

Sales Forecasting

Forecasting :Forecasting is estimation of type , quantity, and quality of future work.

Forecasting has an important role in the development of plans for future work.

Why Forecasting?

- Every firm wants to know the expected demand for its products i.e.
- How much of that product could be sold in a given time?
- Whether sales of a particular product would increase or decrease from the current levels?

How much would be the share of that product in the market ? This particular knowledge is must for the firm. This knowledge decides the requirements of men, material, machines, money etc. for a particular size of a firm. This makes the basis of sales forecasting for future.

Definition: Sales forecasting is a technique of forecasting the future sales of firm.

It indicates how much of a product is likely to be sold during a specific period at specific prices in a specific market.

A sales forecasting should be accurate ,simple and easy to understand and economical.

Purpose and objective of Sales Forecasting

- To formulate suitable production policy so that **over or under production** may not occur.
- To regulate the supply of raw materials . This can be done by evaluating the requirements of raw materials in future so that regular and continuous supply of raw materials may be done.
- To utilize the machine capability at maximum level.
- To arrange the regular availability of trained and untrained labour.
- To formulate the price policy for fixing the price of products.
- To set the sales target.
- To suggest this need for plant expansion.
- To suggest this need for changes in production methods.

Advantages of Sales Forecasting

- Sales forecasting helps in effective planning through a scientific and reliable forecasting technique.
- Sales forecasting helps in removing the weakness of organization structures.
- Sales forecasting helps in better coordination of various resources which leads to better utilization of resources and reduction in waste.
- Sales forecasting provides a basis for effective control over the production.

Limitations of Sales Forecasting

- There is possibility of error as it is based on some postulation and guess.
- Future may not be a copy of past because it is based on past date.
- There may be lack of history in case of new product.
- This may not be full proof if there is change in this general economy of a nation.
- Short term forecasting is more accurate than long term forecasting. It is more useful in case of short term forecasting.

Sales forecasting technique

- Historical estimate
- Sales Forecast estimation by salesman
- Trend line or Time series Analysis technique.
- Market survey
- Statistical technique
- Delphi method
- Judgmental technique
- Prior knowledge
- Forecasting by Past Average
- Forecasting from last period's sales
- Forecasting by Moving Average
- Forecasting by Weighted Moving Average
- Forecasting by Exponential smoothing
- Correlation Analysis
- Linear regression analysis

Forecast estimation by salesman

- The technique is based upon the principle that the person in contact with the market know best about the future market trends.
- In this technique, salesman go to each village and town of their territories and take the opinion of the people regarding the product and estimate for the next year.
- The salesman submit the report to the head office. On basis of the report , sales forecast is made. If this product is not new , a modification could be done at this level. This technique is useful when an industry is making a limited number of products. (Ex. A commercial power generating equipment and a few large customers.)

Advantages:

- The salesman are more closest to the customers to judge their minds.
- The forecast by this technique is more stable and reliable due to closeness to customers.
- The forecast could be easily broken territory wise, product wise, customer wise, supply wise and month wise etc.

Disadvantages:

- Salesman are not certainly expert in forecasting . They can not use the sophisticated techniques.
- They may not know the changes taking place in the economy and the given industry which may be necessary to predict the future.

Statistical Analysis:

Statistical methods of forecasting use the historical/previous information in form of data for forecasting.

These are based on assumptions that future trend will be the extension of past one. The predictions are done by studying the past behavior.

Important statistical methods are:

- Extrapolation methods
- Method of moving average
- Exponential smoothing method
- Least Square method

Moving Average Method:

This is defined as an average of some fixed or predetermined number of observations in a time series (year, month , day) which moves through the time series by dropping (subtracting) the top item of the previous averaged group and adding the next item below in each successive average.

This method uses the previous data(observations) and calculates a rolling (moving average) for a constant period.

At each period, a fresh average is calculated at the end of each period by adding the demand (sales) of the most recent period and subtracting the data of the old period.

A Moving Average(MA) is calculated as:

$$MA = \frac{\textit{Sum of demand/ sales for periods}}{\textit{chosen number of periods}}$$

For example: for the time series of the value demand /sales are $D_1, D_2, D_3, \dots, D_n$ etc., the moving average is given by:

$$\text{First value of Moving Average} = \frac{D_1 + D_2 + D_3 + \dots + D_n}{n}$$

$$\text{Second value of Moving Average} = \frac{D_2 + D_3 + D_4 + \dots + D_{(n+1)}}{n}$$

$$\text{Third value of Moving Average} = \frac{D_3 + D_4 + D_5 + \dots + D_{(n+2)}}{n}$$

Larger the period of moving average greater is the smoothing effect.

$n \propto$ smoothing effect

The value of n depends upon the speed at which the pattern of demand/sales changes. If the demand pattern is stable, a high value of n is selected. If the demand pattern is not stable, a small value of n should be selected.

Problem:

Following are the sales data for a particular company for 12 months of the year 2018:

Months	Sales(Rs.)
January 2018	4000
February 2018	4900
March 2018	5700
April 2018	5000
May 2018	6400
June 2018	6800
July 2018	7100
August 2018	8000
September 2018	8200
October 2018	9100
November 2018	8600
December 2018	9500

Solve the following:-

1. Compute 3 months Moving Average
2. Forecast the demand for month of January 2019.
3. If the actual demand for the month of January 2019 is 9150 units, what should be the forecast for the month of Feb 2019?

Solution: (1)The 3 month moving average is shown as below:

Months	Sales(Rs.)	Moving /total	Moving Average
January 2018	4000		
February 2018	4900	14600	$14600/3= 4866.67=4867$
March 2018	5700	15600	$15600/3= 5200$
April 2018	5000	17100	$17100/3= 5700$
May 2018	6400	18200	$18200/3= 6066.7=6067$
June 2018	6800	20300	$20300/3= 6766.67=6767$
July 2018	7100	21900	$21900/3= 7300$
August 2018	8000	23300	$23300/3= 7766.67=7767$
September 2018	8200	25300	$25300/3= 8433.3=8433$
October 2018	9100	25900	$25900/3= 8633.3=8633$
November 2018	8600	27200	$27200/3= 9066.6=9067$
December 2018	9500		

(2) Forecasting for the month of January 2019 is 9067. As the sales value of January 2019 is not available, therefore forecasting equals last moving average.

(3) Forecast for Feb 2019

$$\begin{aligned} &= \frac{\textit{Last Moving Total} + \textit{Demand for January 2019} - \textit{Demand for Oct 2018}}{3} \\ &= \frac{27200 + 9150 - 9100}{3} = 9083 \end{aligned}$$

Exponential Smoothing Method

The fundamental concept of exponential smoothing method is that:

New estimate = old estimate of latest actual demand + α (latest actual demand - old estimate of latest actual demand).

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

Where F_t is the forecast at time t

D_t is the actual demand at time t

F_{t-1} is the forecast at time t-1

α is the smoothing coefficient, $e_t = (D_t - F_{t-1})$

The procedure is summarised as below:

- i. Find error by subtracting the recent average from the latest incoming observations.
- ii. Multiply error e_t by α . This is the correction to be applied to the past average.
- iii. Add correlation (αe_t) to the past average F_{t-1} . This gives new average F_t as the forecast for the next period.

The performance of this method depends on the value of the **smoothing co-efficient, α** and the **initial forecast F_{t-1}** .

The selection of value for **α** depends on how much weight is desired to be given to later periods relative to earlier periods. A low value of **α** gives more weightage to the past figures and less consideration to incoming observations.

Low values of the **smoothing co-efficient, α** are used where the series is rather stable and high values where the series is fluctuating. **The values of α lies between 0 and 1.**

If cyclic fluctuations are predominant in forecast then low values of **α** should be selected ; and if the long term fluctuations are more dominant, then select high value of **α** .

To main factors should be considered in selection of smoothing coefficient, α :

1. Distribution of random errors.
2. Cost associated with forecasting errors.

In practice α is generally chosen between 0.1 and 0.3 .

The choice of initial forecast F_{t-1} is either based on subjective estimates or as simple arithmetic average of the past few periods.

Example: Forecast the demand for the following series by exponential smoothing method:

Period	1	2	3	4	5	6	7	8	9	10
Actual Demand	10	12	8	11	9	10	15	14	16	15

Solution: The forecast for various periods can be calculated in the following tabular form. Let us take $\alpha=0.3$.

The initial forecast is taken to be 10 for period 1.

Period	Actual Demand D_t	F_{t-1}	F_t at $\alpha=0.3$	Calculations: $F_t = \alpha D_t + (1-\alpha) F_{t-1}$
0	-	10	-	
1	10	10.00	10	$F_t = \alpha D_t + (1-\alpha) F_{t-1}$ $= 0.3 \times 10 + (1-0.3) \times 10 = 10$
2	12	10.00	10.60	$F_t = 0.3 \times 12 + (1-0.3) \times 10 = 10.60$
3	8	10.60	9.82	$F_t = 0.3 \times 8 + 0.7 \times 10.60 = 9.82$
4	11	9.82	10.174	$F_t = 0.3 \times 11 + 0.7 \times 9.82 = 10.174$
5	9	10.174	9.822	$F_t = 0.3 \times 9 + 0.7 \times 10.174 = 9.822$
6	10	9.822	9.875	$F_t = 0.3 \times 10 + 0.7 \times 9.822 = 9.875$
7	15	9.875	11.412	$F_t = 0.3 \times 15 + 0.7 \times 9.875 = 11.412$
8	14	11.412	12.188	$F_t = 0.3 \times 14 + 0.7 \times 11.412 = 12.188$
9	16	12.188	13.33	$F_t = 0.3 \times 16 + 0.7 \times 12.188 = 13.33$
10	15	13.33	13.83	$F_t = 0.3 \times 15 + 0.7 \times 13.33 = 13.83$

Exponential smoothing provides a convenient, systematic and recursive method for revising the forecast for the next period whenever discrepancy exists between the previously forecast demand for current period and the actual demand for current period