyone has written down their ideas, Facilitator asks each expert to share one idea out of own list with the group. The idea shared is written on the 'flip chart' which everyone can see.

iv) Experts give ideas in rotation until all of them are written on the 'flip chart'. No discussion takes place in this phase and usually 15 to 25 ideas emerge from this format.

v) In the next phase, experts discuss ideas presented by them. Facilitator ensures that all ideas have been adequately discussed. During discussions similar ideas are combined and paraphrased appropriately. This reduces the number of ideas.

vi) After completing group discussions, experts are asked to give in writing ranks to ideas according to their perception of priority.

e) Simple Average Method

Among the quantitative techniques for demand analysis, simple Average Method is the first one that comes to one's mind. Herein, we take simple average of all past periods - simple monthly average of all consumption figures collected every month for the last twelve months or simple quarterly average of consumption figures collected for several quarters in the immediate past. Thus,

\[
\text{Simple Average} = \frac{\text{Sum of Demands of all periods}}{\text{Number of periods}}
\]

f) Moving Average Method

Method of Simple Average is faulted on account of the fact that all past periods are given same importance whereas it is justifiable to accord higher importance to recent past periods. Moving Average Method takes a fixed number of periods and after the elapse of each period, data for the oldest time period is discarded and the most recent past period is included. Whatever the period selected, it must be kept constant - it may be three, four or twenty periods by once it decided, we must continue with same number of periods.

\[
\text{Simple Average} = \frac{\text{Sum of Demands of Chosen periods}}{\text{Number of chosen periods}}
\]

g) Weighted Moving Average

In Moving Average Method, weighted given to the selected number of periods is same. This has been refined to include the Weighted Moving Average which allows varying weightages for demands in old periods. Depending upon the age of the period, with-age can be varied:

\[
\text{Weighted Moving Average} = W_1 x D_1 + W_2 D_2 + \ldots + W_n x D_n
\]

where \( W_1, W_2, \ldots, W_n \) are the weightages for the different periods in percentages so that

\[
W_1 + W_2 + \ldots + W_n = 1
\]

This method has the advantage that it allows forecaster to compensate for some known trend in demand or seasonality of demand by carefully fitting appropriate coefficients of weighted to those periods. The weightages have to be decided by the forecast analysts and this decision is critical to the accuracy of demand forecast.

h) Exponential Smoothing Methods

With the advent of computers and availability of software packages, Exponential
Smoothing Methods have become popular. Besides, they do not require much data storage and computing. These methods are distinguished from the weighted average method by the way it assigns weightages to each past period. Pattern of weightages assigned is exponential in form viz., demand for the most recent period and for each successive older periods, weightages decrease exponentially. The decrease in weightages is non-linear. For example, a first order smoothing is given by the expression:

\[ F_t = W \times (Dt-1) + (1 - W) (Ft - 1) \quad \ldots \ldots \quad (1) \]

Where 't' is the time period and value of 'w' varies between 0 to 1.

Continuing further, we have

\[ F_t - 1 = w \times (Dt-2) + (1 - w) (Ft - 2) \quad \text{and} \]
\[ F_t - 2 = w \times (Dt-3) + (1 - w) (Ft - 3) \quad \text{and so on} \]

Substituting these values of \( F_t - 1 \) into Equation (1) above

\[ F_t = w \times (Dt-1) + w \times (1 - w) (Dt-2) + w \times (1 - w) (Dt-3) + \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]

Successive weightages are \( w(1-w), w(1-w) \), etc.

For \( w = 0.3 \), these successive co-efficients will be 0.3, 0.21, 0.147 etc.

When forecast have to be worked out successively for different periods, it is a simple computation as below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Month</th>
<th>Forecast</th>
<th>Demand</th>
<th>Weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>January</td>
<td>200</td>
<td>300</td>
<td>( w = 0.7 )</td>
</tr>
<tr>
<td>2.</td>
<td>February</td>
<td>( 0.7 \times 300 )</td>
<td>350</td>
<td>( w = 0.7 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( 0.3 \times 200 = 270 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>March</td>
<td>( 0.7 \times 350 )</td>
<td>400</td>
<td>( w = 0.7 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( 0.3 \times 270 = 326 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>April</td>
<td>( 0.7 \times 400 )</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( 0.3 \times 326 = 378 )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Choice of co-efficient of smoothing is critical:

i) a value of 0.7 to 0.9 may be more appropriate for new products or for items for which demand is shifting significantly

ii) a value of 0.1 to 0.3 denotes stable trend in demand and when demand is somewhat unstable

iii) value of 0.4 to 0.6 may be used for obtaining more accurate forecasts.

These methods are simple and with the speed and accuracy of computers, are being increasingly used for determining 'quick and easy' forecasts within reasonable budgets.

i) **Adaptive Exponential Smoothing**

If demand is not stable or there is no known pattern of demand, Adaptive Exponential smoothing may be more appropriate. In this method value of 'w' is not fixed. After setting it initially, it is allowed to fluctuate over time in line with the changes in demand pattern. Once again, decision of demand forecaster in assigning different values to 'w' is critical.
j) **Exponential Smoothing with trend and Seasonal Data**

So far all the methods of forecasting have assumed the entire demand as a time series. In case there is a trend for a component of the demand, it can be forecast exponentially, as a separate exercise. Similarly seasonal component can be forecast separately. Thereafter composite forecast can be obtained by synchronising together the constant component, trend and seasonal components.

If the constant component of demand is 800, it can be adjusted for the trend component is 100, the forecast inclusive of trend component will be 900. Now let us assume that the seasonal factor is 90%. The overall composite forecast will be

$$0.9 \times 900 = 810$$

k) **Double Exponential Smoothing**

Sometimes there is too much 'noise' in a stable time series. In such cases, use of Double Exponential Smoothing is suggested. It smooths the first order exponential smoothing forecast as below:

\[
\text{Forecast of Next Period} = w \times \text{First Order Exponential Smoothing Forecast for Next Period} + (1-w) \times \text{Double Exponential Smoothing Forecast for Most Recent Period}
\]

Where ‘w’ varies between 0 to 1.

\[F_{dt} = w \times F_{t} + (1-w) \times F_{dt-1}\]

This method has been used extensively in forecasting demands of drugs in pharmaceutical industry.

l) **Projection by Curve Fitting**

Every company compiles data over time for different products. If it is arranged graphically as shown, we can establish a demand pattern. A curve can be fitted to the past data – it may be a linear or curve linear relationship. A mathematical expression can be evolved to denote the graphical pattern – values of constants can be worked for different group of products and an appropriate algebraic expressions can be arrived at.

Once a curve is fitted, projecting demand forecast is rendered simple and inexpensive. The basic assumption is that past trend of change will continue in future also. Whenever pattern, formula breaks down. In such events, analysts have to anticipate the 'turning point' and lager forecasts accordingly.

Since curve fitting is obtained by the application of the principle of 'Least Sum of Square', this model is also known by that name.

m) **Regression Analysis**

Past data is used to establish a functional relationship between two variables. For example, demand for consumer goods has a relationship with disposable income of individuals and family; demand for tractors is linked to the agriculture income and demand for cement, bricks etc is dependent upon value of construction contracts at any time.

Forecasters collect data and build relationship through co-relation and regression analysis of variables.

n) **Econometric Models**

Econometric models are more complex and comprehensive as they interweave different factors together simultaneously. For example, demand for passenger transport is not only dependent upon the population of the city, geographical area, industrial units, their location etc.
It is not easy to locate one single economic indicator for determining the demand forecast of a product. Invariably, a multi-factor situation applies. Econometric models, although complex, are being increasingly used for market analysis and demand forecasts.

### 3.10 ERRORS IN DEMAND FORECASTING

There is a Chinese proverb which says, "To predict is hazardous, especially the future". Nevertheless, in industry, we cannot survive without predictions and forecasts, without scenario building and analogies. Owing to fierce competition emerging in the market place, accuracy of forecasts is becoming a definite competitive advantage as it improves planning and decision. Already it is hazardous to take short term marketing decisions without undertaking opinion polls, forecasts of customer preferences, trends etc.

Forecasting error may be defined as the numeric difference between forecasted demand and actual demand. Any method of forecasting yielding larger errors is less desirable. Following aspects are important in measuring the effectiveness of any method of forecasting:

**a) Mean Absolute Deviating**

It is a measure of the forecast error without regard to the direction of the error, negative or positive. It is given by the expression:

\[
\text{Mean Absolute Deviation} = \frac{\text{Sum of absolute values of forecast errors for all periods}}{\text{Number of periods}}
\]

Absolute values of forecast errors mean values are taken without algebraic sings. Mean Absolute Deviation (MAD) is the average of the Absolute Values of Forecast Errors. Forecast errors are, by themselves, normally distributed and there is a relationship between MAD & Standard Deviation. If the forecast is reasonably accurate, forecasts errors will be quite smooth. The above measure is then referred to as Smoothed Mean Absolute Devoting (SMAD). In such events,

\[
\text{Standard Devoting} = 1.25 \times \text{SMAD}
\]

**b) Bias**

Bias is a less commonly used measure of forecast errors. It takes into account the direction of errors and sum of errors is the algebraic sum of deviating and is expressed as:

\[
\text{Bias} = \frac{\text{Algebraic sum of forecast errors of all periods}}{\text{Number of periods}}
\]

If forecasts are repeatedly overestimates, bias will have a positive value. Similarly, if forecasts are consistently underestimates, Bias will have a negative value.

For a very accurate forecast, both MAD and bias will be zero. It is preferable to choose a method of forecasting wherein MAD can be controlled and brought nearer to zero. Lowering MAD will reduce Bias also.

**c) Costs of Forecast Errors**

Important decisions - short-term, medium and long-term, are based on forecasts. Large errors of forecasts can lead to costly mistakes, particularly, when used for evaluating investment proposals which are long-term and nearly irreversible.

Errors may be either in direction or in magnitude. In some situations, errors in direction can be critical while in other cases, error in magnitude may be more damaging.

It is always difficult to complete the exact cost of forecast errors. It is advisable that such estimating of cost be undertaken, however approximate it may be.

Demand forecasts forming basis for production and inventory management can be evaluated on the basis of their impact on the overall manufacturing costs, Tanks to
powerful computing facilities available, we can work out the entire simulating and find out the possible reduction in cost that we could achieve if we had more accurate demand forecast.

d) Costs and Accuracy of Forecasts

It is perhaps easy to visualize a relationship between percentage error of forecast and the costs involved in selecting, adopting, operating & maintaining that particular method of forecasting. If we use qualitative methods of forecasting, these would entail less effort and expense but would also yield forecasts with higher percentage error. If we use time-series and other mathematical techniques, costs would increase but it would also reduce the percentage or errors. Similarly, using more sophisticated statistical tools shall further improve the accuracy of forecasts. Correspondingly, cost of operating and maintaining these forecasting techniques will vary as shown in the graphologists would be low when errors are low but costs would increase if we have to base our planning and decision making on of accurats with larger margin of errors.

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Optimal region, corresponding to minimum overall costs, would be somewhere in the middle of the Total Cost Curve - usually nestling between simple and sophisticated statistical techniques which can be complied on a computer.

Activity 4

A Large number of companies in India became such during 1970s because of investing heavily in projects and manufacturing products that had little market demand. Think and draw up the possible causes of much failures.

3.11 SUMMARY

Economic and financial evaluation of an investment proposal must always-be used on reasonably accurate market and demand analysis for forecasting. Depending upon demand pattern, length/time horizon of forecast, level of noise and degree of accuracy required, a suitable method of demand forecasting should be selected as cost of operating not-so-accurate forecast can be exorbitant.

Although forecasts are usually made with the help of statistical models, individuals can use the past data intuitively and forecast future events. The experience confirms that with a host of factors impacting on demand pattern --- noise level, complexity of operation etc, subjective approach decreases the level of accuracy.

Forecasting models are more reliable methods of ascertaining demand although a few individuals can consistently forecast better than models.
3.12 SELF-ASSESSMENT EXERCISES

1. What are the different levels of forecasting and their respective role in decision making?

2. What should be the decision criteria for selecting a suitable method for demand forecasting?

3. ‘Collective opinion survey' method of demand forecasting has often resulted in faulty forecasts. What are the pitfalls of this method?

4. Describe the least sum of square method of fitting a curve to a given data and highlight its usefulness in computerised environments.

5. How can we optimise the conflicting factors of cost and accuracy of demand forecasting?

3.13 BIBLIOGRAPHY AND FURTHER READINGS

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