Raw Material Analysis control of SMBE Slipper Producer using Economic Order Quantity

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Abstract. The growth of small-medium business enterprise in Indonesia is getting faster in decade, including small-medium business enterprise who produce slippers. SISCO is one of small-medium business enterprise who produce slipper. They must keep tight with market requirement. The supply of raw materials in a small-medium business enterprise is one of the important during production process. In some case their products are mismatch number from market demand. It can be worse if there a mismatch between raw materials ordering schedule from supplier and market demand from consumers. One of this problem requires Economic Order Quantity method as a solution, because during slippers production we have to order from supplier. Inventories are materials stored as raw materials, then they processed be finish product. To find out inventory, one of the inventory models used is the economic order quantity model. This method seeks to achieve the minimum possibility of inventory levels and lower costs and better quality. Economic Order Quantity method calculation based on raw material inventory control in SISCO slipper brand. Optimum monthly cost is IDR 5.293.541,03 to meet supply materials.

Keywords: EOQ, Inventory control, Market demand, SMBE.

1 Introduction

Raw material inventory in small-medium business enterprise (SMBE) is a key to conducting production process, if inventories are low, production process will get trouble. Based on that statement, production line of SMBE highly depend on their inventory[1]. When determining demand of raw materials in a SMBE, we need an amount of production volume. Based on these considerations, we can calculate it the amount of raw materials used in a period [2], [3]. When we want to minimize inventory costs in a period, we must know matching data between actual supply raw materials with raw materials using in a period. This can be called efficiency of raw material inventory which can be useful to minimize costs to be incurred. If the raw material inventory is overstock, the costs will be higher[4].

Overstock raw material in inventory, lead to loss for SMBE especially in financial statement. These will have any impact such less profits and lead to other costs like storage costs for raw materials and maintenance costs for raw materials[5]. This problem will have an impact on storage costs and affect the location of the raw materials and the storage layout. In an SMBE, when you want to produce goods, you must look at how to produce goods and the amount of inventory so that there is no overstock in the procurement of raw materials. In addition, the SMBE must consider the surge that will occur by market demand[6].

SMBE must prepare if additional raw materials are needed[7]. An SMBE can make a profit by maximizing sales and minimizing inventory costs. SISCO is an SMBE brand that is engaged in producing slippery. Products produced at the SISCO brand SMBE are often not in accordance with the number of requests from consumers[8]. This problem is also added to the schedule of ordering raw materials from consumers. The problem with this raw material requires a solution using the EOQ (Economic Order Quantity) method because in making these slippery you have to order from a supplier.[9]

In this condition, the control of raw materials at SISCO must be controlled in order to prevent shortages and control the slightest risk in producing slippery. Even will minimize the cost of raw material inventory in every slippery production. The achievement of the desired target in controlling raw material inventory at SMBE SISCO can be used with the EOQ method so that it is able to calculate and control the amount of raw material inventory. The raw materials for making these slippery are EVA sponge, base, glue, slippery and plastic. The process of making these slippery consists of several stages for later slippery ready for sale. The stages of making these slippery include gluing the slippery shape, gluing with a thin layer, pressing, sanding, punching holes for clamps and installing slippery straps. At SMBE, most of these slippery still produce using manual tools in the process.

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2 Methods

This research is a case study type. This research conducted incentive, detailed and in-depth manner on the object of the organism institution or certain symptoms to be observed. This type of research in this analysis uses secondary data collected directly from company. This research discusses case regarding raw materials supplies in SISCO slippery brand. The discussion in this study uses data on raw materials supplies of sandals, such as sponge-EVA, and the costs of procuring raw materials. In this study, the variables are: the use of raw materials, inventory of raw materials (economic order quantity), re-order point (ROP) and Grand Total Cost (TC). Bill of Material of SISCO brand shown on Figure 1.

Fig. 2. Bill of Material of SISCO line production

2.1 Data collection Methods

2.1.1 Interview data collection Method

This interview data collection technique conducting by direct interviews with competent employees and have mature about data needed in this research. Based on this technique, we expect data about general company activity and the costs that affect inventory of raw materials or other related data in this research.

2.1.2 Documentation data collecting Method

On this research data collection from factorization and explanation through document or archive sources. Based on this data we can estimates raw materials, inventory costs, raw materials consumption, safety stock and reorder

2.2 Data processing

Data processing in this study starts from determining the number of sales of goods that will come by using the forecasting method. Then determine the amount of raw materials ordered in one order with the EOQ method. Based on EOQ, we can determine the reorder time (ROP) and determine the Grand total cost (TC)

3 Result

After got data from interviewing crew in SISCO brand based on data collection methods, we have data selling per month of SISCO slippery product during one year. Selling data of SISCO product shown on Table 1.

Table 1. SISCO product demand during 2019.

Month	Selling data per month	Month	Selling data per month
January	641	July	1252
February	564	August	355
March	732	September	473
April	720	October	671
May	633	November	928
June	524	December	1068

We also had data about Material cost, major ordering and lead time for each material. Shown on Table 2.

Table 2. Material requirement and price for single batch production.

Month	Material cost (IDR)	Major Ordering cost (pc)	Lead Time (hours)
Eva Spon/sheet	95.000	10.000	4
Sole/sheet	14.000	10.000	4
Glue/18 litre	270.000	10.000	4
Straps/score	25.000	10.000	4
Plastic/score	14.000	10.000	4

4 Discussion

Based on this data on table 1 and 2 we to predict demand of slippery of SISCO brand aided with three methods, they are moving average, single exponential smoothing, and double exponential smoothing. Moving average using MA-3 to avoiding data lagging or error during forecasting. Demand of SISCO brand has shown on table 3.

4.1 Time Series Methods Forecasting

Result of time series forecasting shown on table 3.

Table 3. Time series forecasting

Month	Actual data	Forecast methods		
		3- MA	SES	DES
1	641		641	641
2	564		641.00	256.40
3	732		625.60	410.16
4	720	644	646.88	485.90
5	633	672	661.50	428.46
6	524	695	655.80	375.93
7	1252	626	629.44	298.44
8	355	803	753.95	1072.93
9	473	710	674.16	-288.76
10	671	693	633.93	646.26
11	928	500	641.34	283.25
12	1068	691	698.68	758.05
		889	772.54	613.17

Based on data from table 3 we analysed Mean Square Error (MSE) forecasting performed using moving average, single exponential smoothing, and double exponential smoothing methods. The MSE data shown on table 4.

Table 4. Font styles for a reference.

Instrument	MA-3	SES	DES
MAD	269	212.05	420.80
MSE	112440.07	77085.08	257647.66
MAPE	0.40	0.31	0.67

Based on the table described above, the smallest MSE in this slippery product performed by SES method. based on this data, we can perform demand data for the next period. The following is the data for forecasting the slippery product 772.54 round up to 773.

4.2 Raw Materials Availability

Based on orders from suppliers, the amount of raw material availability in small businesses with SISCO brand sandals, data obtained from the results of research on the number of raw materials that can be available by the company per month to produce each product shown in the table 4.

Table 4. Font styles for a reference.

Raw Material	Market Demand	Raw Material		
		Demand	Per pc	in inventory
Eva Spon	773	20	40	25 sheets
Sole	773	52	15	75 sheets
Glue	773	4	250	72 lt
Straps	773	39	20	50 score
Plastic	773	39	20	50score

From the data in table 4, we can see the amount of raw material availability for each month is larger than the number of requests for raw materials for each month. Therefore, we adjust the number of raw material requirement to be manufactured from the forecasting

perform using Economic Order Quantity (EOQ) and Re-Order Point (ROP). EOQ flown using Equation[10], [11]

$$EOQ = \sqrt{\frac{2DS}{H}}$$

Where; D= total raw materials; S=Major ordering cost; H=Storage cost

Table 5. Result of EOQ.

Raw Material	D	S	H	EOQ
Eva Spon	20	10,000	792	22
Sole	52	10,000	117	94
Glue	4	10,000	2250	6
Straps	39	10,000	208	61
Plastics	39	10,000	117	82

ROP flown using equation[8].

$$ROP = \left(\frac{D}{t}\right)L$$

Where; D= total raw materials; t=Active work hour per week); L= lead time

Result of ROP shown on table 5

Table 6. Result of ROP

Raw Material	D	t	ROP (Day)	L	ROP (unit)
Eva Spon	20	26	0.77	4	3
Sole	52	26	2.00	4	8
Glue	4	26	0.15	4	1
Straps	39	26	1.50	4	6
Plastics	39	26	1.50	4	6

Based of data on table 5 and table 6 we estimate total ordering cost. Result of Grand total cost per month for SISCO brand SME during slippery production shown on Table 7.

Table 7. Result of Grand total cost per month

Raw Material	Ordering Cost	Holding Cost	Raw material ordering cost	Total Cost (IDR)
Eva Spon	9091	8712.00	1,900,000	1,917,802.91
Sole	5532	5499.00	728,000	739,030.91
Glue	6667	6750.00	1,080,000	1,093,416.67
Straps	6393	6344.00	975,000	987,737.44
Plastics	4756	4797.00	546,000	555,532.10
Grand Total Cost				5,293,541.03

5 Conclusion

On this research applied three time series forecasting they are forecasting performed using moving average, single exponential smoothing, and double exponential smoothing methods. The lowest Mean Square Error is Single Exponential Smoothing with value 77085.08. The most crucial raw material stock is ROP count is Glue, it will be ruined out in 1hour and 12 minutes during process. raw material and grand total od production 773 pairs of slippery in SISCO Brand SME is IDR 5,293,541.03

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