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Controlling Raw Material Inventory using the Economic Order Quantity (EOQ) Method at PT. ICI Paints Indonesia

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ABSTRACT: The inventory control system comprises a set of control policies to determine the level of inventory to be maintained, when orders to replenish inventory should be placed, and how large orders should be. This system determines and ensures the availability of inventory in the right quantity and at the right time. The aim of inventory is in the right quantity and at the right time. Inventory management aims to provide the necessary raw materials for the production process to run smoothly without shortages or excess inventory, thus minimizing inventory control of raw materials, specifically Titanium Dioxide and Calcium Carbonate. The company often faces shortages and excess inventory of these raw materials. The company must estimate the future demand for Titanium Dioxide and Calcium Carbonate raw materials. This prompts the research question of how to analyze the implementation of the Economic Order Quantity (EOQ) method for inventory control of these specific raw materials at PT. ICI Paints Indonesia. This research employs qualitative techniques and analyzes data using the Economic Order Quantity (EOQ) method, Lead Time, Re-Order Point, and Total Inventory Cost Order. The results of this study indicate that inventory control of raw materials using the Economic Order Quantity (EOQ) method is more efficient for managing Titanium Dioxide and Calcium Carbonate raw materials at PT. ICI Paints Indonesia. The company can optimize the inventory of Titanium Dioxide and Calcium Carbonate raw materials and reduce purchasing costs. By establishing a reorder point, the company can anticipate excess or shortage of Titanium Dioxide and Calcium Carbonate raw materials, thus minimizing inventory-purchasing costs.

Keywords: Inventory Control, Economic Order Quantity (EOQ), Re-Order Point, Total Inventory Cost (TIC)

INTRODUCTION

PT ICI Paints Indonesia is a foreign company whose main activity is producing water-based paint (Barry, 2016; Yamashita, 2018). The main raw materials used are TIO2 (Titanium Dioxide) and Calcium Carbonate. PT ICI Paints Indonesia meets its raw material needs by purchasing raw materials continuously and periodically by forecast data determined by the Demand Planner and adjusted to Raw Material Planner data to purchase raw materials that are also adjusted to the capacity of the raw material warehouse (C.-H. Chen et al., 2015; Ibrahim et al., 2019; Milewski,

2020; Sebatjane & Adetunji, 2019a; Shekarian et al., 2016; Sher & Kim, 2015). Forecast data on raw materials (Sharma et al., 2023), raw material purchases, and actual raw material usage can be seen in the following table:

Forecast of Raw Material Needs, Purchase of Raw Materials, and Actual Arrival of Materials Standard Period 2021-2022

2021	Forecast		Pembelian Bahan Baku		Aktual Pemakaian	
Bulan	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Januari	288.869 Kg	554.264 Kg	680.000 Kg	576.000 Kg	262.922 Kg	590.391 Kg
Februari	333.893 Kg	638.531 Kg	600.000 Kg	576.000 Kg	381.700 Kg	645.670 Kg
Maret	392.330 Kg	728.244 Kg	880.000 Kg	864.000 Kg	395.857 Kg	700.638 Kg
April	371.351 Kg	821.508 Kg	360.000 Kg	44.000 Kg	180.244 Kg	884.410 Kg
Mei	206.523 Kg	445.425 Kg	260.000 Kg	370.000 Kg	156.904 Kg	379.595 Kg
Juni	353.823 Kg	763.198 Kg	560.000 Kg	1.884.000 Kg	379.033 Kg	697.299 Kg
Juli	339.090 Kg	687.345 Kg	400.000 Kg	444.000 Kg	110.516 Kg	213.696 Kg
Agustus	339.074 Kg	687.342 Kg	400.000 Kg	540.000 Kg	128.547 Kg	742.750 Kg
September	381.901 Kg	758.326 Kg	120.000 Kg	40.000 Kg	97.850 Kg	362.636 Kg
Oktober	375.083 Kg	753.776 Kg	340.000 Kg	616.000 Kg	230.393 Kg	683.081 Kg
November	387.658 Kg	791.991 Kg	200.000 Kg	960.000 Kg	452.526 Kg	816.225 Kg
Desember	327.395 Kg	610.514 Kg	- Kg	720.000 Kg	462.731 Kg	763.233 Kg
Total	**4.096.990 Kg**	**8.240.462 Kg**	**4.800.000 Kg**	**7.634.000 Kg**	**3.239.224 Kg**	**7.479.624 Kg**

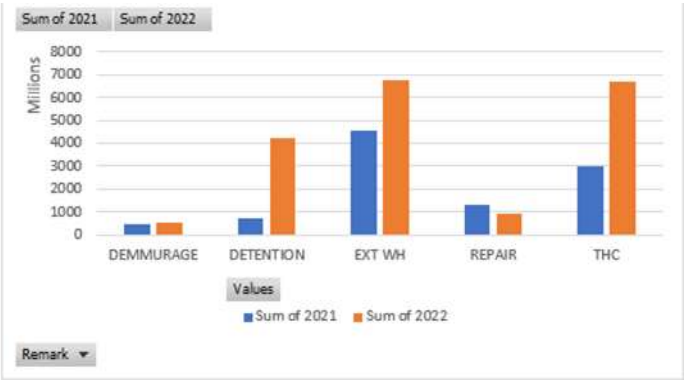
2022	Forecast		Pembelian Bahan Baku		Aktual Pemakaian	
Bulan	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Januari	305.652 Kg	485.660 Kg	540.000 Kg	1.344.000 Kg	370.525 Kg	512.707 Kg
Februari	431.503 Kg	572.909 Kg	820.000 Kg	768.000 Kg	208.425 Kg	384.091 Kg
Maret	552.864 Kg	685.912 Kg	180.000 Kg	288.000 Kg	361.857 Kg	854.581 Kg
April	339.088 Kg	775.619 Kg	200.000 Kg	328.000 Kg	363.131 Kg	958.838 Kg
Mei	377.087 Kg	481.696 Kg	300.000 Kg	308.000 Kg	204.802 Kg	393.167 Kg
Juni	496.348 Kg	832.124 Kg	440.000 Kg	1.096.000 Kg	254.666 Kg	565.550 Kg
Juli	346.757 Kg	701.526 Kg	160.000 Kg	596.000 Kg	133.852 Kg	369.869 Kg
Agustus	471.103 Kg	692.922 Kg	- Kg	384.000 Kg	74.744 Kg	660.135 Kg
September	531.992 Kg	744.574 Kg	280.000 Kg	328.000 Kg	466.589 Kg	729.689 Kg
Oktober	459.605 Kg	769.821 Kg	340.000 Kg	532.000 Kg	172.901 Kg	103.733 Kg
November	551.411 Kg	885.588 Kg	1.000.000 Kg	942.192 Kg	87.402 Kg	100.404 Kg
Desember	551.719 Kg	667.099 Kg	240.000 Kg	244.000 Kg	94.000 Kg	62.450 Kg
Total	**5.415.129 Kg**	**8.295.448 Kg**	**4.500.000 Kg**	**7.158.192 Kg**	**2.792.894 Kg**	**5.695.214 Kg**

Sumber: PT ICI Paints Indonesia, Forecast RM 2022 (..\Supporting Data) 2022_SAP (2022_SAP.XLSX)

Based on the table above, it shows that there is excess raw material inventory which is due to the actual arrival of raw materials being greater than the actual use of raw materials, causing excess raw material inventory (Over Stock) (Gomez et al., 2023; Rudoler et al., 2022; Zankawah & Stewart, 2020). The actual total use of raw materials (Titanium Dioxide and Calcium Carbonate) in 2021 is 10,718,848 Kg with actual raw material purchases of 12,434,000 Kg so excess raw material inventory is 2,321,615 Kg. Meanwhile, the actual total use of raw materials (Titanium Dioxide and Calcium Carbonate) in 2022 is 8,488,107 Kg with actual raw material purchases of 11,658,192 Kg, resulting in excess raw materials of 3,170,085 Kg. This phenomenon results in overcapacity in the raw material storage warehouse and it cannot accommodate the raw materials, so the company has to store the raw materials in an external warehouse for the long term until the processes in the company's warehouse return to normal (Godichaud & Amodeo, 2018; Rezaei, 2014; Taufik & Ahmad, 2014; Zhang et al., 2014). Data on raw material storage and storage costs that must be incurred by the company in the period 2021 to 2022 can be seen in the following table (Rangkutti et al., 2012; Simbolon & Lolyta, 2021):

Data on Raw Material Storage Costs for the 2021-2022 Period

Remark	2021	2022	%
DEMMURAGE	468.384.417	512.624.734	9%
DETENTION	717.945.972	4.264.649.321	494%
EXT WH	4.559.588.574	6.746.071.076	48%
REPAIR	1.313.340.996	948.312.262	-28%
THC	2.991.505.402	6.722.111.992	125%
Total	**10.050.765.361**	**19.193.769.385**	**91%**



Based on the table above, it is known that external warehouse costs for the 2021 period are IDR 4,559,588,574,- and for the 2022 period are IDR 6,746,071,076,- so there will be an increase in costs in 2022 of IDR 2,186,482,502,- or 47%. Therefore, it is necessary to control raw materials more effectively and efficiently so that production activities run according to the production plan and there is no excess or shortage of raw materials. Therefore, companies must be able to determine the optimal amount of raw materials to ensure that the number of purchases can reach minimum inventory costs, one of which is by using the Economic Order Quantity (EOQ) method. According to Vikaliana (2020), Economic Order Quantity (EOQ) is the quantity of goods that can be obtained at the most economical cost or can be said to be an optimal purchase. Planning the EOQ method in a company will be able to minimize the occurrence of Out Stock so that it does not disrupt the production process within the company and will able to save the total inventory costs of purchasing raw materials issued by the company also the company can reduce inventory costs such as reducing storage costs, saving space and resolve problems arising from large amounts of inventory piling up thereby reducing risks that can arise due to inventory in the warehouse (Çalışkan, 2021b; S.-C. Chen et al., 2014; Inventory Control, 2020; Sebatjane & Adetunji, 2019b).

METHOD

A. Research approaches and types

The type of research used in this research study is quantitative. This research uses a quantitative descriptive method, namely research that describes the actual situation of the object being studied, according to the actual situation at the time of direct research. So this research method measures or calculates the optimal supply of raw materials using the Economic Order Quantity (EOQ) method at PT. ICI Paints Indonesia, JL Jababeka IV Blok V No 64, Cikarang Industrial Estate, Bekasi, the results of which are presented in the form of numerical data and interpreted in qualitative sentences. This type of research is quantitative research.

According to Azwar (2012:6), the definition of a descriptive method is a method that carries out analysis only to the level of description, namely analyzing and presenting facts systematically so that everything can always be more easily understood and concluded. Quantitative research

according to Hermawan (2009:19) is an objective approach, including data collection, quantitative data analysis, and statistical testing methods. Quantitative data accSudjana (2005,4) is data in the form of numbers, the price changes or is variable (Çalışkan, 2021a; Liao et al., 2020; Wasiak, 2016).

B. Operational Variables

Variables are varying symptoms that are the object of research (Arikunto, Suharsimi, 2010:169). Research variables according to Sugiyono (2007:3) are anything in any form that is determined by the researcher to be studied so that information about it is obtained, then conclusions are drawn. In this research, there are 2 (two) variables including raw material inventory and the Economic Order Quantity (EOQ) method. Data Collection Techniques

C. Sampling technique

According to Sugiyono (2009:120), sampling technique is a sampling technique that does not provide equal opportunities or opportunities for each element or member of the population to be selected as a sample. The sampling technique used for this research was purposive sampling.

The sampling technique is purposive sampling, namely sampling to select samples intentionally. So, the researcher determines the sample taken himself because there are certain considerations and the sample taken is not random but is determined by the researcher himself. Researchers use purposive sampling techniques because there are often many limitations that prevent researchers from taking samples randomly. So if you use random sampling it will make things difficult for researchers. By using purposive sampling, it is hoped that the sample criteria obtained are truly by the research to be conducted.

The research sample is all data on purchases of Titanium Dioxide (TIO2) and Calcium Carbonate raw materials for the period 2021 to 2022 and all costs related to the purchase of Titanium Dioxide (TIO2) and Calcium Carbonate raw materials for the period 2021 to 2022.

RESULT AND DISCUSSION

A. General Description of Research Objects

PT. ICI Paints Indonesia, is currently part of the Akzonobel Decorative business which was inaugurated on August 11 1971 by ICI Omicron and PT. Dwi Satrya Utama (DSU). Since starting production, PT. ICI Paints Indonesia is known as a premium paint producer "DULUX" which always uses high quality and environmentally friendly materials. PT. ICI Paints Indonesia is located at Jl. Jababeka IV Block V No.64, Cikarang Industrial Estate, Bekasi, West Java 17520.

B. Research result

In this research, the Economic Order Quantity (EOQ) method is applied to control raw material inventories using analytical techniques. The following are the calculation steps for analyzing the data as follows:

1. Data Presentation

The data needed to analyze includes the following:

a. Order Cost Data

Ordering costs are costs that arise from the purchasing process until the goods arrive at our place or company, such as transportation costs, insurance costs, import duties, and taxes. Usually, this landing cost will add to the cost of purchasing raw materials.

The following are the costs for ordering raw materials for Titanium Dioxide (TIO2) and Calcium Carbonate in 2021-2022 based on raw material usage cost data.

Raw Material Order Costs 2021-2022

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Jumlah Barang Per Pemesanan (Kg)	20.000	80.357,89	20.000	83.234,79
Frekuensi Pemesanan per tahun (kali)	240	95	225	86
Biaya Transportasi (Rp)	2.400.000	2.400.000	2.400.000	2.400.000
Biaya Adm & SP2 (Rp)	1.500.000	1.650.000	1.500.000	1.650.000
Biaya Pemesanan per tahun (Rp)	=(240 X Rp 2.400.000) + (240 X Rp 1.500.000) = Rp 576.000.000 + RP 360.000.000 = Rp 936.000.000	=(95 X Rp 2.400.000) + (95 X Rp 1.650.000) = Rp 228.000.000 + RP 156.750.000 = Rp384.750.000	=(225 X Rp 2.400.000) + (225 X Rp 1.500.000) = Rp 540.000.000 + RP 337.500.000 = Rp877.500.000	=(86 X Rp 2.400.000) + (86 X Rp 1.650.000) = Rp 206.400.000 + RP 141.900.000 = Rp 348.0300.000

Source: PT. ICI Paints Indonesia (data processed by researchers)

b. Storage Cost Data

Storage costs holding costs or carrying costs are costs incurred as a result of storing goods or raw materials. Storage costs can be expressed in two forms, namely in the form of a percentage of the average inventory value per year and the form of rupiah per year per unit of goods. PT. ICI Paints Indonesia has set the calculation or percentage of storage costs for each raw material at 25% of the raw material price per kg. The following is data on storage costs for Titanium Dioxide (TIO2) and Calcium Carbonate raw materials in 2021 and 2022.

Data on Raw Material Storage Costs 2021-2022 (in Rp.)

Variabel	2021			2022		
	Persentase Biaya Simpan	Harga Bahan Baku Per Unit	Biaya Penyimpanan Per Unit	Persentase Biaya Simpan	Harga Bahan Baku Per Unit	Biaya Penyimpanan Per Unit
Titanium Dioxide (TIO2)	25%	Rp 41.930	Rp 10.483	25%	Rp 43.805	Rp 10.951
Calcium Carbonate	25%	Rp 4.683	Rp 1.171	25%	Rp 4.528	Rp 1.132

Source: PT. ICI Paints Indonesia (data processed by researchers)

Based on the table above, storage costs for Titanium Dioxide (TIO2) and Calcium Carbonate raw materials are as follows:

1. In 2021, it is known that the storage cost of Titanium Dioxide (TIO2), the percentage of storage costs set by the company is 25% with a price per kg of IDR 41,930,- so that a storage cost of IDR 10,483 can be obtained. Meanwhile, the storage costs for Calcium Carbonate raw materials are known to be a percentage of storage costs set by the company at 25% with a price per kg of Rp. 4,683,- so that a storage cost of Rp. 1,171,- is obtained.

2. In 2022, it is known that the storage cost for Titanium Dioxide (TIO2) is a percentage set at 25% with a price per kg of Rp. 43,805,- so that the storage cost is Rp. 10,951,-. Meanwhile, the storage cost for Calcium Carbonate raw materials is known to be a percentage set at 25% with a price of Rp. 4,528. ,- so that the storage costs are Rp. 1,132,-

c. Data on Raw Material Requirements

The following are the raw materials needed for Titanium Dioxide (TIO2) and Calcium Carbonate that PT. ICI Paints Indonesia from 2021 to 2022 from January to December

Raw Material Order Data 2021 to 2022 (in Kg units)

Bulan	2021				2022			
	TIO2 (Kg)	Freq (kali)	*Calcium Carbonate* (Kg)	Freq (kali)	TIO2 (Kg)	Freq (kali)	*Calcium Carbonate* (Kg)	Freq (kali)
Januari	680.000	34	576.000	7	540.000	27	1.344.000	17
Februari	600.000	30	576.000	7	820.000	41	768.000	9
Maret	880.000	44	864.000	11	180.000	9	288.000	3
April	360.000	18	44.000	1	200.000	10	328.000	4
Mei	260.000	13	370.000	5	300.000	15	308.000	4
Juni	560.000	28	1.884.000	22	440.000	22	1.096.000	13
Juli	400.000	20	444.000	6	160.000	8	596.000	7
Agustus	400.000	20	540.000	7	-	-	384.000	5
September	120.000	6	40.000	1	280.000	14	328.000	4
Oktober	340.000	17	616.000	8	340.000	17	532.000	6
November	200.000	10	960.000	11	1.000.000	50	942.192	11
Desember	-	-	720.000	9	240.000	12	244.000	3
Total	**4.800.000**	**240**	**7.634.000**	**95**	**4.500.000**	**225**	**7.158.192**	**86**

Source: PT. ICI Paints Indonesia (data processed by researchers)

Based on the table above, it is known that the total orders or purchases for Titanium Dioxide (TIO2) raw materials are as follows:

1. In 2021, total orders for Titanium Dioxide (TIO2) raw materials amounted to 4,800,000 Kg with an order frequency of 240 times a year and total orders or purchases of Calcium Carbonate raw materials amounted to 7,634,000 with an order frequency of 95 times a year

2. In 2022, total orders or purchases of Titanium Dioxide (TIO2) raw materials will be 4,500,000 Kg with a frequency of 225 times a year, and total orders or purchases of Calcium Carbonate raw materials will be 7,158,192 Kg with an order frequency of 86 times a year.

2. Determining Order Costs in One Order (S)

The next step is to determine the ordering costs for one order, which can be calculated using the formula according to Fahmi Sulaiman and Nanda (2015) as follows:

$$S = \frac{\text{Total Biaya Pemesanan}}{\text{Frekuensi Pemesanan}}$$

Information :

S: Cost of ordering in one go

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	*Calcium Carbonate*	Titanium Dioxide (TIO2)	*Calcium Carbonate*
Frekuensi Pemesanan per tahun (kali)	240	95	225	86
Biaya Pemesanan per tahun (Rp)	Rp 936.000.000	Rp 384.750.000	Rp 877.500.000	Rp 348.300.000
Biaya Pemesanan per pesanan (Rp)	Rp 3.900.000	Rp 4.050.000	Rp 3.900.000	Rp 4.050.000

3. Determining Storage Costs per Unit (H),

PT. ICI Paints Indonesia has set the calculation or percentage of storage costs for each raw material at 25% of the raw material price per kg. The following is data on storage costs for Titanium Dioxide (TIO2) and Calcium Carbonate raw materials in 2021 and 2022.

Variabel	2021			2022		
	Persentase Biaya Simoan	Harga Bahan Baku Per Unit	Biaya Penyimpanan Per Unit	Persentase Biaya Simoan	Harga Bahan Baku Per Unit	Biaya Penyimpanan Per Unit
Titanium Dioxide (TIO2)	25%	41.930	10.483	25%	43.805	10.951
Calcium Carbonate	25%	4.683	1.171	25%	4.528	1.132

4. Determining the Average Purchase of Raw Materials in One Order (Q)

According to Fahmi Sulaiman and Nanda (2015), the average purchase in one order can use the following formula:

$$Q = \frac{\text{Total Kebutuhan Barang}}{\text{Frekuensi Pemesanan}}$$

Keterangan :
Q = Pembelian rata-rata dalam sekali pesan

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Total Kebutuhan Bahan Baku (Kg)	4.800.000	7.634.000	4.500.000	7.158.192
Frekuensi Pemesanan (kali)	240	95	225	86
$Q = \frac{\text{Total Kebutuhan Barang}}{\text{Frekuensi Pemesanan}}$	= 4.800.000 Kg / 240 = 20.000 Kg	= 7.634.000 Kg / 95 = 80.358 Kg	= 4.500.000 Kg / 225 = 20.000 Kg	= 7.158.192 Kg / 86 = 83.2350 Kg

5. Determining Total Inventory Cost (TIC) before Using the Economic Order Quantity (EOQ) Method

According to Heizer and Render (2015), total inventory costs or Total Inventory Costs (TIC) can be calculated using the following formula:

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

6. Determining Optimal Raw Material Supplies Using the Economic Order Quantity (EOQ) Method. According to Vikaliana (2020), the optimal supply of Titanium Dioxide (TIO2) and Calcium Carbonate raw materials can be calculated using the following formula:

$$Q = \frac{\sqrt{2DS}}{H}$$

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Jumlah Pemesanan Per Tahun (D)	4.800.000 Kg	7.634.000 Kg	4.500.000 Kg	7.158.192
Biaya Pemesanan Per Pesanan (S)	Rp 3.900.000	Rp 4.050.000	Rp 3.900.000	4.050.000
Biaya Peenyimpanan per Unit (H)	Rp 10.483	Rp 1.171	Rp 10.951	1.132
EOQ √2SD/H	= √ 2 (4.800.000 Kg)(Rp 3.900.000) / Rp 10.483 = √ 37.440.000.000.000 / Rp 10.483 = √ 3.571.496.709 **= 59.763 Kg**	= √ 2 (7.634.000 Kg)(Rp 4.050.000) / Rp 1.171 = √ 61.835.400.000.000 / Rp 1.171 = √ 52.805.636.208 **= 229.795 Kg**	= √ 2 (4.500.000 Kg)(Rp 3.900.000) / Rp 10.951 = √ 35.100.000.000.000 / Rp 10.951 = √ 3.205.186.741 **= 56.614 Kg**	= √ 2 (7.158.192 Kg)(Rp 4.050.000) / Rp 1.132 = √ 57.981.355.200.000 / Rp 1.132 = √ 51.220.278.445 **= 229.319 Kg**

7. Determining Economic Purchase Frequency(I)

To determine the economical frequency of purchasing Calcium Carbonate raw materials, you can use the following formula according to Ahyari (2002:72):

$$I = \frac{R}{EOQ}$$

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Jumlah Bahan Baku (R) satuan Kg	4.800.000	7.634.000	4.500.000	7.158.192
Pembelian Optimal (EOQ) satuan Kg	59.763	229.795	56.614	226.319
Frekuensi Pemesanan (I = R / EOQ)	= 4.800.000 / 59.763 **= 80 kali**	= 7.634.000 / 229.795 **= 33 kali**	= 4.500.000 / 56.614 **= 79 kali**	= 7.158.192 / 226.319 **= 32 kali**

8. Determining the Total Inventory Cost Order (TIC) after Applying the Economic Order Quantity (EOQ) Method

The total cost of ordering raw material supplies or Total Inventory Cost Order (TIC) can be calculated using the following formula:

$$TIC = \frac{D}{Q^*} S + \frac{Q^*}{2} H$$

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Jumlah Pemesanan Per Tahun (D)	4.800.000 Kg	7.634.000 Kg	4.500.000 Kg	7.158.192 Kg
Pembelian Rata-Rata (Q)	59.762 Kg	229.795 Kg	56.614 Kg	226.319 Kg
Biaya Pemesanan (S)	Rp 3.900.000	Rp 4.050.000	Rp 3.900.000	Rp 4.050.000
Biaya Penyimpanan (H)	10.483	1.171	Rp 10.951	Rp 1132
Biaya Total (TIC) $TC = \frac{D}{Q}S + \frac{Q}{2}H$	= (4.800.000/59.762)(3.900.000) + (59.762 /2)(10.483) = (80,31 X 3.900.000) + (29.881 X 10.483) = 313.242.529 + 313.242.523 **= Rp 626.485.052,-**	= (7.634.000/229.795)(4.050.000) + (229.795 /2)(1.171) = (33,22 X 4.050.000) + (114.897,5 X 1171) = 134.544.703 + 134.544.973 **= Rp269.089.675,-**	= (4.500.000/56.614)(3.900.000) + (56.614 /2)(10.951) = (79 X 3.900.000) + (28.307 X 10.951) = 309.995.994 + 309.989.957 **= Rp 619.983.951,-**	= (7.158.192/226.319)(4.050.000) + (226.319 /2)(1.132) = (32 X 4.050.000) + (113.160 X 1132) = 128.096.526.000 + 128.096.554 **= Rp 256.193.080,-**

9. Determining the Re-order Point (ROP)

In the process of purchasing raw materials, PT. ICI Paints Indonesia has a lead time (Lead Time Order) for Titanium Dioxide (TIO2) and Calcium Carbonate raw materials of 5 days with the following details:

Aktivitas	Waktu
Proses Pengiriman Bahan Baku (Malaysia ke Priok)	3 hari
Proses Clearance	1 hari
Proses Pengiriman Bahan Baku (Priok ke Warehouse)	1 hari
Total Waktu	5 hari

Before calculating ROP, you need to first find the average usage per day using the following formula:

$$d = \frac{D}{t}$$

Average usage data per day from 2021 to 2022

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Kebutuhan Bahan Baku (D)	4.800.000 Kg	7.634.000 Kg	4.500.000 Kg	7.158.192 Kg
Waktu dalam setahun (t)	270 hari	270 hari	270 hari	270 hari
Pemakaian rata-rata per hari (d = D/t)	= 4.800.000 / 270 **= 17.778 Kg**	=7.634.000 / 270 **= 28.274 Kg**	= 4.500.000 / 270 **= 16.667 Kg**	=7.158.192 / 270 **= 26.512 Kg**

According to Vikaliana (2020), the re-order point can be calculated using the following formula:

$$ROP = L \times (D/t)$$

Re-Order Point (ROP) data for 2021 to 2022

Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Pemakaian rata-rata per hari (d)	17.778 Kg	28.274 Kg	16.667 Kg	26.512 Kg
Lead Time (L)	5 hari	5 hari	5 hari	5 hari
Re-Order Point (ROP = d X L)	= 17.778 X 5 **= 88.889 Kg**	= 28.274 X 5 **= 141.370 Kg**	= 16.667 X 5 **= 83.333 Kg**	= 26.512 X 5 **= 132.559 Kg**

10.Determining the Duration of EOQ (Life Time Use)

To determine the duration of use using the EOQ method, you can use the following formula: Life Time = t / I

Life Time Use Data or Duration of Use of Raw Materials for the Period 2021 to 2022

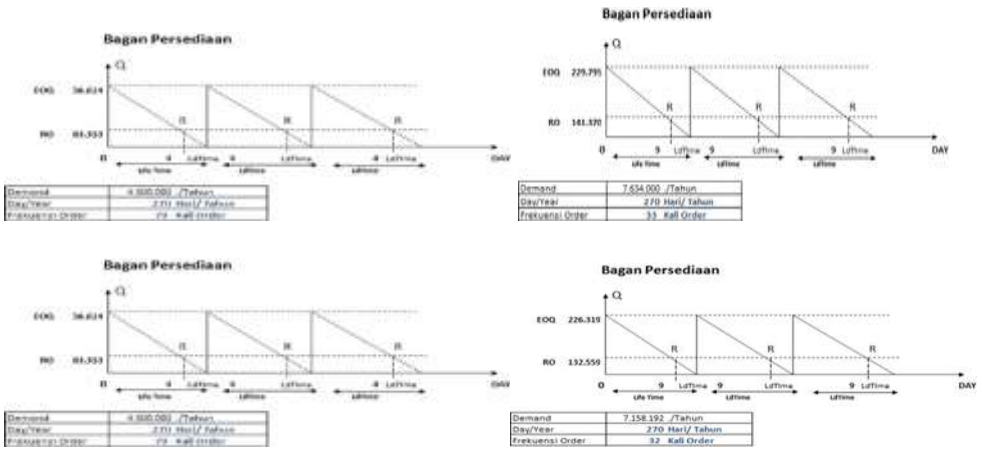
Variabel	2021		2022	
	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
Hari Kerja setahun (t)	270 hari	270 hari	270 hari	270 hari
Frekuensi Pesan (I)	80 kali	33 kali	79 kali	32 kali
Life Time LT = t / I	= 270 / 80 = 3,48 hari = **4 hari** (dibulatkan)	= 270 / 33 = 8,18 hari = **9 hari** (dibulatkan)	= 270 / 79 = 3,41 hari = **4 hari** (dibulatkan)	= 270 / 32 = 8,44 hari = **9 hari** (dibulatkan)

11.Comparison Table Before and After Applying the Economic Order Quantity (EOQ) Method

Comparative Data Before and After Implementing the Economic Order Quantity (EOQ) Method at PT. ICI Paints Indonesia for the period 2021 to 2022

No	Keterangan	Kebijakan Perusahaan				Penerapan Metode EOQ			
		2021		2022		2021		2022	
		Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate	Titanium Dioxide (TIO2)	Calcium Carbonate
1	Jumlah Barang dalam Sekali Pesan (Kg)	20.000 Kg	80.358 Kg	20.000 Kg	83.235 Kg	59.763 Kg	229.795 Kg	56.614 Kg	226.319 Kg
2	Frekuensi Pemesanan (kali)	240 Kali	95 Kali	225 Kali	86 Kali	80 Kali	33 Kali	79 Kali	32 Kali
3	Total Inventory Cost Order (TIC) (Rp)	1.040.830.000	431.799.545	987.010.000	395.410.891	625.253.006	264.145.558	618.089.957	257.697.120
4	Re-Order Point (ROP) (Kg)	-	-	-	-	88.889 Kg	141.370 Kg	83.333 Kg	132.559 Kg
5	Life Time Use / Durasi Pakai (LT = t / I)	-	-	-	-	4 hari	9 hari	4 hari	9 hari
6	Lead Time Use / Masa Tunggu	-	-	-	-	4 hari	9 hari	4 hari	9 hari

12. Draw an Inventory Diagram Using the Economic Order Quantity (EOQ) Method



C. DISCUSSION

1. Year 2021

a. Number of purchases of Titanium Dioxide (TIO2) raw materials in one order using PT policy. ICI Paints Indonesia amounting to 20,000 Kg with a purchasing frequency of 240

times a year. Meanwhile, by applying the Economic Order Quantity (EOQ) method, the average purchase of Titanium Dioxide (TIO2) raw materials in one order is 59,763 Kg with a purchase frequency of 80 times a year.

b. Number of purchases of Calcium Carbonate raw materials in one order using PT policy. ICI Paints Indonesia amounted to 80,358 Kg with a purchase frequency of 95 times a year. Meanwhile, by applying the Economic Order Quantity (EOQ) method, the average purchase of Calcium Carbonate raw materials in one order is 229,795 Kg with a purchase frequency of 33 times a year.

c. Total Inventory Cost Order (TICO) with PT policy. ICI Paints Indonesia for Titanium Dioxide (TIO2) is IDR 1,040,830,000,- while the Total Inventory Cost Order (TICO) by applying the Economic Order Quantity (EOQ) method is IDR 625,253,006,- so that the company can save the total cost of purchasing material inventory standard amounting to IDR 415,576,994,-

d. Total Inventory Cost Order (TICO) with PT policy. ICI Paints Indonesia for Calcium Carbonate is IDR 431,799,545,- while the Total Inventory Cost Order (TICO) by applying the Economic Order Quantity (EOQ) method is IDR 264,145,558,- so that the company can save the total cost of purchasing a raw material inventory of IDR 167,653,987,-

e. The number of re-orders or Re-Order Points (ROP) by applying the Economic Order Quantity (EOQ) method for Titanium Dioxide (TIO2) is 88,889 Kg while for Calcium Carbonate it is 141,370 Kg, so that production activities at PT. ICI Paints Indonesia can still run smoothly.

2. Year 2022

a. Number of purchases of Titanium Dioxide (TIO2) raw materials in one order using PT policy. ICI Paints Indonesia amounting to 20,000 Kg with a purchasing frequency of 225 times a year. Meanwhile, by applying the Economic Order Quantity (EOQ) method, the average purchase of Titanium Dioxide (TIO2) raw materials in one order is 56,614 kg with a purchase frequency of 79 times a year.

b. Number of purchases of Calcium Carbonate raw materials in one order using PT policy. ICI Paints Indonesia amounted to 83,235 Kg with a purchase frequency of 86 times a year. Meanwhile, by applying the Economic Order Quantity (EOQ) method, the average purchase of Calcium Carbonate raw materials in one order is 226,319 Kg with a purchase frequency of 32 times a year.

c. Total Inventory Cost Order (TICO) with PT policy. ICI Paints Indonesia for Titanium Dioxide (TIO2) is IDR 987,010,000,- while the Total Inventory Cost Order (TICO) by applying the Economic Order Quantity (EOQ) method is IDR 618,089,957,- so that the company can save the total cost of raw material inventory amounting to IDR 368,920,043,-

d. Total Inventory Cost Order (TICO) with PT policy. ICI Paints Indonesia for Calcium Carbonate is IDR 395,410,891,- while the Total Inventory Cost Order (TICO) by applying the Economic Order Quantity (EOQ) method is IDR 257,697,120,- so that the company can save total raw material inventory costs of IDR 137,713. ,771,-

e. The number of re-orders or Re-Order Points (ROP) by applying the Economic Order Quantity (EOQ) method for Titanium Dioxide (TIO2) is 83,333 Kg while for Calcium Carbonate it is 132,559 Kg, so that production activities at PT. ICI Paints Indonesia can still run smoothly.

CONCLUSION

Based on the research results, it can be concluded that the application of the Economic Order Quantity (EOQ) method in controlling the inventory of TIO2 and Calcium Carbonate raw materials at PT. ICI Paints Indonesia has a very significant influence, namely the policies of PT. ICI Paints Indonesia previously purchased TIO2 raw materials in 2021 and 2022 240 times and 225 times with 20,000 kg, while by applying the EOQ method the economic quantity was 59,763 kg 80 times and 56,614 kg 79 times in one year. And in PT policy. ICI Paints Indonesia's number of Re-Order Points is uncertain but by applying the EOQ Method the number of Re-Order Points is carried out when inventory reaches 88,889 kg and 83,333 kg with a Life Time of 4 days.

Meanwhile, previously in 2021 and 2022, Calcium Carbonate was carried out 95 times with 80,358 kg and 86 times with 83,253 kg, while with the application of the EOQ Method, the economic quantity was 229,795 kg 33 times and 226,319 kg 32 times in one year. And in PT policy. ICI Paints Indonesia's number of Re-Order Points is uncertain but by applying the EOQ Method the number of Re-Order Points is carried out when inventory reaches 141,370 kg and 132,559 kg with a Life Time of 9 days.

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