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APPLICATION OF FORECASTING TECHNIQUES AT ARIFCO PLASTIC FACTORY, JEDDAH, SAUDI ARABIA

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ABSTRACT
Forecasting is the use of historical data to predict event. ARIFCO is a plastic production company that is based in Jeddah. The company has a big difference between the actual sales and the target budget. Thus, this work was carried out to address the issue faced by ARIFCO. This work has analyzed and determined the best-fit method of forecasting for the sales of ARIFCO. This work has used qualitative and quantitative methods to find out the best forecasting method. Data from interviews and existing sales report were used to generate the findings. The sales in the Saudi Arabia region were focus for this study. Three forecasting methods namely exponential smoothing method, three moving average method and decomposition method was used in this work. The key findings of this work have shown that decomposition method has exhibited the best-fit method of forecasting with 1 % error. Thus, decomposition method will increase the revenue and reduce the losses of ARIFCO.

INTRODUCTION
The plastics business shapes the world we live in today whether it is mechanical, innovative or wares utilized all the time [1]. Quality market investigation, figures and patterns decided from key market drivers help shape the eventual fate of the plastics business [2]. The present market for buyers is concentrated rather high when compared to several years back. Thus, in previous years, plastic product suppliers additionally had a little extra sum to cover the margin, however in recent times; the market of plastic industry has become more competitive due to existence of various plastic suppliers worldwide [3]. Hence, to ensure the stability of the market, suppliers are opting for cost reduction and market analysis for enhanced sales [4]. One of

the methods used is forecasting. This process will enable the organization to understand the rising advances and applications by key market [5].

Forecasting is the use of historical data to predict and determine future trends or event. Companies use forecasting to determine how to allocate their budgets for a certain period [6]. It is very important to give a wider view about the future sales and the sales fluctuation. There are three types of forecasting by time horizon: Short-range forecast, which is used from three months and up to one year, medium-range forecast that is used up to three years, and the long-range forecast that is for used three years and more [7]. Most of the forecasting methods fall into two broad categories; the first approach relies on subjective assessments of a person or a group that is known as qualitative. The second approach is based on quantitative method that relies on historical past data. They are the time series methods include moving average, trend estimation, extrapolation, linear prediction, exponential smoothing, kalman filtering autoregressive moving average, and linear prediction [8].

Forecasting is important for startup business, although predicting demand is a hard task, risky and sometimes costly, it gives investors wider picture of the business statues whether business will successes, face competitors, or fails [9]. It is also, beneficial for existing business to guarantee continuously of work and realize expected profit. Forecasting is important for driving proficient operation management [10]. Forecasting methods depends on the data available and the expertise of the individuals applying the qualitative forecasting technique [11].

Several previous works have been reported in utilizing forecasting method. Lobo et al. [12] work utilized forecasting method based on smoothing technique for regional wind power estimation and found impressively minimal forecast gaffes. Farokhnia et al. [13] exhibited a work on dry spell forecasting on Tehran plain utilizing information mining and ANFIS procedures and found that 90% of the dry season status accurately anticipated. Kisi et al. [14] examined irregular stream flow estimation by utilizing a few information driven strategies and found that ANFIS, ANN and SVM models performed superior to the LLR and DLLR models in determining day by day irregular stream flows. Awojobi et al. [15] presented utilization of reference class estimating strategies for cost overwhelm dangers of hydroelectric dams and found that if chronicled data from the significant lenders of dams is available, cost can be decreased. Thomassey et al. [16] examined sales estimation in garments industry and found that best in class forecasting frameworks is a proficient method to decrease the negative outcome for the attire business. Bacchetti et al. [17] analyzed extra parts characterization and request estimating for stock control and found that forecasting system will enhance the management of stock and distribution. Candelise et al. [18] analyzed the test for innovation estimating for sun powered PV expenses and costs and found that set up gauging strategies have constrained capacity to catch key learning impacts behind recent PV cost and value patterns.

In addition, Alessandrini et al. [19] exhibited a novel utilization of a simple outfit for momentary breeze control forecasting which indicated similar

anticipating ability. González et al. [20] introduced an application for power value gauging using ARMAX time arrangement model and found that this novel methodology permitted to gauge the moving normal terms in practical time arrangement models. Peeters et al. [21] exhibited a work on anticipating waste structures on disposed plastic of electronic showcase lodgings and forecasted that by 2025, 99% of the lodgings of displays can be reused after dismantling.

ARIFCO Plastic Factory is a plastic production company based in Jeddah [22]. It is one of the leading manufacturers of various plastic products in the Kingdom of Saudi Arabia and neighboring countries. ARIFCO Plastic Factories Co. fast moving products include UPVC pipes, catering and household items, PC bottles, engineering plastic refrigeration and air-condition parts. The PVC pipes top the list of the fast-moving company products. The catering and household items are also fast moving compared to the other plastic products. The company produces its products both for local and international consumption. However, at the present moment, after conducting an interview with the management, the authors found out that ARIFCO does not use any forecasting method to predict it sales and it only sets monthly target. For instance, in 2014 the actual sale of January was 4,563,658 where their target was 10,000,000. The main explanation of this huge gap of 3,563,658 is because the company did not use any forecasting method. Thus, this work was done to find the best-fit method of forecasting for the sales of ARIFCO in order to increase revenue and reduce unnecessary losses. Therefore, with a good forecasting model, the company will be able to forecast the future thus close the huge gap between the actual and the company's target.

METHODOLOGY
This work was done to locate the best-fit method of forecasting for the sales of ARIFCO Plastic Factory. Thus, this work has applied two methods, which were qualitative and quantitative methods. Quantitative data measures the research variables since it involves using a large sample and quantifies the problem by generating numerical data or data that can be converted into usable statistics.

Qualitative research has more holistic view of a particular topic than answers to comparisons and detailed surveying questions. There are three types of qualitative data: Firstly, In-Depth Interviews. The second type is the Direct Observation. The last type of qualitative data is the Written Document. Thus, Interviews were conducted among the work personal of ARIFCO Plastic Factory for data collection. In addition, primary data were collected directly from ARIFCO Plastic Factory through survey and questionnaire. As for the sales trend and forecasting, the previous sales record was attained from the management as secondary data. Historical data were gathered to aid in understanding the sales pattern. The observation covers the period from January 2011 till December 2014. Based on the collected data, the authors constructed and analyzed the best-fit method of forecasting for the sales of ARIFCO Plastic Factory. The sales that were done in the Saudi Arabia region were the point of focus. This work applied three forecasting methods, which were exponential smoothing method, three moving average method and

decomposition method and analyzed the company data. The outcome was analyzed accordingly and presented in line graph form. Finally, based on the data studied, the forecasted values are presented. The overall method flow of this work is summarized in Figure 1.
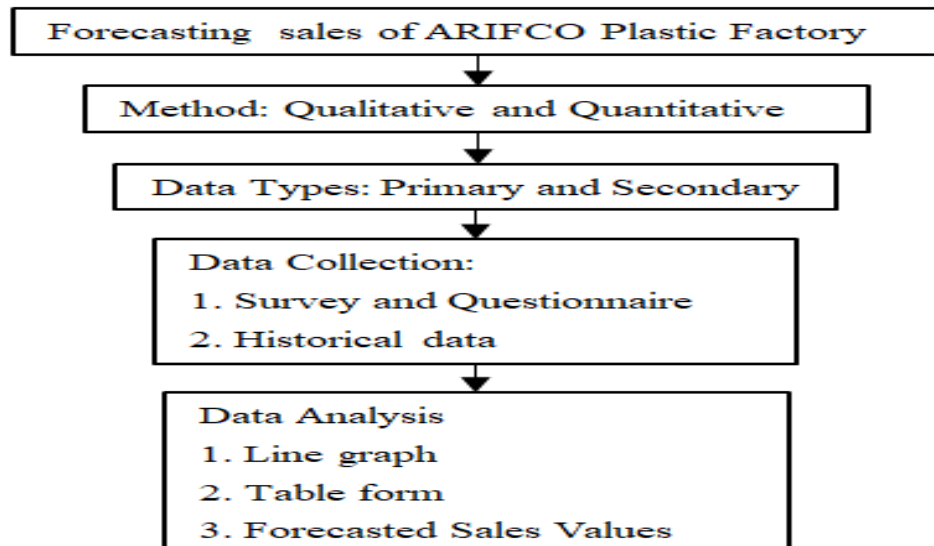


Figure 1: Method Flowchart

RESULT AND DISCUSSION

This work was done to choose the best forecasting technique for ARIFCO Plastic Factory. This work applied three moving average method on the actual data. Based on Figure 2, the forecast hardly meet the actual demand and there is huge gap between the actual demand and the forecasted one, which means this, is not the fit method for the actual data.
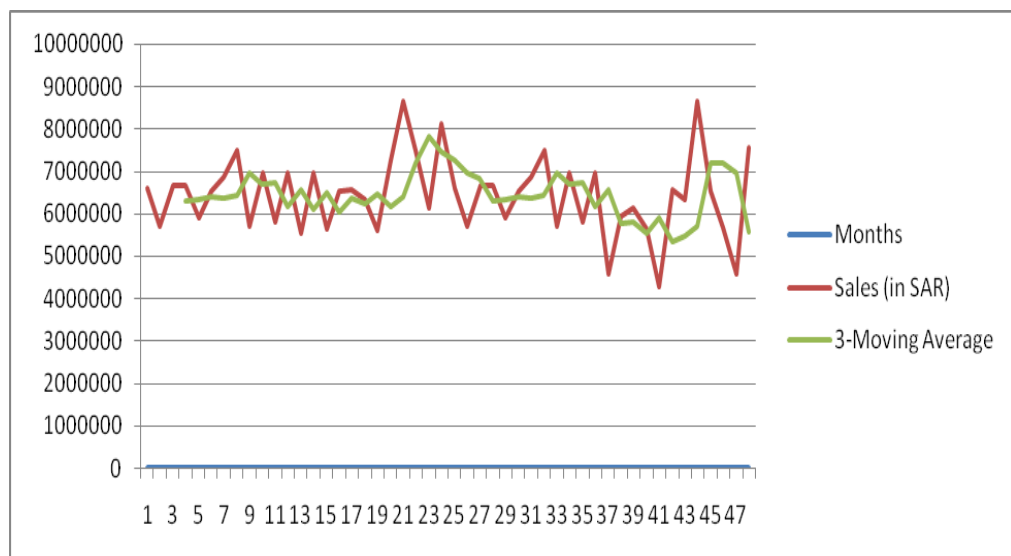
Figure 2: Forecast of Sales for Moving Average Method

Next, the exponential smoothing method was applied and based on Figure 3, that there is huge gap between the actual and the forecast. It was noticed from Figure 3 that there is seasonality in the actual data, which mean this is not the suitable method for the data and the Decomposition is fit.
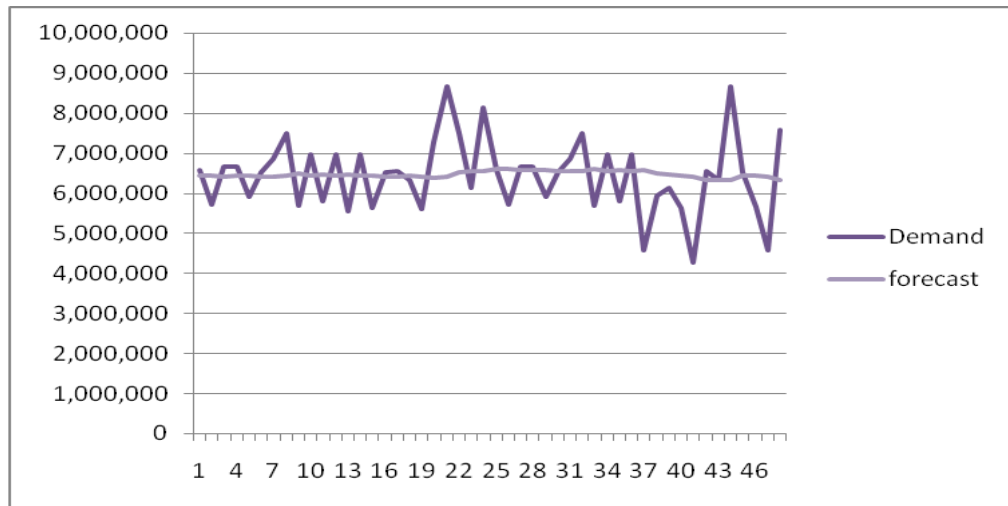
Figure 3: Forecast of Sales for Exponential Smoothing Method

In order to find the feasible solution for the fast moving product at ARIFCO, historical data were gathered to aid in understanding the sales pattern. The observation covered the period from January 2011 till December 2014. The sales data have been plotted to help in analyzing the data and finding the most suitable method, while the graph showed that the data have seasonality as shown in the Figure 4.
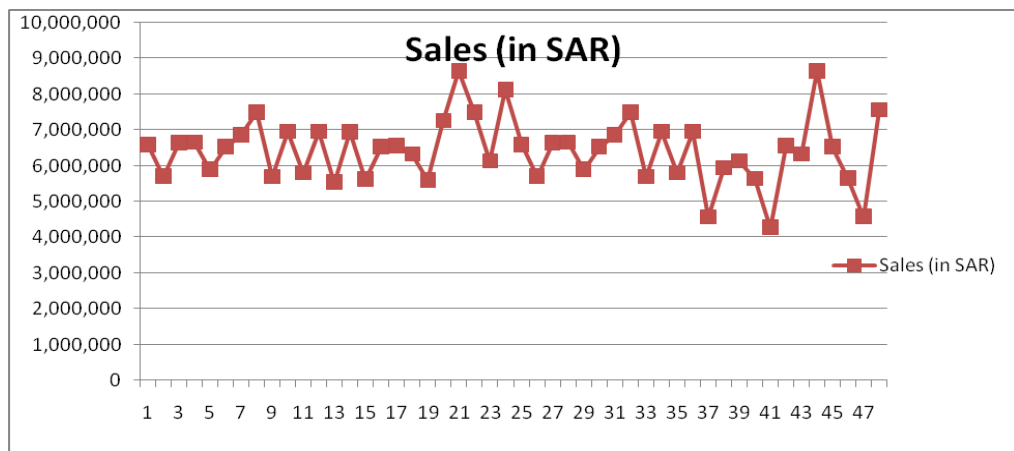
**Figure 4:** Sales in Saudi Arabia Region from January 2011 till December 2014

The data were divided into seasonality basis: winter, spring, summer, and fall. The period of observation covers 16 quarters. The model that was used with this kind of data is the Decomposition Classical Method with seasonal equation $(Y = a + bX)$, where Y represents the sales and X represents the periods in months. Also, bias was used to check the performance and accuracy of the model. It measures the performance of the technique by calculating the error. It shows the difference between the actual demand and the forecasted one by summing up all errors. The measurement tools that are used in this paper are: The Mean Absolute Deviation (MAD), and Mean Squared Error (MSE).

The MAD is calculated by summing up the absolute value of the forecast errors then dividing the outcome by the number of forecasts. The MSE is calculated in the same way but instead of using the absolute value they sum up the squared forecast error. The smaller errors the more accurate the models are. The Table 1 lists the validation of the decomposition model. The MAD showed that the percentage of the error is 1% which consider being small and fit to the model. The MSE is big due the sales volume.

Table 1: Validation of Decomposition Model

Mean Absolute Deviation	1 %
Mean Squared Error	15840471.65
a	20193535
b	-104941.5
Equation	Y = 20193535 -104941.5 X

The Figure 5 illustrates the actual demand and the forecasted ones. As shown below, the actual data facing peak always in the summer. Except in 2012, the peak occurred in the fall. The data pattern is as the following, the winter and the spring in the same range in 2011 then huge increase in the summer then huge decrease in the fall, then in 2012 the winter started to increase and decrease in the spring and then slightly raise in the summer then reached the peak in fall. In 2013, the winter started to decrease and small growth has occurred in the spring then reached the peak in the summer and declined in the fall. The winter in 2014 start to decrease then continuo to decrease in the spring then reached the peak in the summer then declined in the fall. The red line below showed the forecasted data. In some points the forecast meets the seasonality of the actual demand. The forecast meets the demand in spring and summer of 2011, and in spring of 2012, and in winter and fall and close to summer of 2013.
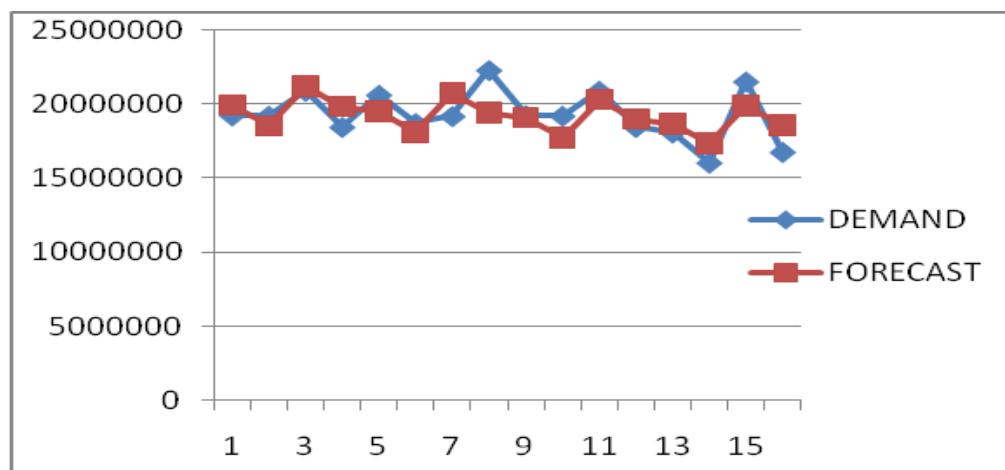
Figure 5: The Actual Demand Vs Forecasted

The Table 2 shows the actual data with the forecasted one. As shown the forecast is meeting the demand data, such as in winter 2011 the actual is 19,245594 and the forecast is the same.

Table 2: Validation of Decomposition Model

Period	Seasons	Demand	Forecast
1	winter 2011	19245594	19245594
2	spring 2011	19209011	38418022
3	summer 2011	20899812	62699436
4	fall 2011	18449706	73798824
5	winter 2012	20622579	103112895
6	spring 2012	18715868	112295208
7	summer 2012	19186016	134302112
8	fall 2012	22300084	178400672
9	winter 2013	19245594	173210346
10	spring 2013	19209011	192090110
11	summer 2013	20899812	229897932
12	fall 2013	18449706	221396472
13	winter 2014	18069519	234903747
14	spring 2014	16031717	224444038
15	summer 2014	21534924	323023860
16	fall 2014	16755563	268089008

The Table 3 shows the forecast for 2015 for ARIFCO Plastic Factory. Based on Table 3, for winter of 2015, the forecasted sales were 18251341, for spring of 2015, the forecasted value was 16975319, for summer 2015, the forecasted value was 19397001 and for fall 2015, the forecasted value was 18149328.

Table 3: Forecast for 2015 for ARIFCO Plastic Factory

Period	Seasons	Trend	SF
17	winter 2015	18409530	0.99
18	spring 2015	18304588	0.93
19	summer 2015	18199647	1.07

| 20 | fall 2015 | 18094705 | 1.00 |

Thus overall, forecasting is the use of historical data to predict and determine future trends or event. Looking at the historical data of ARIFCO, it was noticed that a huge gap between the company sales and the company's actual target. Thus, to better plan its sales the company required implementation of forecasting methods. This is needed, as it will guide in determining the best forecasting model that can be used by ARIFCO in order to increase its revenue and reduce unnecessary losses that the company has experienced in the last several years. In this work, three forecasting methods exponential smoothing method, three moving average method and decomposition method to analyze the company data was used. Hence, based on the key findings of this work, the best-fit method of forecasting for the sales in order to increase revenue and reduce unnecessary losses was decomposition method. This was due to its smallest error of 1%. Decomposition method will increase the revenue and reduce the losses of ARIFCO.

Companies use forecasting to decide how to assign their budgets for a certain period. It is very important to give a wider view about the future sales and the sales fluctuation. Forecasting to only help to eliminate the variances between the actual and target sales but also helps to reduce the losses in the company. If the company underestimates or overestimates its demand, it is likely to incur unforeseen losses. The reason is because the sales targeted determine the number of plastic products that the company produces. It is not enough to use forecasting to forecast the demand of a company's products. It is important to ensure that the forecasting method used is the best. This is inline and was agreed by the work of Laboissiere et al. [23] where it was stated that with forecasting systems, a company can exhibited a better management for enhanced profit. In addition, work done by Heo et al. [24] also showed that with forecasting system, the cash flow and sales target can be anticipated to avoid bankruptcy.

On the other hand, Reddy et al. [25] also demonstrated that forecasting system enables to analyze market trends beforehand and assist in investing in stock market. Nevertheless, forecasting system also plays a significant role for product development resourcing as demonstrated by Hird et al. [26]. Finally, works of Hajek et al. [27] has confirmed that forecasting system coherently assists stake holder to take important decision for enhanced company outcome. Thus, it can be seen that with forecasting system, the overall management of company performance is enhanced and made more organized.

CONCLUSION
This work was done to determine the best demand forecasting method for ARIFCO Plastic Factory. A qualitative and quantitative research method was used for data collection. Primary data from interviews were attained and the existing sales information were analyzed to determine the best demand forecasting method for ARIFCO Plastic Factory. Three forecasting methods were compared and the key findings showed that best-fit method of forecasting for the sales was decomposition method. It exhibited the smallest error of 1%. Thus, companies use forecasting to decide how to assign their

budgets for a certain period. It is very important to give a wider view about the future sales and the sales fluctuation.

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