P-ISSN: 2088-9372 E-ISSN: 2527-8991

Jurnal Manajemen dan Organisasi (JMO),
Vol. 14 No. 3, September 2023, Hal. 310-321
DOI: 10.29244/jmo.v14i3.45513

Inventory Cost Reduction with Economic Order Quantity for Filter Spare Part in Aircraft Filling Depot

Efisiensi Biaya Persediaan pada *Spare Part Filter* dengan *Economic Order Quantity* di Depot Pengisian Pesawat

Atita Furtyfatimah
PLTU Batang, Rowokudo, Ujungnegoro, Kandeman, Batang
E-mail: atitafurtyfatimah@gmail.com
Andian Ari Istiningrum*
Politeknik Energi dan Mineral AKAMIGAS, Jalan Gajah Mada No 38 Cepu Blora
E-mail: andian.istiningrum@esdm.go.id
Sono
Politeknik Energi dan Mineral AKAMIGAS, Jalan Gajah Mada No. 38 Cepu, Blora
E-mail: sono@esdm.go.id

ABSTRACT

Filter is one of the spare parts playing an important role in maintaining the quality of aviation fuel. Filter replacement is increasingly being carried out when the frequency of aviation fuel distribution is higher. Therefore, it is necessary to control the filter level of inventory. This research aimed to design filter ordering schemes by Economic Order Quantity (EOQ) and to reduce the inventory cost for filter in aircraft filling depot. This research was conducted in one of aircraft filling depot in Indonesia. The data regarding filter demand, lead time, ordering cost, and carrying cost were collected from the depot's documents. Several steps were conducted to achieve the purposes of the research including classifying filter category by ABC method, calculating optimal order quantity, order frequency, safety stock, reorder point, and inventory cost. The inventory cost calculated by EOQ was then compared to the actual inventory cost incurred in the depot to determine the inventory cost reduction. The implementation of EOQ enabled the depot to reduce its inventory cost by Rp8.348.848,20 or there was a 73,22 percent inventory cost reduction.. The EOQ used in this research was adapted to the difficulties of the depot to predict the demand of filters. The probabilistic EOQ used in this research was expected to be the contribution from this research since this method tended to be used in the uncertainty condition. Based on this method, the safety stock was calculated as a way to reduce the uncertainty demand and the risk of filter shortage.

***Keywords**: Depot, economic order quantity, filter, inventory cost reduction, spare part.*

ABSTRAK

Filter merupakan suku cadang yang berperan penting dalam menjaga kualitas avtur. Penggantian filter semakin sering dilakukan ketika frekuensi penyaluran avtur semakin tinggi. Oleh karena itu, persediaan filter perlu dikendalikan. Penelitian ini bertujuan untuk mendesain skema pemesanan spare part filter di depot pengisian pesawat udara dengan menggunakan metode Economic Order Quantity (EOQ) dan sekaligus mengurangi biaya persediaan filter tersebut. Penelitian ini dilaksanakan di salah satu depot pengisian pesawat udara di Indonesia. Data mengenai permintaan filter, lead time, biaya pemesanan, dan biaya penyimpanan dikumpulkan dari dokumen-dokumen perusahaan. Beberapa langkah dilakukan untuk mencapai tujuan penelitian, meliputi klasifikasi kategori filter berdasarkan metode ABC, menghitung jumlah pemesanan optimal, frekuensi pemesanan, persediaan pengaman, titik pemesanan, dan biaya persediaan. Biaya persediaan yang dihitung berdasarkan metode EOQ kemudian dibandingkan dengan biaya persediaan aktual yang muncul di depot. Implementasi metode EOQ pada penelitian ini memberikan hasil pengurangan biaya persediaan yang sangat signifikan yaitu sebesar 73,22 persen. EOQ pada penelitian ini diharapkan memberikan kontribusi bagi depot untuk mengatasi kesulitan depot dalam memprediksi permintaan filter. Dalam kondisi yang tidak pasti, EOQ probabilistik dalam penelitian ini membantu depot untuk mengurangi risiko kehabisan filter dengan adanya perhitungan persediaan pengaman.

Kata kunci: biaya persediaan, depot, economic order quantity, filter, suku cadang.

Corresponding author

INTRODUCTION

Indonesia, which is known as the biggest archipelago country around the world, has 17.499 islands with a coastline of 81.000 kilometers (Soemarmi *et al*., 2019). Since the water areas in Indonesia are wider than its land, the aviation sector plays an important role in the transportation system. Air transportation is considered as a transportation system with high level of technology allowing flights to reach their destinations in a short time and high level of safety.

Turbo-engine aircrafts use aviation turbine fuel as their fuel. The provision of aviation turbine fuel for aircraft filling in an airport is managed by the aircraft filling depot. This depot has the role to ensure that the aviation turbine fuel inventory is able to meet the demands of airlines and the facilities are in a good condition and ready to be operated optimally. The aviation turbine fuel distributed to aircraft must meet all specifications set by the Director General of Oil and Gas. This indicates that the quality control of aviation turbine fuel is a major concern for the depot in carrying out operation for receiving, storing, and distributing aviation turbine fuel to airlines.

One of the activities that must be carried out by the depot to ensure the quality of aviation turbine fuel is filtering. This process aims to filter and separate water from aviation turbine fuel so that the accumulation of water, dirt, surfactants, and bacteria contaminations can be minimized (Aviation, 2016). One of the spare parts that plays an important role in the filtering process is the filter itself. Filter performance must be monitored regularly due to its quality depends on the amount of aviation turbine fuel and the usage time. The more the amount of aviation turbine fuel distributed to aircraft, the more often the filter will work to filter out water and other surfactants. As a result, the filter has to be replaced more frequently by the depot. The depot has to maintain filter inventory due to the highly probabilistic nature of filter replacement. The absence of filter may obstruct the operation of distributing aviation turbine fuel to the aircrafts and generate losses for both airlines and depot. Two specific filters hold the most significant role in ensuring that aviation turbine fuel is on-specification. Those filters are filter monitor CDF 230 P located in the refueller and dispenser and coalescer I 565 C5TB located in the receiving lines (Aviation, 2016). The depot must have those filters on hand when they are needed for replacement**.**

The filter inventory control is a challenge for the depot due to the difficulties to predict the demand of filter, as it was observed in one aircraft filling depot in Indonesia. A small number of filter inventory may result in a shortage to replace damaged filters, whereas a big number of filter inventory is a waste for the depot. Due to its physical characteristics, the filter cannot be stored during a long period of time (Zaldiansyah, 2012).

Inventory is a company asset whose availability is crucial in the business world. However, inventory is also seen as an idle resource for the company. The funds that are already invested to acquire inventory cannot be used for funding other business activities. Therefore, the inventory should be managed carefully by implementing an appropriate inventory control method. The method enables the company to plan the optimal level of inventory investment and maintain the optimal inventory cost (Basuki, 2018).

Economic Order Quantity (EOQ) is an inventory control method enabling the company to determine the optimal order quantity and the appropriate time to order (Unsulangi *et al*., 2019). The EOQ method is also a powerful method that can be used to purchase raw materials and spare parts at the optimal number as well as to derive at the minimum inventory costs (Dewi *et al*., 2020). Ordering cost as well as carrying cost as parts of inventory costs have to be considered by the company in determining the optimal order quantity (Ritawiyati *et al*., 2018; Lopez *et al*., 2020). Ordering costs are costs incurred during the ordering process on progress, such as administration cost, delivery cost, unloading cost, and inspection cost during receiving activity. While, carrying costs are the costs related to the item storage for certain period of time, such as utilities cost, material handling cost, inspection cost, administration cost, and wages for warehouse operator (Anggi & Wahyuningsih, 2019).

In addition, the nature of demand and lead time are carefully deliberated to determine whether the EOQ methol will be deterministic or probabilistic. If demand and lead time cannot be determined for certain, the probabilistic EOQ will be the accurate method to be implemented

Jurnal Manajemen dan Organisasi (JMO), Vol. 14 No. 3, September 2023, 310-321

to control the level of inventory (Distriana & Sukmono, 2015). Shortage is a consequency of such probabilistic condition and it may result in the shortage cost and the increase amount of inventory cost (Pulungan & Fatma, 2018). Therefore, it is necessary for the company to calculate safety stock to reduce the risk of shortage (Trihudiyatmanto, 2017; Pulungan & Fatma, 2018). In another situation, deterministic EOQ will be applied in a situation that demand and lead time are constant and able to determined precisely (Distriana & Sukmono, 2015).

Previous researches have been conducted to control the level of optimal inventory. The EOQ method was applied to control the optimum level of packaging box and to reduce its inventory cost (Soares *et al*., 2021). They found that the number of packaging box that should be ordered was 509.416 units in 2018 and 504.857 units in 2019 to achieve the optimal number of packaging box inventory. These optimal order quantity would lead to reduce inventoy costs by Rp2.976.698,00. The EOQ method was also succesfully implemented to reduce the inventory cost for fabric raw materials from Rp365.550,00 to Rp81.783,00 or there was a saving for Rp282.766,00. The inventory cost reduction was obtained after the company order fabric raw materials at 66.762 kilogram for every order (Komariah, 2022). Finally, cost savings at 13,84 percent for packaging cup and 5,88 percent for packaging box were also achieved by the company by designing its inventory control method with EOQ method (Umami *et al*., 2018). These savings were a result from implementing EOQ where the packaging cup had to be ordered at 17.691.504 units and packaging box at 368.573 units. This research also identified the number of safety stock that must be maintained by the company – 447.306 units for packaging box and 9.319 packaging box – to eliminate the risk of shortage.

Based on this background, this research had an objective to design two optimal order schemes for filter monitor CDF230P and coalescer I565C5TB so that inventory cost reduction could be achieved. This research was expected to contribute to aircraft filling depot in determining the optimal number of filter order as well as calculating its optimal order frequency and reorder point. The probabilistic EOQ method is another contribution that was derived from this research. Probabilistic condition is a condition creating difficulties for the company to control its inventory due to uncertainty demand and/or lead time. Calculating safety stock is the key point of probabilistic method and it is likely that providing the information about the number of safety stock would result in the reduction of the shortage risk for those two filters.

RESEARH METHOD

This research was conducted to one of aircraft filling depot in Indonesia. The object of this research was the inventory control for filters to reduce inventory cost. The primary data regarding filter categories, lead time for filter ordering, and filter storage system were collected through interview with maintenance supervisor in the depot. In addition, the secondary data regarding filter demand, filter purchase price, filter ordering and carrying costs, and depot's service level were collected through documentation technique.

The data then were analyzed through several steps, including:

1. Classifying filters into three classes based on ABC method. The ABC classification was performed to determine which groups of filters are prioritized to be monitored with EOQ method. The formula to classify inventory under ABC method is shown below: (Sakinah & Herdiani, 2021).
   Total value = unit price x total stock
   Percentage value = (total value/grand total value) x 100 percent
2. Applying EOQ method to control filter inventory in 2021 by calculating optimal order quantity, optimal order frequency, safety stock, reorder point, and total inventory cost. The formulas that were used in EOQ method are shown in Table 1.
3. Determining existing total inventory cost for filter in 2021
4. Comparing the total inventory cost as shown in the EOQ calculation with the total existing inventory cost incurred by the depot during 2021.
5. Designing order schemes for the two filters by implementing EOQ method in 2022.

The formulas that were used in EOQ method are shown in Table 1.

Table 1. EOQ formulas

EOQ Indicator	Formula
Optimal Order Quantity (Q)	$Q = \sqrt{\frac{2DS}{H}}$ D = demand S = ordering cost per each order H = carrying cost per unit
Optimal Order Frequency (F)	$F = \frac{D}{Q}$ D = demand Q = optimal order quantity
Safety Stock (SS)	SS = SD x Z SD = deviation standard Z = service level
Reorder Point	ROP = (avdD x L) + SS avdD = average demand L = lead time SS = safety stock
Total Inventory Cost	$TIC = \left(\frac{D}{Q} S\right) + (\frac{Q}{2} H)$ D = demand Q = optimal order quantity S = ordering cost per order H = carrying cost per unit

Source: Nirfison (2017); Umami *et al*., (2018); Randi & Meirini (2021)

RESULTS AND DISCUSSION

As observed in the depot warehouse, there were 200 filters with a total value approximately Rp200.000.000, 00. The classification of 200 filters was conducted to determine the type of filter that must be controlled carefully. ABC method was applied to classify based on the average filter demand and annual investment rate for purchasing those filters. Table 2 provides information regarding the result of ABC classification for filter in aircraft filling depot. It can be seen that CDF230P filter monitor and I656C5TB coalescer were categorized as class A, therefore those two filters would be considered to be managed carefully with the EOQ method.

It was necessary to acquire data regarding lead time for CDF230P and I565C5TB as well as their ordering and carrying costs since those data are specific aspects that must be considered for EOQ calculation. Table 3 shows the data regarding lead time CDF230P and I565C5TB and it can be seen that lead time for the two filters is approximately one month.

Table 2. ABC classifying result

Filter Code	Value Percentage (%)	Value Accumulation (%)	Class
CDF230P	30	30	A
I656C5TB	29	59	A
SO630VA5	16	75	B
FO644A3	11	86	B
I644C5TB	8	94	C
SO636PV5	4	98	C
I-633VA5	2	100	C

Table 3. Lead time for filter

Filter Code	Order Time	Arrival Time	Lead Time -day	Lead Time - month
CDF230P	12/1/2021	14/2/2021	33	1,10
I656C5TB	3/11/2021	4/12/2021	31	1,03

Ordering cost in this research consisted of administration cost needed to order filters and unloading cost. The information about ordering cost is presented in Table 4.

Table 4. Filter ordering costs

Filter Code	Administration Cost (Rp)	Unloading Cost (Rp)	Ordering Cost (Rp)
CDF230P	150.390,63	78.125	228.515,63
I656C5TB	150.390,63	78.125	228.515,63

Source: Maintenance department (2022)

Carrying cost is cost incurred due to the storage activity consisting of electricity cost in the warehouse and handling cost. The storage time for each filter was different as it was determined by the vendor. The time that was required to store filter monitor and coalescer respectively was 2 years and 5 years. Table 5 presents the data regarding filter carrying cost.

Table 5. Filter carrying costs

Filter Code	Purchasing Price (Rp)	Fraction (%)	Carrying Cost (Rp)
CDF230P	337.115	11,47	38.672,80
I656C5TB	2.209.870	4,20	92.814,72

Source: Data from Maintenance Department (2022)

The EOQ method was then applied to be the inventory control method for the two filters during 2021. The reason underlying the implementation of this method during the previous year was to have empirical evidence that the EOQ method was the appropriate method to be used to reduce filter inventory cost in the depot. Table 6 presents the optimal order quantity and frequency calculated under EOQ method.

Table 6. The optimal order quantity and frequency – 2021

Filter Code	Demand	Optimal Order Quantity (Pcs)	Optimal Order Frequency
CDF230P	180	46	4
I656C5TB	38	14	3

Safety stock was necessary for the depot since the demand for filter was uncertain. Safety stock was required to anticipate unpredictable demand and reduce the risk of filter shortage. The information needed to calculate safety stock consisted of deviation standard and service level applied in the depot. Deviation standard used in this research was the product of the demand deviation standard multiply by the deviation standard during the lead time. The depot set the service level at 95 percent to arrive at Z value 1,644853. Table 7 provides information regarding filter safety stock as calculated under EOQ method. The depot so far had no safety stock, so the risk of filter shortage was high when the warehouse no longer had filter inventory. Therefore, the risk of filter shortage could be eliminated by having 45 pieces CDF230P and 16 pieces 1656C5TB filters as safety stock in the warehouse.

Table 7. Filter safety stock – 2021

Filter Code	Lead Time	Total Deviation Standard	Safety Stock (Pcs)
CDF230P	1,10	27,28	45
I656C5TB	1,03	9,99	16

EOQ method also provides information regarding the appropriate time to order. Table 8 presents reorder point for filter spare parts. Table 8 informs that it was necessary for the depot to order CDF230P when the inventory in the warehouse was 61 pieces left and to order I565C5TB when the inventory in warehouse was 20 pieces left.

Table 8. Filter reorder point – 2021

Filter Code	Average Demand	Lead Time	Safety Stock	Reorder Point
CDF230P	15	1,10	45	61
I656C5TB	3	1,03	16	20

Finally, the total inventory costs for the two filters were calculated under EOQ method. The data regarding demand and optimal quantity to calculate total inventory cost were derived from Table 6. The result is presented in Table 9.

Table 9. Total Inventory Cost for Filter – 2021

Filter Code	Purchase Price (Rp)	Ordering Cost (Rp)	Carrying Cost (Rp)	Total Inventory Cost (Rp)
CDF230P	337.115	228.515,63	38.672,80	1.783.659,78
I656C5TB	2.209.870	228.515,63	92.814,72	1.269.618,33
				3.053.278,11

The actual inventory cost borne by the depot during 2021 for CDF230P as well as I565C5TB based on the depot record was Rp11.402.126,31. This actual cost was compared to the inventory cost under EOQ method to achieve the efficiency at 73,22 percent. If it was implemented, The EOQ method would enable the depot to save its inventory cost by Rp8.348.848,20 during 2021. Since EOQ method was able to reduce filter inventory cost in the depot, this method would be applied as the inventory control method in the following year. EOQ method was implemented as a based to design filter order scheme in 2022 for CDF230P and I656C5TB.

The initial step to design the scheme was by forecasting the demand for CDF230P and I565C5TB in 2022. The forecasting used the data regarding CDP230P and I656C5TB demands from 2014 to 2021. The plots of those data are shown in Figure 1 and 2. Firstly, it was necessary to determine whether the data is stationary or non-stationary data. The Autocorrelation Function (ACF) Graph was plotted to determine stationary in means as shown in Figure 3 and 4. As can be seen in Figure 3 and 4, no lag exceeded the interval line, therefore the data were non-stationary data. In addition, The Box Cox Test was run to check whether the data were stationary in variances and the results were shown by Figure 5 and 6. From Figure 5 and 6 it can be concluded that the data were not stationary since rounded value for CDP230P data as well as 1656C5TB were not equal to one.

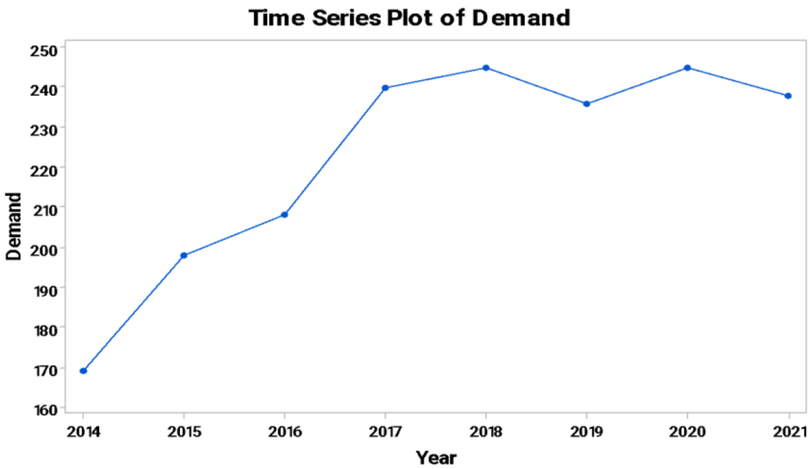

Figure 1. Data Plot for CDF230P Demand

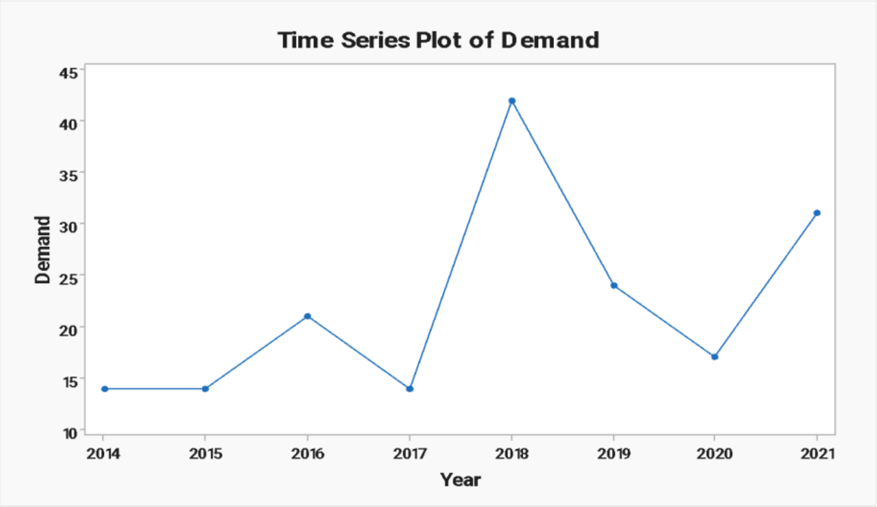

Figure 2. Data Plot for I656C5TB Demand

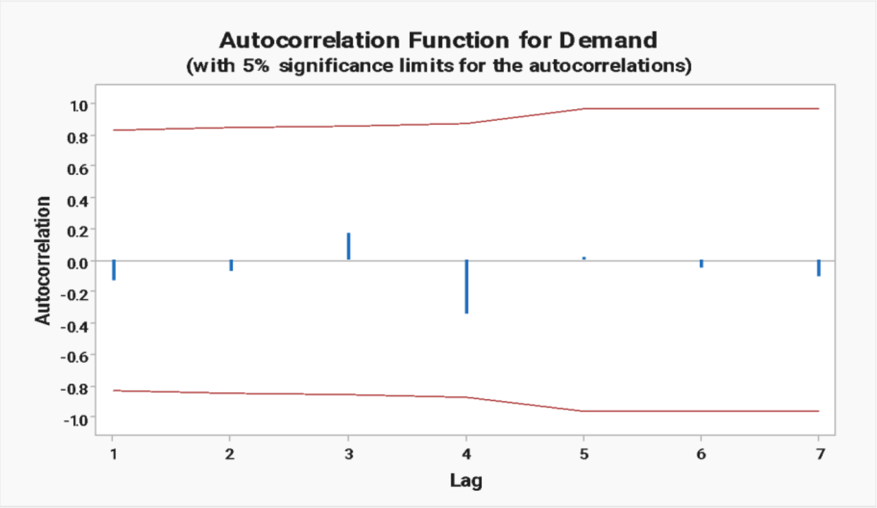

Figure 3. The ACF Graph of CDF230P Demand

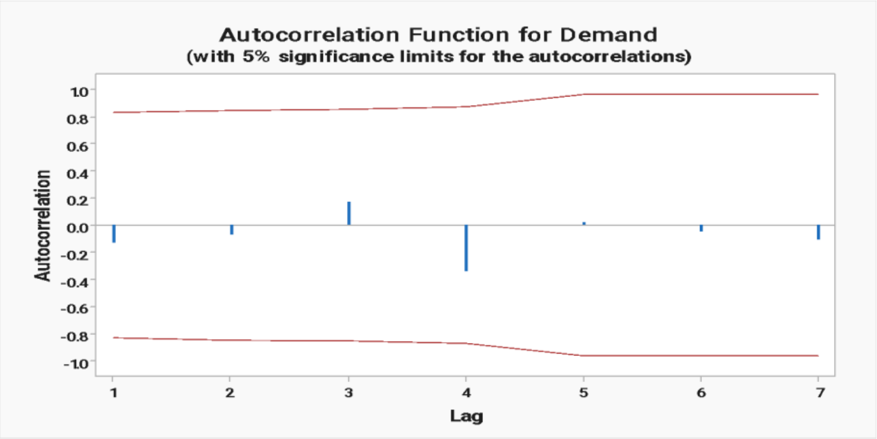

Figure 4. The ACF Graph of I656C5TB Demand

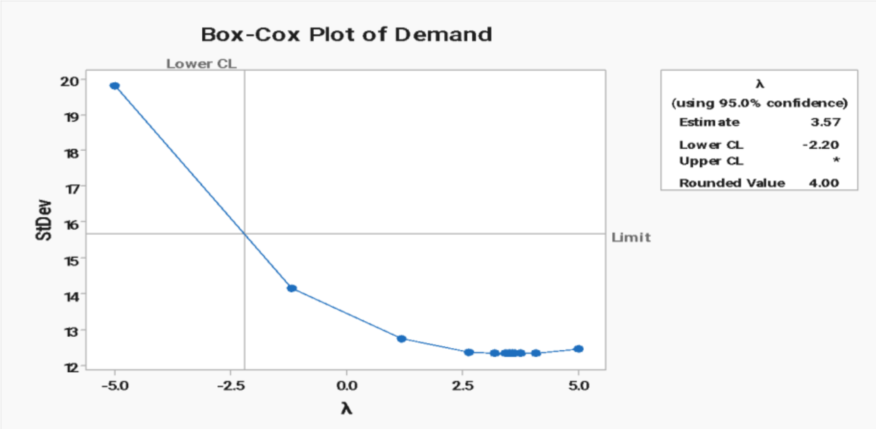

Figure 5. The Box-Cox Plot of CDF230P Demand

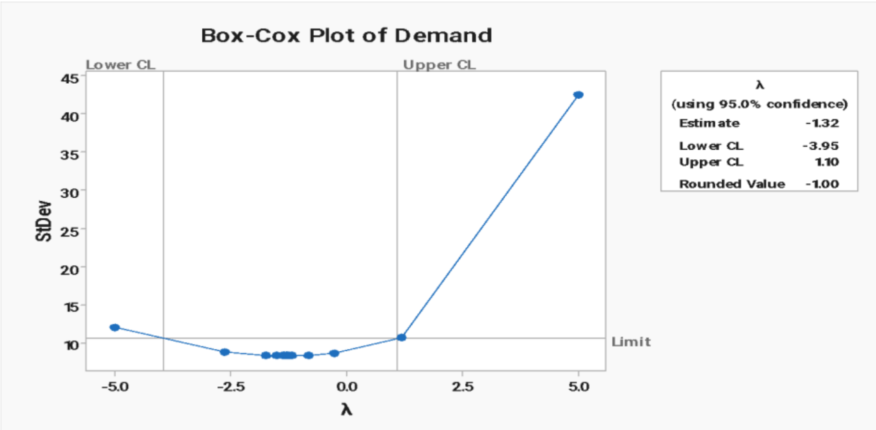

Figure 6. The Box-Cox Plot of I656C5TB Demand

Since the data for CDF230P and I656C5TB demands were non-stationary data, the time series forecasting method could be used as the method to predict the demand for CDF230P and I656C5TB. The time series forecasting method that were tested in this research consisted of 11 methods, as follows: linier trend, quadratic trend, exponential growth trend, s-curve trend, double exponential smooth, decomposition multiplicative trend plus seasonal, decomposition multiplicative seasonal only, decomposition additive trend plus seasonal, decomposition additive seasonal only, winter multiplicative, and winter additive. The selected method was determined from the smallest number of MAPE, MAD, and MSD as presented in Table 10 and 11.

Table 10. The Forecasting Method for CDF230P

Forecasting Method	MAPE	MAD	MSD
Linier Trend	4,6210	10,071	192,174
Quadratic Trend	1,9511	4,4330	31,2924
Exponential Growth Trend	5,1130	11,2380	222,3370
S-Curve Trend	11,7500	21,6700	1523,6000
Decomposition Multiplicative Trend and Seasonal	4,7410	10,3420	193,2860
Decomposition Multiplicative Seasonal Only	10,9820	22,7620	665,5710
Decomposition Additive Trend and Seasonal	4,6810	10,2050	191,5190
Decomposition Additive Seasonal Only	11,0400	22,8750	670,0940
Winter Multiplicative	8,5780	20,3250	920,4170
Winter Additive	8,8770	21,0020	883,6620
Double Exponential Smooth	3,8650	8,6270	151,0520

Table 11. The Forecasting Method for I656C5TB

Forecasting Method	MAPE	MAD	MSD
Linier Trend	25,5390	5,6333	66,1027
Quadratic Trend	27,9417	6,0000	62,5603
Exponential Growth Trend	23,1979	5,4807	69,3154
S-Curve Trend	-	-	-
Decomposition Multiplicative Trend and Seasonal	24,3710	5,4079	64,4939
Decomposition Multiplicative Seasonal Only	41,0390	8,5641	89,9107
Decomposition Additive Trend and Seasonal	24,6860	5,4375	60,4479
Decomposition Additive Seasonal Only	39,9971	8,3475	89,0313
Winter Multiplicative	29,1350	7,2230	107,1690
Winter Additive	29,6130	7,1800	101,1720
Double Exponential Smooth	44,1290	9,3360	129,3400

Table 10 provides the information that quadratic trend was the forecasting method whose MAPE, MAD, and MSD are the smallest among other methods. Therefore, the quadratic trend was selected as the method to forecast the demand for CDF230P in 2022. The quadratic trend model and equation is shown at Figure 7. The predicted demand for CDP230P based on the quadratic trend method was 224 pieces. Moreover, Table 11 provides the information that exponential growth trend was the forecasting method whose MAPE, MAD, and MSD are the smallest among other methods. Therefore, the exponential growth trend was selected as the method to forecast the demand for I656C5TB in 2022. The exponential growth trend model and equation is shown at Figure 8. The predicted demand for I656C5TB based on the exponential growth trend method was 31 pieces.

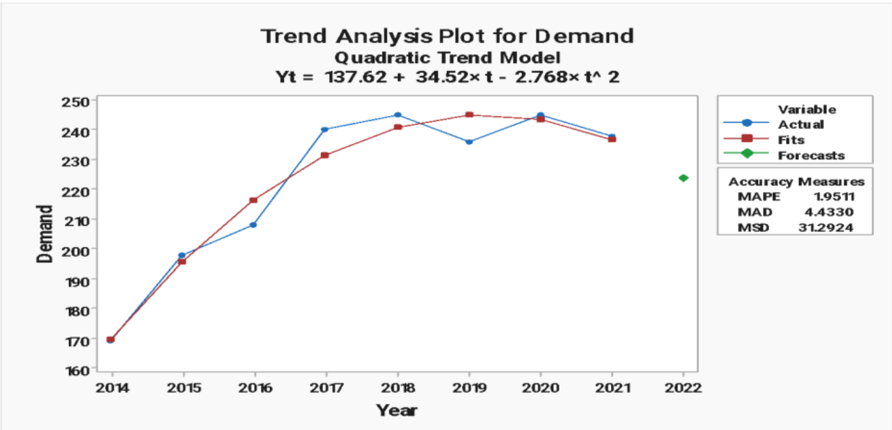

Figure 7. Quadratic Trend Forecasting Method for CSF230P Demand

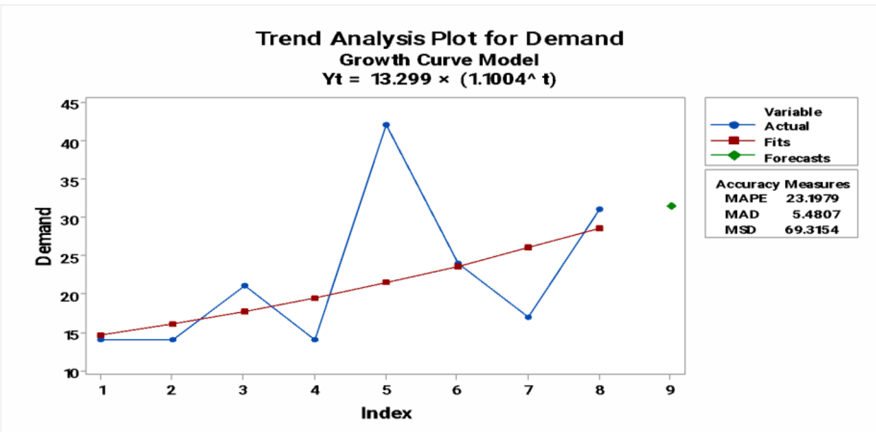

Figure 8. Growth Exponential Trend Forecasting Method for I656C5TB

After the number of predicted demands for CDF230P (224 pieces) and I656C5TB (31 pieces) were calculated, the next step was to design the CDF230 and I656C5TB order schemes based on EOQ method. The optimal order quantity and frequency were calculated first and the result is presented at Table 12.

Table 12. The Optimal Order Quantity and Frequency – 2022

Filter Code	Ordering Cost (Rp)	Carrying Cost (Rp)	Optimal Order Quantity (Pcs)	Optimal Order Frequency
CDF230P	228.515,63	38.672,80	51	4
I656C5TB	228.515,63	92.814,72	12	3

The number of safety stock in the year 2022 was relatively the same as the number of safety stock in the year 2021. The safety stock for CDF 230P was 45 pieces; while the safety stock for I656C5TB was 16 pieces. Afterward, the next step was calculating the maximum inventory of CDF230P and I656C5TB that were stored in the warehouse. Maximum inventory is the sum of optimal order quantity and safety stock (Umami et al., 2018) and the information is presented at Table 13.

Table 13. Maximum Inventory – 2022

Filter Code	Optimal Order Quantity	Safety Stock	Maximum Inventory
CDF230P	51	45	96
I656C5TB	12	16	28

EOQ method enables the company to determine the optimal number to purchase materials as well as the appropriate time to order materials. Therefore, reorder point was also considered as the factor that needs to be recognized in designing order schemes for the depot. Table 14 presents the reorder point for both CDF230P and I656C5TB in the year 2022.

Table 14. Filter Reorder Point – 2022

Filter Code	Average Demand	Lead Time	Safety Stock	Reorder Point
CDF230P	18	1,10	45	65
I656C5TB	4	1,03	16	19

Finally, the EOQ method resulted at the number of total inventory cost. It can be seen from Table 15 that the total inventory cost for CDF230P and I656C5TB were Rp 3.236.488,00.

Table 15. Total Inventory Cost for Filter – 2021

Filter Code	Purchase Price (Rp)	Order Cost (Rp)	Carry Cost (Rp)	Total Inventory Cost (Rp)
CDF230P	337.115	228.515,63	38.672,80	1.989.755,8
I656C5TB	2.209.870	228.515,63	92.814,72	1.246.732,8
				3.236.488,6

The research shows that EOQ method was able to reduce the inventory cost for CDF230P and I656C5TB filters in the aircraft filling depot in the year 2021. This was due to the powerful of EOQ to optimize the order quantity by balancing the ordering and carrying costs (Musoffa *et al*., 2021). The number of order quantity based on EOQ method was higher than the existed method run by the depot. As a result, there was a decline in the number of order frequency and a decrease in the amount of total ordering cost. Lower ordering cost tended to affect total inventory cost. Thus, the total inventory cost based on EOQ method was more efficient than the total inventory cost under existing method in the depot. The result of this research was consistent with previous researches (Distriana & Sukmono, 2015; Ritawiyati *et al*., 2018; Dewi *et al*., 2020)

CONCLUSION

The research provides empirical evidence that EOQ method was able to provide a benefit for the depot in the form of inventory cost reduction. The inventory cost for filter in A category was more efficient since it was significantly reduced by Rp8.348.848,20 or 73,22 percent. Under EOQ method, the inventory cost for CDF230P filter at Rp1.989.755,75 will be reached by the depot, if the depot purchases this filter at 51 pieces in every order. The purchase of CDF230P should be conducted by the depot when there are 65 pieces left in the warehouse. In addition, the depot will successfully achieve total inventory cost at Rp1.246.732,80 for I656C5TB coalescer if the depot purchases this filter at 12 pieces in each order when there are 19 pieces left in the warehouse. It is also advisable for the depot to maintain its safety stock at 45 pieces for CDF230P and 16 pieces of I656C5TB to anticipate the uncertainty demand and eliminate the risk of shortage.

Filter is one type of spare part, so the estimated filter demand should be calculated based on the rate of engine failure. However, this research encountered problems with the availability of date regarding filter failure. The estimated filter demand is therefore predicted using the time series forecasting method. It is advisable for the next research to estimate the demand of filter by considering several aspects, such as spare part reliability, time to failure, time to repair, and time between failure.

REFERENCES

Anggi, L., & Wahyuningsih, S. D. (2019). Analisis Pengelolaan Persediaan Barang Dagang untuk Mengoptimalkan Laba. *Jurnal Penelitian Teori dan Terapan Akuntansi,* 4(1), 95-103.

Aviation, P. (2016). *Prosedur Operasi dan Pengendalian Mutu Pertamina Aviation: Penanganan Operasi dan Pengendalian Mutu Bahan Bakar Penerbangan.* Indonesia: Pertamina.

Basuki, B. (2018). Optimasi Pengendalian Persediaan dengan Menggunakan Pendekatan Teori Wilson. *Industrial Engineering Journal,* 7(1), 4-9.

Dewi, P. C., Herawati, N. T., & Wahyuni, M. A. (2020). Analisis Pengendalian Persediaan dengan Metode Economic Order Quantity (EOQ) guna Optimalisasi Persediaan Bahan Baku Pengemas Air Mineral (Studi Kasus pada PT Tirta Mumbul Jaya Abadi). *Jurnal Akuntansi Profesi*, 10(2), 54-65.

Distriana, F., & Sukmono, T. (2015). Pengendalian Persediaan Bahan Baku Obat dengan Menggunakan Metode EOQ Probabilistik Berdasarkan Peramalan Exponential Smoothing pada PT XYZ. *Spektrum Industri,* 13(2), 115-228.

Komariah, K. (2022). Penerapan Metode EOQ (Economic Order Quantity) dalam Pengendalian Persediaan Bahan Baku. *Journal of Management and Business,* 4(1), 42-49.

Lopez, C., Correia, A., Silva, C., Monteiro, M., & Lopes, R. B. (2020). Inventory Models with Reverse Logistics for Asset Acquisition in A Liquified Petroleum Gas Company. *Journal of Mathematics in Industry,* 10(1), 1-15.

Musoffa, A., Istiningrum, A. A., & Rahayuningsih, S. (2021). Optimasi Persediaan Material Pembungkus Lithos dengan Model Economic Order Quantity. *Prosiding Seminar Nasional Teknologi Energi dan Mineral*, 1683-1694. Cepu: Politeknik Energi dan Mineral Akamigas.

Nirfison, N. (2017). Perencanaan Persediaan untuk Material Kompresor Menggunakan Economic Order Quantity Probabilistik pada Produk AIr Conditioner. *Operation Excellence,* 9(3), 282-289.

Nugraha, E. Y., & Suletra, I. W. (2017). Analisis Metode Peramalam Permintaan TErbaik Produk Oxycan pada PT Samator Gresik. *Seminar dan Konferensi Nasional IDEC,* 414-422. Surakarta.

Nurwahdania, S., & Sulistijanti, W. (2017). Peramalan Hasil Produksi Padi di Provinsi Jawa Timur dengan Menggunakan Metode Seasonal Autoregressive Integrated Moving Average with Exogeneous Input (Sarimax). *Prosiding Seminar Nasional Indonesian R Summit,* 163-170.

Pamungkas, M. B., & Wibowo, A. (2018). Aplikasi Metode Arima Box. *The Indonesian Journal of Public Health*, 13, 181-194.

Pulungan, D. S., & Fatma, E. (2018). Analisis Pengendalian Persediaan Menggunakan Metode Probabilistik dengan Kebijakan Back Order dan Lost Sales. *Jurnal Teknik Industri,* 19(1), 38-48.

Jurnal Manajemen
dan Organisasi
(JMO),
Vol. 14 No. 3,
September 2023,
310-321

Randi, T. R., & Meirini, D. (2021). Analisis Manajemen Persediaan Menggunakan Metode Economic Order Quantity dan Reorder Point dalam Pengendalian Persediaan Gas LPG 3 KG pada SPBE PT BCP Cirebon. *Jurnal Ilmiah Akuntansi dan Keuangan,* 4(4), 1263-1279.

Ritawiyati, R., Maryanti, S., & Thamrin, M. (2018). Metode Economic Order Quantity (EOQ) sebagai Dasar Pengendalian Bahan Baku Tepung Terigu: Studi Kasus Home Industry Roti Sekarsari Kampar. *Jurnal Ilmu Komputer dan Bisnis*, 9(2), 2059-2069.

Robial, S. M. (2018). Perbandingan Model Statistik pada Analisis Metode Peramalan Time Series (Studi Kasus pada PT Telekomunikasi Indonesia, Tbk Kandatel Sukabumi). *Jurnal Ilmiah SANTIKA,* 8(2), 1-17.

Sakinah, G. N., & Herdiani, L. (2021). Pengendalian Persediaan Spare Part dengan Metode Klasifikasi ABC pada Perum Damri Cabang Bandung. *Jurnal TIARSIE,* 18(2), 61-67.

Soares, T. A., Montolalu, C. E., & Manurung, T. (2021). Analisis Persediaan Karton dengan Metode Economic Order Quantity (EOQ) (Studi Kasus PT Asegar Murni Jaya, Minahasa Utara). *Jurnal Ilmiah Sains,* 21(2), 170-175.

Soemarmi, A., Indarti, E., Pujiyono, P., & Diamantina, A. (2019). Konsep Negara Kepulauan dalam Upaya Perlindungan Wilayah Pengelolaan Perikanan Indonesia. *Masalah-Masalah Hukum,* 48(3), 241-248.

Taye, B. A., Alene, A. A., Nega, A. K., & Yirsaw, B. G. (2021). Time Series Analysis of Cow Milk Production at Andassa Dairy Farm, Wesr Gojam Zone, Amhara Region, Ethiopia. *Modeling Earth Systems and Environment,* 7(1), 181-189.

Trihudiyatmanto, M. (2017). Analisis Pengendalian Persediaan Bahan Baku dengan Menggunakan Metode Economic Order Quantity (EOQ) (Studi Empiris pada CV Jaya Gemilang Wonosobo). *Jurnal Penelitian dan Pengabdian Kepada Masyarakat*, 4(3), 220-234.

Umami, D. M., Mu'tamar, M. F., & Rakhmawati, R. (2018). Analisis Efisiensi Biaya Persediaan Menggunakan Metode EOQ (Economic Order Quantity) pada PT XYZ. *Jurnal Agroteknologi*, 12(1), 64-70.

Unsulangi, H. I., Jan, A. H., & Tumewu, F. (2019). Analisis Economic Order Quantity (EOQ) Pengendalian Persediaan Bahan Baku Kopi pada PT Fortuna Inti Alam. *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis, dan Akuntansi*, 7(1), 51-60.

Zaldiansyah, A. (2012). *Perencanaan dan Pengendalian Persediaan Spare Part Mesin di Unit Produksi I PT Petrokimia Gresik Menggunakan Kebijakan Can Order.* Surakarta: Jurusan Teknik Industri, Fakultas Teknik, Universitas Sebelas Maret .