

Analysis of Raw Material Inventory Control Using the EOQ Method at PT Wijaya Karya Beton Tbk

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Abstract—Raw material inventory control is one of the important aspects of operational management of manufacturing companies. This study aims to analyze the control of raw material inventory using the Economic Order Quantity (EOQ) method at PT Wijaya Karya Beton Tbk. The EOQ method is used to determine the optimal number of orders that can minimize the total inventory cost, which consists of order costs and storage costs. Conducting an analysis of the amount of sand safety supplies, pc strands and joint plates that must be provided by PT Wijaya Karya Beton Tbk PPB for the period of 2017-2019, analyzing the control of raw material inventories in sand, pc strands and joint plates using the EOQ method. The variables used are the purchase of sand raw materials, pc strands and splicing plates for the 2017-2019 period, raw material ordering cost data, and raw material storage cost data. The results of the study concluded that the EOQ method was very efficient. The total cost of raw material inventory calculated according to EOQ is less than that incurred by the company, so there is a saving in the cost of raw material inventory if the company uses the EOQ method in its raw material inventory.

Keywords— *Inventory Control; Economic Order Quantity; Raw Material*

I. INTRODUCTION

Raw material inventory control is one of the important aspects in the operational management of manufacturing companies [1]. Optimal raw material inventory can ensure the availability of materials for the production process, thereby increasing the efficiency and productivity of the company [2]. However, improper inventory management can lead to problems, such as excess or shortage of inventory, which will ultimately have an impact on the company's operating costs [3], [4].

PT Wijaya Karya Beton Tbk, as one of the leading manufacturing companies in Indonesia, also faces challenges in controlling the supply of raw materials. As a manufacturer of precast concrete, the company needs a stable and maintained supply of raw materials, such as cement, sand, and gravel [5], [6]. Fluctuating demand and uncertainty of delivery times can lead to over-stock

or under-stock on raw material inventory, which will ultimately increase storage costs [7], [8], [9], order costs, and the risk of raw material shortage. In today's era of digitalization [10], [11] The participation of technology, especially the internet, is urgently needed [12] [13] Many studies use web-based systems [5], [9], [14].

To overcome these problems, an inventory control method is needed that can optimize the number of orders and minimize the total cost of inventory. One method that can be used is Economic Order Quantity (EOQ), which considers order costs and storage costs to determine the optimal order quantity. This study aims to analyze the control of raw material inventory of PT Wijaya Karya Beton Tbk using the EOQ method. The results of this study are expected to provide input for companies in an effort to improve the efficiency of raw material inventory management and minimize the total cost of inventory.

II. METHODS

1. Type of Research

This research is a quantitative descriptive research, Descriptive research is used to describe or describe the phenomenon that occurs, in this case it is the control of raw material inventory at PT Wijaya Karya Beton Tbk. Quantitative research uses numerical data and conducts statistical analysis to measure and evaluate inventory control. The purpose of the quantitative descriptive research is to analyze the control of raw material inventory using the Economic Order Quantity (EOQ) method at PT Wijaya Karya Beton Tbk.



2. Data Source

This study uses secondary data, namely data obtained from a second party or other sources that are not directly obtained from the research subject. The secondary data source in this study is PT Wijaya Karya Beton Tbk. Data Collected:

- a. Historical Data on Raw Material Consumption for One Year, this data includes information on the types of raw materials used by the company as well as the amount of consumption of each raw material during a period of one year. This raw material consumption data is needed to analyze raw material usage patterns and forecast future needs.
- b. Data on Order Costs and Raw Material Storage Costs. Order fees are costs that arise every time you place an order for raw materials, such as administration, telephone, transportation fees. Storage costs are costs incurred as a result of storing raw materials in the warehouse, such as electricity costs, warehouse rent, and labor. This data is needed to calculate the total cost of raw material inventory.
- c. Raw Material Delivery Lead Time Data. Lead time is the waiting time from the time the raw material is ordered until the raw material arrives at the company. Lead time data is needed to determine the reorder point.

3. Data Collection Techniques

The data collection method used in this study is a documentation study. Documentation studies are data collection techniques by studying and analyzing documents related to the object of research. Data Collection Process:

a. Identifying Relevant Documents

The researcher identified company documents that contain information related to the control of raw material inventory at PT Wijaya Karya Beton Tbk. These documents can be in the form of reports, records, archives, or electronic documents.

b. Collecting and Studying Documents

The researcher collected the documents that had been identified. These documents are studied and extracted the necessary information, such as historical data on raw material consumption, ordering and storage costs, and delivery lead times.

c. Data Verification and Validation

After the data is collected, the researcher verifies and validates the data to ensure the accuracy and reliability of the information obtained. The verification and validation process is carried out by crosschecking data from various sources of company documents.

4. Data Analysis

a. Analysis of Raw Material Needs

At this stage, researchers analyze historical data on raw material consumption over a year to identify patterns and trends in raw material use by companies. From this analysis, researchers can estimate the future demand for raw materials.

b. Inventory Cost Analysis

The researcher calculates the cost of ordering and storing raw materials based on data obtained from the company. Booking fees include costs such as administration, telephone, transportation. Storage costs include costs such as warehouse rent, electricity, labor. This inventory cost calculation is needed to determine the total cost of raw material inventory.

c. EOQ Method Analysis

At this stage, the researcher applies the Economic Order Quantity (EOQ) method with the formula:

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

Where:

EOQ = economical optimal raw material purchase amount

S = order cost per order

D = usage per time period

H = storage cost per unit of raw materials

untuk menentukan:

1) Analysis of total raw material inventory

$$TIC = \sqrt{2.DSH}$$

TIC = Total inventory cost per year.

D = Number of goods needed in a unit

H = Storage cost per raw material

S = Cost of messages per order

2) Analisis Reorder Point

$$\text{Reorder point (ROP)} = \text{safety stock} + (\text{lead Time} \times A)$$

Where:

ROP = reorder point

Lead Time = Lead Time

A = average daily purchase of raw materials

$$SD = \sqrt{\frac{\{(x - y)^2\}}{N}}$$

Where:

SD = Standard deviation

X = actual usage

Y = forecast

N = number

d. Comparative Analysis

The results of the analysis with the EOQ method are then compared with the method currently used by the company to evaluate whether the EOQ method can provide cost savings or increase the efficiency of controlling raw material inventory compared to the method used by the company. This comparative analysis will be the basis for recommendations for companies to consider the application of the EOQ method.

5. Research Stages

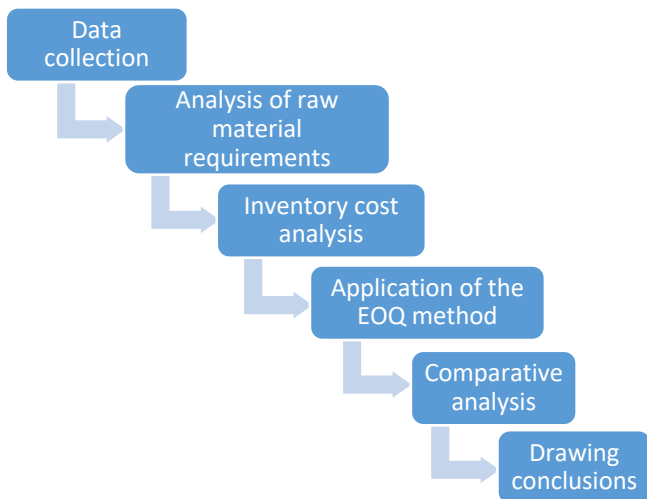


Figure 1. Research Stages

III. RESEARCH RESULT

1. Analysis of Raw Material Needs

Based on historical data on raw material consumption for one year, it is known that the raw material needs of PT Wijaya Karya Beton Tbk are quite stable with slight fluctuations. The average use of sand raw materials in 2017 reached 3,365.73 m³ when compared to the purchase of raw materials which averaged 3,345.10 m³ per month increased. This shows that the level of use in 2017 is higher than the level of purchase of raw materials. In the following year, 2018, the average use of raw materials reached 3,133.55 m³ when compared

to the purchase of raw materials which reached an average of 3,343.90 m³ per month, which decreased. This shows that the level of use in 2018 is lower than the level of purchase of raw materials. In 2019, the average use of raw materials reached 3,902.95 m³ when compared to the purchase of raw materials which averaged 3,861.69 m³ per month, which decreased. This shows that the level. The consumption in 2019 was lower than the level of raw material purchases. To find out the need for raw materials in the first month of 2020 using the trend projection method. As for finding out the projection trend, data is needed on the use of raw materials during 2017 to 2019.

a. Raw Material Sand

$$a = 3.467,41$$

$$b = 15,23$$

$$X = 37 \text{ (January 2020)}$$

$$Y = a + b$$

$$X = 3.467,41 + 15,23 \text{ (37)}$$

$$= 3.467,41 + 563,51$$

$$= 4.030,92 \text{ m}^3$$

So the forecast of sand raw materials for the 37th month (January 2020) is 4,030.92 m

b. Standard PC Material

$$a = 88.268,46$$

$$b = -264,66$$

$$X = 37 \text{ (January 2020)}$$

$$Y = a + b$$

$$X = 88.268,46 + -264,66 \text{ (37)}$$

$$= 88.268,46 + (-9.792,42)$$

$$= 78.476,04 \text{ ton}$$

So the forecast of pc strand raw materials for the 37th month (January 2020) is 78,476.04 tons

c. Connection Plate Material

$$a = 6403,72$$

$$b = 3,02$$

$$X = 37 \text{ (January 2020)}$$

$$Y = a + b$$

$$X = 6.403,72 + 3,02 \text{ (37)}$$

$$= 6.403,72 + 111,57$$

$$= 6.515 \text{ pieces}$$

So the forecast for raw materials for splicing plates for the 37th month (January 2020) is 6,515 pieces

2. Booking Cost Analysis

The cost of ordering sand and joint plates from 2017 to 2019 decreased in 2018 because orders for sand raw materials and joint plates also decreased in 2018. The cost of ordering sand raw materials and splice plates has an order

frequency of 24 times in one year. In 2017 the total order fee reached Rp 17,160,000,-, while the order fee per order or each order in 2017 was Rp 715,000,-. In 2018 the total order fee reached Rp 16,180,000,- while the order fee per order or each order in 2018 was Rp 674,167,-. In 2019 the total order fee reached Rp 17,400,000,- while the order fee per order or each order in 2019 was Rp 725,000,-.

However, the cost of ordering pc strand from 2017 to 2019 has decreased. Because orders for pc strand raw materials have also decreased. The cost of ordering pc strand raw materials has a frequency of ordering 24 times in one year. In 2017 the total order fee reached Rp 29,160,000,-, while the order fee per order or each order in 2017 was Rp 715,000,-. In 2018 the total order fee reached Rp 26,380,000,- while the order fee per order or each order in 2018 was Rp 674,167,-. In 2019 the total order fee reached IDR 25,400,000 while the order fee per order or each order in 2019 was IDR 725,000,-.

3. *Storage Cost Analysis*

In 2017 the total storage cost reached Rp. 122,368,000,- in 2018 it increased to Rp. 133,410,000,- and in 2019 it increased to Rp. 143,972,000,-. The amount of storage costs for raw materials per unit of raw materials is determined by the company, namely the total storage cost per year divided by the total use of raw materials.

4. *EOQ Method Analysis*

PT Wijaya Karya Beton Tbk is an industrial company that produces precast concrete products needed by construction service companies, which is engaged in the concrete industry based on orders. In its business activities, PT Wijaya Karya Beton Tbk requires approximately twenty-five types of raw materials that are useful to meet the needs of its production process.

The total cost of raw material inventory calculated according to EOQ is less than that incurred by the company, so there is a saving in the cost of raw material inventory if the company uses the EOQ method in its raw material inventory. So this research was made so that the planned supply of raw materials at PT Wijaya Karya Beton Tbk. and inventory costs are more efficient. Data obtained from the company shows the relationship between Economic Order Quantity (EOQ), order frequency, safety stock, reorder point, and Total Inventory Cost (TIC) of raw materials for one year.

IV. CONCLUSION

The EOQ method is more efficient than the company's policy method which is seen in the difference in total inventory costs, which is as follows:

1. Sand raw materials in 2017 the total cost according to the company is Rp 27,358,071,- while according to the EOQ method it is Rp 13,228,776,-. So there are savings obtained of Rp 14,129,295,-. The total cost of sand raw materials in 2018 according to the company was Rp 27,297,666,- while according to the EOQ method it was Rp 13,412,176,-. So there is a savings obtained of Rp 13,885,490,-. The total cost of sand raw materials in 2019 according to the company is Rp 29,397,515,- while according to the EOQ method it is Rp 14,448,513,-. So there is a savings obtained of Rp 14,949,002,-
2. The total cost of pc strand raw materials in 2017 according to the company is Rp 39,378,360 while according to the EOQ method is Rp 17,261,730,-. So there is a savings obtained of Rp 22,116,630,- raw materials for pc strand in 2018 the total cost according to the company is Rp 37,513,008,- while according to the EOQ method it is Rp 17,137,349,-. So there is a savings obtained of Rp 20,375,659,- the raw material for pc strand in 2019 the total cost according to the company is Rp 37,428,613,- while according to the EOQ method it is Rp 17,479,327,-. So there are savings obtained of Rp 19,949,286,-
3. Raw materials for splicing plates in 2017 the total cost according to the company is Rp 27,355,204,- while according to the EOQ method it is Rp 13,226,855,-. So there is a savings obtained of Rp 14,128,349,- Raw materials for splicing plates in 2018 the total cost according to the company is Rp 27,298,103,- while according to the EOQ method is Rp 13,412,544,-. So there is a savings obtained of Rp 13,885,559,- Raw materials for splicing plates in 2019 the total cost according to the company is Rp 29,400,000,- while according to the EOQ method it is Rp 14,450,436,-. So there are savings obtained of IDR 14,949,564,-
4. The quantity of raw material purchases using the EOQ method is more optimal compared to the company's policy method.
5. The company does not pay attention to the amount of safety stock. Meanwhile, if the company applies the EOQ method in controlling its raw

materials, the company will be able to determine the safety supply.

6. The company reorders when the item is running low. Meanwhile, if the company applies the EOQ method in controlling its raw materials, then the company will be able to determine the reorder point.

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