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ANALYSIS OF SPARE PARTS INVENTORY PLANNING AND CONTROL TO IMPROVE COST EFFICIENCY AT PT MANUNGGAL JAYA MAKMUR

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KEYWORDS
Cost efficiency, Activity Based Costing (ABC) analysis method, Economic Order Quantity (EOQ) method, Periodic Oder Quantity (POQ) method, and Lot-For-Lot (LFL) method.

ABSTRACT
PT Manunggal Jaya Makmur is one of the companies engaged in the transportation and contracting-based sector that provides integrated services from the start point to the end. In addition, it is also engaged in the repair of heavy equipment such as mixer trucks, dump trucks, colt diesel, and repair of other heavy equipment. In supporting the company's activities, PT. Manunggal Jaya Makmur implements a strategy for supplying raw materials and spare parts. In its operational activities, PT. Manunggal Jaya Makmur is still constrained by the overstock problem which ultimately causes a buildup of goods. In this study, material classification was carried out using ABC Theory analysis. Then the methods used in planning and controlling inventory management are the POQ and EOQ methods. After getting the results, the methods used during the research will be compared with the methods that have been applied so far in the company to find out the most effective methods to be applied in cost efficiency and work productivity and can maximize the profits received by the company. Based on the analysis carried out, the cost of calculating the total inventory of spare parts using the EOQ method was Rp. 205,513,000, the LFL method was Rp. 274,141,349 and the POQ method was Rp. 273,502,120. So, from these data, it can be concluded that the most optimal total cost of inventory is the EOQ method to produce greater profits and minimize overstock.

INTRODUCTION

Production planning and inventory control at the company are shown in activities when planning and controlling materials entering the production system (raw materials, auxiliary materials), flowing in the production system (components, subassembly), and exiting the production system (finished products, spare parts) so that market demand can be met effectively and efficiently (the right quantity, the right delivery time and minimum production costs) (Dedrizaldi et al., 2019).

Inventory management seeks to achieve a balance between shortage and excess inventory in a planning period that contains the risk of uncertainty, involving a number of coordination activities between inventory and production and consumption activities at a number of process stages and related locations. Well-designed inventory management can minimize total costs

and improve service levels. This is because, by managing the right inventory, the company will achieve both at once.

Inventory control is a quantitative control method with strong financial implications. In some companies, inventory control is one of the most significant techniques for directly controlling marketing, production, purchasing, and financial policy relationships. Difficulties in inventory control systems may be affected by fragmented practices due to inadequate procedures for operational standards . Organizing inventory items into groups and taking control of similar inventory policies for items in each group can solve the problem of inefficient inventory control policies. Companies with inventory-related material issues have low inventory turnover ratios. Strong internal control system over financial reporting. Under the provision of decentralized control, the inventory held at the outlet level is very different from the aggregate inventory at each producer level and in this respect, they are similar. Inventory management methods can help practitioners to improve the company's service delivery to ensure a steady flow of materials. Contribute the elements that matter most to inventory system performance, and recognize strengths and weaknesses of inventory management strategies. As a result, it is remarkable to investigate and explore the weaknesses of inventory management in organizations. Very little work has been done to investigate the inventory control of discrete enterprises. Empirical work revealed that strong inventory control has the ability to shape company performance due to the costs associated with inventory as storage costs, inventory costs, ordering costs, and relevant costs at a minimum level (Ahmedet al., 2021)

Inventory management is one of the most important activities in a company. The inventory is very important to be managed so that the company's effectiveness and efficiency goals can be achieved. In inventory management, if the control is not good, it will cause conditions that cause an increase in costs in a company. If there is too much inventory, the company will experience losses because it has to bear damage and storage costs, costs from interest embedded in inventory, warehouse costs, maintenance costs, administration, insurance, and others. If the inventory is too small, it will also cause losses due to the amount of inventory that cannot meet capacity so that the production process can stop and result in backorders.

In this study, the author will conduct research at PT. Manunggal Jaya Makmur. PT. Manunggal Jaya Makmur is one of the companies engaged in the repair of heavy equipment such as mixer trucks, dump trucks, colt diesel and other heavy equipment repairs. In supporting its corporate activities, PT. Manunggal Jaya Makmur implements a strategy of inventory of raw materials and spare parts. This is done to minimize the risk of uncontrollable material inventory that can harm the company. Even so, in its operational activities, PT. Manunggal Jaya Makmur is still constrained by overstock problems which eventually cause a buildup of goods. This can be seen in figure 1 which shows the inventory of raw materials in the company has increased or decreased or fluctuated unsteadily which causes inventory to overstock and sometimes experience shortages in meeting market needs.

Figure 1

Usage and Production Demand Graph 2021-2022

Source: Primary data, 2022

The condition of the stock of goods that is too excessive will certainly have a negative impact on the income and profits received by the company if it is not balanced with balanced sales figures. Sales themselves are one of the important factors that determine much of the least profit or profit received by the company. If there is too much stock while the sales figure is fairly small, this will bring losses to the company and the profit figures received will be less.

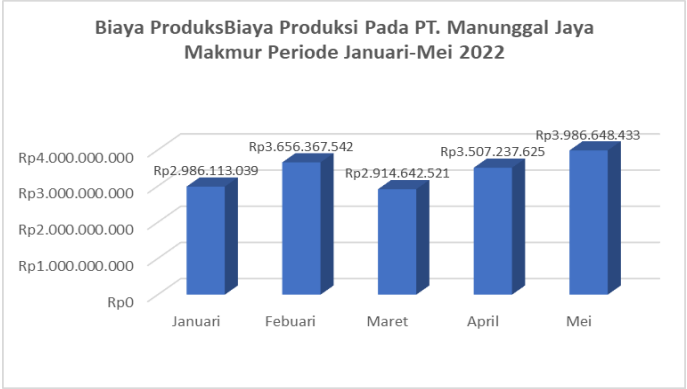

Figure 2

Production Cost Graph at PT. Manunggal Jaya Makmur for January-May 2022 Period

Source: Primary Data, 2022

In figure 2 sourced from PT. Manunggal Jaya Makmur can be concluded that production costs throughout January to May experience fluctuations or unstable increases and decreases. Throughout January, the production cost of goods needed reached Rp 2,986,113,039. While in February production costs reached Rp 3,656,367,542. The highest production cost itself occurred in May which reached Rp 3,986,648,433. FENOMENJow production costs incurred are too large while sales figures are relatively small, the company will certainly experience losses because it has to cover the production costs that have been incurred. Net SalesAtPT. Manunggal Jaya Makmur for January-May 2022 Period

Figure 3

Net Sales Chart at PT. Manunggal Jaya Makmur for January-May 2022 Period

Based on the sales chart, it can be seen if the sales figures of PT. Manunggal Jaya Makmur from January to May also experienced increases and decreases or fluctuations. Throughout January, the total sales obtained by PT. Manunggal Jaya Makmur is IDR 8,753,426,604. Meanwhile, in February total sales at the company fell to Rp 8,548,607,284. In the period from January to May, the highest total sales occurred in May amounting to Rp 10,196,518,723. If the sales figure at the company has decreased while the stock of goods owned by PT. Manunggal Jaya Makmur is not managed properly, this condition will have a negative impact on the income and profits received by the company. Manunggal Jaya Makmur for January-May 2022 Period

Figure 4

Graph. Net Profit at PT. Manunggal Jaya Makmur for January-May 2022 Period

The chart data above explains the net profit received by PT. Manunggal Jaya Makmur, it can be concluded that the profits obtained by the company have also increased and decreased unsteadily. During the month of January net profit obtained by PT. Manunggal Jaya Makmur amounted to Rp 3,567,313,565, while the highest profit was obtained in the month of Rp 4,599,448,954. One of the factors that affect the size of the income received by the company is management, planning, and inventory management. If the management of planning and managing the inventory of goods owned by the company does not run well and causes the inventory of goods to be uncontrolled or overstocked while the sales figure at the company is relatively small, this will have a negative impact on the revenue received by the company.

Based on the phenomenon experienced by PT. Manunggal Jaya Makmur can be concluded that in the company's operational activities, planning management and inventory management have an important role in the survival of a company. The better the management of planning and controlling goods owned by the company, it will minimize the number of hoarding goods, increase the efficiency of production costs and work productivity, reduce losses received by the company and increase profits or profits received by the company. Conversely, if a company has an unstable system of managing planning and controlling goods, this can trigger an increase in production costs due to hoarding stock and losses experienced by the company if the sales flow does not run smoothly. What is meant by production costs here is the total spent to fulfill the stock of goods needed in operational activities and meet client demand.

Spare parts themselves are necessary to ensure the proper functioning of important equipment of many companies, and as such, spare parts play a central role in the operation of these companies. Manufacturers and service providers alike need to keep parts in their inventory to minimize the financial and commercial costs (due to loss of reputation) of downtime. However, parts are usually expensive, and storage costs can also be quite high. Therefore, the inventory of spare parts is very necessary because if the amount of inventory is smaller than the number of damaged parts, it will cause heavy equipment to be unable to operate. This will cause huge losses. Vice versa, if the amount of spare parts inventory in the warehouse is too large, it will cause losses such as the company's capital investment (Delvika, 2016).

Production planning and inventory control at the company are also influenced by several factors. For example, logistical factors. Logistics is an effective and efficient management process of the flow and storage of raw materials, inventories and finished goods to meet the needs of consumers (Adhiningrat, 2017). The shipping factor is also one of the things that affect production planning and inventory control. There are several things that need to be considered in choosing a freight forwarding service, ranging from the selection of expedition services that offer timely estimation of goods, have a wide area coverage, safe goods to their destination, provide tracking features that are easy to track, and have the best shipping rates. Improper selection of shipping services can cause many adverse effects that will be received by the company and affect greater handling costs (Lubis et al., 2019).

The selection of supplier partners is also an important factor in production planning and inventory control. Because not a few suppliers are careless in supplying production needs. Therefore, before establishing cooperation, it is better if the company pays attention to several factors in choosing a supplier partner or supplier of goods. Starting from quality factors, quantity factors, consistency factors, and price factors (Kwartama et al., 2008). In addition, the company must also be careful in supplying the spare parts needed by the company. Some factors that need to be considered in the selection of spare parts include the availability of spare parts needed, the price of spare parts, partners, and spare parts lead time. Selection of bad and unqualified spare parts will have a negative impact and losses on the company.

In this study, material classification will be carried out with ABC Theory analysis. Then the methods used in managing inventory planning and control are POQ and EOQ methods.

After getting the results, the methods used during the study will be compared with the methods that have been applied in the company. Through this comparison, it will be known which method plays an optimal role in planning and managing inventory. Thus the company can reduce the accumulation of goods, minimize losses, increase cost efficiency and work productivity, and can maximize the profits received by the company. From these problems, the researcher wants to conduct a study entitled "Analysis of Planning and Control of Spare Parts Inventory to Increase Cost Efficiency at PT. Manunggal Jaya Makmur".

METHOD RESEARCH

This research included quantitative descriptive research. In this study, the population consisted of all dump truck spare parts in PT. Manunggal Jaya Makmur. In the study of sampling using purposive sampling techniques. Data collection techniques carried out by researchers to obtain primary and secondary data are using the following data collection techniques: Field Research, Observation, and Interview .

RESULT AND DISCUSSION

Data Analysis Results

Spare Parts Classification

Here is the table of classification of spare parts based on ABC analysis:

Table 1
Material Classification Categories

No.	Types of Spare Parts	Value	Volume (amount)	Total (Value* Amount)	Group
1	AF	IDR 17,670,000	45	IDR 795,150,000	A
2	AXLE	IDR 973,000	41	IDR 39,893,000	B
3	AN	IDR 234,000	101	IDR 23,634,000	C
4	BF	IDR 12,897,000	17	IDR 219,249,000	A
5	BS	IDR 833,000	36	IDR 29,988,000	B
6	BN	IDR 177,000	160	IDR 28,320,000	C
7	CF	IDR 12,767,000	10	IDR 127,670,000	A
8	.CS	IDR 791,000	43	IDR 34,013,000	B
9	CN	IDR 191,000	691	IDR 131,981,000	C
TOTAL			**1.144**	IDR 1,240,947,000	-

Source: Company primary data 2021-2022

In the table above, it is a table regarding the classification of spare parts from PT. Manunggal Jaya Makmur, this research is based on ABC analysis, later to find out the amount

of investment from the company. After grouping according to the ABC method, the following results were obtained:

1) Group A

Cumulative funds are required for procurement up to Rp 1,142,069,000

$$\% \text{ Kumulatif Dana} = \frac{\text{Total Dana Pengadaan Keok}}{\text{Total Dana Pengadaan}} \times 100\%$$

$$\% \text{ Kumulatif Dana} = \frac{1.142.069.000}{1.429.898.000} \times 100\% = 79{,}87\%$$

Total types of spare parts in groups of 72 types

$$\% \text{ Kumulatif Barang} = \frac{\text{Total Barang Dalam Kelompok}}{\text{Total Seluruh Barang}} \times 100\%$$

$$\% \text{ Kumulatif Barang} = \frac{72}{1.144} \times 100\% = 6.29\%$$

2) Group B

Cumulative funds are required up to IDR 103,894,000

$$\% \text{ Kumulatif Dana} = \frac{\text{Total Dana Pengadaan Kelompok}}{\text{Total Dana Pengadaan}} \times 100\%$$

$$\% \text{ Kumulatif Dana} = \frac{111.351.000}{1.429.898.000} \times 100\% = 7{,}27\%$$

Total types of spare parts in groups of 120 types

$$\% \text{ Kumulatif Barang} = \frac{\text{Total Barang Dalam Kelompok}}{\text{Total Seluruh Barang}} \times 100\%$$

$$\% \text{ Kumulatif Barang} = \frac{120}{1.144} \times 100\% = 10{,}49\%$$

3) Group C

Cumulative funds are required up to IDR 183,935,000

$$\% \text{ Kumulatif Dana} = \frac{\text{Total Dana Pengadaan Kelompok}}{\text{Total Dana Pengadaan}} \times 100\%$$

$$\% \text{ Kumulatif Dana} = \frac{183.935.000}{1.429.898.000} \times 100\% = 12{,}86\%$$

Total types of spare parts in the group of 952 types

$$\% \text{ Kumulatif Barang} = \frac{\text{Total Barang Dalam Kelompok}}{\text{Total Seluruh Barang}} \times 100\%$$

$$\% \text{ Kumulatif Barang} = \frac{952}{1.144} \times 100\% = 83{,}21\%$$

The grouping results according to ABC analysis can be illustrated with a graph as below:

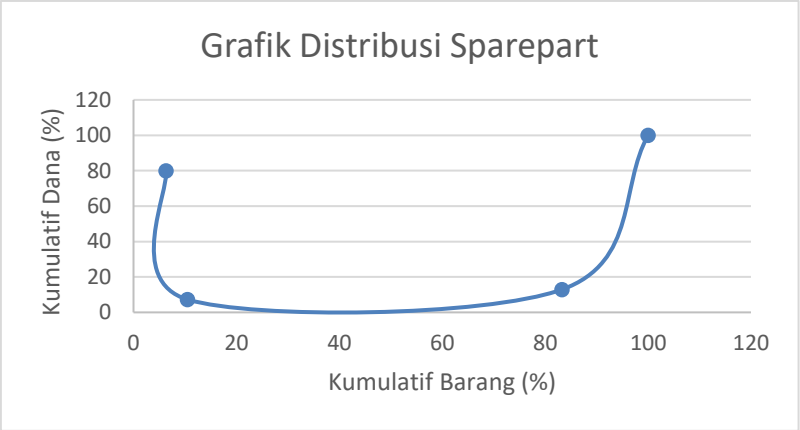

Figure 5
Spare Parts Distribution

The next step is to classify the group of spare parts according to the cumulative percentage amount. The results of data processing using the ABC classification method from each spare part item calculation can be classified into groups A, B, and C according to the amount of cumulative investment value. The results of data processing using the ABC classification method can be concluded as follows:

Table 2
ABC Analysis Based on Spare Part Investment Value

No.	Spare Parts Group	Number of Spare Parts	Percentage of Number of Spare Parts	Investment Value	Percentage of Investment Value
1	Group A	72	6,29%	IDR 1,142,069,000.00	79,87%
2	Group B	120	10,48%	IDR 103,894,000.00	7,3%
3	Group C	952	83,21%	IDR 183,935,000.00	12,86%
Total		**1.144**	**100%**		**100%**

Lot Sizing Method

The technique in determining the size of the inner lot for one level by assuming unlimited capacity can be classified using five ways, namely (Baroto, 2002):

1) *Fixed Order Quantity* (FOQ)
2) *Lot-For-Lot* (LFL)
3) *Fixed Period Requirement* (FPR)
4) *Economic Order Quantity* (EOQ)
5) *Period Order Quantity* (POQ)

There is no standard formula used by PT. Manunggal Jaya Makmur to determine how many replacement parts orders should be placed. Order quantity is affected by stock levels and incidents when certain machine parts are damaged. Since there is a possibility that the order

price will go up if the order is placed in small batches or if the order is too much, the storage cost will go up, this problem can result in waste. So, to find out the optimal number of orders in each order of spare parts at PT. Manunggal Jaya Makmur must be calculated using various optimal ordering methods, namely the *Lot-ForLot* (LFL), Economic Order Quantity (*EOQ), and* Period Order Quantity *(POQ) methods.*

The amount of spare part fees is adjusted to an annual interest rate of 12% money. Transportation fees, administration fees, product inspection fees, loading and unloading fees, and telephone fees are included in domestic and international booking fees.

Lot-For Lot *(LFL)* Method

There is no storage of spare parts with the lot for lot system because purchases are made according to the number of orders needed. There are no storage costs as the company uses the LFL approach in this regard and orders only the required quantity of parts. Illustration of how the LFL method can be used to determine the overall cost of inventory.

- US spare parts:
  The total cost of U.S. spare parts inventory is:
  TC = 41× IDR 187,000 + 0
  TC = IDR 7,667,000
- AN Spare Parts:
  The total cost of AN spare parts inventory is:
  TC = 101× IDR 187,000 + 0
  TC = IDR 18,887,000
- BF spare parts:
  The total cost of BF spare part inventory is:
  TC = 17× IDR 187,000 + 0
  TC = IDR 3,179,000
- BS spare parts:
  The total cost of BS spare parts inventory is:
  TC = 36 × IDR 187,000 + 0
  TC = IDR 6,732,000
- BN spare parts:
  The total cost of BN spare parts inventory is:
  TC = 160× IDR 187,000 + 0
  TC = IDR 29,920,000
- CF spare parts:
  The total cost of CF spare parts inventory is:
  TC = 10× IDR 187,000 + 0
  TC = IDR 1,870,000.00
- CS spare parts:
  The total cost of CS spare parts inventory is:
  TC = 43× IDR 187,000 + 0
  TC = IDR 8,041,000
- CN spare parts:
  The total cost of CN spare parts inventory is:

TC = 691× IDR 187,000 + 0
TC = IDR 129,217,000

From this calculation, the total inventory cost of all spare parts is **Rp. 205,513,000** Economic Order Quantity *(EOQ)* Method In conventional inventory systems, the EOQ approach is often used to determine lot sizes. This method has a fixed lot size. Lots are determined using the following formula based on ordering costs and storage costs:

$$\text{EOQ} = \sqrt{\frac{2SD}{H}}$$

In the EOQ method, the lot size is fixed.

- US spare parts:
  Data required :
  a. Total usage in a period of 1 year (D = 41)
  b. One-time spare part booking fee (S = Rp. 187.000,00)
  c. Storage Cost of spare parts (h = 12%)
  d. Price of goods per unit (US = Rp. 937.000)

  The US spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 41}{0{,}12 * 937.000}}$$

  Then the result of EOQ is 11.68 ≈ 12units/message
  The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{41}{12} \times \frac{12}{2} \times (\times\ 937.000)$$

$$TC = IDR\ 1{,}313{,}556.67$$

- AN Spare Parts:
  Data required :
  a. Total usage in a period of 1 year (D = 101)
  b. One-time spare part booking fee (S = Rp. 187.000,00)
  c. Storage Cost of spare parts (h = 12%)
  d. Price of goods per unit (AN = Rp. 234.000)

  AN spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 101}{0{,}12 * 234.000}}$$

  Then the result of EOQ is 36.67 ≈ 37units/message
  The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{101}{37} \times \frac{37}{2} \times (\times\ 234.000)$$

$$TC = IDR\ 1{,}029{,}939.46$$

- BF spare parts:
  Data required :
  a. Total usage in a period of 1 year (D = 17)
  b. One-time spare part booking fee (S = Rp. 187.000,00)

c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (BF = Rp. 12.897.000)

BF spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 17}{0{,}12 * \ 12.897.000}}$$

Then the result of EOQ is 2.02≈ 2 units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{17}{2} \times \frac{2}{2} \times (\times\ 12.897.000)$$

$$TC = IDR\ 3{,}137{,}140$$

- BS spare parts:

Data required :

a. Total usage in 1 year period (D = 36)
b. One-time spare part booking fee (S = Rp. 187.000,00)
c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (BS = Rp. 833.000)

The BS spare parts for each message are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 36}{0{,}12 * \ 833.000}}$$

Then the result of EOQ is 11.6≈ 12 units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{36}{12} \times \frac{12}{2} \times (\times\ 833.000)$$

$$TC = IDR\ 1{,}607{,}760$$

- BN spare parts:

Data required :

a. Total usage in a period of 1 year (D = 160)
b. One-time spare part booking fee (S = Rp. 187.000,00)
c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (BN = Rp. 117.000)

BN spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 160}{0{,}12 * \ 117.000}}$$

Then the result of EOQ is 65.3≈ 65 units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{160}{65} \times \frac{65}{2} \times (\times\ 117.000)$$

$$TC = IDR\ 916{,}607$$

- CF spare parts:

Data required :

a. Total usage in 1 year period (D = 10)
b. One-time spare part booking fee (S = Rp. 187.000,00)
c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (CF = Rp. 12.767.000)

CF spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 10}{0{,}12 * 12.767.000}}$$

Then the result of EOQ is$1.5 \approx 2$ units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{10}{2} \times \frac{2}{2} \times (\times\, 12.767.000)$$

$$TC = 2{,}467{,}040$$

- CS spare parts:

Data required :

a. Total usage in a period of 1 year (D = 43)
b. One-time spare part booking fee (S = Rp. 187.000,00)
c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (CS = Rp. 791.000)

CS spare parts for each message are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 43}{0{,}12 * 791.000}}$$

Then the result of EOQ is$13.02 \approx 13$units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{43}{13} \times \frac{13}{2} \times (\times\, 791.000)$$

$$TC = 1{,}235{,}518.46$$

- CN spare parts:

Data required :

a. Total usage in a period of 1 year (D = 691)
b. One-time spare part booking fee (S = Rp. 187.000,00)
c. Storage Cost of spare parts (h = 12%)
d. Price of goods per unit (CN = Rp. 191.000)

CN spare parts for each order are as follows:

$$\text{EOQ} = \sqrt{\frac{2 * 187.000 * 691}{0{,}12 * 191.000}}$$

Then the result of EOQ is$106.19 \approx 106$ units/message

The total cost of spare part inventory is calculated using the formula:

$$TC = 187{,}000 + 0.12\,\frac{691}{106} \times \frac{106}{2} \times (\times\, 191.000)$$

$$TC = 2.433788.30$$

From this calculation, the total inventory cost of all imported spare parts amounted to **Rp. 274,141,349**

Period Order Quantity *(POQ)* Method

Hansa (2015) asserts that the POQ approach involves regular orders or purchases with a fixed distance between each order. The steps for working on POQ are as follows:

a. Calculate EOQ
b. Use EOQ to calculate booking frequency per year (N)

- US spare parts:
  Saving Fee:
  TC = 41× IDR 187,000
  TC = IDR 7,667,000
  Message fee:

$$POQ = \frac{41}{2} * (12\% * \ 937.000)) = \text{Rp.}\, 937.000$$

  Total inventory cost/year = storage cost + message cost = Rp. 7,667,000+ = Rp. 9,972,020Rp. 2.305.020
- AN Spare Parts:
  Saving Fee:
  TC = 101× IDR 187,000
  TC = IDR 18,887,000
  Message fee:

$$POQ = \frac{101}{2} * (12\% * \ 234.000) = \text{Rp.}\, 937.000$$

  Total inventory cost/year = storage cost + message cost = IDR 18,887,000+ = IDR 20,305,040Rp. 1.418.040
- BF spare parts:
  Saving Fee:
  TC = 17× IDR 187,000
  TC = IDR 3,179,000
  Message fee:

$$POQ = \frac{17}{2} * (12\% * \ 12.897.000) = \text{Rp.}\, 13.154.940$$

  Total inventory cost/year = storage cost + message cost = IDR 3,179,000+ = IDR 16,333,940Rp. 13.154.940
- BS spare parts:
  Saving Fee:
  TC = 36 × IDR 187,000
  TC = IDR 6,732,000
  Message fee:

$$POQ = \frac{36}{2} * (12\% * \ 833.000) = \text{Rp.}\, 1.799.280$$

  Total inventory cost/year = storage cost + message cost = IDR 6,732,000+ = IDR 8,531,280Rp. 1.799.280
- BN spare parts:

Saving Fee:
TC = 160× IDR 187,000
TC = IDR 29,920,000
Message fee:

$$POQ = \frac{160}{2} * (12\% * 177.000\ ) = \text{Rp. } 1.699.200$$

Total inventory cost/year = storage cost + message cost = IDR 29,920,000 + = IDR 31,619,200Rp. 1.699.200

- CF spare parts:
  Saving Fee:
  TC = 10 × IDR 187,000 + 0
  TC = IDR 1,870,000.00
  Message fee:

$$POQ = \frac{10}{2} * (12\% * \ 12.767.000) = \text{Rp. } 7.660.200$$

  Total inventory cost/year = storage cost + message cost = IDR 1,870,000 + IDR 7,660,200 = IDR 9,530,000
- CS spare parts:
  Saving Fee:
  TC = 43× IDR 187,000
  TC = IDR 8,041,000
  Message fee:

$$POQ = \frac{43}{2} * (12\% * \ 791.000) = \text{Rp. } 2.040.780$$

  Total inventory cost/year = storage cost + message cost = Rp. 8.041.000 + = Rp.10.081.780Rp. 2.040.780
- CN spare parts:
  Saving Fee:
  TC = 691× IDR 187,000
  TC = IDR 129,217,000
  Message fee:

$$POQ = \frac{691}{2} * (12\% * \ 191.000) = \text{Rp. } 7.918.860$$

  Total inventory cost/year = storage cost + message cost = Rp. 129,217,000+ = Rp.137,135,860Rp. 7.918.860 Then the total inventory cost of all spare parts is **Rp. 273,502,120**

Reorder Point Booking

Reoder Point (ROP) is a level that will indicate when to reorder spare parts. The formula used is:

$$ROP = \frac{D \times L}{365}$$

Here are the ROP calculation results from AF spare parts:

$$ROP = \frac{10 \times 45}{365} = 1{,}223 \approx 2 \text{ units}$$

The following is the ROP calculation result from BN spare parts:

$$ROP = \frac{10 \times 160}{365} = 4.4 \approx 4 \text{ units}$$

Based on the calculation above, it is found that when the spare parts inventory level reaches 2 units, orders for that type can be placed again, so that the inventory level rises again to exceed 4 units.

Discussion

ABC Analysis

As a result of the data processing, it can be concluded that there are 72 items in priority A, 120 items in priority B, and 952 items in priority C among nine different types of parts.

EOQ Analysis

Based on data analysis, it can be said that the EOQ approach produces the lowest total inventory cost. The company can save CF spare parts inventory costs of IDR 10,439,670,400. To prevent overstock or stock out, organizations can further optimize their parts inventory by using EOQ.

Reorder Point Analysis

Furthermore, it is necessary to know the point of reordering, which is used as a benchmark for reordering goods to suppliers so as not to experience stockout or overstock, after getting the best method to calculate the number of goods to be ordered. Therefore, by recording the point of reordering each part, the PPIC/Indenter section can determine the minimum stock level required to place another order with the supplier, ensuring that the goods will arrive on time and there will be no overstock or understock.

Inventory Method Analysis

After calculating the inventory costs of all three existing methods. The following is a recapitulation of the calculation of total inventory costs from the three methods:

Table. Calculation of total inventory of Spare Parts

No.	Method	Total Inventory Cost
1.	LFL	IDR 274,141,349
2.	EOQ	IDR 205,513,000
3.	POQ	IDR 273,502,120
4.	Existing	IDR 1,473,330,866

It was found that the EOQ method is the most optimal method in minimizing the total cost of spare part inventory.

Managerial Implications

This research is expected to provide various benefits for related parties, including:

1. Inventory calculation using the EOQ method can optimize the costs incurred by the company for production (purchasing spare parts inventory).
2. With the application of the EOQ method, the potential benefits that will be obtained by the company compared to the benefits obtained when using conventional methods will be greater with the reduction of costs incurred for fulfilling spare part supplies.

CONCLUSION

From the discussion above, it was concluded that based on the results of data processing using the ABC method, for spare parts 72 types of items (6.29%) group A with a budget use of 79.87%, 120 types of items (10.48%) group B with a budget use of 7.26% and 952 types of items (83.21%) group C with a budget use of 12.86%. The total cost of spare part inventory using the EOQ method obtained a total CF inventory cost of Rp. 10,439,670,400, the LFL method of Rp. 1,870,000.00, and the POQ method of Rp. 85,770,000. So that the one that has the most optimal total inventory cost is the EOQ method.

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