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Analysis on the Business Development Strategy Based on Production Analysis: The Case of Wristband Company

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Abstract: The purpose of this study is to determine the planning and control of printers and wristband so that the company can determine the optimum demand and whether the company can achieve the targets previously set. This study uses a quantitative approach through a survey to obtain the data. The methods of analysis used in this study are forecasting, EOQ and analysis of alternative solutions. The results of the study show that linear regression method is the most appropriate forecasting method used by companies to forecast demand for its products. The results of calculations using EOQ generate optimal number of orders for the company for each product. Further, analysis results employing selected alternative solutions generates appropriate alternatives for companies that implement the methods of forecasting and EOQ. By applying the alternatives, company can minimize costs incurred by the company.

Key words: Forecasting, EOQ (Economic Order Quantity), business development strategy, data, forecast

INTRODUCTION

Indonesia with a population density reaches 245,862,034 people (BPS, 2014) is ranked 85, climbing up 15 ratings compared to 2012 in its health industry (USAID, 2014). Along with the increasing rank, the healthcare industry grows one of which is the growing number of hospitals across Indonesia. As the fourth most populous country in the world and given its increasing health awareness, Indonesia is considered as one the largest market for healthcare (Insight Alpha, 2014). Increasing private-sector participation in health care services is stimulating change in the Indonesian health care industry (APCO, 2014).

As to support this, one of the products needed in the health industry is "Wristband". This product is a special bracelet for patients, designed to record patients' identity or health condition and then printed on the bracelet, so the data will not be easily deleted like a hospital bracelet in general. This product provides a solution to hospitals as to reduce medication errors. Wristbands are printed using standard thermal print process (Brenmoor, 2014).

Medication Error (ME) or medication error services according to NCC-MERP (National Coordinating Council Medication Error Reporting and Prevention) refer to any incident which can be avoided which cause or result in improper drug services or patient harm while the medication is under the supervision of medical personnel or patients (Hort *et al*., 2011) medication error is the type most common medical error occurring in hospitals.

Medication error occurs with such unbelievable regularity. Studies in 36 hospitals find that the possibility for ME to occur in a day is 2 (Polli *et al*., 2008). Fatal medication errors are nothing new. The study results published in 1983 reported that labeling errors occurred because the labels confused between vincristine and methotrexate, causing errors in the administration of intrathecal vincristine resulting in fatal effects. Medication errors can occur anywhere in the chain of drug services to patients ranging from production in prescribing, reading prescriptions, compounding, delivery and monitoring of patients. Within each chain there are some actions and every action has potential as a source of error. Every health worker in this chain can contribute to errors. Medication errors occur not only in Indonesia but also in all hospitals in the world.

Based on this, wristband requires well handling because this product is needed in each hospital; it is necessary to forecast the future demand of wristband. Having reasonable forecast is important for the company itself as it can help to forecast the demand for its products as well as to prepare appropriate steps to be taken by the company. It is important for researchers to find the right solution to forecast demand and determine the optimal number of orders for the company as well as the right step in achieving its targets. When the company can predict the demand, then the company can predict the optimal number of reservations that should be done using EOQ Method; yet, at this stage, the company has not yet had an optimal ordering system. By combining forecasting and

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determining the optimal number of orders for the company, then the company can provide the best solution by providing alternatives in which the company will select the most suitable alternatives to apply.

Literature review: The classical Economic Order Quantity (EOQ) Model assumes not only a constant demand rate but also a fixed unit cost (Teng and Yang, 2004). They also stated in the growth stage of a product life cycle, the demand can be well approximated by a linear form. Resh *et al*. (1976) and Donaldson (1977) established an algorithm to determine the optimal replenishment number and timing for a linearly increasing demand pattern. In contrast to the traditional EOQ Models, we assume here not only the demand function but also the unit cost is positive and fluctuating with time. In many real-life situations, products deteriorate continuously such as medicine, volatile liquids, blood blanks and others. Under simplest conditional EOQ methodology balances the charges associated with holding inventory against the expenses incurred when placing and receiving a stream of replenishment orders (Buxey, 2006).

Oni *et al*. (2011) in their study on forecasting demand for office spaces in Ikeja Nigeria State that the simple regression method gives the best results in forecasting demand of the products where research results provide a correlation coefficient with a value of up to 0.932839 at 95% confidence level interval. In addition, the research conducted by Raehsler *et al*. (2012) proves that the analysis employing a production order quantity model is able to lower the cost of production so that the unit cost of production can be suppressed. A similar opinion is expressed by Buxey (2006) in his study investigating the theory of inventory management in the determination of stock in lowering the cost of production. The study supports the research conducted by Duclos (1993) in his empirical study on hospital industry, particularly hospital inventory conducted in forecasting demand. The results of this study suggest that in fact the result of a simulation model of hospital inventory systems was developed to determine the relative significance of several common inventory system variations on a hospital's ability to operate successfully under normal and emergency demand conditions. Chalotra (2013) in his research in 152 wholesalers in district Udhampur of J&K State with snowball sampling, indicated the different previous work experience do not significantly differ in handling inventory and their proper management.

MATERIALS AND METHODS

This research is quantitative method which uses a mathematical model to analyze the data. To forecast demand, six methods of forecasting are used, Naive Method, moving average, weighted moving average, exponential smoothing, exponential smoothing with trend and linear regression. After that, EOQ Method is used to determine the optimal order quantity. Forecasting analysis and EOQ analysis is done using QM Software for windows. After doing forecasting and determining the optimal number of orders, analysis of alternative solutions is carried out to determine the best solution that will be recommended to the company based on available alternatives. The data collection technique used is observations and direct interviews.

RESULTS AND DISCUSSION

Based on the data obtained, an analysis of forecasting demand was done using the 6 forecasting methods, namely Naive Method, moving average, weighted moving average, exponential smoothing, exponential smoothing with trend and linear regression as seen in Table 1.

The results of accuracy analysis of forecasting error by using the six methods for printer products as seen in Table 2.

Based on the calculation and analysis performed, the results obtained from the printer based on the MAD forecasting error measure level of the Naive Method is 8.6154, the Moving Average Method is 7.5152, the

Table 1: The data on wristband and printers sales from January 2013 to February 2014

		Sale	
Years	Months	Printer (unit)	Wristband (unit)
2013	January	9	318
	February	11	298
	March	8	230
	April	32	525
	May	12	390
	June	11	380
	July	9	415
	August	10	584
	September	8	462
	October	22	715
	November	6	492
	December	18	615
		156	5,424
2014	January	6	380
	February	9	498

Table 2: The results of accuracy analysis of printer error from January 2013 to February 2014

Methods	MAD	MSE	Forecast (units)
Naive Method	8.6154	134.4615	9
Moving Average	6.5152	92.4849	11
Weighted Moving Average	7.7727	97.8682	9.9
Exponential Smoothing	6.8055	80.3553	9.604
Exponential Smoothing with Trend	6.8956	75.2314	10.2876
Linear Regression	5.1664	47.1601	10.4835

Weighted Moving Average Method is 7.7727, the Exponential Smoothing Method is 6.8055, the Exponential Smoothing with Trend Method is 6.8956 and the Linear Regression is 5.1664. From the results of the smallest forecasting error of the printer, then based on its MAD value it belongs to the Linear Regression Method.

Meanwhile, based on the calculation and analysis performed, the results obtained from the printer based MSE forecasting error measure level of the Naive Method is 134.4615, the Moving Average Method is 92.4849, the Weighted Moving Average Method is 97.8682, the Exponential Smoothing Method is 80.3554, the Exponential Smoothing with Trend Method is 75.2314 and the Linear Regression is 47.1601. From the results of the smallest forecasting error of the printer, then based on its MSE value it belongs to the Linear Regression Method. Thus, Linear Regression Method is the most appropriate method to be used by the company, so the forecasting results based on the value of the smallest MAD and MSE for printer products using the Linear Regression Method is 10.4835 for March 2014.

The results of accuracy analysis of forecasting error by using the six methods for wristband products as seen in Table 3.

Based on the calculation and analysis performed, the results obtained from the wristband based on the MAD forecasting error measure level of the Naive Method is 138.9231, the Moving Average Method is 100.2727, the Weighted Moving Average Method is 104.2364, the Exponential Smoothing Method is 95.9163, the Exponential Smoothing with Trend Method is 96.6326 and the Linear Regression is 80.509. From the results of the smallest forecasting error of the wristband, then based on its MAD value it belongs to the Linear Regression Method.

Based on the calculation and analysis performed, the results obtained from the wristband based MSE forecasting error measure level of the Naive Method is 27158.46, the Moving Average Method is 19337.6, the Weighted Moving Average Method is 19911.68, the Exponential Smoothing Method is 16928.17, the exponential smoothing with Trend Method is 17226.69 and the Linear Regression is 10650.07. From the results of the smallest forecasting error of the wristband, then based on its MSE value it belongs to the Linear Regression Method. Thus, Linear Regression Method is the most appropriate method to be used by the company, so the forecasting results based on the value of the smallest MAD and MSE for wristband products using the Linear Regression Method is 10.4835 for March 2014 as seen in Table 4.

Table 3: The results of accuracy analysis of wristband error from January 2013 to February 2014

Methods	MAD	MSE	Forecast (units)
Naive Method	138.9231	27158.46	498
Moving Average	100.2727	19337.60	497.6667
Weighted Moving Average	104.2364	19911.68	486
Exponential Smoothing	95.9163	16928.17	488.8818
Exponential Smoothing with Trend	96.6326	17226.69	556.5488
Linear Regression	80.5090	10650.07	590.5165

Table 4: Data on printers and wristband demand

Parameters	Printer	Wristband
Demand	160 units	5,500 units
Setup cost	USD 70	USD 30
Lead time	50 days	50 days
Holding cost	USD 0.2	USD 0.1
Working days	260 days	260 days
Safety stock	10 units	200 units
Unit cost	USD 590	USD 61

From the calculation using QM for windows, it can be seen that the Optimal Order Quantity (EOQ) for the printer is 334.66 units with an average inventory of 167.332 units, the annual setup cost and annual holding cost of USD 33,470, total unit cost of USD 94,400, total cost of USD 94,466.93 and reorder point of 407.692 units.

Meanwhile, from the calculation using QM for windows, it can be seen that the Optimal Order Quantity (EOQ) for the wristband is 1,816.59 units with an average inventory of 908.295 units, annual setup cost and annual holding cost of USD 90.83, total unit cost of USD 335,500, total cost of USD 335,681.7 and reorder point of 1,257.692 units.

Analysis of alternative solutions

Doing the business with the existing method: If the company can achieve the targets, then the alternative is to carry on the business strategy in a way it is running at the moment by paying the total cost of:

- Printer as much as USD 94,712
- Wristband as much as USD 336,170

The strategy to continue this effort is that the company makes order for both printers and wristband once in three months (4 times in 1 year). The number of orders is always in fixed quantity or the same as the number of previous reservations for printers by 40 units and for wristband by 1,375 units. However, the company cannot predict the demand for the following months. The total cost will be greater than if the company applies the EOQ Method.

Applying forecasting and EOQ Method: The alternative is to apply forecasting and EOQ Method and with these two methods, the company can predict the demand for the following months. By applying the EOQ Method, the company will pay a total cost of:

Table 5: Comparative analysis of alternatives offered for printer

Alternatives	Doing the business with the existing method	Applying forecasting and EOQ Method	Creating new strategies to continue running the business	Improving marketing to introduce their products
EOQ	-	334.66 units	-	-
Order per year	4 times	0.48 times	-	-
Total cost	USD 94.712	USD 94,466.93	-	-
ROP	-	40,769.23 units	-	-

Table 6: Comparative analysis of alternatives offered for wristband

Alternatives	Doing the business with the existing method	Applying forecasting and EOQ Method	Creating new strategies to continue running the business	Improving marketing to introduce their products
EOQ	-	1816.59 units	-	-
Order per year	4 times	3.03 times	-	-
Total cost	USD 336.170	USD 335,681.7	-	-
ROP	-	1,257,692 units	-	-

- Printer as much as USD 94,466.93
- Wristband as much as USD 335,681.7

By applying the EOQ Method, the company only needs to make 0.48 times orders for printers within 1 year and 3 times a year for wristband. Thus, the company can minimize the cost of booking. The number of orders represents an optimal number of orders for the company as many as 334.66 units for the printer and 1,816.59 units for wristband. When the company implements this strategy, the costs incurred will be smaller than using a method that is currently running.

Creating new strategies: The alternative of creating a new strategy to continue running the business may be used if the company cannot achieve its targets. This strategy shall be proposed if the company still wants to maintain its business and still wants to remain a master dealer for the products, then the company requires replacement strategy for its business.

Improving marketing: The alternative to improve marketing to introduce products from this company must be applied when the company cannot achieve the target. When the company cannot reach the target, the company should try to improve the way they market the products in order to introduce their products themselves. Comparative analysis of alternatives offered as seen in Table 5.

Based on Table 5, then applying the alternative methods of forecasting and EOQ on printer products results in smaller total cost than doing business with the method currently running as much as USD 94,466.93. Orders made over the year by applying the method of forecasting and EOQ result in fewer number than by applying the method currently running as many as 0.48 times. That way the company can minimize the cost of ordering.

Based on Table 6, then applying the alternative methods of forecasting and EOQ on wristband products results in smaller total cost than doing business with the method currently running as much as USD 335,681.7. Orders made over the year by applying the method of forecasting and EOQ result in fewer number than by applying the method currently running as many as 3.03 times. That way the company can minimize the cost of ordering.

CONCLUSION

Based on the research, it is recommended that in the future the company needs to forecast demand in advance by applying the forecasting method of Linear Regression Method to determine the estimated future demand because it produces the smallest MAD and MSE compared to the other forecasting methods. Thus, this will improve efficiency in planning for both printer and wristband products and minimize the occurrence of deficiency or excess of stocks which may bring a negative effect to the company. The company should apply the EOQ Method because the method can provide information on optimal order quantity at the time order is made. Moreover, it can provide information such as the reorder point and the optimal frequency of orders. Therefore, the company can minimize the cost incurred and avoid paying for something that should not be issued. To predict future demand (2015, 2016 and so on), the company can use several methods of forecasting and choosing a suitable method based on the lowest MAD and MSE. In order to determine the optimal number of orders, the company can use the EOQ Method in determining the optimal order quantity, reorder point and optimal frequency of orders for 1 year.

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