DEMAND FORECASTING IN SME's INVENTORY MANAGEMENT

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ABSTRACT

The company of Small and Mediums Enterprises (SMEs) are among industries that need forecasting the most. The need to forecast in the management and operations is increasing in order to achieve its objectives. SMEs currently facing the problem of meeting the required inventory level for some of the product and the problem might be due to inaccurate demand forecasting. The objectives of this paper are to identify the data pattern and to choose the suitable methods from the identified pattern. Comparison among methods was conducted to determine the best method for the company in order to prepare them for future inventory. This study was conducted using the case study method. The data of demand for one of the product series for nine consecutive years were collected and forecasted for the purpose of this study. From the result, three methods were selected based on pattern data. The finding revealed that, Time-Series Decomposition is the best method when comparison forecast accuracy is made.

Keywords: Demand forecasting, Forecast Model, Forecast Measures of Accuracy

INTRODUCTION

Forecasting is predicting and estimating future demand to provide demand forecasts for company. Many companies do not know their future demands and have to rely on demand forecasts to make decisions in inventory management both in long and short term. Therefore forecasting is one of the important measurement method in decision making (Yassin & Ramlan, 2011) and important issue for manufacturing companies (Kalchschmidt, 2007). If forecasting is accurate, the benefits are reduced safety stock, lower inventory levels and inventory holding costs together with lowering customer service level (Kerkkanen, 2010).

Most of the small and medium enterprise (SME) companies in Malaysia determine product demand forecast using judgmental forecast or simple quantitative forecast method such as simple moving average and simple exponential smoothing method (Bon & Chong,(2009)). Kerkkanen et. al (2009) indicated that the imitation of concepts, targets and principle of forecasting method among consumer product, risk for unrealistic accuracy targets and deceptive error measures. Therefore special characteristics should be addressed and understood before any techniques or approaches are applied (Kerkkanen et. al (2009)). This is supported by Wilson and Keating (2009). Thus, this research objective is to determine the best method for forecasting the inventory demand in SME's in Malaysia based on the given characteristics.

Background of the case study, demand forecasting and forecast accuracy is reviewed in next section. After that, pattern and methods selection are determined. Next, comparison between forecasting methods are explained. While the last section, provide some concluding remarks.

LITERATURE REVIEW

This study has used the data collected from one of the food exporter, Macro SME in Malaysia. The data included the sales unit of the product for nine consecutive years. There are a lot of products produced from the company. The study focused on one of the popular product only.

Kerkkanen et. al (2009) indicated that demand forecasting is commonly applied in companies that operate in consumer markets. Accurate forecasts help to achieve better customer service and lower inventory levels (Poler et al. 2006)

Kerkkanen et. al (2009) also stated when demand patterns are relatively smooth and continuous and demand forecasts based on historical demand are usually quite accurate. Wilson and Keating (2009) outline a guiding principle based on pattern for selecting an appropriate forecasting method that commonly used.

Kerkkanen et. al (2009) mentioned that different types of forecast errors cause different kinds of impacts in production planning and inventory management. In order to get better forecast accuracy, selecting the best forecast measurement is essential. Literature provides several different measures for forecast error. Some of the most popular ones are means absolute percentage error (MAPE), mean squared error (MSE), cumulative error and average error or bias (Russell, 2000; Chopra and Meindi, 2001; Mentzer and Moon, 2005). Lam et. al (2001) stated that Mean absolute percentage error (MAPE) has become popular as a performance measure in forecasting because the easiness in term of interpretation and understandable. It is also useful for conveying the accuracy of a model to managers or other non technical users (Chu, F.L. (1998)). Taylor et al. (2006) found that the relative performance of the RSME methods is avery similar to MAPE. Both are commonly used as error measure in business (Hyndman et al. (2006). According to some authors, measuring forecast errors improves forecast accuracy (Mentzer and Moon) and the smaller the forecast error is, the more accurate the forecasting method will be (Ryu, (2002)). Therefore in this study, all accuracy measurements that have been discussed, applied to find the best forecasting method.

METHODOLOGY

Case study is suitable as the research method in this study as Yin (2003) stated that case study research method can be defined as an empirical inquiry that investigates a contemporary phenomenon within its real-life context. This is when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used. This study used single case study as defined by Yin (2003). Single case study used to confirm or challenge a theory or to represent a unique or extreme case. Moreover, Yin (2003) emphasized that single case study ideal for revelatory cases when an observer may have access to a phenomenon that was previously inaccessible.

In this study, documentation of secondary data will be used. Yin (2003) stated that documents could be letters, memoranda, agendas, study reports or any items that could be added to the database. The data taken will be the past data kept by the respective company.

Yin (2003) stated that, data analysis can be done with examining, categorizing, tabulating, testing or combining both qualitative and quantitative evidence to address the initial propositions of a study. The data obtained in this study will be analyzed using ForecastX software. The rationale of ForecastX as a software because it is a family of forecasting tools

capable of performing the most complex forecast methods and requires only brief learning curve that facilitated immediate, simple and accurate operation regardless of user experience (Wilson and Keating, 2009).

RESULT AND DISCUSSION

Data analysis

The first step in forecasting is to observe the time series data pattern based on the generated time series data. For this data, the graph exhibited cyclical, seasonal and trend pattern. This is due to the increased and decreased demand through out the time based on the season. The represented data is a time series data because there are the values of demand for each month for nine years straight. Therefore, the appropriate selected data analysis method will be the linear regression, Holt-Winter Exponential Smoothing and Time-Series Decomposition method.

Comparison of the Forecasting Methods

Method	MAE	MAPE	MSE	RMSE	Total
Time-Series Decomposition	156.18 (1)	5.52% (1)	45,903.76 (1)	214.25 (1)	4 (The best)
Holt-Winters Exponential Smoothing $\alpha = 0.05, \beta = 0.65$ $\gamma = 0.27$	232.76 (2)	8.77% (2)	103,897.00 (2)	322.33 (2)	8
Linear Trend $y=70.3x - 602.95$	928.88 (4)	37.38% (5)	1,185,894.01 (3)	1,088.99 (3)	15

Table 1: Comparison of the Forecasting Methods

Table 1 above shows a comparison of the accuracy of error measurement for the best of each model and each forecasting method that has been used.

Time-Series Decomposition method has a slight error values for all four measurement techniques when compared with other forecasting methods. Time-Series Decomposition method has the total value of only 4 and has made this as the best method of all. The MAE value for this method is only 156.18, MAPE is 5.52%, MSE is 45,903.76 and RMSE is only 214.25. The Holt-Winters Exponential Smoothing method with $\alpha = 0.05$, $\beta = 0.65$ and $\gamma = 0.27$ is at the second position with the total value of eight. The error value obtained by this method is 232.76 for MAE, MAPE is 8.77%, 103,897.00 for MSE and 322.33 for RMSE.

The method of linear trends is the worst method with total value of 15. Error value obtained was 928.88 for MAE, MAPE is 37.38% for, 1,185,894.01 for MSE and 1,088.99 for RMSE.

Overall, the best forecasting method to predict the demand of the selected product is the method of Time-Series Decomposition. This is because this method has the lowest total

error values of all techniques which are also the least when compared with the other methods of forecasting.

CONCLUSION

In conclusion, the right forecasting method can be achieved by looking into data pattern, forecast accuracy and forecast error. Poor forecast method and neglecting high errors of forecast is a frequent cause of increasing inventory levels. Therefore, utilization of forecasting techniques in inventory demand is economically justified and rational.

For future study, suggested that combining forecasting method is included in selection method. Finding from others study, shows that, combining forecast could yield lower forecast error on average (Fuchun and Greg, 2004), improved forecasting accuracy (Robert and Robert, 2004) and produce more accurate forecast for than individual method (David and Micheal, 2002).

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