Optimization Demand Of Spare Parts Store By Moving Average Method And Verify By Exponential Method

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ABSTRACT
Optimization will surely promote the efficiency of control actions by providing insight on the future. Today's every firm wants to maintain efficient store for avoiding losses, increase benefit and also make good relation with customer. To avoid this problem make a forecast for Commercial Engineers and Body Builders Co. Ltd. Jabalpur store by moving average method and verify by exponential method to optimize the demand for reducing maintenance cost. First compile all data (demand and supply) of stores in A B C Analysis on the basis of their prices. In this thesis forecasting is done by two methods and compare on them which one is more close to supply. Moving average method and Exponential method is apply on the last 12 month demand data and verifies to the last 9 month data.
Keyword: - Forecasting, Store, Supply, Demand.

1.1 INTRODUCTION
Demand optimization may be used in making pricing decisions, in assessing future capacity requirements, or in making decisions on whether to enter anew market. Firms balance the costs of having inventories deviate from their desired level against the costs of adjusting production. The optimal tradeoff is based on current values and expected future paths of inventories, sales, and output investments. In the past, maintenance problems received little attention and research in this area did not have much impact. Today, this is changing because of the increasing importance of the role of maintenance in the new industrial environment. Maintenance, if optimized, can be used as a key factor in organizations efficiency and effectiveness. It also enhances the ability of the organization to be competitive and meets its stated objectives. The research in the area of maintenance management and engineering is on the rise. Over the past few decades, there has been tremendous interest and a great deal of research in the area of maintenance modeling and optimization. Models have been developed for a wide variety of maintenance problems. Although the subject of maintenance modeling is a late developer compared to other area like production systems, the interest in this area is growing at an unprecedented rate. In particular, the availability of spare parts and material is critical for maintenance systems.

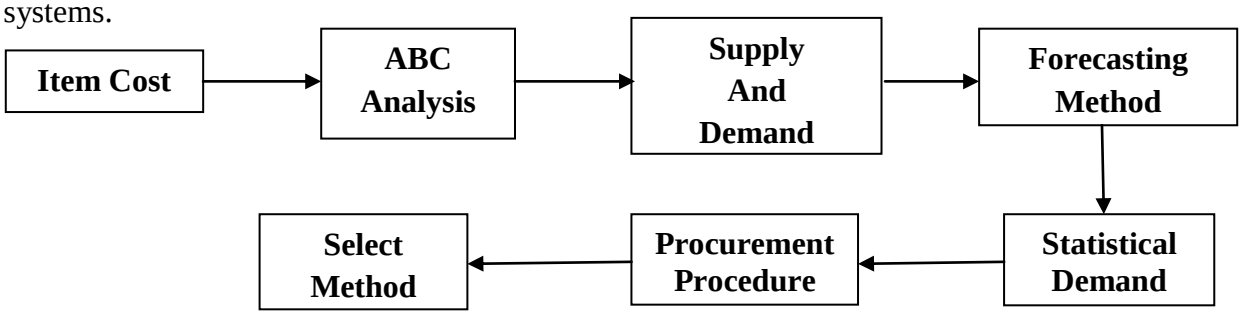


Fig 1.1 Optimize Model

1.2 OPTIMIZATION AND PROBLEMS

On the other hand, some theories reported in the statistical literature are relatively complicated to use in practice, even though their large sample behavior is impressive. The main advantages for such a mathematical tool may be comprehended in several aspects [1]. Forecasters have long had complex algorithmic approaches at their disposal, but their ability to effectively execute those approaches has been limited by the availability of information and costs of manual information manipulation and analysis [2]. When spare parts are forecast, more often the case in developing countries, an appropriate model can be used to provide a good demand for next month. In addition, the level of disaggregation should be considered. Whether disaggregated rates are stable or changing, changes in aggregate rates are attributable to changes in demand arising from subgroup of spare parts. Subgroups with higher growth rates come to dominate, resulting in increased average growth rates. These models, referred to throughout this thesis as the underlying model and the forecasting model respectively, may be distinct or integrated into a single framework [3].

A critical assessment of these studies would enable a better understanding of the techniques used by researchers in the past. Ostertagová et al (2011), prepared a theoretical base for calculation and application of the simple exponential smoothing method. The simple exponential smoothing model is one of the most popular forecasting methods that we use to forecast the next period for a time series that have no pronounced trend or seasonality [4]. Albertson et al (2003), approach on forecasting levels of stocks held by manufacturing industry is problematic. Stocks are the most volatile component of GDP. The forecasting performance of our model is compared to alternative time series approaches [5]. Gardner et al (2002), analyzes procedures for seasonal adjustment of inventory demand series at a large US auto parts distributor, BPX Holding Corporation of Houston, TX. The company's forecasting system made no attempt to classify demand series as seasonal or non-seasonal [6].

The Moving average method is applied to update the parameters of the forecasting model. Thus, the optimizationmodels are extended by using probably exponential techniques. An exponential forecasting model is developed as the second model to forecast the seasonal demand. In inventory management literature, emergency procurement option is not always included in procurement strategy and inventory cost is not considered as a basis to find the best demand forecast.

2.1 METHODOLOGY ADOPTED

In this thesis the methodology adopted is Moving Average method and Exponential method to optimize demand for Commercial Engineers and Body Builders Co. Ltd. Jabalpur store. Monthly supplied data and demanded data has been achieved of spare parts. These spare parts are first compile with ABC Analysis and short it in three categories. In this thesis 'A' category type item are those which are highly costly above Rs 30000/parts, 'B' category items are those which have medium cost below than Rs 30000/parts and above than Rs 5000/parts, 'C' category items are those which are low cost below than Rs 5000/parts.

2.2 ABC ANALYSIS

The ABC analysis is a business term used to define an inventory categorization technique often used in materials management. It is also known as Selective Inventory Control. Policies based on ABC analysis:

- A ITEMS: very tight control and accurate records
- B ITEMS: less tightly controlled and good records
- C ITEMS: simplest controls possible and minimal records

- The ABC analysis provides a mechanism for identifying items that will have a significant impact on overall inventory cost, while also providing a mechanism for identifying different categories of stock that will require different management and controls.

The ABC analysis suggests that inventories of an organization are not of equal value. Thus, the inventory is grouped into three categories (A, B, and C) in order of their estimated importance. [7]

2.3 SIMPLE MOVING AVERAGE

In an application a simple moving average (SMA) is the unweighted mean of the previous *n* datum points. However, in science and engineering the mean is normally taken from an equal number of data on either side of a central value. This ensures that variations in the mean are aligned with the variations in the data rather than being shifted in time. An example of a simple unweighted running mean for n-month sample of closing price is the mean of the previous n month's closing prices. If those supplies are S_m, S_{m-1}, …… $S_{m(n-1)}$ then the formula is

$$SMA = \frac{S_m + S_{m-1} + \cdots + S_{m-(n-1)}}{n}$$

2.4 EXPONENTIAL METHOD

The idea of exponential smoothing is to smooth the original series the way the moving average does and to use the smoothed series in forecasting future values of the variable of interest. In exponential smoothing, however, we want to allow the more recent values of the series to have greater influence on the forecast of future values than the more distant observations. This forecasting method is most widely used of all forecasting techniques. It requires little computation.

Let an observed time series be S_1, S_2 ……S_n. Formally, the simple exponential smoothing equation takes the form of

$$S_{n+1} = \alpha D_n + (1- \alpha)S_n$$

Where S_n is the actual known series value for time period D_n is the forecast value of the variable S for time period S_{n+1} is the forecast value for time period, where α is the smoothing factor, and $0 < \alpha < 1$.

3.1 DATA ANALYSIS

In this thesis the data of 12 months are taken from Commercial Engineers and Body Builders Co. Ltd. Jabalpur store and is compiled by ABC analysis which is shown in table 5.2. After compilation the supply and demand data is sub divided into three categories A, B, & C. Forecasting methods (Average Moving Method and Exponential Smoothing Method) are applied on these demands by taking three months reference make forecast of another nine months and verify to their actual demand.

3.2 CALCULATION

The spare parts of all data are shorted by ABC analysis as per their prices then evaluate their demand and supply of 12 month which is shown in Table 3.1

Table 3.1 Short list by ABC Analysis

	A		B		C	
MONTH	**D**	**S**	**D**	**S**	**D**	**S**
JAN	25	23	110	98	700	668
FEB	25	22	100	96	750	653
MAR	20	18	100	104	700	701
APR	25	20	100	103	750	708
MAY	30	22	110	97	750	728
JUN	25	24	100	104	700	739
JUL	25	26	100	98	750	722
AUG	25	25	90	94	700	712
SEP	25	23	90	89	700	698

OCT	25	21	100	91	720	695
NOV	30	24	110	88	750	703
DEC	30	25	110	99	750	728

On the consideration of 3 month Demand data (Jan. Feb & Mar) moving average method and Exponential method is applied so the result obtain for ABC Type spare parts as shown in Table 3.2

$$SMA = \frac{S_m + S_{m-1} + \cdots + S_{m-(n-1)}}{n}$$

$$ESorS_{n+1} = \alpha[\mathrm{D_n} + (1-\alpha)\mathrm{D_{n-1}} + (1-\alpha)^2\mathrm{D_{n-2}}] + (1-\alpha)^3\mathrm{S_n}$$

Table 3.2 Statistical Result

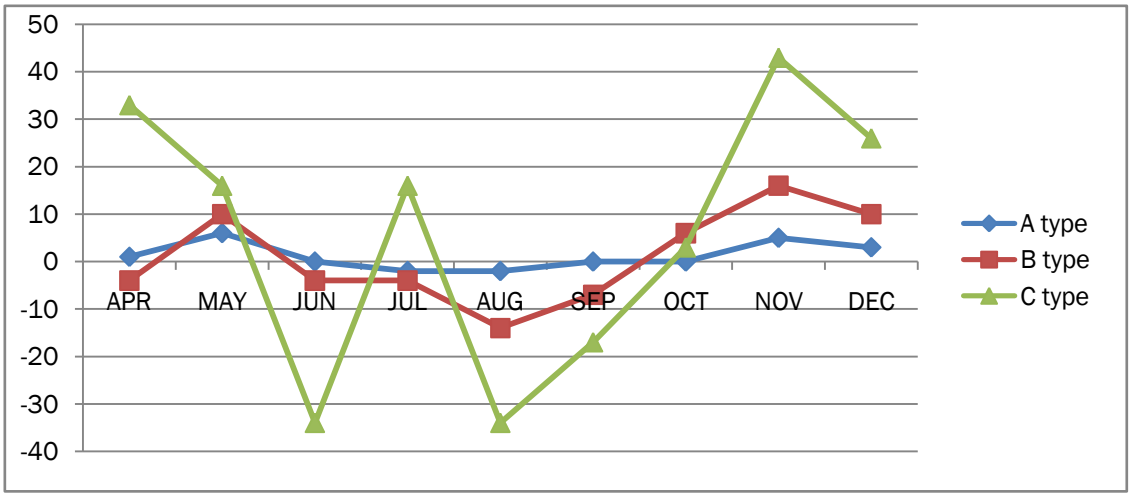
	A		B		C	
MONTH	**SMA**	**ES**	**SMA**	**ES**	**SMA**	**ES**
APR	24	26	104	103	717	713
MAY	24	26	100	102	734	732
JUN	25	26	104	106	734	741
JUL	27	26	104	103	734	721
AUG	27	28	104	102	734	736
SEP	25	26	97	96	717	718
OCT	25	26	97	93	717	709
NOV	25	26	94	97	707	715
DEC	27	28	100	104	724	733

D Demand for inventory
S Supply from inventory
SMA Moving Average Method
ES Exponential smoothing

3.2 DETERMINE THE ACCURACY

In this approach, for each period in the time series for which generated a forecast, take the absolute value of the difference between that period's actual and forecasted values (the deviation). Then average those absolute deviations and get a measure of Accuracy. Accuracy can be helpful in deciding on the number of periods which calculated by both methods, and/or the amount of weight place on each period. Generally, pick the one that result in the lowest accuracy. Here's the Table 5.4 and Table 5.5 shows how Accuracy is calculated:

If forecasting value is more than actual demand so error is shown in positive value.
If forecasting value is minimum than actual demand so error is shown in negative value.
If forecasting is equal to actual supply so error is zero.



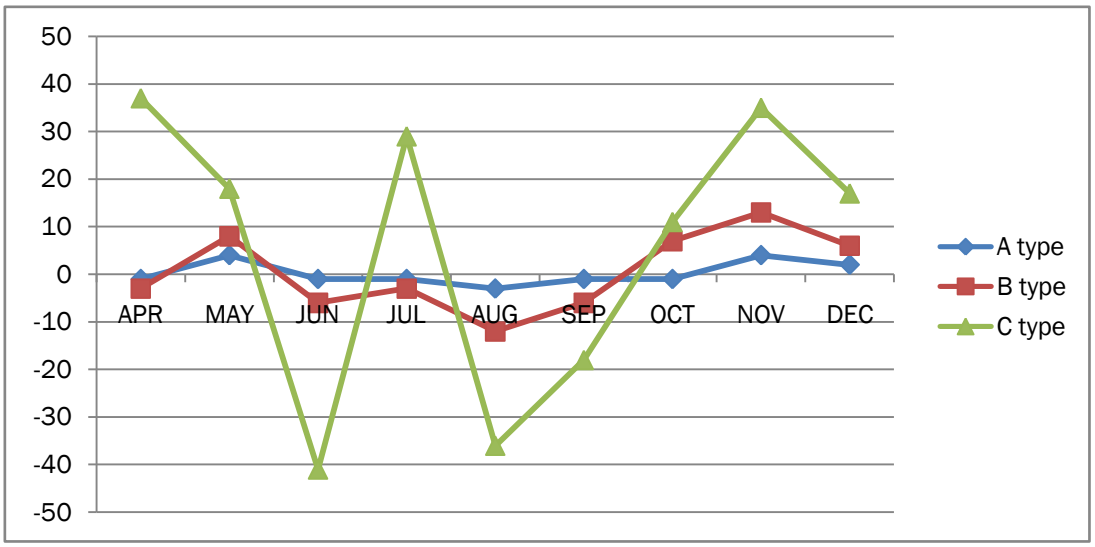


Fig 3.1 Error between Demand and Moving Average Method

Fig 3.2 Error between Demand and Exponential smoothing Method

4.1CONCLUSION

The service period of the case company is 12 months and the final order decision is often made before the spare part has even reached one month age.

- From the above statistics Exponential method is very close to store demand as compare to Moving Average method.
- The error of Exponential method is mostly positive so it will reduce the losses and make a good relation between buyer and supplier.

4.2 FUTURE SCOPE

The future scope of the forecasting process development was to make better use of the data resources. Some convenient approaches were excluded, which includes forecast aggregation and disaggregation. Especially global forecasting (i.e., create a forecast based on global data and disaggregate to DC level) could be a respectable way to improve forecasting accuracy, though this approach has its problems as well.

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