Analysis of Raw Material Ordering with Economic Order Quantity Method

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Abstract. The objective of this study is to create more recommendations and purchases of raw material in each period. This research method used Economic Order Quantity (EOQ) method. This method is one of many methods for supply management, to avoid shortage or surplus raw material which used for production. This study result the number of ideal raw material amount which use for production. The result was gained from the calculation of ordering and storage cost, where the ordering cost is a cost per one order and storage cost is a cost for each unit material per period. Other than that, this method also determine a forecasting based on total amount of the order that would be produced. Certainly, the result of forecasting is very helpful for the company to order raw material which corresponding to the production, so that could decrease the loss of ordering and storage cost due to the excess purchase of these raw materials.

1. Introduction
Raw material is one of many important elements which need a special attention in terms of planning and management, because without raw materials, a production cannot run smoothly. [1] When planning and managing raw material, costs need special attention. There are three costs that must be known, order cost; is a cost that the company incurs when they order raw materials, storage cost; is a cost that the company incurs when they store raw materials in warehouse; and Stock-Out cost; is a cost that the company incurs when there is stock outage [2]. The method used in this study is Economic Order Quantity (EOQ) method for calculating the most efficient order amount so that the company can make more economical ordering and storage cost [3][4].

There are several previous studies which related to this study. First study is focused on raw material stock controlling using EOQ method [5]. Second study is focused on conceptual model of inventory system management using EOQ method [6]. Third study is focused on EOQ method use for product or something that is growing [7]. The difference between this study and the first study is that the first study focused on raw material stock controlling while this study is focused on recommendation about the amount of raw material that must be bought. The difference between this study and the second study is that the second study is same with first study which is focused on raw material stock controlling, while this study is focused on forecasting of amount raw material that must be bought. The different with third study is on the product, which is something that is growing, such as poultry, while this study products are Bag.

Therefore, the objective for this study are produce a recommendation of how many times raw material must bought every period and how many raw materials to buy. Method is using Economic Order Quantity (EOQ). Results to be obtained are ordering cost, storage cost, ordering frequencies as well as the ideal amount of raw materials to be purchased. This matter also been adjusted to the results
of comparison of previous studies and then it is decided to discuss forecasting raw material purchases using the EOQ method, because by using this method can get the amount of raw materials according to the needs so that the cost of ordering and storage can also be optimized.

2. Method
Steps on this study as follows:

2.1 Data Collection
At this stage, researcher collecting data which will be used for research data. The data used is product request data.

2.2 Usage Analysis Economic Order Quantity (EOQ)
At this stage, steps were taken from EOQ. First, determine the raw material needed for create a product. The data is found in the Table 1.

| No | Material       | Qty | Unit   |
|----|----------------|-----|--------|
| 1  | Fabric         | 9   | Roll   |
| 2  | Satin Fabric   | 5   | Roll   |
| 3  | Yarn           | 3   | Cones  |
| 4  | Big Zipper.    | 5   | Dozen  |
| 5  | Velcro Tape 5cm| 45  | Roll   |
| 6  | Webbing Rope 2,5cm | 4 | Roll |
| 7  | Big Slider 2,5cm | 4 | Dozen |

Next are calculating the ordering cost and storage cost. Ordering cost is in the form of telephone costs and transportation costs. While the storage cost is in the form of electricity cost and reserve cost if there is defective raw material. If company want to reduce storage cost, then they must order a few raw materials that have ordering cost as a risk. Otherwise, if they want to reduce order cost, they must increase storage cost \[8\]. The next step is to calculate EOQ with formula:

\[
Q = \sqrt{\frac{2SD}{H}}
\]

Information:
D = Demand Raw Materials
S = Order cost
H = Storage costs

Afterward, calculate order time (t), purchase frequency (F) based on economic order (Q). Order time is result from economical order (Q) divided demand for raw materials, while purchase frequency is the opposite. \[9\] After that count total cost (TC) by adding up the ordering and storage costs. Lastly, the total count of incremental cost (TIC)[10] calculated with formula:

\[
TIC = \sqrt{2SDH}
\]
3. Results and Discussion

First step is to determine ordering cost and storage cost. Data can be found on Table 2.

**Table 2. Ordering cost and Storage cost**

| No | Material            | Qty  | Ordering Cost (S) | Storage Cost (H) |
|----|---------------------|------|-------------------|------------------|
| 1  | Main                | 9 Roll | 50.000           | 100.000          |
| 2  | Satin Fabric        | 5 Roll | 40.000           | 180.000          |
| 3  | Yarn                | 3 Cones | 25.000           | 300.000          |
| 4  | Big Zipper          | 5 Dozen | 30.000           | 180.000          |
| 5  | Velcro Tape 5cm     | 45 Roll | 30.000           | 20.000           |
| 6  | Webbing Rope 2.5cm  | 4 Roll  | 20.000           | 225.000          |
| 7  | Bag Slider 2.5cm    | 4 Dozen | 20.000           | 225.000          |

Next, calculate EOQ by using data on Table 2.

\[ Q = \sqrt{\frac{2SD}{H}} \]

As example, will using data number 1, fabric with total 9 roll, ordering cost 50000 and storage cost 100000.

\[ Q = \sqrt{\frac{2 \times 50000 \times 9}{100000}} = 3 \text{ Roll} \]

Afterward, calculate order time and purchase frequency.

a. Order time

As example, will using data number 1, fabric and working days assumption are 26 days.

\[ t = \frac{Q}{D} \times \text{working days} = \frac{3}{9} \times 26 = 8.6 = 9 \text{ day} \]

b. Purchase Frequency

As example, will using data number 1, fabric.

\[ f = \frac{D}{Q} = \frac{9}{3} = 3 \text{ times} \]

After calculate order time and purchase frequency, next step is to calculate total cost. Here is the total cost for fabric:

\[ TC = H + S = 100000 + 50000 = 150000 \]

Last is calculation is total incremental cost. Here is the total cost for fabric:

\[ TIC = \sqrt{2SDH} = \sqrt{2.50000.9.100000} = 300000 \]
The end result of all calculation processes, can be found at Table 3.

Table 3. Total Cost for each month Recapitulation

| No | Material             | D  | S    | H  | Q  | T | f | TC  | TIC  |
|----|----------------------|----|------|----|----|---|---|-----|------|
| 1  | Main                 | 9 Roll | 50.000 | 100.000 | 3 | 9 | 3 | 150.000 | 300.000 |
| 2  | Satin Fabric         | 5 Roll | 40.000 | 180.000 | 2 | 10 | 3 | 220.000 | 262.328 |
| 3  | Yarn                 | 3 Cones | 25.000 | 300.000 | 1 | 9 | 3 | 325.000 | 212.132 |
| 4  | Big Zipper.          | 5 Dozen | 30.000 | 180.000 | 2 | 10 | 3 | 210.000 | 232.379 |
| 5  | Velcro Tape 5cm      | 45 Roll | 30.000 | 20.000 | 12 | 7 | 4 | 50.000 | 232.379 |
| 6  | Webbing Rope 2,5cm   | 4 Roll | 20.000 | 225.000 | 1 | 7 | 4 | 245.000 | 189.736 |
| 7  | Bag Slider 2,5cm     | 4 Dozen | 20.000 | 225.000 | 1 | 7 | 4 | 245.000 | 189.736 |

After all step is running, economical order (Q) result is obtained, purchase frequency (F), interval time (t), total cost (TC) and total incremental cost (TIC). If compared with previous study, the result is different because the focus is different. First study is focused on stock control, while this study is focused on determine number of orders in economically perspective. Second study is different on study case and on third study is different for the object which analyzed [5][6][7]. However, previous study is very helpful to finished this study.

4. Conclusion

The conclusion from this study is by economic order Quantity method, company can buy raw material according production needs, with interval time and purchase frequency obtained from EOQ process. So that there is no more loss because the raw material purchased is not as needed.

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