

Evaluation Of The Implementation Of Inventory Using The EOQ Method At Toyota Spare Parts Store, Period 2021 – 2023 (Case Study at Mitra Motor Bekasi)

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ABSTRACT

Economic order quantity (EOQ) is one of the inventory management methods used to optimize the cost of inventories company can make decisions for ordering, holding, and managing inventories. The purpose of this research is to compare the optimal ordering quantities and total inventory cost between conventional methods and EOQ methods. The research method used is quantitative research with a case study approach through exploration. The variables this research are ordering cost, holding cost, annual demand, and lead time. The analysis techniques used this research are Economic Order Quantity (EOQ), safety stock, and reorder point. Mitra Motor is a business engaged services and sells inventories, especially Toyota spare parts, Bekasi area. during the store's operation, the store owner never recorded the quantity of ordered items, resulting a buildup of inventories that caused significant storage costs, especially for fast-moving items such as brake pads and spark plugs. The results of this research show EOQ method can be an alternative for inventory management Mitra Motor. This is evident from the total inventory cost after using the EOQ method calculation for brake pads inventory in 2021 amounting to Rp. 12.474 previously Rp. 48.070, indicating a 27% savings, in 2022 amounting to Rp. 13.096 previously Rp. 49.628, indicating a 26% savings, and in 2023 amounting to Rp. 14.331 previously Rp. 49.821 indicating a 29% savings. As for spark plug inventory in 2021 amounting to Rp. 12.409 previously Rp. 55.500, indicating a 22% savings, in 2022 amounting to Rp. 13.875 previously Rp. 57.000, indicating a 24%, and in 2023 amounting to 14.400 previously Rp. 57.114, indicating a 25% savings.

Keywords:

Inventory management, safety stock, reorder point, total inventory cost, ordering cost.

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INTRODUCTION

The spare parts of vehicle are one of the important things in supporting engine maintenance activities. However, an excessive stock of spare parts can lead to cost wastage, and storing piled-up merchandise can cause rust or other factors that make the goods unsellable (Adam & Imaroh, 2019; Lau, 2023).

Mitra Motor is business that sells four-wheeled vehicles spare parts which has been established since 1996 in the Bekasi area. Mitra Motor is a family business founded by two people and at the time, technology and information were still limited, so all records were still done manually. Based on observations and interviews, the owners of Mitra Motor felt difficulty incalculating and finding the stock of goods to be sold. The owner began recording inventory and sales in 2020, so they lack the history data of older inventory. Additionally, they don't know when to order fast-moving items or what the optimal quantity for each order should be. Excessive merchandise stock increases ordering costs and holding costs and this situation also increases the risk of obsolescence and the deterioration of goods quality which is difficult to maintain (Riche & Marpaung, 2022; Yani, 2023). This potentially reduces the profits obtained by Mitra Motor.

Economic Order Quantity (EOQ) was first developed by F. W. Harris in 1915 by developing an economical order quantity formula. The EOQ model is used to determine inventory order quantity minimizing the direct cost of storing inventory and the inverse cost of inventory orders (Hernaeti, 2021; Manta, 2020). According to Jay Heizer and Barry Render (2015: 561), Economic Order Quantity is one of the oldest and most

widely known inventory control techniques. This method of inventory control answers two important questions, namely when to order and how much to order (Andriana, 2024; Hilda, 2023).

The researcher chose the Economic Order Quantity (EOQ) method because of common application and ability to address the typical challenge of determining appropriate inventory levels (Gunawan & Setiawan, 2022; Rahardjo et al., 2023). EOQ is robust scientific inventory management framework that helps minimize costs while meeting customer demand (Krajewski & Malhotra, 2022; Meilani & Azizah, 2023). In the study Tesalonika F.Dagi et al in 2023, EOQ was found to maximize company profits by 1.3%, where before implementing th EOQ method, the company earned Rp. 2.695.758.800 in profit, which increase to Rp. 2.730.843.108 afterward (Dagi et al., 2023).

This research is expected to be a consideration for Mitra Motor as an evaluation material regarding the policy in determining the management of inventory that has been used. Based on the above background, research problems can be identified as follows: First, there was an inventory buildup at Mitra Motor caused by the initial recording of inventory and sales by owners starting in 2020 without any historical records from previous years. Second, the disruption of Mitra Motor's cash flow due to the accumulation of old unsold inventory. The owner tries to determine the optimal number of parts to order, especially for items that sell quickly, in order to minimize inventory costs.

This study aims to evaluate the effectiveness of the application of the Economic Order Quantity (EOQ) method in spare parts inventory management at Mitra Motor Bekasi during the period 2021 to 2023. The main objective of this study was to identify the extent to which the EOQ method can help optimize inventory levels, reduce storage costs, and prevent shortages or overstocks of parts. By analyzing inventory and operational data, this study is expected to provide practical recommendations for improving inventory management at Mitra Motor Bekasi. The benefits of this research include improved store operational efficiency, cost savings, and increased customer satisfaction through more guaranteed spare parts availability. In addition, the results of this study can be a reference for other parts stores that want to implement the EOQ method in their inventory management system.

METHOD

The object of this research is spare parts at Mitra Motor, especially for inventory with higher sales or fast moving goods such as brake pads and spark plugs. In this study, the authors evaluated the process of recording and storing inventory that occurred from January 2021 to December 2023. The research method used is quantitative research with a case study approach through exploration using observation and interviews (Jailani, 2023; Romlah, 2021). The population in this study is all spare parts in Mitra Motor, while the research sample is focused on spare parts that belong to the fast moving category. This research was conducted at Mitra Motor stores during the period January 2021 to December 2023. Data collection techniques are carried out through direct observation of the process of recording and storing inventory as well as interviews with store owners and employees responsible for inventory management. Additional data is also collected from sales and inventory records provided by store owners. The analytical techniques used in this study are the EOQ (Economic Order Quantity) method, safety stock, and reorder point to evaluate the efficiency of inventory management. For hypothesis testing, relevant statistical tests such as t tests are used to see significant differences between storage costs before and after the application of the EOQ method, as well as regression analysis to see the effect of ordering cost, holding cost, annual demand, and lead time variables on inventory performance.

RESULTS AND DISCUSSION

Based on interviews and observations, known that the inventory with higher sales or fast-moving items from January 2021 to December 2023 are brake pads and spark plugs. The following table shows usage of brake pads and spark plugs for the years 2021 to 2023.

Table1. Total Usage of Brake Pads in the Years 2021 – 2023

No	Month	Usage Quantity		
		2021	2022	2023
1	January	80	70	90
2	February	70	80	90
3	March	70	80	90
4	April	80	80	90
5	May	90	80	80
6	June	90	70	70
7	July	90	70	90
8	August	90	70	90
9	September	70	80	80
10	October	70	80	90
11	November	70	80	90
12	December	80	90	90
	Total	950	930	1040
	Average	79	78	87

From table 1, is found that the total usage of brake pads in 2021 was 950 units with an average usage of 79 units, in 2022 was 930 units with an average usage of 78 units, and in 2023 was 1040 units with an average usage of 87 units.

Table 2. Total Usage of Spark Plugs in the Years 2021 – 2023

No	Month	Usage Quantity		
		2021	2022	2023
1	January	80	90	90
2	February	80	90	90
3	March	80	90	80
4	April	80	90	80
5	May	80	80	80
6	June	80	80	90
7	July	80	80	90
8	August	80	70	90
9	September	70	70	90
10	October	70	90	90
11	November	80	90	90
12	December	80	90	90
	Total	940	1010	1050
	Average	78	84	88

From table 2, is found that the total usage of spark plugs in 2021 was 940 units with average usage of 78 units, in 2022 was 1010 units with an average usage of 84 units, and in 2023 was 1050 units with an average usage of 88 units.

Table 3. Total Inventory Cost Components of Brake Pads and Spark Plugs for the Years 2021 – 2023

Years	Brake Pads	Spark Plugs	Other Items	Ordering Cost/ order	Holding Cost/ unit
2021	950	940	250	Rp 630	Rp 130
2022	930	1010	250	Rp 627	Rp 152
2023	1040	1050	250	Rp 621	Rp 159

Based on interviews and data provided by the owner of Mitra Motor, is known that the components of ordering cost components, namely telephone and wifi, in 2021 amounted to Rp 630, in 2022 Rp. 627, and in 2023 Rp. 621. In addition, the holding cost components, namely security and electricity costs, in 2021 amounted to Rp. 130, in 2022 Rp 152, and in 2023 Rp 159. These costs are per unit of inventory. Should be noted that Mitra Motor not only sells brake pads and spark plugs, so the ordering and holding cost in the above table 3 include the prices of other inventory per unit with an average of 250 units per year.

Table 4. Calculation of EOQ and Ordering Frequency of Brake Pads for the Years 2021 – 2023

Description	2021	2022	2023
EOQ Brake Pads	$Q = \sqrt{\frac{2 \times 950 \times 630}{130}}$ Q = 96 units	$Q = \sqrt{\frac{2 \times 930 \times 627}{152}}$ Q = 88 units	$Q = \sqrt{\frac{2 \times 1040 \times 621}{159}}$ Q = 90 units
Ordering Frequency	$= \frac{950}{96}$ = 10 times	$= \frac{930}{88}$ = 11 times	$= \frac{1040}{90}$ = 12 items

Based on the calculations in table 4, it is found that in that 2021 the optimal order quantity for brake pads using the EOQ method for each order is 96 units, with an ordering frequency of 10 items a year. In 2022, optimal order quantity using the EOQ method for each order is 88 units, with an ordering frequency of 11 items a year. In 2023, the optimal order quantity using the EOQ method for each order is 90 units, with an ordering frequency of 12 items a years.

Table 5. Calculation of EOQ and Ordering Frequency of Spark Plugs for the Years 2021 – 2023

Description	2021	2022	2023
EOQ Spark Plugs	$Q = \sqrt{\frac{2 \times 940 \times 630}{130}}$ Q = 95 units	$Q = \sqrt{\frac{2 \times 1010 \times 627}{152}}$ Q = 91 units	$Q = \sqrt{\frac{2 \times 1050 \times 621}{159}}$ Q = 91 units
Ordering Frequency	$= \frac{940}{95}$ = 10 times	$= \frac{1010}{91}$ = 11 times	$= \frac{1050}{91}$ = 12 times

Based on the calculations in table 5. found that in 2021, the optimal order quantity for spark plugs using the EOQ method for each order is 95 units, with an ordering frequency of 10 times a year. In 2022, the optimal order quantity using the EOQ method for each order is 91 units, with an ordering frequency of 11 items a year. In 2023, the optimal order quantity using the EOQ method for each order is 91 units, with an ordering frequency of 12 times a years.

Table 6. Total Inventory Cost of Brake Pads and Spark Plugs for the Years 2021 – 2023

Description	2021	2022	2023
Brake Pads	$TIC = \frac{96}{2} 130 + \frac{950}{96} 630$ TIC = Rp. 12.474	$TIC = \frac{88}{2} 152 + \frac{930}{88} 627$ TIC = Rp. 13.096	$TIC = \frac{90}{2} 159 + \frac{1040}{90} 621$ TIC = Rp. 14.331
Spark Plugs	$TIC = \frac{95}{2} 130 + \frac{940}{95} 630$ TIC = Rp. 12.409	$TIC = \frac{91}{2} 152 + \frac{1010}{91} 627$ TIC = Rp. 13.875	$TIC = \frac{91}{2} 159 + \frac{1050}{91} 621$ TIC = Rp. 14.400

Based on the calculations in table 6 known that the total inventory cost of brake pads incurred by Mitra Motor in 2021 is Rp. 12.474 , in 2022 is Rp. 13.096, and In 2023 Rp. 14.331. Meanwhile, for the total inventory cost calculations using th EOQ method, it is know that the total inventory cost of spark plugs incurred by Mitra Motor in 2021 is Rp 12.409, in 2022 is Rp. 13.875, and in 2023 is Rp 14.400.

Table 7. Comparison of Brake Pads Inventory Control Using Conventional Method and EOQ Method

Description	Conventional Method			EOQ Method		
	2021	2022	2023	2021	2022	2023
Item Usage	950 units	930 units	1040 units	950 units	930 units	1040 units
Optimal Order Quantity per Order	85 units	84 units	84 units	96 units	88 units	90 units
Ordering Frequency	60 times			10 times	11 times	12 times
Reorder Point	-	-	-	346 units	332 units	369 units
Safety Stock	-	-	-	30 units	20 units	21 units
Total Inventory Cost (in Rp)	48.070	49.628	49.821	12.474	13.096	14.331

Based on table 7, can be seen that from 2021 to 2023, Mitra Motor owner ordered brake pads 60 times a year, with orders of 85 units in 2021, 84 units in 2022, and 84 units in 2023.

After using the EOQ method, the ordering frequency for 2021 should be 10 times with an optimal order of 96 units, for 2022 it should be 11 times with an optimal order of 88 units, and for 2023 it should be 12 times with an optimal order og 90 units.

The reorder point for brake pads in 2021 should be 346 units, and the owner should maintain a safety stock of 30 units, in 2022 the reorder point should be 332 units with a safety stock of 20 units, and in 2023, the reorder point should be 369 units with a safety stock of 21 units.

Table 8. Comparison of Spark Plug Inventory Control Using Conventional Method and EOQ Method

Description	Conventional Method			EOQ Method		
	2021	2022	2023	2021	2022	2023
Item Usage	940 units	1010 units	1050 units	940 units	1010 units	1050 units
Optimal Order Quantity per Order	80 units	83 units	90 units	95 units	91 units	91 units
Ordering Frequency	72 times			10 times	11 times	12 times
Reorder Point	-	-	-	322 units	363 units	369 units
Safety Stock	-	-	-	7 units	13 units	9 units
Total Inventory Cost (in Rp)	55.500	57.000	57.114	12.409	13.875	14.400

Based on table 8, can be observed that from 2021 to 2023, the owner of Mitra Motor placed orders for spark plugs 71 times per year, with orders in 2021 totaling 80 units, in 2022 totaling 83 units, and in 2023 totaling 90 units. However, after implementing the EOQ method, the order frequency should be 10 times in 2021 with an optimal order quantity of 95 units, 11 times in 2022 with an optimal order quantity of 91 units, and 12 times in 2023 with an optimal order quantity of 91 units.

The reorder point for spark plugs in 2021 should be 322 units, and the owner should maintain a safety stock of 7 units. In 2022, the reorder point be 363 units with a safety stock of 13 units, and in 2023, the reorder point should be 369 units with a safety stock of 9 units.

The following are tables showing the percentage of total inventory cost for brake pads and spark plugs from 2021 to 2023. The tables below demonstrate the difference in costs when using the conventional method compared to the EOQ method and the percentage indicates the percentage of cost savings.

Table 9. The Percentage of Total Inventory Cost for Brake Pads and Spark Plugs in 2021 is as follows:

Description	Conventional Method	EOQ Method	Percentage
Brake Pads	Rp 48,070	Rp 12,474	27%
Spark Plugs	Rp 55,500	Rp 12,409	22%

Table 9 shows that the total inventory cost in 2021 for brake pads using the conventional method is Rp. 48.070, whereas when using the EOQ method, it is Rp. 12.474, indicating cost saving of 27%. For spark plugs, the total inventory cost in 2021 using the conventional method is Rp. 55.500, while using the EOQ method, it is Rp. 12.409, indicating a cost saving of 22%.

Table 10. The Percentage of Total Inventory Cost for Brake Pads and Spark Plugs in 2022 is as follows:

Description	Conventional Method	EOQ Method	Percentage
Brake Pads	Rp 49,628	Rp 13,096	26%
Spark Plugs	Rp 57,000	Rp 13,875	24%

Table 10, shows total inventory cost in 2022 for brake pads using the conventional method is Rp. 49.628, whereas when using the EOQ method, it is Rp. 13.096, indicating a cost saving of 26%. For spark plugs, the total inventory cost in 2022 using the conventional method is Rp. 57.000, while using the EOQ method, it is Rp. 13.875, indicating a cost saving of 24%.

Table 11. The Percentage of Total Inventory Cost for Brake Pads and Spark Plugs in 2023 is as follows:

Description	Conventional Method	EOQ Method	Percentage
Brake Pads	Rp 49,821	Rp 14,331	29%
Spark Plugs	Rp 57,114	Rp 14,400	25%

Table 11 shows that the total inventory cost in 2023 for brake pads using the conventional method is Rp. 49.821, whereas when using the EOQ method, it is Rp. 14.331, indicating a cost saving of 29%. For spark plugs, the total inventory cost in 2023 using the conventional method is Rp. 57.114, while using the EOQ method, it is Rp. 14.400, indicating a cost saving of 25%.

CONCLUSION

Based on research findings, the following conclusions can be drawn: 1) The inventory control practices currently employed by the owner of Mitra Motor are inefficient. The manual recording system used by the owner is prone to errors and loss of data, leading to unrecorded or missing items. Additionally, ordering of goods is done based solely on estimation, resulting in accumulation of excess inventory and subsequently higher total inventory costs. This situation can disrupt cash flow and increase the risk of damage to stored items due to prolonged storage. 2) The quantity of orders for fast-moving items such as brake pads and spark plugs using the Economic Order Quantity (EOQ) method is significantly more optimal per year compared to the policies currently implemented by the owner of Mitra Motor. 3) The Economic Order Quantity (EOQ) calculation method can be considering as an alternative for managing can be considered as an alternative for managing inventory of inventory, as evidenced by the lower total inventory costs after implementing the EOQ method compared to conventional method.

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