

Demand Forecasting for Batik Product of Community Enterprise in Songkhla province, Thailand.

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Abstract

The current economic for growing and technological development Include the customer requirements are changing rapidly as the resulting problems are complex. In terms of production to keep up with the demands of markets and customers. Therefore, the prediction will happen in the future based on historical data analysis. The current data and experience to make the business of forecasting results used to understand the changing trends of the business environment will impact to business process in the future. The objectives of study are to applying the demand forecast technique for batik products by simple moving average, weighted moving average and exponential smoothing. The methods in this study used the daily sales data for the batik products mentioned were collected for the period starting Jan 2015 and ending Dec 2015. The data were obtained by contacting the selected retail outlet manager. Their user friendly database allows us to view daily sales of individual batik products such as number of units sold and product code for this study. The result was found that simple exponential smoothing, when $\alpha = 0.5$, the MAD was 34.47, the moving average forecasting method weighted to the MSE minimum of 1551.21 and forecasting with simple exponential smoothing when $\alpha = 0.5$ to the MAPE was 21.07 %. The results shown that the exponential smoothing technique was the best method in this study.

Keywords: Forecasting, Production, Batik products

Introduction

The garment industry in Thailand was considered to a sector that is vital to the country. The value of exported up to US \$ 2,900 million. The united states remains a key market at 30%, Europe 26%, Japan 13% Asia 7% and the rest of the domestic market (Thai garment export challenged this year, 2015, Mar 11), which in this amount will include the batik industry, which was a longtime industry and produced in several southern provinces such as Yala, Pattani, Narathiwat and Songkhla, but the ubiquity of the batik. The beginning in the southern provinces have been influenced from Malaysia.

Local people in the southern called the batik as "batik" or "batea" while the older generation called batik that are not produced in Thailand that "Yava" or "Java".

The current business conditions in the industry competition is fierce for products to retain customers and market share as much as possible. One important strategy in the business industry to build a profitable and growing a business is production management and inventory management. This can be considered an important and necessary to predict production by Kasemset et al (2014) referred about the shelf life and quantity saving the EOQ with Nonlinear Holding Cost. In addition, the current economic growth and technological development is fast. The Customer demand has rapidly improved as the resulting problems are large and complex in terms of production to keep up with the demands of markets and customers. The predicted will happen in the future based on historical data analysis, current information and experience to make the business of forecasting results can be used to understand the changing trends of the business environment will affect business in the future and makes it possible plan or policy to achieve the objectives of the business. The method of calculation of the forecast will be a multi-step process of calculating the feature selection methods are used to calculated the difference between the complex and difficult to calculated. Therefore, to help better understand the capabilities and limitations of the various forecast techniques and make to decision by using the time-series method and adopt the information to plan production and achieve maximum efficiency in production.

Objectives

1. Adopt to forecasting technique for predict demand of batik products.
2. Predict the suitable demand of batik products to production by using the time series method

Theory

1. Forecasting

Forecasting aims at reducing uncertainty that confounds future decisions. However, difficulties arise while fulfilling the assumptions of Economic Order Quantity (EOQ) model, which includes a continuous, constant and a known rate of demand (Hill, 1988). Prescription items can be substituted for one another, which obviates EOQ assumptions. Forecasting methods are of two major types, qualitative and quantitative. Quantitative forecasting technique relies on the use of statistical methods for making projections about the future based on the past, while qualitative analysis is based on judgmental and expert opinion. Qualitative methods model demand from solicited opinions. For products (for use in our current study) with demand history available,

future activity can be predicted better using quantitative models from sales in the previous cycle (Tersine, 1994). There are two main types of quantitative forecasting – time series and causal. Time series analysis predicts future attributes from the historical past and prior experience. This method uses time as the independent variable to predict demand. The causal relationship is applicable under the assumption that there exists a cause and effect relationship between an input variable and its corresponding output (Wheelwright & Makridakis, 1985).

2. Time Series Components

Time series components may contain up to three interacting components, namely, raw-data, trend and seasonality. Raw-data, or level component, is the central tendency of a time series at any given time. The trend is a continuing pattern which exhibits either an incline or decline in growth rate. The factors that affect and explain the trend component are inflation, invention and innovation of technology, and increase in productivity (Hanke & Reitsch, 1992). The seasonal factor corresponds to fluctuations that repeat with every year or season.

3. Forecast Models

All time series smoothing methods use some form of smoothing (weighted average) of historical observations to suppress short term fluctuations. The forecasting techniques that are examined in this study are as follows, (Chopra & Meindl, 2010)

3.1 Simple moving average

The systematic component of demand is represented as level. The level in period “t” (L_t) is calculated as an average of the demand over the most recent N time periods. This is expressed as,

$$L_t = \frac{(D_t + D_{t-1} + \dots + D_{t-N+1})}{N}$$

Where

D_t = Observed demand in time period t

F_{t+1} = Forecasted demand for t+1 made in time period t

N = Number of time periods

The current forecast is stated as

$$F_{t+1} = L_t \quad F_{t+n} = L_t$$

After observing the demand for period “t+1”, the revised estimates of level are as follows:

$$L_t = \frac{(D_t + D_{t-1} + \dots + D_{t-N+2})}{N}; F_{t+2} = L_{t+1} \text{ and so on.}$$

3.2 Simple exponential smoothing

This technique uses only historical values of a time series to forecast future values and is suitably employed when there is no trend or seasonality associated with the data. The initial estimate of level (L_0) is taken as the average of all historical data and is given as,

$$L_0 = \frac{(D_t + D_{t-1} + \dots + D_{t-N+1})}{N}$$

The current forecast for all future periods is equal to the current estimate of level and is given as,

$$F_{t+1} = L_t \text{ and } F_{t+n} = L_t$$

After observing the demand for period $t+1$, the revised estimates of level are as follows:

$$L_{t+1} = \alpha D_t + (1-\alpha) L_t$$

Where

α = Smoothing constant for level ($0 < \alpha < 1$)

D_t = Actual Demand in period t

F_t = Forecast made in period t

4. Measuring Forecast Accuracy

A forecast is never completely accurate. The principle objective of forecasting is that there is as small deviation from actual demand as possible. Forecast error measures also allow comparing forecasts and help to determine the better technique. The measures of forecast error used in the study are Mean Absolute Deviation, Mean Square Error, and Mean Absolute Percentage Error. Mean Absolute Deviation (MAD) measures the average of difference between the forecast and actual demand. It is the simplest determinant of forecast error. A smaller value of MAD represents a more accurate forecast. The MAD formula is presented as,

$$MAD = \frac{1}{n} \sum_{i=1}^n |\hat{Y}_i - Y_i|$$

Where

\hat{Y}_i = Forecast demand value at time t

Y_i = Actual demand value at time t

n = Number of time periods

The MSE is similar to the MAD, except that each residual is squared. In this way, larger forecast errors are more heavily penalized. It is used in this study so that the forecasts with relatively large errors will be highlighted. The MSE is calculated as,

$$MSE = \frac{1}{n} \sum_{i=1}^n (\hat{Y}_i - Y_i)^2$$

Where

\hat{Y}_i = Forecast demand value at time t

Y_i = Actual demand value at time t

n = Number of time periods

The MAPE compares the error in terms of percentages. The MAPE gives an indication of average relative magnitude of forecast errors in comparison to actual forecast error. MAPE is pertinent across different time series methods. For this reason it is included in this study. The formula for MAPE is presented as,

$$MAPE = \frac{100}{n} \sum_{t=1}^n \left| \frac{A_t - F_t}{A_t} \right|$$

where

F_t = Forecast demand value at time t

A_t = Absolute value of Error at time t

n = Number of time period

5. Related Research

In the year 2014 have been forecasting techniques medication needs of retailers in India, (Anusha et al, 2014) by this study demonstrates the application and screening of simple forecast models (Moving Average, Exponential smoothing, Winter's Exponential) to forecasted demand for pharmaceuticals. Two products were empirically chosen for the study – Okacet 10mg tablet (seasonal demand, contains Citrizine) and Stamlo Beta tablet (non-seasonal, contains Amlodipine 5 mg & Atenolol 50 mg). The accuracy assessment parameters indicate that the least sales forecasted error for Okacet (seasonal) was obtained used WES ($\alpha=0.2$, $\beta = 0.1$, $\gamma = 0.01$, ET = 92.28) and (MAPE = 27.50) indicated highest forecasted accuracy, whereas for Stamlo Beta (non-seasonal) WES provided no additionally superior forecast as other models.

Later, such techniques have been used to create a system to forecasted sales of the service companies to delivered chemicals in Mexico (Palavicini et al, 2015), which developed software was written in PHP language (for web development dynamic content) and HTML (for making Web pages) and by the used of XAMPP software (Apache

server module), runs on different operating systems. These program to applied five quantitative sales forecasting techniques for each marketable product, with continuous error assessment, in order to selected case by case, the monthly more accurate prediction method. The proposed system has been already applied in two companies; the first one used simple moving average, as a quantitative technique to predict its sales and expert opinion as qualitative technique; the second company used trend projection as quantitative, and Delphi Method as qualitative techniques. Both companies consider that a suitable sales prediction is the starting point for good operations planning. For each product it is required to use a different technique, because the behavior of historical sales in each case is different. The proposed system allows identifying the lowest mistake technique to applide in the following sales monthly forecast, which was necessary to properly plan the operations in the companies under studied based on the sales data of the last three years it is possible to make a yearly sales forecast, but each month, the monthly forecast should be updated with the last month data..

The study has been applied to forecasted the peak of production of Ko Yo woven (Sukkrajang & Rattanakool, 2014) . As a result found that the forecasting method used time series analysis technique. In order for the model to predicted the best to used for forecasting production planning of woven products of Ko Yo was the Kritsanar strip textile product by analyzing data on past sales of each product analyzed. The study forecast models of Ko Yo woven has major problem to planned production for the month of Ko Yo woven will used the sales forecasts from marketing, who is responsible for the planning to the production planned again from experience planner. The data were not take into account sales in the statistics to help in the decision the other way and found that calculated using the exponential smoothing was the best method.

Methods

This section intends to provide a research procedure, data collection and data analysis for the selection of forecast method.

1. Research procedure

1.1 Studying problems and theories in predicting the production process is the cause of the error in production planning decisions regarding the efficient application of techniques to predicted the peak of production.

1.2 The study to collected data and analyzed the models in forecasting by giving priority to the analysis of predictive models that make the fewest mistakes the information in the decision to used any form prophecy which the results of this study involved the following theory (Snyder et al, 2002), as

1.2.1 The 3-month moving average.

1.2.2 The 3-month weighted moving average, which was determined the weighted three-month moving average. In table 1

Table 1

Weighting	Period
3	1 last month
2	2 last month
1	3 last month
6	Total of weighting

1.2.3 Simple Exponential Smoothing, when $\alpha = 0.10$ and $\alpha = 0.50$.

2. Data Collection

Daily sales data for the batik products mentioned were collected for the period starting Jan 2015 and ending Dec 2015. The data were obtained by contacting the selected retail outlet manager. As observed, Their user friendly database allows us to view daily sales of individual batik products such as number of units sold, product code for this study.

3. Data analysis

The forecasting techniques were evaluated based on their accuracy in forecasting actual production data. Thus, Mean Absolute Deviation (MAD), Mean Squared Error (MSE) and Mean Absolute Percentage Error (MAPE) were used to measure the error of forecast obtained by used various techniques because of MAPE was a percentage, it is a relative measurement and sometimes preferred to the MAD. The MSE was a squared measurement selected as it helps in penalizing errors more heavily.

Results

This section to demonstrated the result of total production of batik in year 2015 and forecasted total production of batik in year 2015 with a 3-month moving average, simple exponential smoothing and evaluated results based on their accuracy in forecasting actual production data of three forecasting techniques in this study.

Total production of batik in year 2015, as Figure 1

1. The forecasting total production of batik in year 2015 with a 3-month moving average and 3-month weighted moving average, as table 2.

2. The forecasting total production of batik in year 2015 with a simple exponential smoothing, as table 3.

3. Evaluated results based on their accuracy in forecasting actual production data of three forecasting techniques, as table 4-6

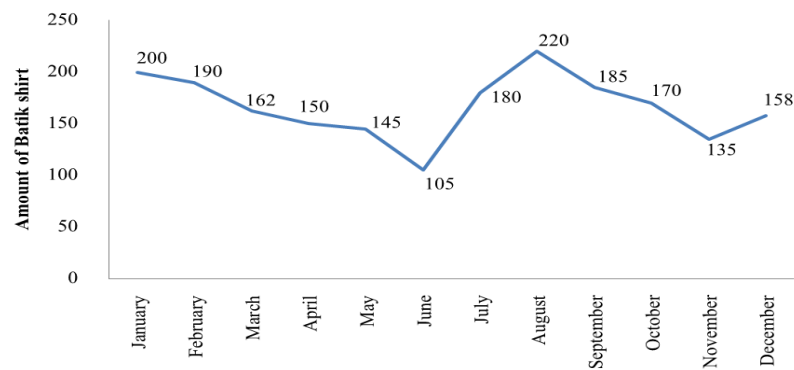


Figure 1 Production yield in year 2015 (shirt)

Table 2 The result of forecasting total production of batik in year 2015 with a 3-month moving average and 3-month weighted moving average

Month	Batik shirt (Shirt)	Moving average	Weighted moving average
January	200	-	-
February	190	-	-
March	162	-	-
April	150	184.00	177.67
May	145	167.33	160.67
June	105	152.33	149.50
July	180	133.33	125.83
August	220	143.33	149.17
September	185	168.33	187.50
October	170	195.00	195.83
November	135	191.66	183.33
December	158	163.33	155.00

Table 3 The result of forecasting total production of batik in year 2015 with simple exponential smoothing, when $\alpha = 0.10$ and $\alpha = 0.50$

Month	$\alpha = 0.1$ (Unit : shirt)	$\alpha = 0.5$ (Unit : shirt)
January	250.00	250.00
February	245.00	225.00
March	239.50	207.50
April	231.75	184.75
May	223.58	167.38
June	215.72	156.19
July	202.19	155.30
August	203.97	187.65
September	202.07	186.33
October	198.86	178.17
November	192.47	156.59

Table 4 Mean Absolute Deviation (MAD)

Forecasting techniques	Mean Absolute Deviation (MAD)
Simple moving average	36.74
Weighted moving average	36.04
Simple exponential smoothing , $\alpha = 0.1$	35.78
Simple exponential smoothing , $\alpha = 0.5$	34.47

Table 5 Mean Squared Error (MSE)

Forecasting techniques	Mean Squared Error (MSE)
Simple moving average	1,788.09
Weighted moving average	1,551.21
Simple exponential smoothing , $\alpha = 0.1$	3,685.51
Simple exponential smoothing , $\alpha = 0.5$	1,574.16

Table 6 Mean Absolute Squared Error (MAPE)

Forecasting techniques	Mean Absolute Squared Error (MAPE)
Simple moving average	23.66%
Weighted moving average	23.20%
Simple exponential smoothing , $\alpha = 0.1$	21.85%
Simple exponential smoothing , $\alpha = 0.5$	21.07%

Conclusions and Discussion

In summary, comparator values indicate that simple exponential smoothing, when $\alpha = 0.5$ the MAD was 34.47, moving average forecasting method weighted to the MSE minimum of 1551.21 and forecasting with simple exponential smoothing when $\alpha = 0.5$ to the MAPE was 21.07 %, accord the Lorchirachoonkul & Jitthavech (2005) demonstrated the result by providing a exponential weighted moving averages for time series that not a trend or a time-series trends and time series are not seasonal or a season. How to found the moving average by the exponential weighted moving averages was a very high flexibility for analyzing and forecasting trend data in the event of a season or more likely, and seasons based on the applications in use. Because of weight to put on each period based on the consideration of those who applied for such reasons to make predictions with this method is highly flexible with applications in many areas of research and Sukkrajang & Rattanakool (2014) were forecasted the peak production of Ko Yo textile products, the results were found that the exponential smoothing forecasting models used to forecast the best methods. The total production of this information, alpha 0.1 is the most reasonable average absolute value is equal to 77.58. Moreover, Snyder et al. (2002) referred that the method of exponential smoothing used to control inventory and margin error of the forecast in the range of control explained in terms of statistical models such as error variance, which the exponential smoothing technique used in research under general conditions. The degree of variance were higher movement of data that consistent things associated with the estimation and predictions was subject of the investigation on the part of research was the key issue to found the forecast distribution of lead-time for using in the calculation of inventory control to consider applying the method of estimating the level of orders increased. It is done by simulating the spread of the forecasts for the examination with the concept of Bermudez et al (2006) noted that the exponential smoothing was forecasting techniques that widely used in order to controlled inventory and the business planning process of predicting which exponential smoothing used to deal with time-series forecasting and

forecasting techniques that can lead to minimal tolerances to be applied as a tool for decision support system.

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