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Analysis of Raw Material Inventory Control using the ABC Analysis Method and EOQ Method in the Fajar Onion Crackers Business

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Abstract. Inventory control is one aspect that affects the company's smooth operation. This study applies the Activity Based Costing (ABC) analysis and Economic Order Quantity (EOQ) methods to control raw material inventory. The Bawang Fajar cracker business is one of the SMEs whose raw material inventory control has yet to use the ABC analysis method and the EOQ method. This research is applied research. Based on the results of this study, it was found that the grouping of raw material inventories according to ABC analysis was divided into three groups, namely group A; wheat flour and cooking oil, group B; eggs, and group C; onion and garlic. The TIC value based on the EOQ method is Rp. 1,749,102.00, while the TIC value based on the method used by the company is Rp. 3,582,200.00. So the EOQ method is more effective than the method used by the company in the Fajar Bawang Crackers Business.

Keywords: Stock, Activity Based Costing, Economic Order Quantity.

1 Introduction

Inventory is one factor that affects a company's smooth operation. Inventory is a crucial component of the company. Inventory refers to the stock of a material or item owned by a company [1]. In addition to significant inventory for production operations, inventory also plays a role in achieving customer satisfaction. Raw material inventories are stocks of materials that have been purchased but have not been processed [2]. Inventories of raw materials are brought in from outside, and these materials are physically stored in warehouses.

A trading company's inventory of raw materials has a vital role in its business activities. However, the company still faces problems in raw material inventory. The company carries out inventory storage for various functions [3]. If the company can control inventory effectively, the company will get many benefits, one of which is streamlining the company's expenses. Inventory control is a plan to determine the stock that must be ordered, when it will be ordered, and how much stock will be provided so that the production and sales process is not disrupted. Costs associated with ordering and storage can be optimized [4].

Raw material inventory control requires regular management. Inventory control is a group of raw materials used repeatedly to meet demand [5]. If the supply of raw materials is in excess (overstock), it can result in higher storage costs and reduce funds in other fields. An insufficient supply of raw materials (out of stock)

can result in unfulfilled company needs and even loss of consumers. Inventory control is used when deciding how much to store and when to order inventory [6].

The Bawang Fajar Crackers Business is a small and medium enterprise (UKM) built by Rahmanita's mother. This UKM is located on Jalan Raya Indarung, Indarung Village, Lubuk Kilangan District, Padang City. This UKM produces food, namely onion cakes. Based on the results of the interviews, it is known that the Bawang Fajar Cracker Business purchases raw materials without considering production needs. So that in this study will be studied inventory costs in controlling raw materials.

Companies can use the Activity Based Costing (ABC) analysis method and the Economic Order Quantity (EOQ) method to facilitate raw material inventory control and perform calculations with Reorder Point and Safety Stock to determine when a reorder should be made. ABC analysis is the selection of raw materials based on the value of absorption of funds using the principle of the Pareto diagram [7]. ABC analysis is an inventory control method that applies the Pareto principle. ABC analysis classifies inventory into three to determine which raw materials are prioritized in its control [8].

While the EOQ method is the purchased quantity of raw materials with the lowest cost in each order, companies can save on expenses in purchasing raw materials [9]. The EOQ method aims to minimize the overall inventory cost during the production planning cycle and supply sufficient quantities. The EOQ method can minimize total costs, specifically ordering and storage costs [10]. Therefore, from the description above, a study on raw material inventory control was carried out entitled "Analysis of Raw Material Inventory Control using the ABC Analysis Method and the EOQ Method in the Fajar Onion Crackers Business."

2 Method

This research is applied research. The data type is secondary data regarding raw material purchasing data in 2022. The Fajar Bawang Cracker Business provided the data in this study. The data processing techniques carried out by applying the ABC analysis method and the EOQ method are:

a. Collection of purchase data along with the price of raw materials in the Fajar Bawang Cracker Business.
b. Calculating the absorption value of funds (M_i) for each type of raw material with the formula:

$$M_i = D_i \cdot p_i. \tag{1}$$

Where:
D_i : Quantity (amount) usage
p_i : Unit price of inventory

c. After getting the absorption value of the funds, then sort the values from the largest to the smallest value.
d. Calculating the total absorption value of funds (M) with the formula:

$$M = \Sigma M_i. \tag{2}$$

e. Calculating the percentage of absorption of funds (P_i) with the formula:

$$P_i = \frac{M_i}{M} \times 100. \tag{3}$$

f. Then calculate the cumulative percentage of absorption of funds.
g. Grouping raw materials into classes A, B, and C [11].

1) Class category A: 0-80%.
2) Class category B: 80-95%.
3) Class category C: 95-100%.

h. Perform Economic Order Quantity (EOQ) calculations with the formula:

$$Q^* = \sqrt{\frac{2DS}{H}}. \quad (4)$$

Where:
Q* : The optimal number of units per order
D : Total purchase of raw materials
S : Order fee
H : Storage fee

i. Perform calculations of Safety Stock (SS) with the formula:

$$\mathrm{SS} = \mathrm{Z}.\sigma. \quad (5)$$

Where:
Z : Safety factor
σ : Standard deviation

j. Calculating Reorder Point (ROP) with the formula:

$$\mathrm{ROP} = (\mathrm{d} \cdot \mathrm{L}) + \mathrm{SS}. \quad (6)$$

Where:
d : Daily use of raw materials
L : Lead Time
SS : Safety Stock

k. Calculating Total Inventory Cost (TIC) with the EOQ method can be calculated by the formula:

$$\mathrm{TIC} = \left(\frac{\mathrm{D}}{\mathrm{Q}*}\mathrm{S}\right) + \left(\frac{\mathrm{Q}*}{2}\mathrm{H}\right). \quad (7)$$

Dimana:
D : Total raw material requirements
Q* : The optimal number of units per order
S : Order fee
H : Storage fee

While the calculation of Total Inventory Cost (TIC) with the method used by the company can be calculated using the formula:

$$\mathrm{TIC} = (\bar{\mathrm{x}} \cdot \mathrm{H}) + (\mathrm{N} \cdot \mathrm{S}). \quad (8)$$

l. Then compare the Total Inventory Cost values obtained from the EOQ method with those of the company.
m. We are concluding the results of the discussion and providing suggestions for improvement and development of this research.

3 Results and Discussion

The raw materials to be analyzed in this study were wheat flour, garlic, shallots, cooking oil, and eggs. Data on purchasing raw materials at the Fajar Bawang Crackers Business is shown in Table 1.

Table 1. Raw Material Inventory Data for 2022.

No	Month	Wheat Flour (kg)	Garlic (Kg)	Shallots (Kg)	Cooking Oil (Kg)	Egg (Board)
1	January	116	6	8	57	10
2	February	116	6	8	57	10
3	March	126	7	9	64	11
4	April	126	7	9	64	11
5	May	114	4	8	56	8
6	June	114	4	8	56	8
7	July	114	4	7	56	8
8	Augustus	114	4	7	56	8
9	September	118	5	8	59	9
10	October	118	5	8	59	9
11	November	114	4	8	56	8
12	December	114	4	8	56	8
Total		1404	60	96	696	108
Average Purchase Price		117	5	8	58	9

1.1 Activity Based Costing Analysis (ABC)

The ABC analysis method is a method that divides raw materials into three groups based on the cumulative percentage value of absorption of funds. In determining these groups, it is necessary to calculate the total value of funds absorption shown in Table 2.

Table 2. Absorption Value.

No	Raw Material	Unit	Purchase Totals	Unit Price	Absorption Value of Funds
1	Wheat Flour	Kg	1404	Rp. 10.000,00	Rp. 14.040.000,00
2	Garlic	Kg	60	Rp. 24.000,00	Rp. 1.440.000,00
3	Shallots	Kg	96	Rp. 32.000,00	Rp. 3.072.000,00
4	Cooking Oil	Kg	696	Rp. 15.000,00	Rp. 10.440.000,00
5	Egg	Board	95	Rp. 55.000,00	Rp. 5.940.000,00
		Average Purchase Value			Rp. 34.932.000,00

The ABC analysis method is a method that divides raw materials into three groups based on the cumulative percentage value of absorption of funds. In determining these groups, it is necessary to calculate the total value of funds absorption shown in Table 2.

After obtaining the value of absorption of funds, then sort the value of absorption of funds from the most significant value to the smallest value, namely flour, cooking oil, eggs, shallots, and garlic. Pareto diagrams can be used to classify raw materials based on the cumulative percentage of absorption of funds and the

percentage of types of raw materials [12]. Calculate the percentage of absorption of raw material funds using the formula in equation (3). The percentage of absorption of funds for each raw material is shown in Table 3.

Table 3. Data on Percentage of Absorption of Raw Material Funds

No	Raw Material	Percentage of Absorption of Funds	Cumulative Percentage of Fund Absorption	Group
1	Wheat Flour	40,19%	40,19%	A
2	Cooking Oil	28,89%	70,08%	A
3	Egg	17,00%	87,08%	B
4	Shallots	8,79%	95,88%	C
5	Garlic	4,12%	100,00%	C

So the percentage of funds absorption for each raw material group A, B, and C based on the ABC analysis is shown in Table 4.

Table 4. Data on the Percentage of Absorption of Funds for Groups A, B, and C

No	Raw Material Group	Types of Raw Materials	Percentage of Total Types of Raw Materials	Absorption Value of Funds	Percentage of Absorption of Funds
1	A	2	40%	Rp. 24.480.000,00	70,08%
2	B	1	20%	Rp. 5.940.000,00	17,00%
3	C	2	40%	Rp. 4.512.000,00	12,92%
Total		5	100%	Rp. 34.932.000,00	100%

Based on calculations with ABC analysis, the Pareto diagram can be obtained in Figure 1.

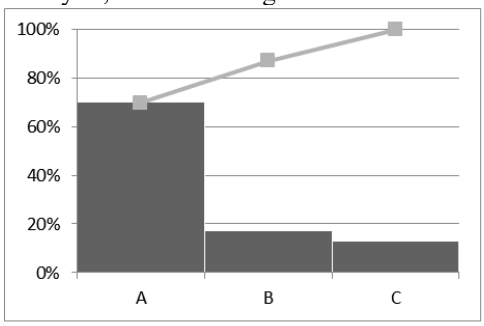

Fig. 1. Pareto Charts

1.2 Economic Order Quantity (EOQ)

A mathematical model called the Economic Order Quantity (EOQ) method calculates the number of raw materials needed to be ordered to meet demand and minimize inventory costs [13]. Calculating the optimal

amount of raw materials by applying the EOQ method requires data regarding ordering and storage costs. Costs included in ordering costs, namely telephone costs and transportation costs, are shown in Table 5.

Table 5. Order Cost Data.

No	Fee Type	Cost
1	Telephone costs	Rp. 20.000,00
2	Transportation costs	Rp. 30.000,00
	Total	Rp. 50.000,00

The delivery of raw materials from suppliers to the Fajar Bawang Crackers Business is two days. Meanwhile, the company has set the storage fee at 20% of the product price, as shown in Table 6.

Table 6. Storage Costs Data.

No	Raw Material	Raw Material Prices	Storage Costs
1	Wheat Flour	Rp. 10.000,00	Rp. 2.000,00
2	Garlic	Rp. 24.000,00	Rp. 4.800,00
3	Shallots	Rp. 32.000,00	Rp. 6.400,00
4	Cooking Oil	Rp 15.000,00	Rp, 3.000,00
5	Egg	Rp. 55.000,00	Rp. 11.000,00

By applying the EOQ method to calculate the optimal amount of raw materials, we can use the formula in equation (4). Calculations using the EOQ method for raw materials are shown in Table 7.

Table 7. EOQ Value Data.

No	Raw Material	EOQ Value
1	Wheat Flour	265 kg
2	Garlic	35 kg
3	Shallots	39 kg
4	Cooking Oil	152 kg
5	Egg	31 boards

1.3 Safety Stock

Safety Stock is used to anticipate stock-out conditions [14]. The safety stock value is obtained by calculating the average demand value for each type of raw material. This study assumes that the service level value is 95%, so the service factor value is 1.65, obtained based on the normally distributed Z table. The formula for determining the value of safety stock is contained in equation (5). The calculation of the value of Safety Stock on raw materials is shown in Table 8.

Table 8. Safety Stock Value Data.

No	Raw Material	Raw Material Cost	Storage Costs
1	Wheat Flour	Rp. 10.000,00	Rp. 2.000,00
2	Garlic	Rp. 24.000,00	Rp. 4.800,00
3	Shallots	Rp. 32.000,00	Rp. 6.400,00
4	Cooking Oil	Rp 15.000,00	Rp, 3.000,00
5	Egg	Rp. 55.000,00	Rp. 11.000,00

1.4 Reorder Point

Reorder Point is where the company must reorder raw material stock to ensure that the ordered stock can be received on time [15]. This is necessary because suppliers do not always send raw material orders immediately, so how long does it take? This study's lead time (L) is two days, and working time (t) is 300 days in 1 year. The formula for determining the reorder point value is contained in equation (5). The calculation of the reorder point value for raw materials is shown in Table 9.

Table 9. Reorder Point Value Data.

No	Raw Material	Daily use of raw materials	Reorder Point Value
1	Wheat Flour	4,68	17 kg
2	Garlic	0,2	2 kg
3	Shallots	0,32	2 kg
4	Cooking Oil	2,32	10 kg
5	Egg	0,36	3 papan

1.5 Total Inventory Cost

Calculating Total Inventory Cost (TIC) by applying the EOQ method can be calculated using the formula in equation (6). From this formula, the TIC value obtained using the EOQ method for raw materials is shown in Table 10.

Table 10. TIC EOQ method.

No	Raw Material	Total Inventory Cost
1	Wheat Flour	Rp. 529.906,00
2	Garlic	Rp. 169.706,00
3	Shallots	Rp. 247.871,00
4	Cooking Oil	Rp, 456,946,00
5	Egg	Rp. 344,674,00

TIC dengan metode yang digunakan perusahaan untuk setiap jenis bahan baku terdapat dalam Tabel 11.

While the calculation of Total Inventory Cost (TIC) with the method used by the company can be calculated using the formula in equation (8). From this formula, the TIC value is obtained using the method used by the company for each type of raw material shown in Table 11.

Table 11. TIC method company.

No	Raw Material	Total Inventory Cost
1	Wheat Flour	Rp. 834.000,00
2	Garlic	Rp. 624.000,00
3	Shallots	Rp. 651.200,00
4	Cooking Oil	Rp, 774.000,00
5	Egg	Rp. 699.000,00

So that the comparison of TIC using the EOQ and the company methods can be shown in Table 12.

Table 12. Comparison of TIC EOQ with Enterprise TIC.

No	Raw Material	EOQ Method	Company Methods	Difference
1	Wheat Flour	Rp. 529.906,00	Rp. 834.000,00	Rp. 304.094,00
2	Garlic	Rp. 169.706,00	Rp. 624.000,00	Rp. 454.294,00
3	Shallots	Rp. 247.871,00	Rp. 651.200,00	Rp. 403.329,00
4	Cooking Oil	Rp, 456,946,00	Rp, 774.000,00	Rp, 317.054,00
5	Egg	Rp. 344,674,00	Rp. 699.000,00	Rp. 354.326,00
	Total	Rp. 3.582.200,00	Rp. 1.749.102,00	Rp. 1.833.098,00

4 Conclusion

Based on the results and discussion, it was found that the grouping of raw materials according to the ABC analysis was divided into three groups. Group A has two types of raw materials, wheat flour and cooking oil, with a capital of 70.08% of the total raw materials budget. Raw materials included in group B are eggs, with a capital of 17% of the total raw materials budget. In group C, there are two types of raw materials, namely shallots, and garlic, with a capital of 12.92% of the total raw material budget. The results of calculating the total inventory cost of raw materials using the EOQ method are Rp. 1,749,102.00, while the total inventory cost of raw materials using the method used by the company is Rp. Rp. 3,582,200.00 with a difference of Rp. 1,833,098.00. This shows that the EOQ method is more effective than the method applied to the Fajar Bawang Crackers Business.

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