

Evaluation Of Operating Cost For Money Packaging

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Abstract: Evaluation operational costs need to be done in company operations, including inventory costs so that inventory costs become effective. For this reason, the EOQ method will be applied. Inventory management carried out by PT ADP company engaged in money packaging services, where the costs incurred by the company in 2017 amounted to IDR 361,422,557 for 27,834 rolls with a frequency of purchases of 15 times. By using the EOQ method the inventory costs incurred by the company for the production process during 2017 were IDR 64,794,240, for 679 rolls at a purchase frequency of 25 times. By using the EOQ method the company can save costs by IDR 296,628,317 or 82.07% more efficient. Costs incurred by the company in 2018 was IDR 902,176,802 for 33,473 rolls with a frequency of purchase of 10 times. Using the EOQ method the inventory costs incurred by the company for the production process in 2018 were IDR 370,116,620, for 1465 roll at a purchase frequency of 43 times. By using the EOQ method the company can save costs by IDR 532,060,182 or 59% more savings. Referring to the evaluation of inventory costs in 2017 and 2018, it can be proposed using the EOQ method for 2019 in determining the amount of inventory and its costs.

Keywords: Inventory management, EOQ, Inventory Cost.

1 INTRODUCTION

Inventory management is part of production and operations management, therefore managing inventory is closely related to production costs. This can occur in production activities, both in the form of services and products [1]. Too much inventory will cause increased inventory costs, while too little inventory will result in increased ordering costs and excessive ordering frequency. To minimize inventory costs, the EOQ method is applied, which method has been used a lot by [1][2][3][4]. The EOQ method will be used to evaluate inventory management for companies that carry out their activities in money packaging services, to package of money for the needs of ATMs and banks. By using the EOQ method, it will be evaluated whether this method can reduce inventory costs, and can set the time when orders must be made. PT. ADP is a money management service company such as Money Processing, Money Pick Up, and ATM money filling. Materials used by companies in their activities are plastic packagings and band strapping which are used for packaging of money. The company purchases the materials only based on management's policy for the nominal amount of operating costs determined at the beginning of the year. Costs incurred by the company in 2017 amounted to IDR 361,422,557 for 27,834 rolls with a frequency of purchases of 15 times. While the costs incurred by the company in 2018 amounted to IDR. 902,176,802 for 33,473 rolls with a purchase frequency of 10 times. An increase in inventory costs of nearly 200%. In this case, the Company has not applied the EOQ method. For this reason, this article will be evaluated using the EOQ method.

2. LITERATURE REVIEW

Inventory management is an activity that is related to the planning, implementation, and supervision of the determination of material or other goods, so that on one hand the operational needs can be met on time and on the other hand the investment in the supply of material or other goods can be optimally suppressed[5][6]. Inventories are part of the company's current assets which can be raw materials, semi-finished goods and finished goods [7]. Thus the inventory used in the smooth production process, or goods to be resold within a certain period to meet customer needs or demands. The company's inventory must be done so that operational activities can still be carried out without having to wait for the availability of raw materials and other needs. In inventory, there are cost elements that must be considered by management[2] namely: Ordering Cost, Holding Cost / Carrying Cost, Stockout Cost / Shortage Cost. With EOQ inventory management, it can be determined the number of raw material orders in such a way that the total ordering costs are minimized and the order frequency in one year is optimal, so that it will minimize inventory costs, as have been done by ([8][9][10][11][12][13][14][15][16]) Economic Order Quantity (EOQ) is one of the classic models first introduced by FW Harris in 1915, but better known as the Wilson method because in 1934 the EOQ method was developed by Wilson[17]. According to[18], EOQ is one of the oldest and most widely known inventory control techniques, this inventory control method answers two important questions, when to order and how much to order. While according to[19], Economic Order Quantity (EOQ) is the number of goods that can be obtained with minimal costs. In general, this method aims to reduce costs and can reach the optimal number of ordering units. The use of the EOQ method can only be done if it meets the following assumptions [4][18][20]:

- The amount of material or goods needed is fixed or unchanged in the period.
- Materials are always available at any time or easily available.
- The prices of goods are fixed.
- Order lead times can be determined and are relatively fixed.
- All orders are sent at the same time and add to inventory.

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- The item is a single product and has no relation to other products.
 - The calculated costs are the cost of ordering and holding costs.
- According to [18][20][21], to determine the most economical number of orders is the following formula:

Table 1. The formula of Economic Order Quantity

EOQ Formula	Frequency Formula	
$EOQ \text{ atau } Q = \sqrt{\frac{2DS}{H}}$	$N = \frac{D}{Q^*}$	EOQ or Q*: Optimal order amount (in units). D: Number of demand per year (in units). S: Ordering cost. H: Holding cost per unit. N: Frequency of orders for one year
Total Holding cost	Total Ordering Cost	
$TCC = \frac{Q}{2} H$	$TOC = \frac{D}{Q} S$	TCC: total holding cost TOC: total ordering cost Q: EOQ H: ordering cost D: demand S: holding cost
Total Cost	Reorder Point	
$TC = TOC + TCC$	$ROP = (Lxd) + SS$	TC: Total cost ROP: Reorder point L: Lead time d: rate of need per day SS: safety stock
Standard deviation	Safety Stock	
$\text{Standart Deviasi} = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$	$SS = Sd \times Z \text{ or } SS = Sd \times 1.65$	X: The number of goods needed \bar{x} : Average amount of goods needed n: Amount of data SD: Standard deviation Z: Safety factor

Then, after the data is obtained, data processing and data analysis using these formulas.

3. METHOD

To be able to analyze the operational costs of inventory, this research was conducted using the EOQ (Economic Order Quantity) method. This research is a quantitative study, data obtained by observation to the research site and conducting interviews, namely inventory data for 2017 and 2018. After the data is obtained, the next step is to calculate EOQ, TC, and ROP. The result of EOQ computation will be compared to the actual operation of inventory, to see the effectivity and efficiency.

4. Result and Analysis

The PT ADP cash management process is carried out in the CPC (Cash Processing Center) division. The operational process on the division of the CPC in money management is as follows:

1. The CPC division accepts the money sent by branches.
2. The CPC operator unpacks the bag containing the money and calculates the amount whether it is the same as in the handover document from the branch to the CPC.
3. If there is have a difference, then the CPC division makes the minutes of the difference to the branch.
4. Then the CPC section does the sorting based on:

- Denomination, which is the separation of money based on the value of money.
 - Orientation, which is the separation of money based on 4 sides of money.
 - Conditions, namely separation based on Eligible Money, not Eligible Money, Minor / Major Damage, Counterfeit Money / Doubtful Money
 - Emissions, i.e. the separation of money based on the edition of new money or old money.
5. Finished money is sorted, then packaged in a per 100 sheet and per 1000 sheet basis.
 6. After packing money is complete, then the money is ready to be sent. The packaging of money per 100 pieces was sent for branches and ATM filling, while the packaging of money per 1000 sheets was sent to Bank Indonesia.

4.1. Purchase and Demand for Raw Materials

The demand for the money packaging process is based on PT ADP's maximum daily production capacity of 5,000,000 pieces of money. But in practice, the amount of money received per day from the BCA branch does not always reach the maximum production limit that has been set, so that the use of raw materials will not always be the same per day, because it is adjusted to the amount of money received by the company. The purchase of raw materials by PT ADP is only based on a budget that has been set by the company's management so that purchases made by the company exceed the amount of

raw material produced. Purchases and demand for raw materials can be seen in the table-2:

Table 2 Purchasing and Demand of Raw Materials for 2017

NO	The Raw Materials	Year of 2017		Year of 2018	
		Purchasing	Demand	Purchasing	Demand
1	Band Strap (100K)	6.000	100	9.900	2.009
2	Band Strap (50K)	6.000	187	9.900	2.554
3	Band Strap (Blank)	7.000	81	9.900	1.338
4	Barcode Label Roll	742	103	286	67
5	Bander Roll Foil	150	16	396	70
6	Foil, 106mm	6.894	1.184	2.475	1.390
7	Shrinking Film	880	118	495	55
8	Sytec 701 Polyolefin, Wide 450mm	168	2	121	99
TOTAL		27.834	1.791	33.473	7.562

Based on table-2, it can be explained that the items needed in the money packaging process consist of 8 items. Purchases made by the company in 2017 amounted to 27,834 rolls, while the number of demand for production was only 1,791 rolls. Purchases in 2018 amounted to 33,473 rolls, and the number of demand in the production process is only 7,562 rolls. The lead time for band strapping and plastic packaging is 2

months.

4.2. Inventory cost

In general, the total inventory costs at the company consist of ordering costs and holding costs. Ordering costs are costs caused by the purchase of raw materials. The ordering fee is 2% of the price of the item.

Table 3 Ordering and Holding cost

NO	ITEM	Ordering Cost		Holding Cost	
		2017	2018	2017	2018
1	Band Strap 100K	233.835	3.712.632	54.880	86.715
2	Band Strap 50K	437.271	4.719.792	54.880	86.715
3	Band Strap Blank	180.051	2.085.407	47.040	86.715
4	Barcode Label Roll	1.358.475	2.303.949	443.774	2.167.879
5	Bander Roll Foil	640.194	3.015.024	2.195.200	3.001.678
6	Foil 106mm	4.396.938	5.730.275	47.763	346.861
7	Shrinking Film	8.750.635	4.437.890	374.182	1.734.303
8	Sytec 701 Polyolefin Wide 450mm	147.759	7.338.405	1.960.000	7.094.876
TOTAL		16.145.158	33,343,374	5,020,919	14.605.742

Based on table 3, it can be explained that the total ordering cost per item for 2017 is IDR 16,145,158, while the total ordering cost in 2018 is IDR 33,343,374. Holding costs per item are calculated byways of total holding costs in 1 year divided by inventory capacity. Therefore, the holding cost for 100K Band Strap items in 2017 is IDR 329,280,000: $6,000 = \text{IDR } 54,880$. For 100K Band Strap items in 2018 is $\text{IDR } 885,480,000: 9,900 = \text{IDR } 86,715$. So that the total

holding cost per item of the 8 items amounted to IDR 5,020,919 for 2017, while in 2018 it was IDR 14,605,742

4.3. Materials used

The use of raw materials and costs incurred by PT ADP in the production process can be seen in table-4.

Table 4 Use of Raw Materials and Inventory Costs for 2017

NO	ITEM	D	Q	N	TOC (IDR)	TCC (IDR)	TC (IDR)
1	Band Strap (100k)	100	29	3	801,026	801,026	1,602,052
2	Band Strap (50k)	187	55	3	1,497,919	1,497,919	2,995,838

3	Band Strap (Blank)	81	25	3	585,678	585,678	1,171,356
4	Barcode Label Roll	103	25	4	571,988	571,988	1,143,976
5	Bander Roll Foil	16	3	5	3,353,033	3,353,033	6,706,066
6	Foil 106mm	1.184	467	3	11,150,210	11,150,210	22,300,420
7	Shrinking Film	118	74	2	13,899,114	13,899,114	27,798,228
8	Sytec 701 Polyolefin, Wide 450mm	2	1	2	538,152	538,152	1,076,304
TOTAL		1.791	679	25	32,397,120	32,397,120	64,794,240

Based on table 4, it can be explained that the total use of materials for the production process of 8 items in 2017 is 679 roll, with a frequency of 25 times. The total ordering cost is IDR 32,397,120 and the total holding cost is IDR 32,397,120,

so the total inventory cost incurred by the company for the production process in 2017 is IDR 64,794,240. The use of raw materials in 2018 and the costs in detail can be seen in table 5.

Table 5 Use of Raw Materials and Inventory Costs in 2018

NO	ITEM	D	Q	N	TOC (IDR)	TCC (IDR)	TC (IDR)
1	Band Strap (100k)	2.009	415	5	17,983,053	17,983,053	35,966,105
2	Band Strap (50k)	2.554	527	5	22,861,482	22,861,482	45,722,963
3	Band Strap (Blank)	1.338	254	5	10,999,069	10,999,069	21,998,139
4	Barcode Label Roll	67	12	6	12,935,295	12,935,295	25,870,590
5	Bander Roll Foil	70	12	6	17,797,601	17,797,601	35,595,203
6	Foil 106mm	1.390	214	6	37,167,010	37,167,010	74,334,020
7	Shrinking Film	55	17	3	14,548,462	14,548,462	29,096,924
8	Sytec 701 Polyolefin, Wide 450mm	99	14	7	50,766,338	50,766,338	101,532,675
TOTAL		6331	1465	43	185,058,310	185,058,310	370,116,619

Based on table 5, it can be explained that the total use of materials in 2018 is 1465 roll, with a frequency of 43 times. The total ordering cost is IDR 185,058,310 and the total holding cost is IDR 185,058,310, so the total inventory cost incurred by the company for the production process in 2018 is IDR 370,116,619.

4.4. Reorder Point (ROP)

Reorder point (ROP) is a time when a company must reorder raw materials used in the production process so that the raw materials can arrive on time. The results of the 2017 and 2018 ROP calculations can be seen in table-6

Table 6 Reorder Point for 2017 and 2018

NO	ITEM	2017	2018
		ROP	ROP
1	Band Strap 100K	9	168
2	Band Strap 50K	16	213
3	Band Strap Blank	7	112
4	Barcode Label Roll	9	4
5	Bander Roll Foil	2	6
6	Foil 106mm	99	116
7	Shrinking Film	10	5
8	Sytec 701 Polyolefin Wide 450mm	1	9

4.5. Comparison of Company Policies with the EOQ Method

A comparison of the results of EOQ calculations with company policies is presented in table-7.

Table 7 Comparison of Total Company Purchases with EOQ 2017

Note	Demand (D)	Purchases (Q)	Frequency (N)
Company policies	1.791	1856	15

EOQ Method	1.791	679	25
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Based on table 7, using the EOQ method the company can be more efficient in purchasing goods by 1.177 rolls or 63.4% more efficient in one order.

Table 8 Comparison of Total Company Purchases with EOQ 2018

Note	Demand (D)	Purchases (Q)	Frequency (N)
Company policies	7.582	3.347	10
EOQ Method	7.582	1.465	43

Based on table 8, using the EOQ method the company can be more efficient in purchasing goods by 1.882rolls or 56.23% more efficient in one order.

Table 9 Comparison of Total Costs in 2017

Note	TOC (IDR)	TCC (IDR)	TC(IDR)
Company policies	32,142,557	329,280,000	361,422,557
EOQ Method	32,397,120	32,397,120	64,794,240

Based on table 9, it can be explained that the total costs incurred by the company in 2017 amounted to IDR 361,422,557, while the EOQ method amounted to IDR 64,794,240. So, by using the EOQ method the company can save more costs by IDR 296,628,317 or 82.07% more efficient.

Table 10 Comparison of Total Costs in 2018

Note	TOC(IDR)	TCC(IDR)	TC(IDR)
Company policies	43,696,802	858,480,000	902,176,802
EOQ Method	185,058,310	185,058,310	370,116,620

Based on table 10, it can be explained that the total costs incurred by the company in 2018 amounted to IDR 902,176,802, while the EOQ method amounted to IDR 370,116,620. So, by using the EOQ method the company can save more costs by IDR 532,060,182 or 59% more efficient. Based on the evaluation, it can be proposed using EOQ for determine amount of raw materials and inventory cost for the next year, because by using EOQ, the costs are more efficient and operations are more effective,

5. CONCLUSIONS

Based on the results of the analysis it can be concluded that the control of raw materials using the EOQ method is more optimal and efficient compared to PT ADP's company policy,

The analysis results are as follows:

In terms of cost:

- In 2017 it was IDR 361,422,557, while the EOQ method was IDR 64,794,240, So, by using the EOQ method the company can save costs by IDR 296,628,317 or 82,07% more efficient,
- In 2018 it was IDR, 902,176,802, while the EOQ method was IDR 370,116,620, So, by using the EOQ method the company can save costs by IDR 532,060,182 or 59% more efficient,

In terms of the number of orders:

- Using the EOQ method the company can be made more efficient in purchasing materials by 1,177 rolls or 63,4% more efficient, for one order,
- Using the EOQ method the company can be made more efficient in purchasing materials by 1,882rolls or 56,23% more efficient, for one order,

6. RECOMMENDATION

To control the inventory, PT ADP can apply the EOQ method for the 2019 year, because it can control inventory effectively and efficiently, and can minimize inventory costs,

REFERENCES

- [1]. M. Ferguson, V. Jayaraman, and G. C. Souza, "Note : An Application of the EOQ Model with Nonlinear Holding Cost to Inventory Management of Perishables," *Eur. J. Oper. Res.*, vol. 180, no. 1, pp. 1–12, 2007.
- [2]. T.-Y. Lin and M.-T. Chen, "An economic order quantity model with screening errors, returned cost, and shortages under quantity discounts," *African J. Bus. Manag.*, vol. 5, no. 4, pp. 1129–1135, 2011.
- [3]. L. B. Schwarz, "The economic order-quantity (EOQ) model," in *International Series in Operations Research and Management Science*, 2008.
- [4]. A. R. Maisuriya and P. H. Bhathawala, "A Deterministic Economic Order Quantity Model with Delays in Payments and Price Discount Offers," *J. Eng. Res. Appl.*, vol. 3, no. 5, pp. 384–385, 2013.
- [5]. J. L. Gonzalez and D. González, "Analysis of an Economic Order Quantity and Reorder Point Inventory Control Model for Company XYZ," *California Polytechnic State University San Luis Obispo Graded*, 2010.
- [6]. W. L. Winston, *Operations Research, Applications and Algorithms*. Belmont, CA 94002: Brooks/Cole, a division of Thomson Learning, Inc., 2004.
- [7]. A. M. Yusuf, "Inventory Control and Economic Order Quantity in National Electric Power Authority (NEPA)," *ST Clements University*, 2003.
- [8]. C. Yuliana, Topowijono, and N. Sudjana, "Penerapan model EOQ (Economic Order Quantity) dalam rangka meminimumkan biaya persediaan bahan baku (Studi Pada UD . Sumber Rejo Kandangan-Kediri)," *J. Adm. Bisnis*, vol. 36, no. 1–9, 2016.
- [9]. G. A. Darmawan, W. Cipta, and N. N. Yulianthini, "Penerapan Economic Order Quantity (EOQ) Dalam Pengelolaan Persediaan Bahan Baku Tepung Pada Usaha Pia Ariawan di Desa Banyuning TAHUN 2013," *e-Journal Bisma Univ. Pendidik. Ganesha*, vol. 3, no.

- 2, 2015.
- [10]. T. R. Yopan Maulana, "Analisis Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode Economic Order Quantity (EOQ) Dalam Upaya Meminimumkan Biaya Produksi Pada CV. Delapan-Delapan Kuningan," *Indon J. Strateg. Manag.*, vol. 1, no. 1, pp. 1–8, 2018.
- [11]. G. L. Saragi and R. Setyorini, "Analisis Pengendalian Persediaan Bahan Baku Daging Dan Ayam Dengan Menggunakan Metode Economic Order Quantity (EOQ) Pada Restoran Steak Ranjang Bandung," *E-Proceeding Manag.*, vol. 1, no. 3, pp. 542–553, 2014.
- [12]. N. Fahmi Sulaiman, "Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode EOQ Pada UD. Adi Mabel," *J. Teknovasi*, vol. 02, no. 1, pp. 1–11, 2015.
- [13]. Rorim Panday; Hernawati, "Application Methods Economic Order Quantity (EOQ) For Raw Materials Inventory Cost Analysis," in *Semnas & Call of Paper, APMMI 2015*, 2015, pp. 300–306.
- [14]. Emmanuel Adjin Okwabi, "Application of Economic Order Quantity With Quantity Discount Model. A Case Study of West African Examination Council," *College of Science / Institute of Distance Learning*, 2014.
- [15]. M. Al-salamah, "Economic order quantity with imperfect quality , destructive testing acceptance sampling , and inspection errors," *Adv. Manag. Appl. Econ.*, vol. 1, no. 2, pp. 59–75, 2011.
- [16]. M. Ameli, A. Mirzazadeh, and M. A. Shirazi, "Entropic Economic Order Quantity Model for Items with Imperfect Quality Considering Constant Rate of Deterioration under Fuzzy Inflationary Conditions," 2008.
- [17]. D. K. Sofyan, "Analisis Persediaan Bahan Baku Buah Kelapa Sawit pada PT . Bahari Dwikencana Lestari," *Ind. Eng. J.*, 2017.
- [18]. B. Heizer, J., & Render, *Operations Management*, 7th editio. New Jersey: Pearson Education., 2014.
- [19]. R. C. Bahtiar, "Analisis Persediaan Bahan Baku Tebu pada Pabrik Gula Pandji PT. Perkebunan Nusantara XI (Persero) Situbondo, Jawa Timur," *E-Jurnal Agribisnis dan Agrowisata*, 2013.
- [20]. F. S. Hillier and G. J. Lieberman, *Introduction to Operation Research*, Ninth Edit. New York: McGraw-Hill, 2010.
- [21]. D. E. Blumenfeld, *Operations Research Calculations Handbook*, Second Edi. New York: Boca Raton London New York CRC Press, 2009.