*Banking and Management Review*

# The Analysis of Raw Material Control using the Economic Order of Quantity (EOQ) Method in Teng-teng Mulyati Home Industry

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ABSTRACT

**Introduction/Main Objectives:** The purpose of this study was to analyze raw material inventory control with Economic Order Quantity (EOQ) method for helping the company to control the inventory of raw material by looking for how much raw material the rice must be ordered so that the company does not experience shortages and advantages in its raw materials, so the inventory in the company is optimal. **Finding/Results:** The result showed that Economic Order Quantity (EOQ) is the appreciate and can optimize the supply of special vehicle raw material in home industry Teng-teng Mulyati compared with the existing policies in the company, using the Economic Order Quantity (EOQ) method the order quantity becomes 682 kg with 1 time the order frequency, Safety Stock 679,98 kg, Reorder Point 718,61 kg, Maximum Inventory 1.361,98 kg, so the Total Inventory Cost is Rp. 174.539,39. **Conclusion:** This method can be a company reference in controlling the inventory of raw material and the company obtains cost savings between calculations based on company policy and the Economic Order Quantity (EOQ) method.

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## 1. Introduction

A company has a main goal, namely making a profit, there are various factors that can influence the process to achieve this main goal, one of which is the smooth production factor. According to the West Java Provincial Central Statistics Agency (https://jabar.bps.go.id Downloaded in December 2022) the number of medium-large industries based on industrial subsectors based on industry groups in West Java from 2010 to 2014, the food industry is in 10th position as an industrial group that has developed a lot in West Java.

One thing that affects the smoothness of production is whether or not there is a supply of raw materials that will be processed in the production process. In Teng-teng Mulyati home industry experience constraint in Manage inventory control. The calculation method in Economic Order Quantity (EOQ) is a calculation method that can streamline inventory distribution so that undesirable things will not happen, such as running out of raw material supplies or stock outs. The Economic Order Quantity method also aims to ensure an efficient quantity when there is an order, so that the funds that will be spent on inventory are smaller.

Based on the results of observations made at the Teng- teng Mulyati home industry and looking at this situation, it was discovered that there was a problem with the supply of raw materials due to frequent shortages of raw materials which could later lead to large order funds, besides that there was also an excess of raw materials with risks. Material standard become broken, happened accumulation, and expenditure cost excessive. Based on the background, so we chose the Economic Order Quantity (EOQ) method in the Teng- teng home industry Mulyati.

**Table 1.** Quantity Purchase and Use of Materials in Teng- teng *Home Industry* Mulyati in 2021

| No | Month | Initial | Rice (kg) | | Ending | Initial | Sugar (kg) | | Ending |
|---|---|---|---|---|---|---|---|---|---|
| | | Inventory (kg) | Purchase | Usage | Stock (kg) | Inventory (kg) | Purchase | Usage | Stock (kg) |
| **1** | **Jan** | 550 | 950 | 900 | 600 | 50 | 500 | 450 | 100 |
| **2** | **Feb** | 600 | 825 | 800 | 625 | 100 | 400 | 400 | 100 |
| **3** | **Mar** | 625 | 685 | 700 | 610 | 100 | 350 | 350 | 100 |
| **4** | **Apr** | 610 | 750 | 800 | 560 | 100 | 400 | 400 | 100 |
| **5** | **May** | 560 | 1000 | 1400 | 160 | 100 | 700 | 700 | 100 |
| **6** | **Jun** | 160 | 1000 | 1300 | (-140) | 100 | 600 | 650 | 50 |
| **7** | **Jul** | 0 | 825 | 800 | 25 | 50 | 500 | 400 | 150 |
| **8** | **Aug** | 25 | 725 | 700 | 50 | 150 | 400 | 350 | 200 |
| **9** | **Sept** | 50 | 525 | 500 | 75 | 200 | 300 | 250 | 250 |
| **10** | **Oct** | 75 | 950 | 600 | 425 | 250 | 350 | 300 | 300 |
| **11** | **Nov** | 425 | 750 | 700 | 475 | 300 | 200 | 350 | 150 |
| **12** | **Dec** | 475 | 950 | 1000 | 425 | 150 | 450 | 500 | 100 |
| | **Qty** | | **9,935** | **10,200** | | | **5,150** | **5100** | |
| | **Average** | | **827.92** | **850** | | | **429.16** | **425** | |

Source : Data on Purchase and Use of Raw Materials in Tengteng Mulyati , 2021

Based on results interviews and observations with owner named Ms. Mulyati and her employees industry of Teng- teng Mulyati, they said that this industry often experiences shortages of rice raw materials which can have bad risks such as hampered production processes and lack of supplies, besides that there is also an excess of raw materials with risks material standard become broken, happened accumulation, and expenditure cost excessive. For carry out supply material standard Teng-teng industry for Rice raw materials cost Rp. 11,000 per kg. It can be explained in the following table below the amount of rice purchased and the cost of purchasing rice from January to December in 2021.

**Table 2** Total Purchase of Raw Materials in January- December Year 2021

| No | Month | Purchase (kg) | | Price Per kg (Rp) | | Amount (Rp) | |
|---|---|---|---|---|---|---|---|
| | | Rice | Sugar | Rice | Sugar | Rice | Sugar |
| **1** | Jan | 950 | 500 | 11,000 | 12,500 | 10,450,000 | 6,250,000 |
| **2** | Feb | 825 | 400 | 11,000 | 12,500 | 9,075,000 | 5,000,000 |
| **3** | Mar | 685 | 350 | 11,000 | 12,500 | 7,535,000 | 4,375,000 |
| **4** | Apr | 750 | 400 | 11,000 | 12,500 | 8,250,000 | 5,000,000 |
| **5** | May | 1000 | 700 | 11,000 | 12,500 | 11,000,000 | 8,750,000 |
| **6** | Jun | 1000 | 600 | 11,000 | 12,500 | 11,000,000 | 7,500,000 |
| **7** | Jul | 825 | 500 | 11,000 | 12,500 | 9,075,000 | 6,250,000 |
| **8** | Aug | 725 | 400 | 11,000 | 12,500 | 7,975,000 | 5,000,000 |
| **9** | Sept | 525 | 300 | 11,000 | 12,500 | 5,775,000 | 3,750,000 |
| **10** | Oct | 950 | 350 | 11,000 | 12,500 | 10,450,000 | 4,375,000 |
| **11** | Nov | 750 | 200 | 11,000 | 12,500 | 8,250,000 | 2,500,000 |
| **12** | Dec | 950 | 450 | 11,000 | 12,500 | 10,450,000 | 5,625,000 |
| **Amount** | | 9,935 | 5,150 | | | 109,285,000 | 64,375,000 |
| **Average** | | 827.92 | 429.16 | | | 9,107,083 | 5,364,583.33 |

Source : Document purchase material standard rice *Home Industry* Teng- teng Mulyati in 2021

Based on table 2 has is known the result that rice and sugar are the most important raw materials in the production process Teng- teng Mulyati Home Industry. However, the author will choose one raw material to study in more depth, such as rice for further research because it is one of the raw materials whose purchase and use cannot be estimated so its advantages and disadvantages are the most dominant compared to sugar raw materials.

## 2. Literature Review

### *2.1. Operational Management*

According to Haizer and Render (2017:4), Operational Management is an action related to the creation of goods and services through changing input into output.

### *2.2. Inventory Management*

According to Harsanto (2013:63), Management supply is a series of company provisions to ensure that the company is experienced in preparing supplies of a certain quality, quantity and time. According to Fahmi (2014: 109), inventory management is a company's ability to manage every need for goods,

whether in the form of raw goods, semi-finished goods or finished goods, so that they are always available in stable and fluctuating market conditions. The Inventory Management Techniques are Economic Order Quantity (EOQ), Material Requirement Planning (MRP), Just In Time (JIT), ABC analysis, and Periodic Review.

### *2.3. Supply*

According to Stevenson and Chuong (2014:179, inventory is a supply or reserve of goods in a company which usually keeps hundreds to thousands of items in inventory, usually starting from goods small like nuts, pencils, bolts, clamps paper, and also large items such as construction equipment, machinery, trucks and airplanes. According to Assauri (2016:225), Inventory is supply of a unit or resource that can be used in a company organization. According to Handoko (2019:164) Inventory is a term that refers to everything or organizational resources that are stored in anticipation of fulfilling demand.

### *2.4. Inventory Control*

According to Assauri (2016:248) supply control is something activities to determine the level and composition of parts, raw materials and manufactured goods, so that later the company can protect the smooth production and sales as well as the company's spending needs effectively and efficiently. According to Rusdiana (2014:337) supply control is activities related to planning, implementation and supervision determination material/goods requirements other so that in a party need operation can be fulfilled at the specified time and other parties who invest in other inventory of goods can be optimally suppressed.

### *2.5. Economic Order of Quantity (EOQ)*

According to Fahmi (2014:120) the Economic Order Quantity (EOQ) model is a mathematical model that determines amount must have items ordered for fulfil projected demand, with minimized inventory costs. According to Heizer and Render (2017:496) Economic Order Quantity (EOQ) is an inventory control method that minimizes total ordering and storage costs.

## 3. Result and Discussion

### *3.1. Raw Material Supplies Control*

In controlling raw material inventory rice is done Teng- teng *home industry* Mulyati , there is control inventory during the process of purchasing raw materials. Below is the process of purchasing rice raw materials at the Teng- teng *home industry* Mulyati:

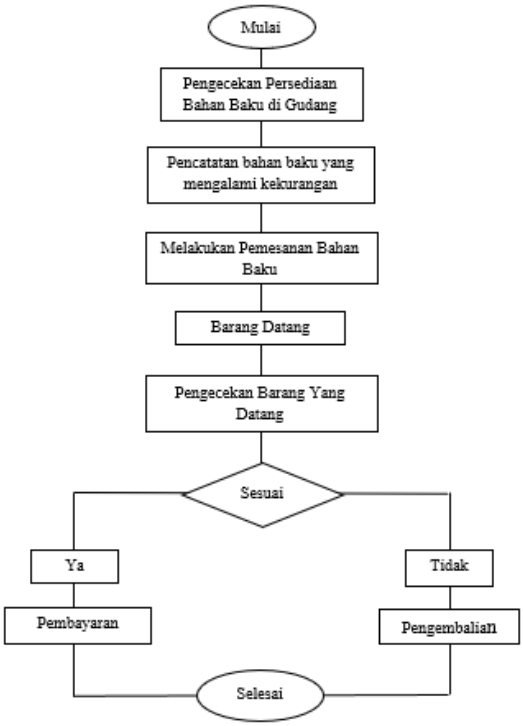



**Figure 1** Process Flow for Purchasing Rice Raw Materials

Source : Interview Results with Home Industry Owner Teng-Teng Mulyati , 2023

### *3.2. Problems in Raw Material Supplies Control*

Based on the results of an interview on September 17 2022 with the owner, there is a number of problems that occur at the company in supplies control system, among others as follows:

1. Inventory Levels

   The level of inventory owned by the company is not optimal, this can occur due to decreases and increases in the price of raw materials which occur due to the influence of demand and supply in the market, continuity of *supply* of raw materials that is not appropriate, production process patterns that are not appropriate due to the recording system which is still carried out conventionally, as well as the Covid 19 *pandemic* which hampered the production and purchasing process of raw materials.

   Based on these observations, the impact on the company is that costs are inefficient because the company often does not have *safety stock* for production activities, and sometimes it is often *over stocked* so that the company has to incur unnecessary costs for raw materials.

2. Process of Ordering and Purchasing Raw Materials

   Inventory levels carries out the process of ordering raw materials at the beginning of every month, but with inconsistent quantities each month. Booking through *suppliers* with through telephone

and *WhatsApp*, and there are some raw materials that are their own. *Suppliers* come from Sumedang, and after the raw materials arrive, the raw materials will be stored in the warehouse storage material standard for checking completeness and quality.

Companies usually rarely check how much is left/*stock w*hen purchasing raw materials especially for rice raw materials, so sometimes the company will run out of *stock* for large orders. Then the company has to take *stock* from private property.

### *3.3. Raw Material Inventory Level*

In this home industry, there is no proper scheduling of raw material purchases, so purchasing becomes inefficient. The supply of raw materials in this home industry will also become waste with a small space and will take up a lot of space if the home industry continues to make purchases while the raw materials are still available. Likewise, when the home industry does not have a large supply of raw materials, the result is that the production process will not run as it should, raw materials will continue to decrease so that later the home industry will not have any safety stock at all. The inventory recording system carried out by the company is still done manually with recording done using books without using any method.

### *3.4. Process of Ordering and Purchasing Raw Materials*

This home industry purchases raw materials at the beginning of the month. In general, it will take around 1 to 3 days to arrive after ordering raw materials from the supplier. However, on certain days the process of ordering raw materials will be hampered, due to stock running out, scarcity, or other problems.

After the raw materials arrive, the raw materials will be immediately stored in the inventory storage warehouse. This can cause a buildup of raw materials if the raw materials are stored for a long period of time, damage and a decrease in the quality of the raw materials.

### *3.5. Application of Economic Order Quantity, Safety Stock, Reorder Point Methods in Raw Material Inventory*

Based on the problems found in Teng-teng Mulyati's home industry regarding raw material inventory control, the researcher used the Economic Order Quantity (EOQ) method to analyze existing inventory control with the aim of preventing excess and shortages of rice as raw materials. Ordering costs and storage costs are needed to calculate raw material inventory control using the Economic Order Quantity (EOQ) method. The following is a breakdown of the costs for ordering rice at the Teng- teng Mulyati home industry:

**Table 3** Costs Ordering Rice Raw Materials

| No. | Fee Type | Amount of Fee (Rp) |
|---|---|---|
| **1** | Telephone Costs | 20,000 |
| **2** | Transportation costs | 50,000 |
| | **Total Cost/Month** | 70,000 |
| | **Total Cost/Year** | 840,000 |

Source: Interview results with owner Teng- teng Mulyati Home Industry, 2022

Based on the results above, the ordering cost is consisting of telephone costs and transportation costs. Telephone costs incurred to buy credit/quotas every time you order raw materials from suppliers and transportation costs incurred when raw materials are sent by car from the supplier to home industry. The following is data on storage costs:

**Table 4** Storage Cost of Rice Raw Materials

| No. | Cost component | Storage Fee (Rp) |
|---|---|---|
| **1** | Damage Fees | 18,000 |
| **2** | Electricity cost | 200,000 |
| | **Total Cost/Month** | 218,000 |
| | **Total Cost/Year** | 2,616,000 |

Source: Interview results with owner Teng- teng Mulyati Home Industry, 2022

Based on the results above, the storage cost is consisting of damage fees and electricity cost. Damage fees are costs incurred by the company due to damage to raw materials when stored in the warehouse. The following are total supply and use of rice as raw materials from January to December 2021:

**Table 5** Total Supply and Use of Rice Raw Materials from January- December 2021

| No | Month | Supply | Use | Difference |
|---|---|---|---|---|
| **1** | **January** | 1,500 | 900 | 600 |
| **2** | **February** | 1,425 | 800 | 625 |
| **3** | **March** | 1,310 | 700 | 610 |
| **4** | **April** | 1,360 | 800 | 650 |
| **5** | **May** | 1,560 | 1,400 | 160 |
| **6** | **June** | 1,160 | 1,300 | (-140) |
| **7** | **July** | 825 | 800 | 25 |
| **8** | **August** | 750 | 700 | 50 |
| **9** | **September** | 575 | 500 | 75 |
| **10** | **October** | 1,025 | 600 | 425 |
| **11** | **November** | 1,175 | 700 | 475 |
| **12** | **December** | 1,425 | 1,000 | 425 |
| | **Amount** | **14,090** | **10,200** | **3,980** |
| | **Average** | **1,174.17** | **850** | **331.67** |

Source: Data on the supply and use of rice raw materials in 2021

### *3.6. Economic Order Quantity (EOQ)*

In order to determine the optimum ordering point for rice raw materials, we use the Economic Order Quantity (EOQ) calculation for rice raw materials, as follows:

Ordering cost per order (S) = Rp. 70,000

Rice usage per month (D) = 850 kg

Storage Cost per unit (H) $= \frac{Total\ Storage\ Cost}{Total\ usage\ of\ raw\ material}$ (1)

$$= \frac{218.000}{850} = 256{,}47$$

= Rp. 256

$$EOQ = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(850)(70.000)}{256}} = 681{,}79 = 682 \text{ kg/order} \quad (2)$$

The frequency of purchasing rice raw materials required by the company is:

$$F = \frac{D}{EOQ} = \frac{850\ kg}{682\ kg} = 1{,}2 \approx 1\ time \quad (3)$$

Required time interval:

$$I = \frac{EOQ}{D} \times 1\ year = \frac{682\ kg}{850\ kg} \times 365\ days = 292{,}85\ days \approx 293\ days \quad (4)$$

### *3.7. Safety Stock*

According to Heizer and Render (2017), generally tolerance limits are used is 5% above estimates and 5% below estimates, the company uses a standard deviation of 5% with a value of 1.65. To calculate the standard deviation of rice raw materials, it is as follows:

**Table 6** Standard Deviation of Rice Raw Materials in 2021

| Month | Unit | Inventory (x) | Usage (y) | Deviation (xy) | Squared $(xy)^2$ |
|---|---|---|---|---|---|
| **January** | Kg | 1,500 | 900 | 600 | 360,000 |
| **February** | Kg | 1,425 | 800 | 625 | 390.625 |
| **March** | Kg | 1,310 | 700 | 610 | 372,100 |
| **April** | Kg | 1,360 | 800 | 560 | 313,600 |
| **May** | Kg | 1,560 | 1,400 | 160 | 25,699 |
| **June** | Kg | 1,160 | 1,300 | (-140) | (-19,600) |
| **July** | Kg | 825 | 800 | 25 | 625 |
| **August** | Kg | 750 | 700 | 50 | 2,500 |
| **September** | Kg | 575 | 500 | 75 | 5,625 |
| **October** | Kg | 1,025 | 600 | 425 | 180,625 |
| **November** | Kg | 1,175 | 700 | 475 | 225,625 |
| **December** | Kg | 1,425 | 1,000 | 425 | 180,625 |
| **Amount** | | **14,090** | **10,200** | **3,980** | **2,038,049** |

Source: Data processed, 2022

Before calculating *Safety Stock* (SS), you must first calculate *the squared error* (q) for rice raw materials using the following formula:

$$q = \sqrt{\frac{\in(x-y)^2}{n}} = \sqrt{\frac{2.038.049}{12}} = 412{,}11\ kg \quad (5)$$

*Safety Stock* rice = Zq (6)

= 1.65 x 412.11 = 679.98 kg

### *3.8. Reorder Point*

Before calculating *the Reorder Point* (ROP), we have to calculate for the average use of rice raw materials per day in one month, as follows:

$$Q = \frac{850\ kg}{22\ days} = 38{,}63\ kg \quad (7)$$

So, we can calculate the reorder point, as follows:

ROP = *Safety Stock* + (*Lead time* x Q) (8)

= 679.98 kg + 38.63 kg = 718.61 kg

### *3.8. Maximum Inventory (MI)*

In order to find out the maximum inventory of materials standard rice can be calculated as follows:

Maximum Inventory rice = Safety Stock + EOQ (9)

= 679.98 kg + 682 kg = 1,361.98 kg

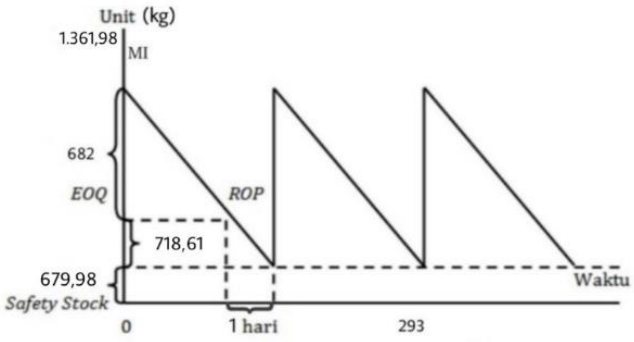
The result of EOQ, Safety Stock, Reorder Point and Maximum Inventory can be resumed and illustrated as follows:

**Table 7** The Amount of EOQ, Safety Stock, Reorder Point and Maximum Inventory

| Raw material | EOQ | *Safety Stock* | ROP | *Maximum Inventory* |
|---|---|---|---|---|
| **Rice** | 682 kg | 679.98 kg | 718.61 kg | 1,361.98 kg |

Source: Data processed, 2022

**Figure 2** Chart Connection between EOQ, SS, ROP and MI




Source: Data processed 2022

### *3.9. The Inventory Cost Comparison between Company Policy and the EOQ Method*

The calculation of the total cost of rice raw material supplies based on company policy is as follows:

$$TIC = \sqrt{2DSH} \quad (10)$$

$$= \sqrt{2(10.200)(70.000)(256)}$$

= Rp. 604,622.19

To find out the total cost supply material standard rice with use EOQ method is as follows:

$$TIC = \sqrt{2DSH} \quad (11)$$

$$=\sqrt{2(850)(70.000)(256)}$$

= Rp. 174,539.39

From the result above, we can resume the comparison table as follows:

**Table 8** The Inventory Cost Comparison between Company Policy and the EOQ Method

| Information | Company policy ( per month) | EOQ method ( per month) |
|---|---|---|
| **Average purchase of rice raw materials** | 827.92 kg | 682 kg |
| **Frequency of orders** | 1-2 times order | 1 order |
| ***Safety stock*** | | 679.98 kg |
| ***Reorder point*** | | 718.61 kg |
| ***Maximum inventory*** | | 1,361.98 kg |
| **TIC** | Rp. 604,622.19 | Rp. 174,539.39 |

Source: Data processed 2022

From the result above, it can be concluded that using the *Economic Order Quantity* (EOQ) method will make the average purchase of rice raw materials and total inventory costs are better compared to company policy.

## 4. Conclusion and Suggestion

From the result above, we can make conclusion as follows:

1. There are two types of inventory control carried out by Teng-teng Mulyati's home industry for rice raw materials, including the process of purchasing and storing raw materials. It can be said that control of raw material supplies carried out by Teng-teng Mulyati's home industry is not optimal and does not use any methods. The flow of the process of purchasing raw materials begins with checking the remaining inventory of raw materials, recording them, then purchasing, after the goods arrive, they will check again whether the goods are suitable or not, if they are suitable then the employee will make payment. Otherwise, the return process will be carried out.
2. The Economic Order Quantity (EOQ) method for rice raw materials is 682 kg/order, with an order frequency of 1 time, Safety Stock (SS) is 679.98 kg, Reorder Point (ROP) is 718.61 kg, Maximum Inventory (MI) of 1,361.98 kg, and Total Inventory Cost (TIC) of Rp. 174,539.39. Companies can make supplies of raw materials more optimal. The positive thing that can be taken is avoiding the possibility of shortages or excesses of raw materials in the company. The Economic Order Quantity (EOQ), Safety Stock (SS), Reorder Point (ROP) and Maximum Inventory (MI) methods can be a reference for companies in determining quantities when ordering raw materials. The Economic Order Quantity (EOQ) method makes the company's raw material inventory more efficient.
3. According to company policy the average purchase of rice raw materials is 827.92 kg, whereas using the EOQ method the average purchase of rice raw materials is 682 kg. The frequency of

orders based on company policy is 1 to 2 orders, whereas the EOQ method has a frequency of 1 order. Because the company has not implemented any methods, the company does not have Safety Stock, Reorder Point, and Maximum Inventory. Meanwhile, with the EOQ method, the total Safety Stock is 679.98 kg, Reorder Point is 718.61 kg, and Maximum Inventory is 1,361.98 kg. Furthermore, the Total Inventory Cost at the time of company policy was IDR. 604,622.19, while with EOQ Total Inventory Cost for the company is Rp. 174,539.39. The comparison between company policy and when using the Economic Order Quantity (EOQ) method is very significant. Where calculations using the Economic Order Quantity (EOQ) method can produce more efficient costs compared to previous company policies.

Thus, the suggestion can be taken as follows based on the above conclusion:

1. The company should review the company policy in controlling the supply of raw materials which has been implemented by the company, the company policy in question is such as buying raw materials 1 to 2 times per month, buying rice raw materials in quantities that cannot be estimated so that this occurs. excess raw materials can accumulate in the warehouse, and sometimes there is a shortage of raw materials so that the production process cannot run optimally. By reviewing it, it is hoped that the company will be very wise in the process of purchasing raw materials so that the production process can run optimally with minimal costs.
2. Companies should start using methods to control their raw material inventory, such as the Economic Order Quantity (EOQ) method, which is useful for minimizing shortages and excesses of raw materials to be ordered, apart from that it can also streamline the production process and quality of their products. For example, the Economic Order Quantity (EOQ) method can minimize the average purchasing cost of raw materials which was initially 827.92 kg per month to only 682 kg per month, the order frequency which was initially made 1 to 2 times becomes sufficient only order once, the EOQ method also has Safety Stock (SS) for the company, namely 679.98 kg per month for company savings, Reorder Point (ROP) of 718.61 kg per month, Maximum Inventory (MI) of 1,361, 98 kg per month, the last is Total Inventory Cost (TIC) which was initially Rp. 604,622.19 to Rp. 174,539.39 using the EOQ method.
3. Companies should compare the costs incurred before and after using the Economic Order Quantity (EOQ) method in order to avoid risks and minimize raw material costs for the company. By comparing costs it can be seen that the EOQ method can minimize costs in the home industry, such as the difference in the average purchase of raw materials based on company policy and using the EOQ method as much as 145.92 kg per month, and the difference in TIC based on

company policy and using the EOQ method as much as Rp. 430,082.8 per month. From this difference, it can be seen that the EOQ method can minimize the costs

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