THE ANALYSIS OF SPARE PARTS SUPPLY CONTROL: A CASE STUDY

[*1]**Marliza Noor Hayatie**,[2]**Yusuf Al Arief**, [3]**Rina Pebriana**

[1]*Akuntansi, Komputer dan Bisnis, Politeknik Negeri Tanah Laut, Pelaihari, Indonesia*
[2]*Pendidikan Bahasa Inggris, FKIP, Universitas Lambung Mangkurat,Banjarmasin, Indonesia*
[3]*Akuntansi, Komputer dan Bisnis, Politeknik Negeri Tanah Laut, Pelaihari, Indonesia*

Author's email:
[1]*marliza@politala.ac.id ;* [2] *rina@politala.ac.id ;*[3] *yusufalarief@ulm.ac.id*
Corresponding Author : [1]*marliza@politala.ac.id*

Abstract. *PT. Sumber Berlian Motors is a company engaged in services and trade or 3S (sales, service, spare parts). In the process of buying and selling spare parts, it is closely related to inventory, to optimize the control of spare parts inventory by using historical data from the previous year, namely the Economic Order Quantity (EOQ) method. The purpose of this study is to determine the application of the Economic Order Quantity (EOQ) method to help determine the economic amount in each order to minimize the total cost of inventory. The results of this study, inventory control for oil filters, fuel filters, and brake shoe products are more efficient when using the EOQ method, proven to be able to save inventory costs of Rp. 405.819, Rp. 343.864, and Rp. 138.074, with the number of orders optimally 708 pcs, 568 pcs, and 144 pcs in each order in a year. The company must also hold a safety stock of 237 pcs, 198 pcs, and 27 pcs, and Reorder points when the stock is 553 pcs, 462 pcs, and 63 pcs to anticipate delays in merchandise.*

Keywords: *EOQ method, inventory control, inventory costs*

1. INTRODUCTION

Sparepart is a tool that supports the procurement of goods for equipment used in the production process, spare parts are the main factor that determines the course of the production process in a company (Indrajit & Djokopranoto, 2003).

As times progress and business competition continues to increase, of course, it requires business people to increase efficiency in all fields. One means to make it happen is with inventory control. In general, it is the inventory of raw materials that costs a lot because errors often occur such as shortage of raw materials, excess ordering of raw materials which results in increased storage costs, delays in the arrival of raw materials due to delays in ordering raw materials to suppliers, and other problems other. To avoid these things the company needs to have planning, management, and control in the process of controlling its raw materials (Indriasari & Sani, 2019).

Inventory control relates to the design, operation, and control of inventory systems (Bhunia et al., 2019). Inventory control aims to control inventory so that the company does not overstock) which will cause the waste or out of-stock (Tareque Aziz & Azila Mohd Noor, 2013). If something like that happens, then the delivery time of raw materials or goods that have been previously agreed upon by consumers and companies will be late (Assauri, 2008).

Inventory is a fundamental part of a company. In inventory, some goods are valuable assets for the company. These goods are stored in a warehouse which can be reduced or increased at any time. If the amount of inventory is too little (out of stock) and requests cannot be fulfilled, then this can lead to customer disappointment and impact loss of customer trust. Meanwhile, if the amount of inventory is too much (overstock), it can cause problems such as increased storage costs (Veza & Badri, 2021).

Inventory is closely related to business because inventory includes the stock of company goods that are stored (Chuong & Stevenson, 2014). Companies must be able to meet consumer needs which of course is supported by the availability of products in the warehouse. Companies need to carry out inventory determination analysis to minimize costs or obtain the most economical level (Yamit, 2008). The determination of

the amount of inventory should not be too large, to reduce inventory costs (Assauri, 2008).

The use of the EOQ method can reduce the total cost of inventory. By using the EOQ method, the value of safety stock and reorder points can be determined so that raw materials are available on time and there is no shortage (Hidayat et al., 2020).

Economic Order Quantity (EOQ) inventory control method for planning inventory for one year by minimizing storage costs and ordering costs (Ahmad & Sholeh, 2019).Based on the information the author has obtained from PT. Sumber Berlian Motors, that the company still does not use the Economic Order Quantity (EOQ) method. Companies order stock of goods only by estimating the amount to be purchased and reordering when inventory is running low. So that it can cause inventory to accumulate in warehouses or run out of stock, resulting in non-fulfillment of consumer demand.

By using the EOQ method, the value of safety stock and reorder points can be determined so that raw materials are available on time and there is no shortage.

Based on this description, the author takes the title "Spare parts Inventory Control Analysis at PT Sumber Berlian Motors".

2. LITERATURE REVIEW
2.1 Inventory Management
Inventories are the main reason to exist of commercial enterprises (Flores PhD et al., 2021). Firms can meet customer needs more effectively by controlling fewer inventories that they classify according to their importance level (A. Goswami et al., n.d.). The implementation of inventory management could contribute to an increase of certain sales aspects of the company (Marcela Malindzakova & Dominik Zimon, n.d.). Manufacturing organizations often use inventory management systems to reduce their carrying costs (Singh & Yadav, 2019). Inventory management seeks to maximize the wealth of the share holders by minimizing the cost of procuring and maintaining (P. Basaiah & G. Sindhu, n.d.).

Effective inventory management of a trading enterprise should be based on: the use of powerful information technologies; improving inventory control and supply coordination; ensuring the continuous interaction of the functional subsystems of the whole set of enterprises-producers, consumers and suppliers and establishing effective communication with them (Onyshchenko et al., 2019).

2.2 Inventory Control Spare part
Demand is a critical variable in the inventory control system (Munyaka & Yadavalli, 2022). The inventory level is developed by determining the optimal quantity order using an economic ordering quantity method (Sato & Jauhari, 2019). The combination of economic order quantity and continuous review control has a major impact on the success of inventory control (Pardede & Vanany, 2021). Instantaneous deterioration of the products is considered to give some managerial insights to the retailer how can he manage his inventories in profitable way (A. Mashud & R. Hasan, n.d.). The circularity level has impact on the demand, cost and selling price of the product (Rabta, 2020).

3. RESEARCH METHODS
The data analysis used in this research is descriptive quantitative. The quantitative descriptive method is a writing method that describes the actual situation regarding an object under study. In this case, the object under study is the spare parts inventory. The stages and calculation formulas used in the research are as follows:

3.1 Determination of economic order quantity (EOQ)
Model Economic Order Quantity (EOQ) adalah salah satu teknik pengendalian persediaan yang paling sering digunakan. Dengan model EOQ, kuantitas pesanan yang optimal akan muncul pada titik dimana kurva biaya pemesanannya sama dengan total biaya penyimpanan (Jay & Barry, 2015). The formula used in the EOQ calculation is:

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

Information:
D = Number of requirements per year in units
S = Order fee per order (Rp)
H = Storage cost (Rp) per unit per year

3.2 Purchase frequency
Determining the frequency of purchasing the most profitable merchandise can be done by dividing the need for merchandise during one period by the optimal purchase of merchandise (Nilwan et al., 2011). The formula used to calculate purchase frequency is:

$$Fr = \frac{D}{EOQ}$$

Information:
D = Number of requirements per year in units
EOQ = Economic Order Quantity

3.3 Safety Stock
Safety stock (safety stock) determines inventory control (Efrilianda et al., 2018). Companies must have safety stock to minimize stock out, overstock at the company will also increase raw material storage costs (Biswas et al., 2017). The following is the safety stock formula :

Safety stock = Average delay x Daily merchandise needs

3.4 Reorder Point
The reorder point is the inventory level, when the inventory has reached a certain level, an order must be placed (Jay & Barry, 2015). The formula used to determine ROP is as follows:

ROP = d x L

Information:
d = Requests per day
L = lead time for new orders (in days)

3.5 Maximum Inventory Determination
To find out the maximum amount of inventory, you can use the following formula:

Maximum Inventory (MI) = SS + EOQ

Information:
SS = Safety Stock
EOQ = Economic Order Quantity

3.6 Total Inventory Cost
Total Inventory Cost (TIC) consists of ordering costs, namely costs for purchasing goods or ordering costs from suppliers and holding costs, namely costs related to storage. The mathematical formula for TIC is as follows: (Heizer & Render, 2011)

$$TIC = (\frac{D}{Q}.S) + (\frac{Q}{2}.H)$$

Information:
Q = Number of items in each order
D = Annual demand for supplies (units)
S = Order fee for each order
H = Storage cost per unit per year

3.7 Inventory Cost Efficiency
The formula for calculating inventory cost efficiency achieved before and after an effective inventory analysis is carried out is as follows:

Cost efficiency = TIC before EOQ – TIC after EOQ

Information:
TIC = Total Inventory Cost
    EOQ = Economic Order Quantity

4. RESULTS AND DISCUSSION

Trade goods sales data for oil filter, fuel filter and brake shoe products are presented in the following table:

Table 1. Frequency of Purchase of Spareparts

Month	Purchase Frequency		
	Oil Filter	Fuel Filter	Brake Shoe
January	1	1	2
February	10	9	5
March	7	9	6
April	13	14	8
May	7	8	5
June	14	15	10
July	9	12	9
August	12	13	10
September	12	9	5
October	9	10	12
November	14	17	10
December	15	14	16
Total	123	131	98

Source: Results of data processing, 2022

4.1 Storage Fee

Storage costs are costs that lead to the amount of money that must be paid to store inventory in a storage warehouse. It is known that the storage warehouse can accommodate around 100,000 pcs of spareparts with an annual storage cost in the 2021 period of IDR 57,038,348. The following shows the cost of storing spareparts trade goods in one period and in units of goods during the 2021 period at PT. Sumber Berlian Motors.

Table 2. Storage Fees

Storage fee per year	Rp 57.038.348
Warehouse storage quantity	100.000 pcs
Cost of storage / unit of merchandise	Rp 570,4

Source: Results of data processing, 2022

4.2 Order Fee

Ordering costs are costs incurred related to ordering costs. The higher the frequency of orders, the higher the costs required for ordering. It is known that the cost for 1 trip/1 truck is IDR 50,000, which is the cost for loading and unloading and shipping from the port to the company address, while the distributor does not charge for sending orders.

In 1 trip / 1 truck is able to load Oil Filter and Fuel Filter products around 128 boxes which in 1 box contains 12 pcs, and is able to load Brake Shoe products around 160 boxes which in one box contains 4 pcs. Details for each product are presented as follows:

Table 3. Order cost details

1 trip / 1 truck		
Oil Filter	128 box x 12 pcs	1536 pcs
Fuel Filter	128 box x 12 pcs	1536 pcs
Brake Shoe	160 box x 4 pcs	640 pcs

Source: Results of data processing, 2022

Average quantity/order of Oil Filter =

$$\left(\frac{D}{f}\right) = \left(\frac{23.211}{123}\right) = 189 \text{ pcs}$$

Average quantity/order of Fuel Filter =

$$\left(\frac{D}{f}\right) = \left(\frac{19.229}{131}\right) = 147 \text{ pcs}$$

Average quantity/order of Brake Shoe =

$$\left(\frac{D}{f}\right) = \left(\frac{2.719}{98}\right) = 28 \text{ pcs}$$

Calculation of the cost of ordering / ordering:

Oil Filter = $\frac{189}{1.536}$ x 50.000 = 6.152,34 = Rp 6.152
Fuel Filter = $\frac{147}{1.536}$ x 50.000 = 4.785,15 = Rp 4.785
Brake Shoe = $\frac{28}{640}$ x 50.000 = 2.187,5 = Rp 2.188

4.3 Waiting time

The waiting time for the procurement of spareparts is the time it takes from the time the product is ordered until the product arrives at the company. Based on information from the company, the waiting time needed to order spareparts is 7 (seven) days from the time the product is sent from the head office, provided that nothing unexpected happens. And the delay in the arrival of the order is about 3 (three) days.

4.4 Discussion

The results showed that by using the EOQ method, the total inventory costs incurred by the company were less. The following is a comparison table between the application of the EOQ method and company policies in controlling spareparts inventory (oil filters, fuel filters, and brake shoes):

Table 4. Comparison Results

Description	Oil Filter		Fuel Filter		Brake Shoe	
	Company Policy	EOQ Method	Company Policy	EOQ Method	Company Policy	EOQ Method
Order Quantity	189	708	147	568	28	144
Purchase Frequency	123	33	131	34	98	19
Safety Stock		237		198		27
Re-Order Point		553		462		63
Maximum Inventory		945		766		171
Total Cost of The Order	809,427	403,608	667,848	323,984	220,456	82,382
Cost Efficiency		405,819		343,864		138,074

Source: Results of data processing, 2022

The table above shows the average number of orders according to company policy for oil filters, namely 189 pcs/order, fuel filters 147 pcs/order, brake shoes 28 pcs/order. Whereas with the EOQ method the number per order is more, namely 708 pcs, 568 pcs and 28 pcs, so the order frequency with the EOQ method is not as much as the frequency of orders according to company policy. After knowing the number of economical orders for each product, the order frequency is not as much as before. Reduced order frequency results in lower order costs.

Companies that previously did not determine safety stock and reorder points for spareparts inventory control, with the EOQ method are able to determine the amount of safety stock and when reorder points should be made. Safety stock for oil filter products is 237 pcs, fuel filter products are 198 pcs, and brake shoes are 27 pcs. Provision of safety stock is intended to anticipate delays in incoming orders, with the presence of

safety stock it will greatly affect the company's efforts to maintain a smooth sales process. So that when there is a delay the company still has safety stock.

Reorders are made when the supply of goods for oil filter products remains 553 pcs, when there is remaining 462 pcs for fuel filter products, and when there is 63 pcs remaining for brake shoe products, this amount does not include safety stock. The amount of inventory is an estimate that when the goods in the warehouse are running out, orders for merchandise that have been ordered before have arrived at the warehouse so that sales do not stop. The reorder point is determined in order to know the right time to place an order again, because if an order is made when there is still a lot of stock, it will cause stock to accumulate, but if a reorder is made when the stock is low, it is feared that stock out will occur or run out of stock. The maximum inventory for spareparts merchandise for oil filter products is 945 pcs, fuel filter products is 766 pcs, and brake shoe products is 171 pcs. Determination of maximum inventory in order to avoid the accumulation of inventory items that affect storage costs.

The results of calculating the total cost of inventory using the EOQ method show results that are more efficient than those based on company policy. The total inventory cost with company policy for oil filter products is Rp. 809,427, while with the EOQ method it is Rp. 403,608, which means that the company is able to save as much as Rp. 405,819. Then the total inventory cost for fuel filter products with company policy is IDR 667,848, while with the EOQ method it is IDR 323,984, meaning that the company can save as much as IDR 343,864 if using the EOQ method. And the total cost of inventory for brake shoe products with company policy is Rp. 220,456, while using the EOQ method is Rp. 82,382, which means that the company is able to save as much as Rp. 138,074 if it applies the EOQ method. So, the use of the EOQ method is able to reduce the total inventory costs that must be incurred by the company.

Inventory cost efficiency occurs because the EOQ method is able to determine the number of orders that are economical so that companies that previously ordered very often from distributors with a smaller number of orders become less frequent with the number of orders that are economical. In addition, the number of economical orders allows the company to maximize the use of warehouses that can accommodate around 100,000 pcs for various types of spareparts, so that merchandise does not just pass through the warehouse. The EOQ method makes merchandise inventory optimal, and costs as low as possible. The use of the EOQ method in controlling merchandise inventory is able to minimize the occurrence of out of stock or run out of inventory so that the sales process runs smoothly and realizes cost efficiency of merchandise inventory.

The purpose of implementing planning and controlling merchandise inventory is to reduce costs and minimize excess and shortage of merchandise inventory. Inappropriate control of merchandise will affect determining what quantity to buy, when to place an order, the minimum quantity of merchandise that is always in safety stock to avoid bottlenecks in fulfilling requests, and the limit on the maximum amount of inventory that should be in the storage warehouse. so that there is no accumulation of inventory items.

CONCLUSION

The results of the analysis and discussion regarding the control of spareparts using the Economic Order Quantity (EOQ) method show that the company is able to determine the number of orders that are economical in one order and the frequency of purchases is effective. Companies are able to maximize the use of storage warehouses. The results of these calculations show that of the three product samples, namely the oil filter, fuel filter, and brake shoe, the total cost of inventory is lower than the company's policy. Companies that have not previously determined the amount of safety stock, reorder points and maximum inventory, with the calculation of the EOQ method can determine the amount properly, thereby maximizing the use of the Economic Order Quantity (EOQ) method. The use of the EOQ method is also able to minimize the occurrence of out of stock or running out of inventory so that the sales process runs smoothly.

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