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Accurate Sales Prediction and Raw Material Inventory at PT. XYZ

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ABSTRACT

PT. XYZ is a company which manufactures standard board. The inability to accurately predict the future leads to overstocking of commodities. This research aims to help PT. XYZ to determine the most accurate forecasting method. Using the Economic Order Quantity (EOQ) model, it will help the company with optimal inventory management. The results show that the most accurate forecasting is Linear Regression method and the optimal order quantity of stucco is 137,805.3 kg, water is 761.58 kl, paper pulp is 64,752,12 kg, and starch is 37,600.91 kg. In conclusion, if the company adopts this model, its overall yearly profit will increase from Rp. 241.735.285.000, - to Rp. 255.315.500.000, - an increase of about 6%.

Keywords: Forecasting, Economic Order Quantity Inventory Control Reorder Point

INTRODUCTION

In any industry, innovation is imperative for purposes of capitalist accumulation and facing competition. In order to achieve excellence, a company has to improve its operational activities through good management. This will ensure quality goods and services and hence, optimal profit for the company.

A production company needs good inventory management to assist with its production activities. There are three kinds of inventory: raw materials, finished goods, and work in progress. Managing the inventory is important as productions are subjected to fluctuating demands. If supply is greater than demand, this is known as overstocking and when supply is less than demand the company will run out of stock. This scenario can result in financial losses for the company. Thus, forecasting sales is very important to gauge consumer demand and manage supplies for maximum profit.

In order to obtain the desired results, it is necessary to have production control to meet consumer demand for quality

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and quantity. Miscalculation in the procurement of the factors of production will lead to wastage resulting in financial losses.

PT. XYZ[1] is manufacturing company that produces gypsum with different specification in addition to standard boards, den shield, fire shield, moisture shield, and sound shield. In recent times, there has been an excess stock of standard board because of uncertain sales. The company has not been able to predict the amount of raw materials to order. PT. XYZ produces 396.000 pieces of standard board every month, Based on preliminary observations recent sales figures have fluctuated and there was a gap between the inventory of finished goods and sales. The stock from April 2014-March 2015 is about 2.649.880, and if this is left unchecked the company will suffer losses every month due to increase in storage cost; in addition, the company would not be able to stock any more goods until the old ones are sold.

The present researcher aimed to help solve these problems using a method of forecasting, namely to perform forecasting sales in the next period and estimate the order for optimal raw materials. The EOQ (Economic Order Quantity) and ROP (Reorder Point) methods were employed to help the company know when to order the raw materials to minimise operational costs and ensure maximum profit.

[1]It is a real company with a fictitious name.

THEORETICAL REVIEW

Operational Management

In a manufacturing or service-oriented company, operations or management are important to change the input to goods and services. Input could be energy, material, labour, capital, and information. Output is the produced goods or services.

Forecasting

Inventory is ordered though no one knows what sales will be, new equipment is purchased though no one knows the demand for products, and investments are made though no one knows what profits will be. Managers are always trying to reduce this uncertainty and to make better estimates of what will happen in the future. Accomplishing this is the main purpose of forecasting.

Forecasting is the first stage of planning; before making a plan, the company need to have in place contingency plans in case of unanticipated events occur. Companies must be able to anticipate the needs of customers and have the capacity and resources to meet those needs. According to Sahu and Kumar (2014) over forecast is better than under forecast despite the former giving rise to increased labour costs; this is because the latter would affect the bottom line of the company.

Inventory

According to Gozali, Andres and Handika (2013), inventories represent the second largest asset category for manufacturing

companies, next only to plant and equipment. The proportion of inventories to total asset generally varies between 15 to 30 percent. Given substantial investment in inventories, the importance of inventory management cannot be overemphasised. The present study is intended to highlight industry practice in inventory management and to evaluate management performance in this regard. In order to evaluate the performance of the inventory management, data were collected from the annual reports of the company.

According to Simamora (2015), an effective inventory management should:

- Ensure a continuous supply of raw materials to facilitate uninterrupted production.
- Maintain sufficient finished goods inventory for smooth sales operation and efficient customer services.
- Minimise the carrying cost and time.
- Control investment in inventories and keep it at an optimum level.
- It permits a better utilisation of available stocks by facilitating interdepartmental transfers within a company.
- Maintain sufficient stocks of raw materials in periods of short supply and anticipated price changes.

Economic Order Quantity

According to Rezaei & Salimi (2012) EOQ model is mathematical calculations to determine the optimal amount of merchandise to order in a single reservation.

There are some assumptions in EOQ techniques:

1. Demand is known and constant.
2. The lead time.
3. The receipt of inventory is instantaneous.
4. The purchase cost per unit is constant throughout the year.
5. The only variable costs are the cost of placing an order, ordering cost, and the cost of holding or storing inventory over time.
6. Orders are placed so that stockouts or shortages are avoided completely.

With EOQ model, the optimal order quantity will occur at a point where the total setup cost is equal to the total holding cost.

Reorder Point

The reorder point occurs when the quantity on hand drops to a predetermined amount. That amount includes expected demand during lead time and perhaps an extra cushion of stock, which serves to reduce the probability of experiencing a stock out during a lead time. Note that in order to know when the reorder point has been reached, a perpetual inventory is required. The goal in ordering is to place an order when the amount of inventory on hand is sufficient to satisfy demand during the time it takes to receive that order (i.e., lead time).

Safety Stock

Safety stock inventory is surplus inventory that protects against uncertainties in

demand, lead time, and supply changes. Safety stocks are desirable when suppliers fail to deliver either the desired quantity on the specified date or items of acceptable quality, or when manufactured items require significant amounts of scrap or rework. The bigger amount of safety stock will reduce the possibility of out-of-inventory stock, but the consequence is that can increase holding cost because of total inventory increase. If it happens, then the purpose of minimising total cost has not been achieved.

RESEARCH METHODOLOGY

This research used secondary data such as figures related to demand, sales, and costs. The data was analysed as follows:

Forecasting Analysis

The main variable in this research is sales related to gypsum board called standard board. .Six methods of forecasting were used to study sales figure from April 2014 to March 2015: Naïve Method, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend, and Linear Regression.

Inventory Analysis

The calculation of inventory was based on forecasting result. The main variable of inventory is stucco, water, paper pulp, and starch. Two methods of inventory were used to study this: Economic Order Quantity (EOQ) and Reorder Point (ROP).

Analysis and Solution Design

In this research, researcher used several methods to perform calculations on sales forecast to ensure cost efficiency. The researcher began with the input stage using the forecasting method to derive the smallest MAD and MSE value to meet future needs. The results of forecasting demand are used to determine optimal amount of Economic Order Quantity of raw material that should be ordered to meet sales predictions and when the company reaches some level of inventory (Reorder Point) they should place an order of raw materials to ensure seamless production processes.

RESULTS AND DISCUSSION

Data Analysis

The following are sales and inventory record from April 2014 to March 2015 for standard board products.

Table 1
Inventory and Sales Standard Board 2014-2015

Month	Inventory (unit)	Sales (unit)	Residual (unit)
Apr-2014	551.619	391,125.3	139.020
May-2014	508.020	392,839.7	118.131
Jun-2014	487.131	394,554.2	164.339
Jul-2014	533.339	396,268.6	241.381
Aug-2014	610.381	391,125.3	226.441
Sep-2014	595.441	392,839.7	231.935
Okt-2014	600.935	394,554.2	194.610
Nov-2014	563.610	396,268.6	297.690
Des-2014	666.690	391,125.3	334.170
Jan-2015	703.170	392,839.7	257.578
Feb-2015	626.578	394,554.2	229.153
Mar-2015	598.153	396,268.6	215.432
Total	7.045.067	4.395.187	2.649.880

Forecasting Analysis Results

The sales forecast of standard board products used QM for Windows software to facilitate the calculation of six forecasting methods: Naïve Method, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend, and Linear Regression.

Table 2
Forecasting Analysis Results

Forecasting Method	Forecasting Result	MAD	MSE	Actual Sales
Naïve Method	382,721	59,839.09	5,104,624	377,408
Moving Average	408,579	58,141.33	4,761,762	377,408
Weighted Moving Average	399,706	54,072.83	4,623,710	377,408
Exponential Smoothing	380,370.4	47,588.85	3,832,915	377,408
Exponential Smoothing with Trend	376,441	54,908.57	4,337,955	377,408
Linear Regression	377,409.6	41,724.3	2,530,269	377,408

From the table above, the smallest value MAD and MSE is in Linear Regression with 377,409.6 units. The results of this is supported by earlier studies. Candra and Sarjono (2012) and Gozali, Andres & Handika (2013) said the most accurate method is the Linear Regression method.

Inventory Analysis Results

After performing calculations pertaining to the forecasting method, the results are calculated using an inventory method, namely EOQ and ROP method, using software QM for Windows.

Table 3
Data Inventory of Stucco

Demand	2.321.035 kg
Unit Cost	Rp. 5.500
Ordering Cost (Co)	Rp. 4.500.000
Lead Time	5 days
Holding Cost	Rp. 1.100
Working Hours	300 days
Safety Stock	60000 kg

Using QM for Windows software, the result for Stucco is as follows:

Parameter	Value		Parameter	Value
Demand rate(D)	2321035		Optimal order quantity (Q*)	137,805.3
Setup/Ordering cost(S)	4500000		Maximum Inventory Level (Imax)	137,805.3
Holding cost(H)	1100		Average inventory	68,902.63
Unit cost	5500		Orders per period(year)	16.84
Days per year (D/d)	300		Annual Setup cost	75,792,890.
Daily demand rate	7736.783		Annual Holding cost	75,792,890.
Lead time (in days)	5			
Safety stock	60000		Unit costs (PD)	12,765,690,000.
			Total Cost	12,917,280,000.
			Reorder point	98683.91 units

Figure 1. Output QM for Windows Stucco

From Figure 1, the optimal order (Q*) for Stucco is 137,805.3 kg, reorder point is 98684 kg, number of order is 17/ year, average inventory on hand is 7736.783 kg and total cost is Rp. 12,917,280,000/ year.

Table 4
Inventory of Water

Demand	928 kl
Unit Cost	Rp. 2.350
Ordering Cost	Rp. 250.000
Lead Time	1 days
Holding Cost	Rp. 800
Working Days	300 days
Safety Stock	30 kl

Using QM for Windows software, the result for Water is as follows:

Parameter	Value		Parameter	Value
Demand rate(D)	928		Optimal order quantity (Q*)	761.58
Setup/Ordering cost(S)	250000		Maximum Inventory Level (Imax)	761.58
Holding cost(H)	800		Average inventory	380.7887
Unit cost	2350		Orders per period(year)	1.22
Days per year (D/d)	300		Annual Setup cost	304,630.9
Daily demand rate	3.093333		Annual Holding cost	304,630.9
Lead time (in days)	1			
Safety stock	30		Unit costs (PD)	2,180,800.
			Total Cost	2,790,062.
			Reorder point	33.09333 units

Figure 2. Output QM for Windows Water

From Figure 2, the optimal order (Q*) for water is 761.58 kg, reorder point is 33 kg, number of order is 1/year, average inventory on hand is 3.09 kg and total cost is Rp. 2.790.062/ year.

Table 5
Inventory of Paper Pulp

Demand	928.414 kg
Unit Cost	Rp. 6.720
Ordering Cost (Co)	Rp. 2.100.000
Lead Time	3 days
Holding Cost	Rp 930
Working Days	300 days
Safety Stock	40000

Using QM for Windows software, the result for Paper Pulp is as follows:

Parameter	Value		Parameter	Value
Demand rate(D)	928414		Optimal order quantity (Q*)	64,752.12
Setup/Ordering cost(S)	2100000		Maximum Inventory Level (Imax)	64,752.12
Holding cost(H)	930		Average inventory	32,376.06
Unit cost	6720		Orders per period(year)	14.34
Days per year (D/d)	300		Annual Setup cost	30,109,740.
Daily demand rate	3094.713		Annual Holding cost	30,109,740.
Lead time (in days)	3			
Safety stock	40000		Unit costs (PD)	6,238,942,000.
			Total Cost	6,299,162,000.
			Reorder point	49284.14 units

Figure 3. Output QM for Windows Paper Pulp

From Figure 3, the optimal order (Q*) for Paper Pulp is 64,752,12 kg, reorder point is 49284 kg, number of order is 14/year, average inventory on hand is 3094.71 kg and total cost is Rp. 6.299.162.000/ year.

Table 6
Inventory of Starch

Demand	464.207 kg
Unit Cost	Rp. 4.800
Ordering Cost (Co)	Rp. 1.500.000
Lead Time	2 days
Holding cost	Rp 985
Working days	300 days
Safety Stock	30000

Using QM for Windows software, the result for Starch is tabulated below:

Parameter	Value		Parameter	Value
Demand rate(D)	464207		Optimal order quantity (Q*)	37,600.91
Setup/Ordering cost(S)	1500000		Maximum Inventory Level (Imax)	37,600.91
Holding cost(H)	985		Average inventory	18,800.46
Unit cost	4800		Orders per period(year)	12.35
Days per year (D/d)	300		Annual Setup cost	18,518,450.
Daily demand rate	1547.357		Annual Holding cost	18,518,450.
Lead time (in days)	2			
Safety stock	30000		Unit costs (PD)	2,228,194,000.
			Total Cost	2,265,230,000.
			Reorder point	33094.71 units

Figure 4. Output QM for Windows Starch

From Figure 4, the optimal order (Q*) for Starch is 37,600.91 kg, reorder point is 33095 kg, number of order is 12/year, average inventory on hand is 18,518,450 kg and total cost is Rp. 2,265,230,000/ year.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The result of forecasting method based on sales between April 2014 and March 2015 shows that Linear Regression has the smallest MAD and MSE value namely 41,724.3 and 2,530,269 respectively. Thus, the MAD and MSE value proves that Linear Regression is the most suitable method to study PT. XYZ. By using EOQ method, it can be concluded that the optimal order of stucco raw material to manufacture standard board is 137,805.3 kg, optimal order of water is 762 kl, optimal order for paper pulp is 64,752,12 kg, and optimal order of starch is 37,600.91 kg.

Recommendations

Based on the Forecasting for Inventory Control model developed by Candra and Sarjono (2012) six methods of forecasting were employed, namely Naïve Method, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend, and Linear Regression. The method that showed the smallest value of MAD and MSE is Linear Regression. The result of forecasting is then used as a reference to calculate demand using Economic Order Quantity (EOQ) method. Result of this research showed that if the company uses forecasting and inventory method then sales of standard board will increase to 246.913 units or an increase 0.056% and will have an impact on company profit as it increases with unit cost Rp. 55.000. If company use this method then profit will increase from Rp. 241.735.285.000 to Rp. 255.315.500.000. or increase of about 6% in the two periods studied.

REFERENCES

Candra, S., & Sarjono, H. (2012). Forecasting for inventory control. *Journal of Supply Chain Management, 6*(1), 1-14.

Gozali, L., Andres, A., & Handika, R. (2013). Usulan penentuan teknik lot sizing terbaik dengan minimasi biaya dalam perencanaan dan pengendalian kebutuhan canvas EP 200 conveyor belt di PT. XWZ. *Jurnal Kajian Teknologi, 9*(2), 1-10.

Rezaei, J., & Salimi, N. (2012). Economic order quantity and purchasing price for items with imperfect quality when inspection shifts from buyer to supplier. *International Journal Production Economics, 137*(1), 11-18.

Sahu, P. K., & Kumar, R. (2014). The evaluation of forecasting methods for sales of sterilized flavored milk in Chhattisgarh. *International Journal of Engineering Trends and Technology (IJETT), 8*(2), 98-104.

Simamora, B. H. (2015). Economic order quantity model for minimizing total inventory cost at PT PQR in Indonesia. *Advanced Science Letters*, *21*(4), 1053-1056.