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Demand Forecasting Techniques Applicable to the Supplier of Industrial Products in Bangladesh (An Exploratory Study)

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Abstract

Appropriate demand forecasting is very important for decision and policy making of an organization. Different types of forecasting techniques are appropriate for various types of products and for different industrial settings because of demand variations and other influencing factors. Accurate forecasting technique is useful for accurate decision making for business operation. This research carried out to identify appropriate method of forecasting for a renowned supplier of industrial product in Bangladesh. The company has good number of sub dealers, who distribute the products in different parts of the country. Out of many products two products namely; Angel Grinder GWS 8-600 and Hot Air Gun GWG 500-2 were selected. For study purpose, preliminary investigation was carried out in the case organization to determine its present demand pattern and current practice of forecasting. From the study, we found that, currently they are not following any scientific approach, they take decision based on experience. Then the volume of sales and actual demand pattern of nine sub-dealers were also studied. For the study, actual sales data of 36 months for both supplier and dealers were collected. For the verification, four scientific approaches have been applied to select the best technique to fit in data set. The mean absolute deviation (MAD) was chosen as comparative parameter of different techniques. The study identifies that, weighted moving average method is the best suited one for Angel Grinder GWS 8-600 and the simple moving average method is suitable for Hot Air Gun GWG 500-2. Total inventory cost was calculated applying fixed order quantity model to verify the inventory cost involvement in existing procedure with the scientific approaches.

Keywords: Supplier, Forecasting, Inventory cost.

1. Introduction

Several demolishments (besides some development) have occurred during the past few years which offer all of us an opportunity to integrate forecasting and decision-making. Understanding and predicting customer demand is vital to manufacturers and distributors to avoid stock-outs and maintain adequate inventory levels [1]. Demand forecasts are necessary since the basic operations process, moving from the suppliers' raw materials to finished goods in the customers' hands, takes time. Most firms cannot simply wait for demand to emerge and then react to it. Instead, they must anticipate and plan for future demand so that they can react immediately to customer orders as they occur. Thus, once a customer order materializes, it can be fulfilled immediately – since most customers are not willing to wait the time it would take to actually process their order throughout the supply chain and make the product based on their order. While forecasts are never perfect, they are necessary to prepare for actual demand. In order to maintain an optimized inventory and effective supply chain, accurate demand forecasts are imperative. Forecasting can also play the crucial role of management control in that the basic control activities in business organizations focus or controlling the quantity and quality of resources, actual performance of work and monitoring performance [1]. The report finds that economic conditions are improving worldwide, and states that demand for machines for agricultural use, packaging, material handling, and machine tools will drive a 6.3% annual improvement in revenues this year, up to an estimated $1.6 trillion, from $1.5 trillion in 2013. IHS technology further forecasts that growth will continue through 2018, with revenue rising to $2.0 trillion by that year. Over the five-year period, the study forecasts that the machinery market's annual growth rate will average 5 to 6%. The improving economic outlook is a key factor in the strong growth of machinery in the coming years. "The growing populations and the expanding middle classes in developing countries are generating more disposable income. This translates into increased demand across a vast

number of sectors [2]. Over the past years, forecasting has played a crucial role in performance evaluation in process industry. Many techniques have been presented to deal with the related issues in forecasting, classification and detection, including multivariate statistic methods, general exponential smoothing, stochastic time series and support vector machines etc. [3].

2. Research Background

The choice of a forecasting technique is influenced significantly by the stage of the product life cycle and sometimes by the firm or industry for which a decision is being made. In the beginning of the product life cycle, relatively small expenditures are made for research and market investigation. Forecasting an ongoing project's actual duration and cost is an essential aspect of project management. Some commonly used method of forecasting are simple moving average and weighted moving average. Another widely used and well-performing technique for making forecasts based on time series data is exponential smoothing. This technique arose in the late 1950s and early 1960 and has formed the basis for some of the most successful forecasting methods ever since [4-7]. The main feature of an exponential smoothing method is that the produced forecasts are based on weighted averages of past observations, moreover, with the weights decaying exponentially as the observations age. Furthermore, the technique enables forecasting for time series data that display a trend and/or seasonality, exponential smoothing models have been widely employed given their simplicity, robustness and forecasting accuracy [8]. Single exponential smoothing of the level of a time series was introduced by [4-5]. Holt et. al, extended it to linear exponential smoothing to allow forecasting of data with trends and he also proposed a method for seasonal data [6]. It can incorporate additive or multiplicative seasonality. Later the methods have been adapted to time series with multiplicative trend, damped trend and time series of intermittent demand [9-14]. Their solid statistical background was established when state-space stochastic models were introduced [15-16]. Recently, the methods have been adapted to time series with multiple seasonal periods or seasonality [17-18]. Very few studies have been performed to forecast the demand of industrial products. And also the demand of these types of products is also different from consumer goods. So it is necessary to identify appropriate method of forecasting for the industrial products. In this situation, this research aimed for identifying suitable technique for the organizations that deals with industrial products. On the basis of this situation the objectives of the research have been selected.

The objectives are mentioned below:

1. To identify the status of demand forecasting of industrial products.
2. To identify best suited method for demand forecasting comparing time series model such as moving average, single exponential smoothing, and double exponential smoothing.

3. Research Methodology

For the study two industrial products were selected from "Abedin Equipment Ltd." The products are as follows; Angel Grinder GWS 8-600 and Hot Air Gun GWG 500-2. A case study research was performed in a selected industry situated in Dhaka and its sub Dealers in different region in Bangladesh. The adopted research mathodology for this study is a combination of questionnaire survey and concept from the theory.

3.1 Research approach

Different approaches were used to collect data and information. Each of the approaches has its own strengths and weaknesses depending on what type information that is to be collected. At first, some papers related to forecasting and various research works on forecasting were reviewed. After visiting the show room and outlet of related product, preliminary questionnaire was made. Though the main focus point of this research is secenary of demand forecasting so most of the questions were generated related to that area on the basis of preliminary survey of showroom as well as on the basis of theoritical aspects of the study. After making the priliminary questionnaire it was sent to sub dealers and dealer and at the sametime, direct observation is performed and data were collected to validate the questionnaire. After final investigation of the entire areas, the preliminary questionnaire is finalized and necessary modifications were made considering specific study area through addition, deletion as well as reformation. Data were collected by two methods. One is by direct observation. Major quantitative data was collected by direct interview with structured based questionnaire from key persons such as manager of planning department and sales manager. Some past record also collected from manager and planning department.

3.2 Data analysis tools

For the study, actual sales data from 2008, 2009 and 2010 for both supplier and dealers were collected. For the analysis, four established forecasting techniques namely the simple moving average, weighted moving average, single exponential smoothing and double exponential smoothing methods were applied. The mean absolute deviation (MAD) was chosen as comparative parameter.

4. Findings and Analysis

Here, the case study deals with demand forecasting and scenario of demand forecasting of industrial products such as Angle grinder GWS 6-100 and Hot air gun GSG 500-2. The information as well as data was gathered through the questionnaire, interview and some past record from the sales manager. Finally all data were analyzed by using various forecasting methods such as; simple moving average weighted moving average, single exponential smoothing and double exponential smoothing where MAD is the comparative parameter. Also provided order quantity for fixed order quantity model.

4.1Demography of the studied organization

The studied organization is located at Dhaka, Bangladesh. It was established in 2003.Currently 50 workers are working there. The organization import products and sell to the local markets countrywide through nine enlisted sub dealers situated at different parts of the country.

4.2 Forecasting

First of all a direct observation was made at the conducted organization. From their record, sales data were collected and their business position was also observed. Through questioners information related to the research was collected. After taking information of supplier, the sales data of nine sub dealers were collected. Summation of all sub dealers sale data of an individual month finally we can get suppliers monthly demand. Then we applied different forecasting technique on the actual market demand. The result obtained from different type of forecasting techniques of Angle grinder and Hot air gun are mentioned below:

4.2.1 Result obtained from different types of forecasting technique for Angle grinder:

After collecting data of three years for Angle grinder has been performed using selected forecasting techniques. The actual sales data collected from dealers varies from the data collected from the mother organization. For example, actual sale of year 2008 was 1257, whereas actual demand collected from the company was 1518. Due to the difference between data, for further verification standard deviation of both data were identified. The standard deviations are 33.51 and 121.3841 respectively. This variation occurred due to bull-whip effect between supplier and dealers. Because the dealers have direct connection to end customer, for that reason actual demand considered in this study is actual sales data of dealers.

Table 1: Comparison of various methods for year 2008 of Angle grinder

	Actual Demand of year 2008 (sales data of Dealer)	Forecast using simple moving average	Forecast using weighted moving average	Forecast using single exponential smoothing (α =0.1)	Forecast using single exponential smoothing (α =0.3)	Forecast using double exponential smoothing (α =0.3, β=0.5)
January	77					
February	137					
March	145			83	95	137
April	106	120	129	89	110	201
May	107	129	124	91	109	219
June	106	119	114	92	108	216
July	104	106	106	94	108	197
August	134	106	105	95	107	169
September	155	115	119	99	115	153
October	186	131	139	104	127	148
November	144	158	166	113	145	160
December	70	162	159	116	144	154

The table 1 shows, forecasted demand of 12 months of year 2008 using different forecasting techniques such as; simple moving average, weighted moving average, exponential smoothing (α= 0.1, 0.3) and double exponential smoothing (with α =0.3, β=0.5). Also the surplus and shortage were calculated. Similar analysis have been performed for year 2009 and 2010.
The mean absolute deviation (MAD) of four forecasting methods of year 2008, 2009 and 2010 for Angle grinder are mentioned below in figure 1

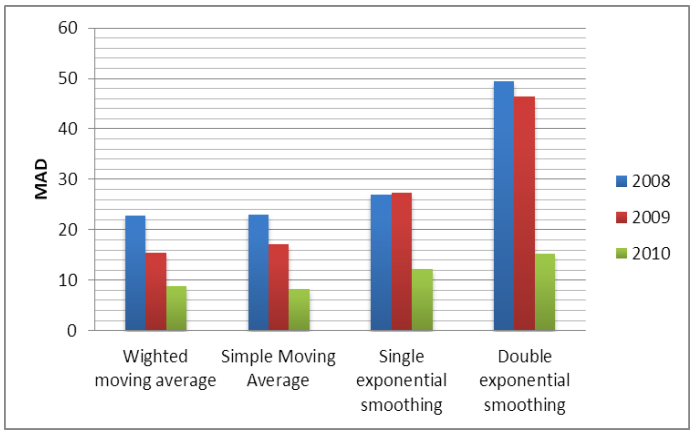

Figure 1: MAD of four forecasting methods (Angle grinder)

From above analysis, we find minimum error with Weighted Moving Average method. In every Weighted Moving Average absolute deviation was not too high and actual demand best match with forecast in comparison to other forecasting methods. According to the study, annual total cost would have been 4095889 tk. But in 2008 total annual cost of this organization was 4518740. That means the organization could have easily saved about 5 lac tk. for the single product.

4.2.2 Result obtained from different types of forecasting technique for Hot air gun:
Similar analyses have been performed for Hot air gun. The demand identified using different techniques for Hot air gun for year 2008 are shown below in table:

Table 2: Comparison of various methods for year 2008 of Hot air gun

Month	Actual Demand of year 2008 (Dealers)	Forecast using simple moving average	Forecast using weighted moving average	Forecast using single exponential smoothing (α =0.1)	Forecast using single exponential smoothing (α =0.3)	Forecast using double exponential smoothing (α =0.3, β=0.5)
January	627					
February	548			627	627	627
March	580			619	603	548
April	531	585	580	615	596	483
May	594	553	549	607	577	431
June	600	568	572	605	582	437
July	546	575	584	605	587	468
August	517	580	572	599	575	485
September	590	554	542	591	558	493
October	587	551	559	591	567	535
November	535	565	574	590	573	571
December	667	571	562	585	562	576

The MAD found from different methods for Hot air gun for year 2008, 2009 and 2010 are mentioned below:

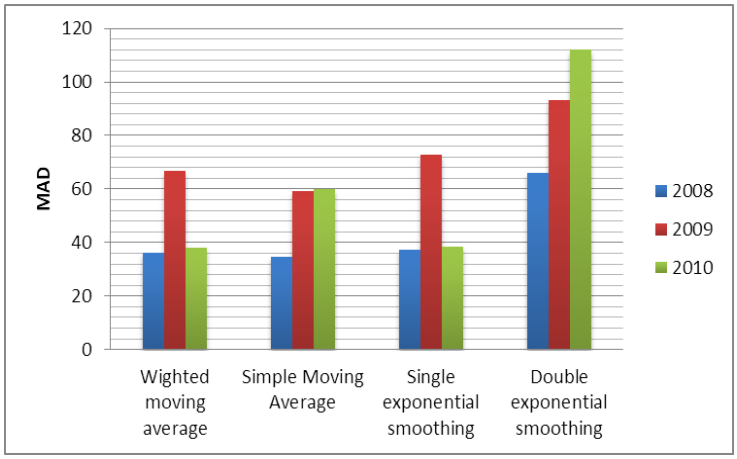

Figure 2: MAD of four forecasting methods (Hot air gun)

From the figure, it is found that simple moving average shows lower MAD for hot air gun in 2008 and 2009. In 2010 the MAD slightly increased. It is found from the study that the forecasted demands are more accurate while using this method. From the analysis, it is found that two different methods are suitable two products. The Economic Order Quantity (EOQ) and total cost were also calculated using the demand identified from selected methods. For hot air gun EOQ is 9062 pieces. According to the study, annual total cost would have been 74822169 tk. But in 2008 total annual cost of this organization was 81092300.

5. Conclusion

The main focal point of the study is to identify an appropriate forecasting method for industrial product. There is no sufficient work on forecasting technique for industrial products in Bangladesh. From the study, it is found that particular method is not applicable for all products. If the company can select appropriate forecasting technique they can save considerable amount of money. It is also found that if mother organization supplies based on the sales to dealers, it could not rely on this for future decision making as the actual demand varies at dealer end which is what the study explored. Actual demand pattern can only be identified from the actual sales data of the dealers as they finally sell to the end customers. It is concluded that, the methodology followed and developed in the study would be applicable to others industrial settings dealing with industrial products.

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