Calculation of EOQ (Economic Order Quantity) In Optimizing the Inventory Level of Dacron at Mell Toys’ Home Industry

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Abstract. Inventory control is very important so that the production can operate run well, one of the inventory controls is by using the EOQ method (Economic Order Quantity) on the purchase of raw materials. The purpose of the research is to optimize inventory costs in the manufacturing of Mell Toys home industry and to find out the total optimal of raw material orders. The method used in this study is a quantitative method. The data used in the study were obtained from interviews. Data will be calculated manually obtained from the company using the EOQ method approach. This research produces data using EOQ the number of orders for raw materials is 3885 kg, this is greater than the company's purchasing policy but with the calculation of EOQ, the total inventory cost can be saved from Rp. 4,800,000 to Rp. 424,250,867.1. So using EOQ in purchasing raw materials can optimize inventory costs in Mell Toys home-made doll industry.

1. Introduction
The company must provide the best service to satisfy customers, one of them is by fulfilling their needs by providing their products in a timely and quality manner. To achieve this accuracy, the production process must keep runs, if it stops then nothing to produce and then customer needs are not met.

One of the causes of obstructed the production process is the lack of raw materials to be processed into finished goods. To prevent shortages of raw materials, providing inventory is a must. Inventories are goods belonging to the company for the purpose of being sold within a normal business period, or goods that are still in production or raw materials that are waiting to be done in the production process [1].

Inventory is something that is really needed by companies large, medium, and small companies, which differ only the total and type of goods stored in the storage. There are 5 types of inventory in manufacturing companies, namely: (1) raw material inventory, components used in the production process are usually obtained from nature or purchased from suppliers or made of its own, (2) intermediate goods inventory, goods produced from the production process still need further processing into finished goods, (3) finished goods inventory, finished processed goods that have value and are ready for sale. (4) Inventory of assembled components, components purchased from other companies can be directly assembled in the production process, (5) helper supplies, inventories that are not components of finished goods [2].
Raw material inventory is a really important thing because it can be an obstacle if the inventory level is low or in stock out conditions that make the production process disrupted, but if the inventory level is too high or overstock, it will absorb considerable company finances, inventory costs and increase the risk of goods be damaged or expired, lost, etc.

Companies must maintain or make optimal inventory levels. Then there must be inventory control. Inventory control is a core activity of the process of optimizing inventory because this activity seeks the availability of optimal raw materials so that there is no shortage or excess inventory which means that it is suitable for the needs of the processing process [3]. Inventory management is a business enterprise in managerial functions. Inventory control tries not to overstock because if the stock is over, the storage and product maintenance costs will increase so that the stock is not damaged, the production process will be hampered so that it cannot meet customer needs quickly which make customers move to other products so that the company will lose [4].

One of the inventory controls is using the EOQ method (Economic Order Quantity), with this method the number of orders will produce optimal costs. Optimal is the quantity of Dacron raw material that can be obtained through purchase by issuing minimal costs but does not result in shortages and excess raw materials [5]. The use of this method can also reduce inventory costs so that inventory efficiency runs well and can reduce total inventory costs [6]. And companies also need to pay attention to the reorder point of inventory so that inventory levels remain optimal so as not to interfere with the production process.

The purpose of the study is to optimize inventory costs in the manufacturing of Mell Toys home doll industry and to find out the optimal number of raw material orders. It is expected that the number of orders and inventory costs will make the inventory level optimal so that the production process can run well.

Mell Toys is a Home Industry engaged in the production of dolls, car sets and neck pillows located in Kampung Rawa Roko RT.07 / 05 Bojong Rawalumbu-Rawalumbu Bekasi. This Home Industry has been established since 2012. The dolls itself have several anatomies such as flannel, accessories, and dacron. An item that is very important to control is the supply of dacron because the price is quite significant to the selling price of the product, which is about 42% of the total cost per doll. On that basis, we will focus our research on optimizing the dacron inventories at Mell Toys which indeed plays an important role. The period of May 2018 to April 2019 total inventories of the dacron is 32.840 kg but the production needs are 32.968 kg, then the occurrence is less than 128 kg so that the inventory at Mell Toys is not optimal therefore using EOQ will help the availability of goods in the warehouse and make inventory level optimal.

2. Research Method
This study used a quantitative approach because study data were in the form of numbers [7] and this type of study is a descriptive study because this study was conducted to provide a more detailed picture of a problem [8]. This study was conducted at Mell Toys in May 2019. Data were obtained from interviews in the form of data on needs for dacron from May 2018 to April 2019, raw material prices, holding costs and ordering costs. The frequency of ordering raw materials, and the waiting time when ordering raw materials until the order is received in the warehouse.

The data analysis technique used in this study is by calculating:

a. Economic Order Quantity (EOQ)
To optimize inventory levels using EOQ calculations, EOQ can be searched by the formula as follows [2]:

$$EOQ = \sqrt{\frac{2DS}{H}}$$
**EOQ** = Economic Order Quantity  
**S** = Ordering cost per order  
**D** = Needs for raw material  
**H** = Holding cost per unit

b. Total Inventory Cost  

The total cost of inventory according to [2]:

\[ TIC = \frac{D \cdot S}{Q} + \frac{Q \cdot H}{2} \]

**D** = Needs for raw material  
**S** = Ordering cost per order  
**H** = Holding cost per unit  
**Q** = The number of items each order

c. Reorder Point  

To search for Re-Order Point it can use the formula [9]:

\[ ROP = \frac{D \times L}{Y} \]

**D** = Needs for raw material in one period  
**L** = Lead Time  
**Y** = The number of working days in one year

d. Order Frequency  

Frequency or number of times to order in one period [10].

\[ \text{Order Frequency} = \frac{D}{Q} \]

**D** = Needs for raw material  
**Q** = Order amount according to EOQ

e. Order Duration  

Duration or number of days to order within one period [10].

\[ \text{Order Duration} = \frac{Y}{F} \]

**Y** = Number of working days in one year  
**F** = Order frequency

3. Result and Discussion  

Mell Toys is a business or company in the form of a home industry located in Kampung Rawa Roko RT.07 / 05 Bojong Rawalumbu-Rawalumbu, Bekasi which produces various types of dolls such as animal dolls, mini pillows, and bolsters, neck pillows and carset. For the production of dolls, it only produces dolls of the cotton doll. The company was founded by Mr. Khotmun Arfin in 2012. The company has 10 workers added as owners, with working hours on Monday - Saturday and starting hours at 08.00-16.00, with a wage of Rp. 1.500.000 / person every month.
3.1 Data analysis
3.1.1 Purchasing Raw Materials
Mell Toys in 2018 to April 2019 has a dacron needs of 32.968 Kg and the company's policy to order is 4 times a month which means that during the May 2018 to April 2019 order frequency is 48 times with an average purchase of 684 kg with a delivery lead time for 1 day.

3.1.2 Holding Costs
Holding Costs are costs incurred by the company because they store raw materials as inventories for a certain period of time [11]. For costs incurred by the company, it is only for warehouse rental costs of Rp.3,600,000 per year, with the holding cost per Kg is Rp. 109,19. Warehouses do not use electricity because working hours only are finished in the afternoon and uses a transparent roof so the sunlight can enter the warehouse so it does not need electricity.

3.1.3 Ordering Cost
Ordering costs are all costs incurred every time purchasing raw materials [12]. For the costs incurred by the company every time purchasing raw materials is a telephone fee is Rp. 1,200,000 per year with an order cost per order is Rp. 25,000.

3.2 Data Analysis using the Economic Order Quantity (EOQ) Approach
3.2.1 Economic Orders Quantity
In determining the optimal number of orders, we need costs, namely holding and ordering costs and data needs for raw material are needed for 1 period. Here are data from Mell Toys:
Ordering cost (per order) (S) : Rp. 25,000
Holding cost (per Kg) (H) : Rp. 109,19
Needs of May 2018 - April 2019 (D) : 32.968 Kg

\[
EOQ = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2 \times 32968 \times 25000}{109,19}} = 3885 \text{ Kg}
\]

3.2.2 Order Frequency
By calculating the EOQ we can determine the frequency of purchasing raw materials so that the frequency of purchases can be optimal. Company data needed is
Needs for raw material (D) : 32.968 Kg
Order amount according to EOQ (Q) : 3885 Kg

Order frequency formula:

\[
Frequency = \frac{D}{Q} = \frac{32968}{3885} = 8.485971686
\]

So, with the calculation of EOQ, the optimal number of orders can be obtained for the period May 2018 to April 2019 of 3885 Kg. With the frequency of purchasing raw materials carried out 8.485971686 times in one period of May 2018-April 2019.

3.2.2 Ordering Costs
According to [13] The cost of ordering after EOQ can be searched by the formula:

\[
\text{Ordering Cost} = F \times \text{Ordering Costs}
\]
So, the ordering cost after using the EOQ method is Rp. 212,149,2921.

3.2.3 Holding Costs

According to [13] Holding costs after EOQ can be searched by the formula:

\[
\text{Holding Costs} = \frac{EOQ}{2} \times \text{Holding Costs}
\]

\[
= \frac{3885}{2} \times 109.19
\]

\[
= \text{Rp. 212,101,575}
\]

So, the holding cost after using the EOQ method is Rp. 212,101,575

3.2.4 Order Duration

The order duration is the number of days to order in one year[10], which requires company data in the form of data:

- Number of working days in 1 year (Y) : 295 days
- Order frequency (F) : 8 times

The order duration formula is:

\[
\text{Order Duration} = \frac{Y}{F}
\]

\[
= \frac{295}{8}
\]

\[
= 37 \text{ days}
\]

So, the duration order of the dacron in the 18 May 2018 - April 2019 period is every 37 days.

3.2.5 Re-Order Point (ROP)

The Reorder Point (ROP) is the time when a company must order its raw materials again when it reaches a certain inventory level, the receipt of ordered raw materials can be on time [14]. To calculate ROP, it is known the company data as follows:

- Delivery Lead Time (L) : 1 day
- Number of working days in 1 year (Y) : 295 days
- Needs for raw material (D) : 32,968 Kg

With the formula:

\[
\text{ROP} = \frac{D \times L}{Y}
\]

\[
= \frac{32968 \times 1}{295}
\]

\[
= 112 \text{ Kg}
\]

So, the reorder point of the dacron at Mell Toys when the level inventory of the dacron in the warehouse reaches 112 Kg. when the dacron has reached that level, the company must reorder then the inventory level becomes optimal so that the production process runs well.

3.2.6 Total Inventory Cost (TIC)

The optimal total cost of inventory of dacron by calculating TIC, the company will know the economic cost of financing dacron inventories.

\[
\text{TIC before EOQ} = \text{Ordering Cost} + \text{Holding Cost}
\]

\[
= 3,600,000 + 1,200,000
\]

\[
= \text{Rp. 4,800,000}
\]

The total cost of dacron inventories issued according to the policy at Mell Toys is Rp. 4,800,000

\[
\text{TIC after EOQ} = \frac{DS}{Q} + \frac{QH}{2}
\]
\[
\begin{align*}
\frac{(32968 \times 25000)}{3885} + \frac{(3885 \times 109.19)}{2} &= 212.149,2921 + 212.101,575 \\
&= Rp. 424.250,8671
\end{align*}
\]

Total cost of dacron inventories issued according to the EOQ method is Rp. 424,250,8671.

### 3.3 Comparative Analysis of Company Policies and EOQ Policies

| Description            | Company Policy | EOQ Policy       |
|------------------------|----------------|-----------------|
| Order Amount           | 684 Kg         | 3885 Kg         |
| Order frequency        | 48             | 8,485,971,686   |
| Holding Costs          | Rp. 1,200,000  | Rp. 212,149,2921|
| Ordering Costs         | Rp. 3,600,000  | Rp. 212,101,575 |
| Order duration         | -              | 37 days         |
| Re-Order Point         | -              | 112 Kg          |
| Total inventory costs  | Rp. 4,800,000  | Rp. 424,250,8671|

From the table, it can be seen that the results of the study and calculations having been done find out the comparison between the company policies and EOQ policies, so that the total inventory costs according to the EOQ method are Rp. 424,250,8671, this is smaller than the total cost according to the company policy of Rp. 4,800,000. Of the total inventory costs have a difference of Rp. 4,375,749,1329 or by using the EOQ method experiencing savings seen from the total inventory cost of 91%.

### 4 Conclusion

Based on the results of the study, it can be concluded:

1. The number of economical orders on the purchase of raw materials in dacron based on the EOQ method during May 2018-April 2019 is greater than company policy. The purchase of dacron raw materials for the period of 2018 - April 2019 is 3885 Kg
2. The frequency of ordering used the EOQ method, the frequency of raw material purchases is carried out 8 times in one period. Before using the EOQ method, the frequency of the company is carried out 48 times so by using the EOQ method, it can reduce the ordering cost of dacron.
3. Reorder Point (ROP) when the level of dacron inventory in the warehouse reaches 112 Kg, the company must reorder so the inventory level becomes optimal again. The order duration according to the EOQ method is every 37 days.
4. Using the EOQ method is far more cost-effective than using company policy when purchasing raw materials. Before using EOQ the result is greater than after using EOQ.
5. Using the EOQ method can be saving the inventory cost of dacron as big as 91%
6. In using warehouse at Mell Toys can be eliminated, with using JIT method, so the warehouse is the responsibility of the vendor.
7. The inventory level of dacron with EOQ is can be optimal because order amount with EOQ can cover the needs of the dacron in Mell Toys on a period of May 2018-April 2019

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