
Article

Optimization of Re-Order Point (ROP) and Safety Stock (SS) for RON 92 Fuel (Pertamax) Using the Economic Order Quantity (EOQ) Method at Pertashop Ulak Bandung, Muara Enim Regency

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Abstract: This study examines inventory control for RON 92 (Pertamax) fuel using the Economic Order Quantity (EOQ) method at Pertashop Ulak Bandung, Muara Enim Regency. The objective of this research is to analyze inventory control by implementing Economic Order Quantity (EOQ), Safety Stock (SS), Re-Order Point (ROP), and Total Inventory Cost (TIC) through a quantitative descriptive approach. Primary data were used, covering a one-year period from January 2024 to December 2024. Data were processed using Microsoft Excel. The results show that the optimal economic order quantity is 6,289.37 liters per order. The required safety stock is 119.05 liters, while the re-order point is determined at 1,719.05 liters. Furthermore, implementing the EOQ method successfully reduced the Total Inventory Cost (TIC) by Rp12,306,739.12 compared to the existing company policy.

Keywords: *Inventory Control, RON 92 Fuel (Pertamax), Economic Order Quantity (EOQ), Safety Stock (SS), Re-Order Point (ROP), Total Inventory Cost (TIC)*

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1. Introduction

Inventory is one of the essential elements in company operational activities because it supports the smooth process of production and distribution in meeting customer demand. Effective inventory control is required to ensure product availability without causing excessive holding costs or stockout risks that may disrupt operational activities (Render & Heizer, 2017). In operations management, balancing inventory levels with demand is crucial to maintain cost efficiency and service continuity (Handoko, 2019).

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Inaccurate inventory management can increase operational costs, lower service levels, and result in lost sales opportunities due to delayed order fulfillment (Rangkuti, 2017). Stockout risks can hinder business activities, while overstocking increases inefficient carrying costs (Tampubolon, 2019). Therefore, an appropriate inventory control method is needed to determine optimal order quantity and timing to achieve cost efficiency and stable operations.

Previous studies have shown that the EOQ method effectively reduces inventory costs and improves operational efficiency. Laoli et al. (2022) [1] proved that the EOQ method can reduce total inventory costs in the distribution sector. However, most previous studies focused on manufacturing and retail industries. Limited research has examined inventory control models for small-scale energy distribution sectors such as Pertashop. This raises a research gap in the need for a more applicable inventory control approach for volatile demand conditions with high stockout risks.

In fuel distribution operations, inventory availability is crucial to maintaining service continuity. This condition also applies to Pertashop, an official fuel distributor managed by Pertamina that operates in rural areas far from conventional gas stations. However, several Pertashop units experience challenges in inventory control due to unplanned procurement policies. Pertashop Ulak Bandung, for instance, frequently experiences stockouts of RON 92 (Pertamax) due to supply fluctuations.

Operational data in 2024 show that Pertashop Ulak Bandung operated only 223 days (61%) throughout the year. The remaining 39% represent non-operational days due to stock depletion and delayed re-ordering. This issue disrupts customer service, reduces potential revenue, and diminishes operational reliability. Furthermore, procurement decisions are based on subjective estimates and cash availability without structured inventory calculations. The absence of safety stock (SS) and re-order point (ROP) policies results in a lack of minimum inventory thresholds to trigger re-ordering decisions.

These issues show that Pertashop Ulak Bandung lacks optimal inventory control implementation. Inventory management is currently based on estimation rather than structured quantitative calculations. Consequently, risks of stock depletion, increasing operational costs, and declining service quality remain significant. Implementing the Economic Order Quantity (EOQ) method combined with Safety Stock (SS) and Re-Order Point (ROP) becomes a relevant solution to support more accurate fuel ordering decisions.

Based on this explanation, this study aims to:

- i. Calculate optimal order quantity using the Economic Order Quantity (EOQ) method
- ii. Determine appropriate Safety Stock (SS) levels to anticipate demand fluctuations
- iii. Determine Re-Order Point (ROP) as a basis for fuel re-ordering timing

The findings of this study are expected to provide an effective inventory control recommendation for Pertashop and serve as a reference for similar energy distribution businesses in improving operational efficiency.

2. Methods

The Economic Order Quantity (EOQ) is a method used to optimize ordering quantities by determining the most economical order size while ensuring budget efficiency and meeting demand (Latifah et al., 2024) [2].

According to Waters (2003) [3] in Inventory Control and Management, the EOQ formula is as follows:

$$\text{Economic Order Quantity} = \sqrt{\frac{2 \times RC \times D}{HC}}$$

Description:

- Re-Order Cost (RC): Cost incurred for re-ordering
- Demand (D): Amount of demand to be supplied
- Holding Cost (HC): Storage cost

After determining the optimal order quantity, total holding costs are expected to become more efficient. According to Badriyah et al. (2022) [4], the Total Inventory Cost (TIC) formula is as follows:

$$TIC = \left(\frac{D}{Q} S\right) + \left(\frac{Q}{2} H\right) + (UC \times D)$$

Description:

- TIC: Total Inventory Cost
- D: Demand
- S: Ordering Cost
- H: Holding Cost
- UC: Unit Cost

According to Nur Bahagia (2006) [5], the safety stock (SS) formula is as follows:

$$\text{Safety Stock} = ZaS\sqrt{L}$$

Description:

- a: Probability of stock shortage
- Za: Standard normal distribution value
- S: Standard deviation of daily demand
- L: Lead Time

According to Nur Bahagia (2006) [5] in Inventory System, the formula for Re-Order Point is:

$$r^* = DL + SS$$

Description:

- r^* : Re-Order Point (ROP)
- D: Demand
- L: Lead Time
- SS: Safety Stock

3. Results

Table 1. RON 92 (Pertamax) Fuel Ordering Data

Month	Order Stok RON 92 Fuel (Liters)	Price of RON 92 Fuel (IDR)
January	2.000	12.700
February	7.000	12.700
March	2.000	12.700
April	3.000	12.700
May	4.000	12.700
June	2.000	12.700
July	1.000	12.700
August 1	3.000	12.700
August 2	1.000	13.000
September	1.000	12.150
October	2.000	11.500
November	2.000	11.500
December 1	1.000	11.500
December 2	1.000	11.200
Total	32.000	172.450

Table 2. RON 92 (Pertamax) Re-Order Point (ROP)

Definition	Total
Travel Distance	150 km
Fuel Allowance	50 Liters x Rp 9.000 = IDR 450.000
Travel Allowance	IDR 625/km x 150 km = IDR 93.750
Total Re-Order Cost	IDR 543.750

Based on the table above, the fuel and transportation costs associated with ordering RON 92 (Pertamax) fuel in 2024 amounted to Rp543,750. In addition, the distance from the

depot to the unloading location (Pertashop), as well as related fuel and transportation costs, remained constant and unchanged throughout the period. As a result, order quantities remained the same throughout 2024.

Table 3. Holding Cost

Keterangan	
Holding Cost Depot	Rp 24.950.000,00
Holding Cost Pertashop	Rp 3.202.333,33
Total	Rp 28.152.333,33

Based on the table above, the total annual holding cost is Rp28,152,333.33, which includes depot rental fees, employee wages, electricity and water costs, as well as other expenses related to operational activities at Pertashop Ulak Bandung, Muara Enim Regency.

Based on data obtained from PT Lematang Mandiri Group, the following is the calculation and analysis of inventory control of RON 92 (Pertamax) fuel at Pertashop Ulak Bandung:

$$\text{Average purchase} = \frac{\text{Total Fuel Demand (RON 92 fuel)}}{\text{Order Frequency per Year}}$$

$$\text{Average purchase} = \frac{32,000 \text{ liters}}{32 \text{ orders}}$$

$$\text{Average purchase} = 1,000 \text{ liters}$$

Based on the calculation, the average purchase volume of RON 92 (Pertamax) fuel by the management of Pertashop Ulak Bandung is 1,000 liters per order.

$$\text{Holding Cost} = \frac{\text{Total Holding Cost}}{\text{Total Fuel Demand}}$$

$$\text{Holding Cost} = \frac{\text{Rp } 28,152,333.33}{32,000 \text{ liters}}$$

$$\text{Holding Cost} = \text{Rp}879.76$$

Thus, the holding cost per liter is determined to be Rp879.76, which must be allocated by the management of Pertashop Ulak Bandung.

$$TIC = \left(\frac{P}{Q} s \right) + \left(\frac{Q}{2} H \right) + (\text{unit cost} \times D)$$

$$TIC = \left(\frac{32,000}{1,000} \times 543,750 \right) + \left(\frac{1,000}{2} \times 879.76 \right) + (12,317.86 \times 32,000)$$

$$TIC = \text{Rp}412,011,400$$

Economic Order Quantity (EOQ) Calculation

The Economic Order Quantity (EOQ) calculation is a key inventory control method used to determine the optimal order size that minimizes total inventory cost. The following data were obtained from Pertashop Ulak Bandung, Muara Enim Regency:

- Total demand for RON 92 fuel: 32,000 liters
- Re-order cost (RC): Rp543,750
- Holding cost per liter (HC): Rp879.76
- Average unit cost (UC): Rp12,317.86
- Lead time: 1 day
- Number of working days: 365 days per year

$$\begin{aligned}
 \text{Economic Order Quantity (EOQ)} &= \sqrt{\frac{2 \times RC \times D}{HC}} \\
 &= \sqrt{\frac{2 \times 543,750 \times 32,000}{879.76}} \\
 &= 6,289.37 \text{ liter}
 \end{aligned}$$

Based on the EOQ calculation, the optimal order quantity per purchase is 6,289.37 liters. To determine purchase frequency, the following formula is applied:

$$\begin{aligned}
 N &= \frac{D}{EOQ} \\
 N &= \frac{32,000}{6,289.37} \\
 N &= 5.09
 \end{aligned}$$

The results indicate that RON 92 (Pertamax) fuel purchases should be made five times per year. The total inventory cost after implementing EOQ is shown as follows:

$$\begin{aligned}
 TIC &= \left(\frac{D}{Q} s\right) + \left(\frac{Q}{2} H\right) + (\text{unit cost} \times D) \\
 TIC &= \left(\frac{32,000}{6,289.37} \times 543,750\right) + \left(\frac{6,289.37}{2} \times 879.76\right) + (12,317.86 \times 32,000) \\
 TIC &= Rp399,704,661.88
 \end{aligned}$$

Safety Stock Calculation

Pertashop Ulak Bandung must determine an appropriate safety stock level to ensure inventory availability functions effectively. Based on the data obtained, the safety factor set by management is 1.65, equivalent to a 95% service level. The selection of a 95% service level is intended to reduce the risk of stockouts by 5%. The following data are required to determine the safety stock:

Table 4. Standard Deviation Calculation

- Service level (α) = 95% $\rightarrow$ z-score = 1.65
- Lead time (LT) = 1 day $\rightarrow \sqrt{(1/365)}$ = 0.05
- Standard deviation calculation:

No.	Month	Demand (Liter)	$\bar{x}$	$(x - \bar{x})^2$
1	January	2,753.88	2,812.82	3,473.69
2	February	6,636.46	2,812.82	14,620,208.78
3	March	3,070.00	2,812.82	66,141.54
4	April	2,646.00	2,812.82	27,828.91
5	May	3,200.00	2,812.82	149,908.35
6	June	2,447.54	2,812.82	133,428.13
7	July	1,000.00	2,812.82	3,286,316.35
8	August	4,500.00	2,812.82	2,846,576.35
9	September	1,500.00	2,812.82	1,723,496.35
10	October	1,700.00	2,812.82	1,238,368.35
11	November	2,064.00	2,812.82	560,731.39
12	Desember	2,236.00	2,812.82	332,721.31
Jumlah		33,753.88		24,989,199.53

$$\text{Standar Deviasi (S)} = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

$$\text{Standar Deviasi (S)} = \sqrt{\frac{24,989,199.53}{12}}$$

$$\text{Standar Deviasi (S)} = 1,443.06$$

From the calculation, the standard deviation of daily demand is 1,443.06 liters. The lead time required is one day, and the period considered is 365 days.

$$\begin{aligned} \text{Safety Stock (ss)} &= Z\alpha S\sqrt{L} \\ &= 1.65 \times 1,443.06 \times \sqrt{1/365} \\ &= 119.05 \text{ liters} \end{aligned}$$

Based on the Safety Stock calculation, the optimal safety stock required is 119.05 liters.

Re-Order Point (ROP) Calculation

The Re-Order Point (ROP) is the threshold at which a new order must be placed to ensure timely replenishment and prevent prolonged stockouts. Based on operational data, total annual demand during 2024 was recorded at 32,000 liters. The calculated safety stock is 119.05 liters, with a lead time of one day or 0.05 years. The ROP calculation is as follows:

$$\begin{aligned}
 r^* &= DL + SS \\
 &= (32.000 \times 0,05) + 119,05 \\
 &= 1.719,05 \text{ liter}
 \end{aligned}$$

Based on the calculation, the re-order point is set at 1,719.05 liters. This means an order should be placed when the remaining inventory reaches this level.

4. Conclusion and Recommendations

4.1 Conclusion

Based on the calculations using the EOQ, SS, ROP, and TIC formulas, the results obtained before and after implementing these methods are as follows:

Table 5. Results Before and After Implementing EOQ, SS, ROP, TIC

No.	Description	Calculation Using Company Policy	Calculation Using EOQ Method
1	Average Purchase	1,000 liters	6,289.37 liter
2	Re-Order Cost	IDR 6,525,000 (543,750*32)	IDR 2,718,750 (543,750*5)
3	Holding Cost	IDR 879.76	IDR 879.76
4	Total Inventory Cost	IDR 412,011,400	IDR 399,704,660.88
5	Order Frequency	32 times	5 times
6	Safety Stock	80 liters	119.05 liters
7	Re-Order Point	-	1,719.05

Based on the EOQ calculation, the recommended average purchase volume is 6,289.37 liters compared to the previous policy of only 1,000 liters. This adjustment significantly affects ordering costs. According to the EOQ calculation, the required ordering cost is Rp2,718,750, whereas the previous policy incurred Rp6,525,000. This difference arises because, prior to implementing the EOQ method, the company placed 32 orders throughout the year. Frequent ordering contributed to excessive ordering expenses.

The safety stock (SS) required after implementing the EOQ method is 119.05 liters. Previously, Pertashop Ulak Bandung maintained a safety stock of 80 liters stored in the main bunker. An additional safety bunker with a capacity of 3,000 liters is available at the Pertamina depot; however, this facility has not been utilized effectively.

The re-order point (ROP) calculated using the EOQ method indicates that replenishment should occur when inventory levels fall to 1,719.05 liters or 1.28% of the main bunker capacity. Previously, Pertashop Ulak Bandung did not apply structured inventory calculations, resulting in unplanned and irregular ordering schedules.

Based on the calculation and graphical analysis, it can be concluded that the difference in total inventory cost before and after implementing the EOQ method is significant. This is

evidenced by a reduction in Total Inventory Cost (TIC) of Rp12,306,739.12, representing a substantial improvement in cost efficiency.

4.2 Recommendation

Based on the conclusions derived from this study, Pertashop Ulak Bandung in Muara Enim Regency is advised to re-evaluate its RON 92 (Pertamax) fuel inventory policy by adopting the EOQ method. Inventory control can be optimized by aligning the capacity of the Pertashop bunker with the available storage facilities at the Pertamina depot.

To prevent capacity overload, one feasible approach is to divide ordering into two cycles. This strategy ensures continuous fuel availability while maintaining compatibility with the 3,000-liter bunker capacity at both the Pertashop facility and the depot. Given that management previously accommodated 32 ordering cycles, this adjustment should be manageable.

Adjusting the safety stock level to 119.05 liters is necessary to enhance inventory stability. Additionally, considering the high demand for fuel, expanding the storage bunker capacity should be considered as a strategic measure to increase supply reliability.

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