Analysis of Raw Material Inventory Control Using Economic Order Quantity (EOQ) for Furniture Manufacturing Company in Indonesia

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ABSTRACT
Intense competition between companies requires companies to develop their products to meet increasingly high consumer needs. This requires companies to improve efficiency in all fields. One way to make it happen is by controlling the inventory of raw materials, in which the amount of inventory should neither be too much nor too little. The purpose of this study is to determine the order quantity of raw materials using the Economic Quantity Order (EOQ) method and determine the reorder point of raw materials at a Furniture Manufacturing Company. The result of this research shows that using EOQ can save the total cost for raw material inventory up to Rp 13.486.411. It also conclude that the optimal order quantity for raw material is 144,697 m^3 where in a year the order is ordered 31 times and the point of reordering the company's raw materials is when the amount of raw material is 449.61 m^3 thus the company does not have excessive raw materials.

Keywords: *inventory control, economic order quantity, reorder point, minimum total cost*

1. INTRODUCTION

Intense competition between companies requires companies to develop their products to meet increasingly high consumer needs. Beside that, companies also have to make sure their strategies they follow are right. This requires companies to improve efficiency in all fields. There are many aspects that must be considered to improve company efficiency. One way to make it happen is by controlling the inventory. Inventory costs which consist of ordering costs and holding costs can cost a lot of money. With a good inventory strategy, the company can ensure that inventory can be fulfilled properly without excess stock or shortage of stock.

Company X is a company engaged in furniture manufacturing. This company produces various types of products such as cupboards, dressing tables, sideboards, television tables and several other products. Policies regarding the procurement of raw materials at the company are currently carried out traditionally. The company will only order when it feels the current inventory is running low. The amount of raw materials ordered at each purchase is not based on calculations but only based on estimates. This condition has the potential to cause an increase in ordering costs because there is no control over raw material management. So it is necessary to make improvements to the company's inventory control.

Research on raw material inventory control has been carried out previously in various fields, the methods that can be used in planning and controlling raw materials are EOQ[1][2][3][4], POQ [5] and MRP[6][7]. These methods are quite easy to use so they can be applied to various aspects, such as in large industries [2], [6], [8], [9], home industries [1][10][11][12], and even hospitals [13][4][14]. In this study, the EOQ method will be used to resolve the case, because it is easy to use so that it can help the company.

These are the purpose of our research, we eager to:

1. Determine the order quantity of raw materials using the Economic Quantity Order (EOQ) method
2. Determine the reorder or reorder point of raw materials at the company

This 2 purposes are needed to be calculated so we can make a suggestion for the company about new purchase policy using EOQ, which is hopefully can reduce the total inventory cost.

2. METHODS

The method used in this research is the Economic Order Quantity (EOQ) method to determine the quantity of every purchasing, the frequency of purchasing in a year, reorder point, and the total inventory cost. The EOQ used to make sure that the number of order company made is optimum. The number of inventory is not too much thus makes the accumulation of raw materials in the warehouse, but also not too little so that it can cause an out of stock. Because excess number of raw materials could effect to higher holding cost and overall inventory cost, on the other hand out of stock could effect the production process and made lost for the company.

3. RESULTS AND DISCUSSION

The data used in this research is the raw material requirement from 2021 as can be seen at table 1. The raw materials used by the company to produce various kinds of products entirely using teak wood. In addition, there are additional raw materials in the form of dyes, plywood, bolts, glue, wood, bolt nuts, HCL drugs and so on. However, in this study only focus on teak wood raw materials because the use of these materials is the most and costs a lot of money.

Table 1. The Raw Material Requirements at 2021

Month	m^3
January	477.32
February	352.98
March	269.46
April	361.22
May	219.25
June	537.33
July	350.45
August	573.16
September	320.41
October	402.04
November	387.25
Desember	245.31
Total	**4,496.18**

Based from company historical data

The Company Inventory Policy

The company's policy regarding the purchase of raw materials at this time is to only make purchases when they feel they are needed. The number of orders is only made based on estimates without any special calculations. So here are the brief of current inventory in the company:

a. Average Purchase
   Average purchase in a company are follow
   Average purchase (Q) $= \frac{Amount\ to\ Purchase\ (D)}{Purchase\ freq}$
   $= \frac{4{,}496.18}{192}$
   $= 23.42\ m^3$

b. Order Cost
   Order costs which are calculated as expenses related to ordering raw material inventory is cost of unloading materials. The cost incurred is Rp 100,000 per one time purchase (S)

c. Holding cost

Storage cost are costs incurred by the company related to the storage of raw materials for certain period of time is the cost of labor working in the area.

Employee salary = Rp 2,011,514 x 8 x 12 = Rp 193,105,344 / year

Holding cost (H) $= \frac{Employee\ Salary}{Purchase\ Amount/year}$

$= \frac{193,105,344}{4,496.18}$

= Rp 42,948.76/m^3

d. Total Inventory Cost

Based on table 1, the raw material needs from January to December 2021 are 4,496.18 m^3. The amount of each order of raw materials (Q) is 23.42 m^3 with a one-time cost of ordering (S) of Rp. 100,000. Meanwhile, the storage cost per unit per year (H) is IDR 42,948.76. Then the total cost of inventory (total cost) is

$TIC = \left(\frac{D}{Q} x\ S\right) + \left(\frac{Q}{2} x\ H\right)$

$= \left(\frac{4,496.18}{23.42} x\ 100,000\right) + \left(\frac{23.42}{2} x\ 42,948.76\right)$

= Rp 19,198,035.87 + Rp 502,929.98

= Rp 19,700,965.85

The EOQ Method

To improve efficiency, planning for the purchase of raw materials is then carried out by applying the EOQ method. The calculation includes the optimal number of orders for each purchase, the frequency of purchases in a year, as well as reorder points. Then it can be compared between the company's current policy with the results of the EOQ method calculation which shows a smaller total inventory cost

a. EOQ

The need for raw materials from January to December 2021 (D) is 4,496.18 m^3. The cost of one order (S) is Rp 100,000. Meanwhile, the storage cost per unit per year (H) is Rp 42,948.76. Then the amount of raw material inventory that is economical is as follows.

$EOQ = Q = \sqrt{\frac{2\ X\ D\ X\ S}{H}}$

$= \sqrt{\frac{2\ X\ 4.496,18\ X\ 100.000}{42.948,76}}$

$= \sqrt{\frac{899.236.000}{42.948,76}}$

$= \sqrt{20.937,41}$

= 144,697 m^3

b. Order Frequency

Amount of raw material requirement in a company is 4,496,18 m^3. The amount of each order of raw materials (EOQ=Q) is 144,697 m^3. Then the frequency of orders in a year is as follows.

Order Frequency (F) $= \frac{D}{Q}$

$= \frac{4.496,18}{144,697}$

= 31,07≈ 31 times a year

c. Total Inventory Cost

Total inventory cost if using EOQ method is

$TIC = \left(\frac{D}{Q} x\ S\right) + \left(\frac{Q}{2} x\ H\right)$

$= \left(\frac{4.,496.18}{144.697} x\ 100,000\right) + \left(\frac{144.697}{2} x\ 42,948.76\right)$

= Rp 3,107,306.99 + Rp 3,107,248.36

= Rp 6,214,555.35

d. Reorder Point

The reorder point (ROP) is used to monitor the inventory of raw materials, so that when ordering raw materials, the raw materials come back on time and there is no need to worry about an empty stock of raw materials.

Lead time (LT) = 1 month = 30 days

Demand per day (d) $= \frac{4,496.18}{300}$

$= 14.99\ m^3$

ROP = demand per day X lead time

= 14.99 x 30

$= 449.7\ m^3$

After that we can compare both result. The order quantity using EOQ mehod is higher than current company policy as seen from Figure 1. It can be happen because the EOQ method calculates the optimal amount that can be ordered in each purchase taking into account the needs in a year. It is intended that the company can minimize the cost of ordering. Because companies don't have to waste time and money on purchases that should be done all at once.

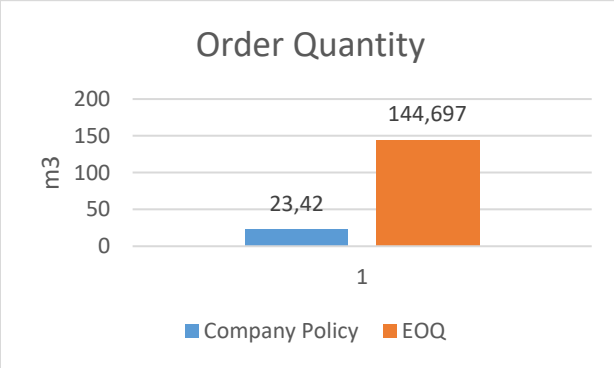

Figure 1. Comparation of order quantity

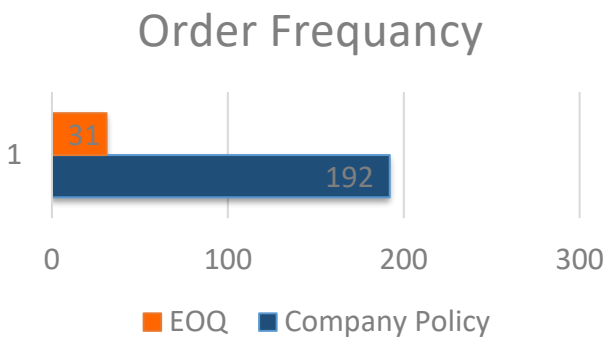

Figure 2. Comparation of order frequency

The frequency of ordering using the EOQ method is less than the company's current policy. With the EOQ method, the company only needs to order raw materials 31 times a year, while based on the company's historical data, it shows that in 2021 the company made 192 orders, as can be seen in Figure 2. Of course, this difference in the frequency of orders will greatly affect inventory costs. . Repeated orders lead to higher ordering costs. With the EOQ method, it is enough to order 31 times but it can already meet the company's raw material needs.

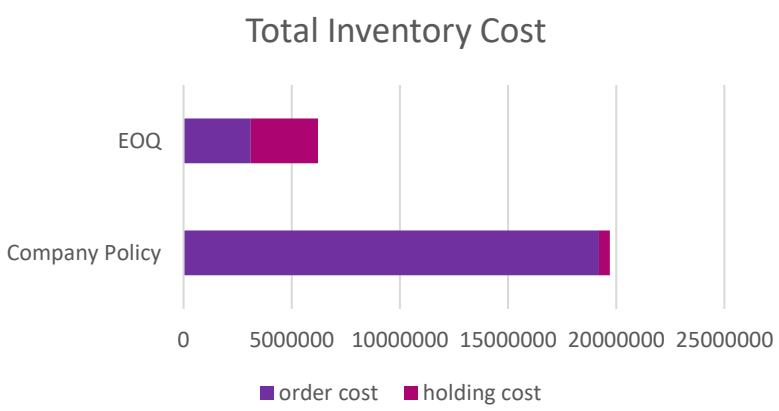

Figure 3. Comparation of total inventory cost

The comparison of total inventory costs can be seen in Figure 3. As can be seen that the EOQ method produces a total inventory cost that is much less than the company's current policy. The cost of ordering in the company's current policy is very high because the order is made up to 192 times a year. This is very ineffective. By using the EOQ method, ordering costs can be cut so that overall inventory costs can be minimized up to Rp 13,486,411.

4. CONCLUSION

1. The Economic Order Quantity for ordering raw materials is 144.697 m^3 and order frequency is 31 times a year.
2. The reorder point (ROP) or the company's reorder of raw materials is when the amount of raw materials is 449,7 m^3 thus the company does not have excessive raw materials.
3. Using EOQ can save the total cost for raw materials inventory up to Rp 13,486,411

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REFERENCES

[1] K. Hidayat, J. Efendi, R. F.-P. M. I. Teknik, and undefined 2020, "Analisis pengendalian persediaan bahan baku kerupuk mentah potato dan kentang keriting menggunakan metode economic order quantity (EOQ)," *jurnal.uns.ac.id*, vol. 18, no. 2, pp. 125–134, 2019, doi: 10.20961/performa.18.2.35418.

[2] H. Unsulangi, … A. J.-J. E. J. R., and undefined 2019, "Analisis economic order quantity (eoq) pengendalian persediaan bahan baku kopi pada pt. fortuna inti alam," *ejournal.unsrat.ac.id*, vol. 7, no. Januari, pp. 51–60, 2019, Accessed: Jun. 16, 2022. [Online]. Available: https://ejournal.unsrat.ac.id/index.php/emba/article/view/22263.

[3] S. Hastari, … A. P.-J. M. D., and undefined 2020, "Penerapan Metode EOQ dalam Pengendalian Bahan Baku Guna Efisiensi Total Biaya Persediaan Bahan Baku," *scholar.archive.org*, Accessed: Jun. 16, 2022. [Online]. Available: https://scholar.archive.org/work/exifrhkuyfg6veufgno3a6ktpu/access/wayback/http://jurnal.unmer.ac.id/index.php/jmdk/article/download/4030/pdf.

[4] J. P.-J. M. (Manajemen dan Bisnis) and undefined 2021, "ANALISIS PENGENDALIAN PERSEDIAAN OBAT DENGAN METODE ABC, EOQ, DAN ROP PADA INSTALASI FARMASI RUMAH SAKIT AL-IRSYAD SURABAYA," *jasf.upnjatim.ac.id*, Accessed: Jun. 16, 2022. [Online]. Available: https://jasf.upnjatim.ac.id/index.php/mebis/article/view/145.

[5] T. Pranata, "Analisis Perbandingan Pengendalian Persediaan Bahan Baku dengan Metode EOQ dan Metode POQ pada Home Industri Dompet Anugrah Promotion Semarang," 2019, Accessed: Jun. 16, 2022. [Online]. Available: http://repository.unika.ac.id/id/eprint/20700.

[6] Z. Zahra, F. F.-S. dan K. N. IDEC, and undefined 2020, "Implementasi Metode MRP untuk Pengendalian Bahan Baku Produk ABC Pada PT XYZ," *idec.ft.uns.ac.id*, 2020, Accessed: Jun. 16, 2022. [Online]. Available: https://idec.ft.uns.ac.id/wp-content/uploads/IDEC2020/PROSIDING/ID044.pdf.

[7] D. Kurnia, … S. B.-J. (Jurnal I., and undefined 2018, "Analisis Pengendalian Bahan Baku Pada Produk Tas Dengan Menggunakan Metode Material Requirements Planning (Mrp) Untuk Meminimalkan Biaya," *openjournal.unpam.ac.id*, Accessed: Jun. 16, 2022. [Online]. Available: http://openjournal.unpam.ac.id/index.php/JITM/article/view/1402.

[8] Z. Yusdinata, … A. S.-J. T. I. S., and undefined 2019, "Analisa Pengendalian Persediaan Bahan Baku Digipass pada Perusahaan Industri Elektronik (Study Kasus di PT. Venturindo Jaya Batam)," *ojs3.lppm-uis.org*, Accessed: Jun. 16, 2022. [Online]. Available: http://ojs3.lppm-uis.org/index.php/JT-IBSI/article/view/90.

[9] D. Didiharyono, M. Marsal, B. B.-S. J. I. Ilmu, and undefined 2018, "Analisis pengendalian kualitas produksi dengan metode six-sigma pada industri air minum PT Asera Tirta Posidonia, Kota Palopo," *ojs.unm.ac.id*, vol. VII, no. 2, pp. 163–176, 2018, Accessed: Jun. 16, 2022. [Online]. Available: https://ojs.unm.ac.id/sainsmat/article/view/7370.

[10] W. Putri, I. S.-J. Multinetics, and undefined 2018, "Sistem pengendalian persediaan bahan baku, inventory dan produksi pada Home Industry Mamake dengan metode reorder point berbasis web," *researchgate.net*, doi: 10.32722/multinetics.Vol4.No.2.2018.pp.22-27.

[11] E. L.-J. E. dan Manajemen and undefined 2020, "Analisis Pengendalian Bahan Baku Kedelai Pada Produk Keripik Tempe Cap Kiky Di Desa Sanan Tahun 2015-2016," *ejournal.unigamalang.ac.id*, Accessed: Jun. 16, 2022. [Online]. Available: http://ejournal.unigamalang.ac.id/index.php/JEM/article/view/529/223.

[12] P. Pengendalian Bahan Baku Laundry Di Samarinda Laundry Mart Barbasis Android Hanifah Ekawati, P. Adytia, S. Widya Cipta Dharma, and J. M. Yamin, "Penerapan Metode EPQ (Economic Production Quantity) Pada Pengendalian Bahan Baku Laundry Di Samarinda Laundry Mart Barbasis Android," *journal.binadarma.ac.id*, vol. 22, no. 1, 2020, Accessed: Jun. 16, 2022. [Online]. Available: https://journal.binadarma.ac.id/index.php/jurnalmatrik/article/view/840.

[13] F. Y.-S. N. T. Informasi and undefined 2018, "Pengendalian Persediaan Darah Dan Penentuan Titik Bank Darah Rumah Sakit (BDRS) Yang Optimal Di Kota Pekanbaru," *ejournal.uin-suska.ac.id*, Accessed: Jun. 16, 2022. [Online]. Available: http://ejournal.uin-suska.ac.id/index.php/SNTIKI/article/view/5945.

[14] R. Siregar, "Analisis Pengendalian Persediaan Bahan Baku Laundry Linen untuk Mengoptimalkan Persediaan di RSUD Dr. Pirngadi Kota Medan," 2021, Accessed: Jun. 16, 2022. [Online]. Available: https://repositori.usu.ac.id/handle/123456789/43942.