# Technical Guide On

# “Demand Forecasting”


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## 1.Disclaimer

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## 2. Introduction to SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in Employment Generation and Value Addition to the national income, through development of SME sectors, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify Policy, Access to Finance, Business Development Services, strategic initiatives and institutional collaboration & networking initiatives.

Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA.

Concurrent to the prefeasibility studies, a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

For more information on services offered by SMEDA, please contact our website: www.smeda.org

### 2.1 Industry Support Program

In order to enhance competitiveness of SMEs and achieve operational excellence, SMEDA established an Industry Support Cell (ISC) for provision of foreign technical support and knowledge transfer in collaboration with International Development Organizations. SMEDA's Industry Support Program (ISP) initially launched with Japan International Cooperation Agency (JICA) and actively engaged in reducing energy inefficiencies and improving production and quality of products with the support of Japanese Experts. Later on, similar activities with other international partner organizations like German Corporation for International Cooperation (GIZ), Training and Development Centers of the Bavarian Employers' Association (bfz), Germany, and United Nations Industrial Development Organization (UNIDO) were also successfully implemented

## 3.Demand Forecasting

Demand forecasting is the process of using predictive analysis of past data to estimate and determine the future demand of the product or service. Demand analysis assists the business to take better decisions regarding the sales , inventory and production.

It plays a major role in productivity improvement and production planning by analyzing the historical data and facilitate while making decisions regarding the production , procurement , human resource and capital requirement.

It is not based on mere prediction or guessing but is backed by past trends , historical data and evidence.

### 3.1 Factor Affecting Demand Forecasting

Demand is not constant and varies with the change in various factors. Following are some of the crictical factors which influence demand forecasting:

**A-Technology** – change in the technology changes the demand all of sudden , therefore, businesses must have the knowledge and awareness of the technology devolvement while making any forecasting

**B-Competition** – less competitive market means easy to gauge the future requirements and it becomes difficult to forecast when more firms enters into the same market segment in which you are operating

**C-Price of Goods** – Demand estimation is dependent on the good's prices. Increase or decrease in prince changes the demand of that particular product or service .

**D-Economic Perspective (Govt Policies)** – Change in rules , regulations and policies related to the economic environment of the country impact the demand forecasting.

### 3.2 Benefits

a. Improved Inventory Control
b. Better Production Planning
c. Cost Saving and Increased Profit margins
d. Improved Cash Flows
e. Improved Supply Chain

## 4.Demand Forecasting Techniques

Various techniques for demand forecasting have been developed and used in the industry. Each technique has its own constraints , limitations , benefits and accuracy.

Few techniques are discussed below :

### 4.1 Simple Moving Average

In this technique , smooth out the forecast for fluctuations in the past actual demand figures. For demand forecast take demand of that particular month of the last year and add the demand of proceeding and following month of that year and divided by 3.
Let's take a example , the actual demand data of a product for the last year's 6 months is as follows :

| July 2021 | Aug 2021 | Sep 2021 | Oct 2021 | Nov 2021 | Dec 2021 |
|---|---|---|---|---|---|
| 260 | 235 | 310 | 280 | 305 | 315 |

Now determine the demand forecast for the Aug 2022

| Months | Actual Demand | 3 months Moving Average | Forecast Month |
|---|---|---|---|
| July 2021 | 260 | | |
| Aug 2021 | 235 | 268 | Aug 2022 |
| Sep 2021 | 310 | 275 | Sep 2022 |
| Oct 2021 | 280 | 298 | Oct 2022 |
| Nov 2021 | 305 | 300 | Nov 2022 |
| Dec 2021 | 315 | | |
| | | | |

### 4.2 Simple Moving Average With Trend Factor

This method cab be more effective to forecast month wise and annual demand when the demand varies with season or random. To improve the forecasting trend factor is added.

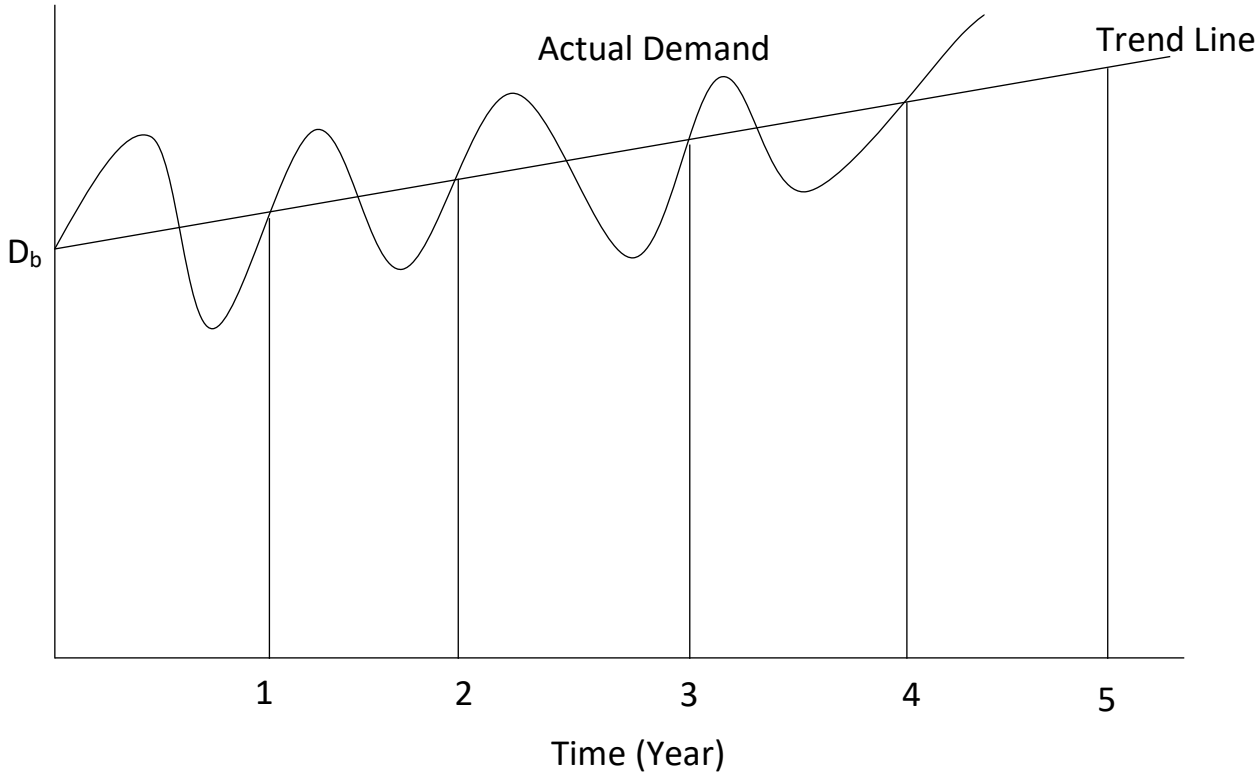
For instance , sales of past 5 years of air conditioning manufacturing company as follows :

| 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| 6450 | 7350 | 8010 | 8240 | 8625 |

The month wise actual sales for the last 13 months

| Dec 20 | Jan 21 | Feb 21 | Mar 21 | Apr 21 | May 21 | Jun 21 | Jul 21 | Aug 21 | Sep 21 | Oct 21 | Nov 21 | Dec 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 460 | 470 | 485 | 720 | 825 | 960 | 980 | 810 | 790 | 815 | 670 | 640 | 490 |

The actual demand is different from the mean demand. The demand of any month is a composite of seasonal variation over the trend line.




The trend line for a horizon of one year may be assumed to be approximately a straight line.

The trend value and seasonality is combined in a single factor t , which can be calculated by :

$$t = 1 + \frac{\Delta D}{n.Db} = 1 + \frac{Dn - Db}{n.Db}$$

Where $D_b$ is the demand of the base year , and in case of example base year is 2017.

$$t = 1 + \frac{8625-6450}{4.6450} = 1.0843$$

Forecast for a next year's months will be the moving average of the precedent year multiplied by the trend factor.

For instance , forecast of January 2022 will be :

$$= \frac{460 + 470 + 485}{3}$$

= 471.67

Forecast Jan'2022 = 471.67 x 1.0843 = 511

Month-wise demand forecast for the year 2022 is as follows :

| Months | Actual Sale | 3 Months Moving Average | Forecast | Forecast Month |
|---|---|---|---|---|
| Dec 2020 | 460 | - | | |
| Jan 2021 | 470 | 471.67 | 511 | Jan 2022 |
| Feb 2021 | 485 | 558.33 | 605 | Feb 2022 |
| Mar 2021 | 720 | 676.67 | 734 | Mar 2022 |
| Apr 2021 | 825 | 835 | 905 | Apr 2022 |
| May 2021 | 960 | 921.67 | 999 | May 2022 |
| Jun 2021 | 980 | 916.67 | 994 | Jun 2022 |
| Jul 2021 | 810 | 860 | 933 | Jul 2022 |
| Aug 2021 | 790 | 805 | 873 | Aug 2022 |
| Sep 2021 | 815 | 758.33 | 822 | Sep 2022 |
| Oct 2021 | 670 | 698.33 | 757 | Oct 2022 |
| Nov 2021 | 610 | 590 | 640 | Nov 2022 |
| Dec 2021 | 490 | 534.33 | 582 | Dec 2022 |

**4.3 Weighted Moving Average**

This is model is more useful when the seasonality and trends play a little role in the demand variation and demand varies randomly.

In this technique , higher weightage is assigned to recent demand data and total sum of the weightage must be equal to 1.

Let's take an example , if the demand for the months 1 , 2 and 3 are 620 , 670 and 640 the forecast for the month 4 will be as follows :

Forecast for month 4 = W.F x Month 1 + W.F x Month 2+ W.F x Month 3

Where , W.F is weighted factor

= 0.1 x 620 + 0.3 x 670 + 0.6 x 640

= 647

Businesses can assign different weighted factor based on their historical data , experience and market dynamics. But maximum value be given to the last month and least value to the first month.

**4.4 Exponential Smoothing**

In this technique , a smooth factor is added used to smooth out the errors over actual demand. The value varies from 0.1 to 0.3 and higher value is used when the difference between actual and forecast value is greater.

This model is useful for demand forecast where the current demand has close relevance with the immediate future.

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

Where $F_{t+1}$ is the forecast for the next month
$F_t$ is the forecast for the present month
$D_t$ is the actual demand for the present month

For Example :

Monthly demand figures from July 2020 to Dec 2020 are 503 , 484 , 460 , 565 , 580 and 615. Demand forecast for Jan 2022 by using average demand is :

= (503 + 484 + 460 + 565 + 580 + 615) / 6 = 535

If actual demand for Jan 2022 is 580 , then demand forecast for Feb 2022 using the smoothing factor is :

Smoothing factor value of 0.2 is used

= 0.2 x 580 + (1-0.2) x 535
= 116 + 244
= 544

**4.5 Regression Analysis**

In this model , a relationship between demand and unknown is established with some known variable. For example , demand of batteries may be related with the number of cars registered. Past data is used to establish a functional relationship of the two variables.

Relationship may be expressed in the form :

$$Y = a + bX$$

Where ,

Y = unknown variable
X = known variable
a & b = constants determined from the past data

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - n(\sum X)^2}$$

$$a = \frac{\sum Y - b\sum X}{n}$$

Take an example , the total requirements of the batteries for the past five years in millions is 1.45 , 1.68 , 1.98 , 2.26 and 2.58 . And the registered vehicles in millions are 0.36 , 0.41 , 0.47, 0.53 and 0.6. Number of registered vehicles in 6th years is to be estimated 0.66 million. Using the regression analysis batteries demand is calculated as follows:

| | No. of Registered Vehicles (X) | Batteries Demand (Y) | $X^2$ | XY |
|---|---|---|---|---|
| Year 1 | 0.36 | 1.45 | 0.1296 | 0.5220 |
| Year 2 | 0.41 | 1.68 | 0.1681 | 0.6888 |
| Year 3 | 0.47 | 1.98 | 0.2209 | 0.9306 |
| Year 4 | 0.53 | 2.26 | 0.2809 | 1.1978 |
| Year 5 | 0.60 | 2.58 | 0.3600 | 1.5480 |
| Total | 2.37 | 9.95 | 1.1595 | 4.8872 |

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - n(\sum X)^2}$$

$$b = \frac{5(4.8872) - (2.37x9.95)}{5(1.1595) - (2.37)^2}$$

$$= 4.73$$

$$a = \frac{\sum Y - b\sum X}{n}$$

$$a = \frac{9.95 - (4.73x2.37)}{5}$$

$$= -2.52$$

Forecast for 6th year = a + bX
= -2.52 + (4.73x6.6)
= 2.87 million

## 5. Reference

First Edition 2011 ,“Operation Management for Productivity & Cost Reduction” by Prof. M.H.Zuberi