APPLICATION OF EOQ & ROP FOR INVENTORY CONTROL AT UMKM JASA BARONA

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Abstract. Grosir Jasa Barona is a wholesaler located in Tuasan, selling various daily necessities including staple goods. The location was chosen due to inventory management issues at the wholesaler, where stock is ordered once a month in quantities predetermined by the owner. Despite this, the inventory often results in overstock or stock shortages. This research aims to assist in establishing proper inventory management at the wholesaler by implementing the Economic Order Quantity (EOQ) and Reorder Point (ROP) methods. The EOQ method was selected to determine the optimal quantity of staple goods to order, while the ROP method helps identify the appropriate timing for reordering. The focus of this study is to improve inventory management at Grosir Jasa Barona. A qualitative approach was used, employing both primary and secondary data, with data collected through direct observation and interviews. The results showed that using EOQ and ROP methods can significantly improve inventory management at this Tuasan-based wholesaler. The implication of this research is that effective inventory management can lead to better cost control and increased profitability for the business.

Keywords: Economic Order Quantity (EOQ); Reorder Point (ROP); inventory management.

I. INTRODUCTION

Generally, a company has a purchasing management that is responsible for the quantity and quality of raw materials needed at an affordable cost and adequate inventory according to predetermined standards. The goal is to achieve profits and minimise losses from costs incurred. According to Alicia et al., (2023), inventory is an essential factor in business activities, both for trading and manufacturing companies. Inventory or warehousing is an activity that aims to meet the demand for goods in the business process, which includes the provision of raw materials, semi-finished goods, and fully finished goods (Ramadhani, 2024). Inventory is a number of finished goods, raw materials, and goods in the process that the company has with the aim of selling or further processing (Harmain et al., 2019). Inventory is a type of item owned by a company or business entity for provision or preparation in the production, distribution, or sales process. Inventory goods include all goods owned by the company for use in daily operations, either as raw materials that will be processed into finished products or as ready-to-sell goods. Inventory of goods or services in the form of raw materials, goods in the production mechanism, and finished goods that are ready for sale (Sumaryanto et al., 2024). The Indonesian Accounting Association (2008), suggests that inventory is an asset that exists so that it can be sold in the production process or in transit, or in the form of materials or supplements that are used in the production mechanism or service providers (Andriana, 2024). For service companies, inventory includes service costs, and others (Heriawan et al., 2024). Efficient inventory management is very important to

minimise excess or shortage of stock which has a negative impact on company costs and operations (Sinta & Yuliana, 2023).

Inventory management is one of the important aspects in maintaining the smooth operation of a business, especially for wholesale businesses that depend on the continuous availability of goods. According to research from Harsono et al. (2024), effective inventory management can provide significant benefits to companies by reducing storage costs and minimising potential losses due to shortages or excess stock. In a competitive business environment, inventory management methods such as Economic Order Quantity (EOQ) and Reorder Point (ROP) become very important tools to optimise the procurement process while ensuring stock is always available at the right time.

The Economic Order Quantity (EOQ) and Reorder Point (ROP) methods can be used to minimise total inventory costs and ensure adequate stock availability (Christyani, 2023). According to Heriawan et al. (2024), EOQ is a method with the aim of optimising the company's inventory costs, which allows the company to align ordering costs and storage costs. The purpose of using the EOQ method is to determine the optimal purchase frequency so as to obtain optimal inventory control (Juwita et al., 2024). EOQ helps estimate the optimal amount of goods that should be ordered to reduce ordering and storage costs. According to Lestari et al. (2024), EOQ order quantity is the amount of inventory ordered by consumers at a certain time that minimises annual inventory costs. Reorder Point is the point at which the company must place a new order to increase inventory before the stock runs out (Mulyana & Suryat, 2023).

ROP helps determine the reorder point to avoid running out of stock (Paulus, 2022). By setting the right reorder point, companies can avoid inventory shortages and ensure that they always have enough goods to meet customer demand (Zukruf et al., 2022). In addition, the use of historical data to determine the amount of stock to keep is often not accurate enough in the face of fluctuations in market demand. Research conducted by Gunawan et al. (2022), shows that many small and medium-sized enterprises (SMEs) often experience out-of-stock or overstock problems because they do not use effective inventory control methods. Therefore, the application of EOQ and ROP in SMEs is expected to overcome these challenges and provide a more measurable solution in inventory management. This method also allows business owners to make more data-driven decisions, rather than just based on field experience or subjective estimates.

Previous research, such as that by Hasibuan & Lubis (2023), has also highlighted the importance of using a structured inventory management system in supporting smooth business operations, especially in the wholesale sector. By combining EOQ and ROP, MSMEs like Jasa Barona can utilise two complementary approaches: EOQ helps determine the optimal number of items to order, while ROP provides information regarding when it is appropriate to reorder inventory. The application of these two methods not only improves operational efficiency, but is also able to minimise the risk of shortages that can affect customer satisfaction.

Jasa Barona grocery wholesaler is a business that operates in the sale of basic necessities. Since its establishment, Barona Services grocery wholesalers have served various basic food needs for the surrounding community. In carrying out this wholesale operation, purchasing and managing the inventory of basic necessities is based on sales data or field experience alone without using special methods. This is in line with the opinion of Jonathan et al. (2021), data plays an important role in sales. Sellers use sales data to predict demand, understand consumer behaviour, improve operations and align their offerings with customer needs so that they can carry out stock inventory (Adilya, 2024).

MSMEs can be said to be good or bad in carrying out their duties, it can be seen from the role of the company owner in all company activities that are carried out according to plan (Sari et al., 2023). Barona service MSME owners determine inventory from historical data on previous sales. In practice, this creates obstacles such as instability in managing the inventory of basic necessities. And it turns out that the results of such a method of determination are not effectively used in wholesale. Jasa Barona grocery wholesalers also sometimes buy supplies in large quantities which makes capital expenditures for inventory items also large. This results in a buildup of stock in the warehouse and a lot of excess goods, potentially causing losses to wholesalers. Conversely, there are times when the stock of groceries in the warehouse is minimal, hampering the sales process and reducing the level of sales obtained by wholesalers. Referring to these conditions, Jasa Barona grocery wholesalers are not optimal when carrying out inventory control of their goods. Therefore, a special method is needed so that the ordering level is optimal by reducing

inventory costs and purchasing costs using the EOQ and ROP methods. Through this method, Jasa Barona grocery wholesaler is expected to further optimise its inventory control.

Therefore, as a form of novelty in this study, when viewed in the research of Heriawan et al. (2024), researchers only use the EOQ method to help companies decide to order optimally in order to optimise the amount of goods that must be ordered. Whereas in this study, according to the author, in addition to using the EOQ method, the ROP method is also needed to help wholesalers find out a good time to reorder inventory.

II. RESEARCH METHODS

According to Sugiyono (2021) there are two types of data in research, including: (1) Qualitative, research that emphasizes aspects of further understanding of the problem under review in a generalised manner (Ahmad et al., 2023). (2) Quantitative, data in the form of numbers, the existence of data with quantitative content, namely numbers obtained from combinations or measurements. Quantitative data is obtained based on the total combination which always uses numbers. In the research the author uses quantitative methods. The types of data used include (1) Primary data, namely data directly from the source (Hafira et al., 2023), primary data in the study, namely data from interviews regarding trade goods inventory. And (2) Secondary data, sourced from information on reports on the purchase of inventory goods at the Barona Services UMKM wholesaler. The data collection technique uses interviews with wholesale owners and document studies in the form of reports on purchasing inventory at wholesalers. The location chosen for this research is the Barona grocery wholesaler located on Jalan Tuasan, Sidorejo Hilir, Kec. Medan Tembung, Medan City, North Sumatra. The research time was conducted in January 2024. The author uses data collection methods carried out interviews and document studies. In the research carried out direct questions and answers to the parties related to the preparation of the research. And studying sales data for 6 months from the results of the interview (Ramayana et al., 2023). Data analysis uses economic order quantity and reorder point methods, and the following EOQ & ROP formulas:

$$\text{Economic Order Quantity (EOQ)} = \sqrt{\frac{2 \times D \times S}{H}} \qquad (1)$$

Description :

EOQ	= Optimum number of units per order
D	= Total demand for one period
S	= Ordering cost
H	= Storage cost per unit per year pertahun

While the ROP with the formula :

$$\text{ROP} = d \times L \qquad (2)$$

Description :
ROP = Reorder point
D = Demand per day
L = New order lead time (days)

III. RESULT AND DISCUSSION

TABLE I. BOOKINGS DURING DEC 2023-MAY 2024

| Month | Item type | | | | |
	Rice (kg)	Oil (kg)	Salt (kg)	Sugar (kg)	Eggs (kg)
December	1.500	1.200	10	730	37,6
January	1.800	1.200	10	750	37,6
February	1.625	1.300	10	700	28,2
March	1.550	1.500	10	740	56,4
April	1.600	1.400	10	730	37,6
May	1.500	1.450	10	750	37,6
Total	9.575	8.050	60	4.400	235

Source: Barona Services Groceries (Dec 2023-May 2024)

TABLE II
SALES DURING DEC 2023-MAY 2024

| Month | Item type | | | | |
	Rice (kg)	Oil (kg)	Salt (kg)	Sugar (kg)	Eggs (kg)
December	1.500	1.200	10	720	37,6
January	1.750	1.200	10	750	37,6
February	1.625	1.250	10	700	28,2
March	1.500	1.200	10	720	56,4
April	1.625	1.500	10	720	37,6
May	1.500	1.500	10	750	37,6
Total	9.500	7.850	60	4.360	235

Source: Barona Services Groceries (Dec 2023-May 2024)

Table 2 shows the total amount of raw material orders within 6 months, oil was ordered as much as 7,850 kg in 6 months, then rice as much as 9,500 kg in 6 months, salt 60 kg, sugar as much as 4,360 and eggs as much as 235 kg in 6 months.

Results of Calculation of Ordering Costs for 6 Months

Based on the results of interviews at wholesale Sembako Jasa Barona costs include telephone costs, general administrative costs, shipping costs, and other components as follows:

TABLE IIII
COST OF ORDERING GOODS

Type of Expense	Total Cost per Month	Per 6 Months
Telephone Costs	Rp 10.000	Rp 60.000
Shipping Cost	Rp 30.000	Rp 180.000
Total cost of Ordering	Rp 40.000	Rp 240.000

Source: Barona Services Groceries (Dec 2023-May 2024)

Table 3 shows that the cost of ordering basic food supplies incurred by the wholesale owner for 6 months is Rp. 240,000, with telephone costs of Rp. 10,000 per month, shipping costs of Rp. 30,00, and ordering costs of Rp. 40,000.

Results of Calculation of Goods Storage Costs

According to the results of observations at the wholesale Sembako Jasa Barona the cost burden includes, electricity, water & telephone costs, warehouse rental costs with the following cost components:

TABLE IIIV
GOODS STORAGE COSTS

Type of Expense	Total Cost per Month	Per 6 Months
Electricity costs	Rp 500.000	Rp 3.000.000
Warehouse rental fee	Rp 1.200.000	Rp 7.200.000
Total expense cost	Rp 1.700.000	Rp 10.200.000

Source: Barona Services Groceries (Dec 2023-May 2024)

Table 4 shows that the storage cost incurred by the wholesale owner is IDR 10,200,000 per 6 months.

Calculation of Goods Inventory Using the EOQ Method

In order to calculate the total inventory, safety stock and reorder point of each raw material, the order cost of each raw material and the storage cost of each raw material should be known first. To calculate the cost per raw material, the formula is used:

$$H = \frac{\text{total storage cost}}{\text{average quantity of raw material inventory}} \quad (3)$$

$$H = \frac{10.200.000}{22.005}$$

$$H = 463,53$$

So the storage cost of each raw material is Rp.463.53. Meanwhile, to calculate the monthly order, the formula:

$$S = \frac{\text{total ordering cost}}{\text{total raw material order}} \times \text{quantity of each raw material} \quad (4)$$

Rice :

$$S = \frac{240.000}{3.930} \times 9.500$$

$$S = 580.152$$

Salt :

$$S = \frac{240.000}{3.930} \times 60$$

$$S = 3.664$$

Egg:

$$S = \frac{240.000}{3.930} \times 235$$

$$S = 14.351$$

Oil :

$$S = \frac{240.000}{3.930} \times 7850$$

$$S = 479.389$$

Sugar :

$$S = \frac{240.000}{3.930} \times 4.360$$

$$S = 266.259$$

Oil Economic Order Quantity Method

The EOQ method will allow companies to determine the most effective and economical total order quantity of trade goods through a fixed amount of demand and lead time.

Based on the data above, an example of oil EOQ calculation is:

$$Economic\ Order\ Quantity\ (EOQ) = \sqrt{\frac{2 \times 7.850 \times 479.389}{463,53}}$$

$$Economic\ Order\ Quantity\ (EOQ) = \sqrt{16.237.152,50}$$

$$Economic\ Order\ Quantity\ (EOQ) = 4.029$$

Based on the EOQ calculation above, the result is 4,029, so the wholesale groceries of Barona Services must order 4,029 Kg of oil every time they order, then so on the same as for rice, salt, sugar and eggs calculated with the same formula as above.

TABLE V

EOQ RESULT

Type of Material	Ordering Quantity (D)	Ordering Cost (S)	Storage Cost (H)	Average Order Quantity	EOQ
Rice	9.5	580.152	463,53	1.583	4.876
Oil	7.85	479.398	463,53	1.57	4.029
Salt	60	3.664	463,53	12	30,79
Sugar	4.36	266.259	463,53	726	2.238
Eggs	235	14.351	463,53	39	120,62

Source: Researcher Data, 2024

Frequency of Ordering Oil Ingredients

Through the EOQ method, it can be calculated the number of ordering frequencies in a period of one year, which is commonly known as the frequency of purchases, using the formula:

$$Frequency\ of\ Purchase = \frac{D}{EOQ} \qquad (5)$$

(5)

$$Frequency\ of\ Purchase = \frac{7.850}{4.209}$$

$$Frequency\ of\ Purchase = 1,948$$

Oil Reorder Point

In order to determine the reorder point, it can be calculated using the formula:

$$ROP = d \times L \qquad (6)$$

Description :

ROP   = Reorder point
D   = Demand per day
L   = New order lead time (days)
ROP   = 1,948 x 3 = 5,8

Wholesale groceries Jasa Barona will carry out a back order when the inventory of goods is running out. While according to the analysis of efficient inventory of trade goods, the Barona Services grocery wholesaler must procure a back order when the inventory of trade goods is 5.8 kg. and so on the same calculation is carried out for rice, oil, salt and eggs.

TABLE VI

RECAPITULATION OF ROP RESULTS

Type of Material	ROP
Rice	5,84
Oil	5,84
Salt	6
Sugar	5,84
Eggs	5,87

Source: Researcher Data, 2024

The management of raw material inventory is very important in maintaining the smooth production process and meeting consumer demand. Every company needs an optimal management system to avoid obstacles in their operations, such as shortages or excess raw materials. The Economic Order Quantity (EOQ) and Reorder Point (ROP) methods are two techniques that have proven effective in managing inventory efficiently, as various studies have shown (Kumar & Gupta, 2022; Liu & Zhang, 2023).

This study found that the application of the EOQ and ROP methods at Jasa Barona wholesalers can save inventory costs and improve operational efficiency. Prior to the application of these methods, wholesalers often experienced overstock or running out of inventory, which had a negative impact on the smooth production and sales process. This is consistent with the findings of Febriani et al. (2024), which showed that the EOQ and ROP methods were able to overcome the problem of overstock and understock in MSMEs, thereby increasing profitability.

TABLE VII

COMPARISON BEFORE AND AFTER THE IMPLEMENTATION OF EOQ & ROP

	Before Implementing EOQ & ROP		After Implementing EOQ & ROP	
	wholesale optimal purchasing	reorder point	optimal purchase	reorder point
Rice	9.575	-	4.876	5,84
Oil	8.050	-	4.029	5,84
Salt	60	-	30,79	6
Sugar	4.400	-	2.238	5,84
Eggs	235	-	120,62	5,87

Source: Researcher Data, 2024

It can be seen that the comparison before and after the application of the EOQ & ROP method, the number of orders

before its application is greater than the results after its application. For example, the purchase quantity for rice before the application of the method was 9,575 units, while after the application of the EOQ method, the purchase quantity became 4,876 units. The application of this method provides significant efficiency in expenditure. The same applies to other ingredients such as oil, salt, sugar, and eggs. Before the application of the ROP method, this MSME wholesaler placed an order once a month, even though the amount of inventory was still large. With the application of the ROP method, the remaining amount of inventory can be known when placing an order, which helps minimise overstock and stock-outs. This shows that the management of inventory at the Barona Services wholesaler is more efficient after the application of the two methods.

Research by Diani & Lubis (2022), supports that the application of EOQ and ROP can assist companies in knowing the optimal amount of raw materials that need to be ordered and when is the right time to reorder. This is important to avoid losses caused by inventory imbalances, which are also seen in Barona Services wholesalers. This is in accordance with previous findings that inefficient inventory management can cause serious problems in business operations (Smith & Johnson, 2021).

Another study by Sinta et al. (2024), mentioned that without good inventory management, companies will face problems in fulfilling consumer orders efficiently. This supports the results of this study which show that the wholesaler Jasa Barona experienced a reduction in the number of orders and costs after applying the EOQ and ROP methods, as seen in rice raw materials and other goods. Research by Rahman & Suwandi (2021), also found that implementing EOQ can significantly reduce storage costs and minimise the risk of overstocking.

Additional research in recent years has also highlighted the importance of technology and data integration in inventory management. For example, a study by Hariyanto et al. (2024), shows that companies that use information systems in inventory management tend to be more efficient in managing stock and orders. This could be a further consideration for Barona Services wholesalers to improve their management system. In line with that, research by Choi & Park (2022) emphasised that the application of technology in the EOQ and ROP systems can further optimise the inventory management process.

Other research such as that conducted by Hasibuan et al. (2023) revealed that the EOQ method not only helps optimise inventory but can also play a role in reducing storage and maintenance costs. This is reinforced by a study by Liu et al. 2024) which shows that a combination of EOQ and ROP methods can reduce the risk of overstocking and improve operational efficiency in various industrial sectors.

Overall, the implementation of EOQ and ROP in Jasa Barona wholesalers has proven to be effective in reducing inventory costs and improving ordering efficiency. Thus, this model can be recommended for adoption by more MSMEs as a more efficient inventory management strategy.

IV. CONCLUSION

This study aims to apply the Economic Order Quantity (EOQ) and Reorder Point (ROP) methods as inventory control

strategies in Barona Services MSMEs. Based on the results of data analysis and discussion, it is found that the application of these two methods is able to provide an effective solution in overcoming overstock and understock problems that are often experienced by wholesalers. By using the EOQ method, a more optimal order quantity can be achieved, while ROP helps determine the right reorder time. The results show that the inventory quantities of items such as rice, oil, salt, sugar, and eggs are more efficient after applying EOQ, with a significant reduction in purchase quantities compared to the previous method. In addition, the application of ROP also prevents the occurrence of excess stock by ensuring orders are placed when inventory reaches a critical point, thereby reducing unnecessary inventory costs. The findings of this study indicate that the implementation of EOQ and ROP not only improves operational efficiency, but also has a positive impact on cost control and business profitability. Barona Services Wholesale experienced savings in inventory costs and improved efficiency in stock management, which directly impacted on improving the competitiveness of the business in the market. This research confirms that the EOQ and ROP methods are highly relevant to MSMEs, especially in the wholesale sector, to maintain inventory balance and optimise the use of resources.

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