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Analysis of Fuel Supply Control (Palm Shell) Using EOQ Method in Pt. Charoen Pokphand Indonesia Tbk

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ABSTRACT

PT. Charoen Pokphand Indonesia Tbk. (Gorontalo) is still experiencing problems in managing fuel supply where the company often experiences a lack of inventory that hinders the production process. The company also experienced excess inventory, causing storage costs to rise. For this reason, companies need to exercise inventory control. One of the analytical tools that can be used to control inventory is the "Economic Order Quantity" (EOQ). From the calculation results, it was found that the optimal number of fuel supply purchases from palm oil shells using the EOQ method is 352 tons with a purchase frequency of 3 times in one period (1 year) so that the company can save fuel procurement costs. . The total inventory cost of raw materials with an EOQ of Rp. 32,845,640 while the cost incurred by the company without using EOQ amounted to Rp. 34,731,000. The savings that can be made by the company is Rp. 1,885,360 with a Reorder Point of 81.9 tonnes and a total safety stock of 241 tonnes.

Keywords: *Economic Order Quantity (EOQ), Fuel Supply*

INTRODUCTION

Fuel supply is an important factor in the company to support the smooth production process, therefore the company must optimize fuel supply, in this case, palm shells. PT. Charoen Pokphand Indonesia Tbk. (Gorontalo) is a company engaged in the processing of agricultural products, especially drying wet corn with levels above 15% dried to levels below 15% and then stored in silos. Drying corn with a dryer system where the corn will be dried using the hot air generated from combustion. There are two dryers and use a combustion furnace which requires fuel to operate so that it produces heat that can be channeled to dry the corn.

According to the observations made by the author during the case study process, fuel supplies at PT. Charoen Pokphand Indonesia Tbk. (Gorontalo) are still not optimal so that companies often experience insufficient inventory and can hinder the production process, if there are obstacles in the production process, then can affect the level of productivity of an industry (Hazimah, et al. 2020). In addition, the company has experienced too much inventory and experienced too many holding costs. For inventory control, an analysis of "Economic Order Quantity" (EOQ) can be used. By using the EOQ method, it is

also possible to calculate safety stock, maximum inventory and also the optimal reorder point for the company so as to avoid shortages or excess inventory.

METHOD

The method used to control palm shell fuel at PT. Charoen Pokphan Indonesia Gorontalo is an economic order quantity (EOQ) method. Economic Order Quantity (EOQ) is an inventory model that minimizes total carrying costs and ordering costs, an inventory model that was first developed in 1915 separately by Ford Harris and R.H. Wilson. The EOQ method is a calculation with a formula regarding the most economical quantity, or order frequency, or order value. In almost all situations involving finished goods inventory managers, this method can be said to be suitable for use (Widyastika and Nerli Khairani, 2020.)

Inventory is a number of goods or materials provided by the company, in the form of raw materials, finished goods, or goods in the process that are used by the company to meet consumer demand at any time to maintain a smooth production process called inventory (Viona Afrilia, 2021).

Inventory control is an inventory management activity that is interconnected with one another with good planning in terms of time, quantity, quality, and costs (Vito Arifanto Pradana and Ribangun Bamban Jakaria, 2021).

Inventory control is a series of control policies to determine inventory levels that must be maintained, when orders to increase inventory must be made and how large orders must be held, the amount or level of inventory required varies for each factory company, depending on production volume, type of company and process (Muhammad Nur Daud, 2017).

EOQ is an inventory model that minimizes total carrying costs and ordering costs, an inventory model that was first developed in 1915 independently by Ford Harris and R.H. Wilson**.** The EOQ method is a calculation with a formula regarding the most economical quantity, or order frequency, or order value. In almost all situations involving finished goods inventory management, this method can be said to be suitable for the use (Widyastika dan Nerli Khairani, 2020.).

According to Sri Hastari (2020), the EOQ formula in inventory control :

$$TIC = \left(\frac{D}{Q}S\right) + \left(\frac{Q}{2}H\right) \quad (1)$$

Calculation of economical purchase of raw materials:

$$Q^* = \sqrt{\frac{2DS}{H}} \quad (2)$$

D = Total Raw Material Requirements
S = One-time Ordering Cost
H = Holding Cost per Ton
Q = Average Purchase Of Raw Material
Calculation of the total cost of inventory before using the EOQ (TIC) calculation:

Safety stock is additional inventory held to protect or guard against the possibility of material shortages (Enggar Paskhalis Lahu et al., 2017). Safety stock is also a useful method to protecting the company from all risks that can arise from the existence of inventory. The safety stock calculation is based on how much the value of the deviation has occurred to the average over the last few months (Dea Misbachul Umami et al., 2020).

$X_{mean} = \frac{d}{n}$ (3)

d = Total data

n = Lots data

Sqfety stock = SD X Z (4)

Reorder Point (ROP) is a number that shows at what level of inventory an order must be made so that the goods arrive on time (Tri Ernita, 2019). According to Abdurahan Ahmad (2018), states that lead time is the time required to receive several economic orders after orders are placed or preparation begins. In essence, ordering inventory requires waiting time, that is from the ordering, manufacturing period, delivery period until the goods are received and entered the warehouse. Reorder Point is used to determine when or when it is appropriate to reorder raw materials to replace supplies that have been used.

FINDING AND DISCUSSION

The following is a table regarding the amount of usage palm shell in PT. Charoen Pokphand Indonesia Tbk.

Tabel 1. The amount of usage palm shell in september 2021- august 2022

Month	amount(kg)	lots (ton)
September	10.260	10,26
Oktober	87.540	87,54
November	73.810	73,81
Desember	294.718	294,718
Januari	557.990	557,99
Februari	521.802	521,802
March	634.641	634,641
April	349.370	349,37
May	217.215	217,215
June	281.457	281,457
July	193.446	193,446
August	309.580	309,58
amount	3.531.829	3.531,829
Average	294.319,0833	294,3190833

Source : PT. Caroen Pokphannd Indonesia

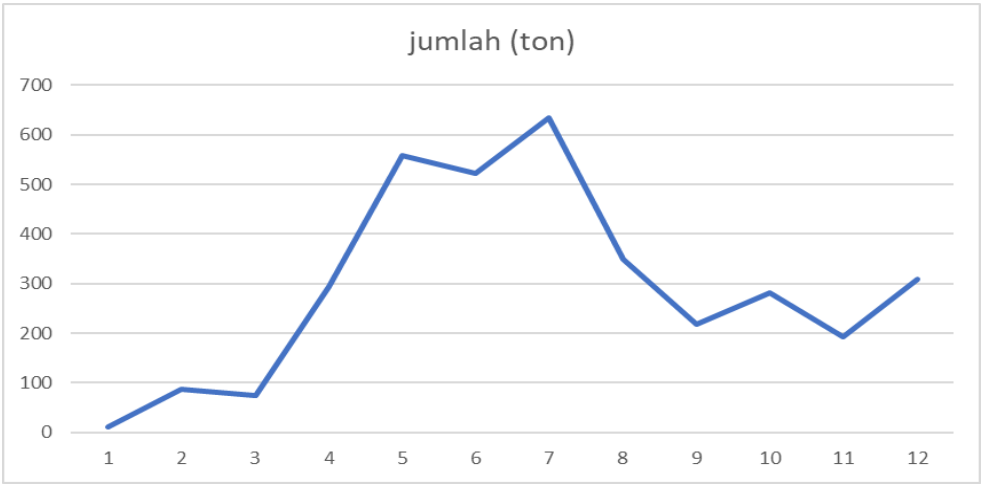


Figure 1 graph of the use of palm shells

The use of shells in PT Charoen Pokphand Indonesia Tbk. From September to August, it was 3,531.83 tons. During the use of the shells, from September to presently, the company has ordered 4 times with different order quantities and different places of ordering.

Tabel 2. Order Cost Table September 2021 - August 2022

Month	***Order cost***				
	Demolition worker (Rp.)	*Telecommunication (Rp.)*	*Loader (Rp.)*	*Solar (Rp.)*	*Operator (Rp.)*
September	1.881.000	100.000	2.750.000	420.000	30.000
Oktober					
November					
Desember		100.000	5.500.000	840.000	60.000
Januari					
Februari					
March		100.000	5.500.000	840.000	60.000
April					
May					
June	1.529.000	100.000	2.750.000	420.000	30.000
July					
August					
Total	3.410.000	400.000	16.500.000	2.520.000	180.000

Source : PT. Charoen Pokphand Indonesia

The cost of ordering for one period at PT. Charoen Pokphand Indonesia consists of demolition labor costs, telecommunication costs, loader cost, diesel fuel costs, and operator cost with a total order cost for one period of Rp. 23.010.000

Tabel 3. Holding Cost Table september 2021 – august 2022

Month	***holding cost***					
	Electricity (Rp.)	*Loader (Rp.)*	*Operator (Rp.)*	*Solar (Rp.)*	*Paint (Rp.)*	*Tarp (Rp.)*
September	100.000					
Oktober	100.000					
November	100.000					
Desember	100.000					
Januari	100.000	41.250.000	450.000	6.300.000		
Februari	100.000	33.000.000	360.000	5.040.000		
March	100.000				273.000	
April	100.000					5.900.000
May	100.000					
June	100.000					
July	100.000					
August	100.000					
Total	1.200.000	74.250.000	810.000	11.340.000	273.000	5.900.000

Source: PT. Charoen Pokphand Indonesia

holding costs are costs incurred by the company in the storage process where the storage costs include electricity costs. Loader costs, operator fees, diesel costs, paint costs, and tarpaulin costs. The total storage fee incurred by the company from September 2021 to August 2022 is Rp. 93.773.000.

Calculation of Order Costs and Holding Costs

a. Order Cost

Demoliton	Rp. 3.410.000
Telecommunication	Rp. 400.000
Loader	Rp. 16.500.000
Solar	Rp. 2.520.000
Operator	Rp. 180.000
Total	Rp. 23.010.000

b. Holding Costs

Loader	Rp. 74.250.000
electricity	Rp. 1.200.000
Operator	Rp. 810.000
Solar	Rp. 11.340.000
Cat	Rp. 273.000
Tarp	Rp. 5.900.000
Total	Rp. 93.773.000

S = order costs

$$= \frac{Total\ Order\ Cost}{\text{Order frequency}}$$

$$= \frac{23.010.000}{4}$$

= Rp. 5.752.500 each time order

H = Holding costs

$$= \frac{Total\ Order\ Cost}{\text{Order frequency}}$$

$$= \frac{93.773.000}{3.532}$$

= Rp. 26.549 per ton

Average Purchase of Fuel

Q = Average purchase of palm shell fuel

$$= \frac{\text{Total fuel usage}}{\text{Order frequency}}$$

$$= \frac{3.532}{4}$$

= 883 ton per order

Total Inventory Cost

D = Fuel require total (3.532 Ton)
Q = Average Purchase of Fuel (883 Ton)
S = One-time Order fee (Rp. 5.752.500)
H = Holding Cost per Ton (Rp. 26.549)

Calculation of Inventory Cost (TIC) :

$$TIC = \left(\frac{3532}{883} * 5.752.500\right) + \left(\frac{883}{2} * 26.549\right)$$

= Rp. 23.010.000 + Rp. 11.721.383

TIC = Rp. 34.731.383

Economical Purchase of Fuel

D = Total of Raw Material requirements (3.532 Ton)
S = one-time order cost (Rp. 5.752.500)
H = holding cost per Ton (Rp. 26.549)

Therefore, the economic cost of raw materials can be calculated using the EOQ method:

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

$$Q^* = \sqrt{\frac{2\ X\ 3.532\ X\ 5.752.500}{26.549}}$$

$$Q^* = \sqrt{530.590}$$

Q * =1.237 Ton

So, the ideal purchase of fuel of raw material is 1.237 Ton per purchase

Purchase Frequency of Fuel

$$F = \frac{D}{Q}$$

$$F = \frac{3.532}{1.237}$$

F = 3 times purchase

So, the frequency of purchasing raw material is made 3 times order in one year

Inventory costs after the calculation using EOQ Method

D = Total of Raw Material requirements (3.532 Ton)
S = one-time order cost (Rp. 5.752.500)
H = holding cost per Ton (Rp. 26.549)
Q*= The most economical purchase of raw materials (1.237 Ton)

Calculation of inventory total cost (TIC):

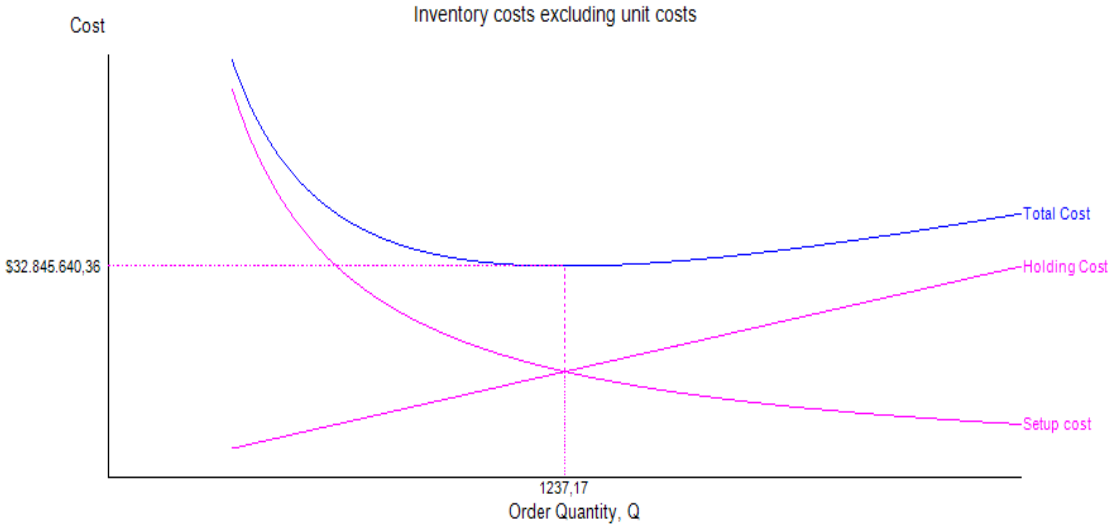
$$TIC = \left(\frac{D}{Q^*} \times S\right) + \left(\frac{Q^*}{2} \times H\right)$$

$$TIC = \left(\frac{3.532}{1.237} \times 5752500\right) + \left(\frac{1237}{2} \times 26.549\right)$$

TIC = Rp. 16.425.084 + Rp.16.420.556

TIC = 32.845.640

So, the total inventory cost that has been spent using EOQ is Rp. 32.845.640



Graph 2 Calculation of EOQ

Determination of Safety Stock

Safety stock is also known as safety stock. safety stock is used to calculate safety stock using a statistical method by comparing the average raw materials with the actual use

of raw materials after that look for deviations. Calculation of Standard Deviation is presented in table 4.

Tabel 4. Calculation of standard deviation tabel

Months	*Lots(kg)*	*Lots (Ton)(X)*	*X Average*	*X - X Average*	*(X-X Rata-Rata)^2*
September	10.260	10,26	294	-283,74	80.508,3876
Oktober	87.540	87,54	294	-206,46	42.625,7316
November	73.810	73,81	294	-220,19	48.483,6361
Desember	294.718	294,718	294	0,718	0,515524
Januari	557.990	557,99	294	263,99	69.690,7201
Februari	521.802	521,802	294	227,802	51.893,7512
March	634.641	634,641	294	340,641	116.036,2909
April	349.370	349,37	294	55,37	3.065,8369
May	217.215	217,215	294	-76,785	5.895,936225
June	281.457	281,457	294	-12,543	157,326849
July	193.446	193,446	294	-100,554	10.111,10692
August	309.580	309,58	294	15,58	242,7364
Total	3.531.829	3.531,829	3.528	3,829	428.711,9763
Average	294.319,0833	294,3190833	294	0,319083333	35.725,99802

Source: PT. Charoen Pokphand Indonesia

X Average = $\frac{3532}{12}$

X Average = 294

SD = $\sqrt{\sum(\frac{(x-x\,Rata-Rata)\text{^}2}{n})}$

SD = $\sqrt{\sum(\frac{428711}{12})}$

SD = $\sqrt{35.726}$

SD = 189,01

By using estimates or assumptions that the company chooses a standard deviation of 10%, Z is obtained with a standard deviation table of 1.28.

Safety stock = SD X Z

= 189,01 x 1,28

= 241

Safety stock = 241 Ton

So, the safety stock that must be provided by the company is 241 tons

Reorder Point

PT. Charoen Pokphand Indonesia Tbk. has a waiting time in waiting to order palm shell fuel for 14 days, or in other words a lead time (L) of time is 7 days with an average number of working days (t) 300 days a year. Before calculating the amount of ROP, the first step is to look for the usage level of raw materials/day in the following way:

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

$$D = \frac{3.532}{300}$$

D = 11,7 Ton

Then, the ROP is as follows

ROP = D x L

ROP = 11,7 x 7

ROP = 81,9 Ton

So, the company must order raw materials when the remaining raw material inventory at the company is 81.9 tons.

CONCLUSION

The optimal purchase amount for palm shell fuel supplies with EOQ is 1,237 tons with a purchase frequency of 3 times in one period (1 year) while the fuel procurement at the company is not regular. The total cost of raw material inventory with an EOQ of Rp. 32,845,640 while the company's policy is Rp. 34,731,000. Savings of Rp. 1,885,360. Reorder Point of 81.9 Tons and total stock safety of 241 Tons.

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