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Inventory Control of Lubricating Oil Raw Materials with Silver Meal Heuristic Method at PT. Alp Petro Industri - Pasuruan

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ABSTRACT

PT. Alp Petro Industri is a company engaged in the lubricating oil industry. The raw materials needed are Feed Stock, Base Oil, and Additives. PT. ALP Petro Industri experienced problems in its inventory, which sometimes experienced excess inventory which resulted in high storage costs, and sometimes experienced a shortage of raw materials which resulted in the cessation of the production process so that the company could not fulfill the products desired by consumers. This study aims to determine the level of inventory control of lubricating oil raw materials at PT. Alp Petro Industri Pasuruan optimally to minimize inventory costs. The existing data in the company has the characteristics of varying demand levels, so it is processed with a dynamic deterministic inventory control model, namely the Heuristic Silver Meal method. From the calculation of the total cost of inventory with the company's method of IDR. 50,722,980,000 while the Heuristic Silver Meal method is IDR. 50,536,660,000. The Heuristic Silver Meal method produces a total cost of inventory that is cheaper than the company's method of IDR. 50,722,980,000 with a savings of IDR. 186.320.000. The optimal number of orders for raw materials for Feed Stock raw materials is 348,697 kg per month, Base Oil raw materials are 408,733 kg per month, and Additives raw materials are 141,783 kg per month.

Keywords: Raw material, efficiency, heuristic silver meal, stock

Introduction

All industrial companies, whether intentionally or not, will always have a stock of raw materials. Raw materials are one of the most vital factors for the continuity of a production process. Inventories of raw materials that exceed the need will lead to high storage costs. While the amount of inventory that is too small will cause losses, namely disruption of the production process, and also result in the loss of opportunities for profit if it turns out that the actual demand exceeds the expected demand. To achieve the expected target, it is necessary to have an optimal supply of raw materials so that it does not interfere with the smooth running of the production process. The existence of proper handling of raw material inventory is very necessary to anticipate the sudden high market demand at a certain period so that the supply of products can be optimized and the costs associated therein can be reduced as efficiently as possible.

Some of the literature reviews used in this research are Chemical Inventory Control Analysis with the Heuristic Silver Meal method (Siswanto & Handayani, 2016). Application of the Siver Meal Method in Economical Raw Material Inventory Control at CV. Lintas Alam Mahameru (Adi, 2018), Implementation of Heuristic Silver Meal in Planning and Control Scrap Supplies in Growth Sumatra Industry Company (Parinduri et al., 2018), Control of Drug Supplies at PT. Pratama Nirmala Palembang with Heuristic Silver Meal (Kartika et al., 2019). The application of the Silver Meal Heuristic Model for optimizing the supply of Bulog rice sub-drive Ciamis (Dwiputranti &

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Gandara, 2021), and Calculation of the efficiency of tofu production costs using the Silver Meal Heuristic method (Taufan et al., 2021).

PT. Alp Petro Industri is a company engaged in the lubricating oil industry. The raw materials needed are Feed Stock, Base Oil, and Additives. PT. ALP Petro Industri experienced problems in its inventory, which sometimes experienced excess inventory which resulted in high storage costs, and sometimes experienced a shortage of raw materials which resulted in the cessation of the production process so that the company could not fulfill the products desired by consumers. The purpose of this study is to determine the level of inventory control of lubricating oil raw materials.

Material and Methods

In the research method, the following steps are carried out:

1. Data collection
   Collected data:
   a. Data on raw materials needs to be based on demand data for one year
   b. Data storage costs
   c. Order cost data
   d. Purchase cost data
2. Calculating the average inventory cost, with the formula:

$$Average\ inventory\ cost = \frac{ordering\ cost + total\ holding\ cost\ at\ the\ end\ of\ period\ t}{t}$$

Or

$$\frac{AC}{TU} = \frac{k + [(1-1)D_1 + (2-1)D_2 + (3-1)D_3 + \cdots + (t-1)D_t]\ h}{t}$$

Where:

$\frac{AC}{TU}$ = Average inventory cost per unit time.

K = Cost per message

D_t = Demand during period t

H = Cost of holding per unit per period

The settlement rule is to calculate $\frac{AC}{TU}$ for successive purchase periods until the lowest $\frac{AC}{TU}$ value is the purchase period and the amount of material purchased is the number of needs during that period.

$$Q_t = D_1 + D_2 + D_3 + \ldots\ldots\ldots + D_t$$

3. Create a procurement table

Table 1. Procurement

Periode	t	Needs	$\frac{AC}{TU}$	Repurchase

If $\frac{TRC(T+1)}{T+1} > \frac{TRC(T)}{T}$ then in the T+1 period, procurement of raw materials must be carried out again and the procurement time (T) starts again from 1, so that the holding cost returns to 0 and the ordering cost (c) returns.

4. Create a control table

Table 2. Inventory control

Month	Needs	Purchase	Save	Total cost

5. Calculating the total cost of inventory using the *Heuristic Silver Meal* method.
6. Calculate the total cost of inventory issued by the company.
7. Comparing the total cost of inventory with the *Heuristic Silver Meal* method with the total cost of inventory issued by the company so far.
8. Conclusion

Results and Discussion

Calculating the average cost of inventory as an example of raw material feedstock from January to March

Average inventory cost per unit time = $\frac{(ordering\ cost)+(total\ holding\ cost\ at\ the\ end\ of\ period\ t}{t}$

atau $$\frac{AC}{TU} = \frac{k + \{(1-1)D_1 + (2-1)D_2 + (3-1)D_3 + \cdots\cdots + (t-1)D_T\}h}{t}$$

The calculation for raw material Feed Stock:

- January (D_1), t = 1

  $\frac{\text{AC}}{\text{TU}} = \frac{340.000 + \{(1-1)346.800\}115}{1}$ = Rp. 340.000

  The purchase period is only one month, the costs incurred are only ordering fees without any storage costs.
- February (D_2), t = 2

  $\frac{\text{AC}}{\text{TU}} = \frac{340.000 + \{(1-1)346.800 + (2-1)351.000\}115}{2}$ = Rp. 20.352.500

  There is an increase in cost $\frac{AC}{TU}$ in period t = 2, then period t = 2 is the beginning of the purchase.

- February (D_1), t = 1

  $\frac{\text{AC}}{\text{TU}} = \frac{340.000 + \{(1-1)351.000\}115}{1}$ = Rp. 340.000

  The purchase period is only one month, the costs incurred are only ordering fees without any storage costs.

- March (D_2), t = 2

$$\frac{\text{AC}}{\text{TU}} = \frac{340.000 + \{(1-1)351.000 + (2-1)342.100\}115}{2} = \text{Rp. } 19.840.750$$

There is an increase in cost $\frac{AC}{TU}$ in period t = 2, then period t = 2 is the beginning of the purchase.

- March (D_1), t = 1

$$\frac{\text{AC}}{\text{TU}} = \frac{340.000 + \{(1-1)342.100\}115}{1} = \text{Rp. } 340.000$$

The purchase period is only one month, the costs incurred are only ordering fees without any storage costs.

Creating a feed stock purchase table

Summary of raw material purchases of Feed Stock from January to December, as shown in Table 3.

Table 3. Purchase of feed stock raw material

No.	Period	T	$\frac{AC}{TU}$	Repurchase ($\Leftarrow$)
1.	January	1	Rp. 340.000	$\Leftarrow$
2.	February	2	Rp. 20.352.500	
3.	February	1	Rp. 340.000	$\Leftarrow$
4.	March	2	Rp. 19.840.750	
5.	March	1	Rp. 340.000	$\Leftarrow$
6.	April	2	Rp. 20.300.750	
7.	April	1	Rp. 340.000	$\Leftarrow$
8.	May	2	Rp. 20.634.250	
9.	May	1	Rp. 340.000	$\Leftarrow$
10.	June	2	Rp. 20.099.500	
11.	June	1	Rp. 340.000	$\Leftarrow$
12.	July	2	Rp. 20.168.500	
13.	July	1	Rp. 340.000	$\Leftarrow$
14.	August	2	Rp. 19.967.250	
15.	August	1	Rp. 340.000	$\Leftarrow$
16.	September	2	Rp. 20.369.750	
17.	September	1	Rp. 340.000	$\Leftarrow$
18.	October	2	Rp. 20.197.250	
19.	October	1	Rp. 340.000	$\Leftarrow$
20.	November	2	Rp. 20.266.250	
21.	November	1	Rp. 340.000	$\Leftarrow$
22.	December	2	Rp. 20.525.000	
23.	December	1	Rp. 340.000	$\Leftarrow$

Table 3 shows that the purchase of Feed Stock raw materials is carried out once a month because the value $\frac{AC}{TU}$ cannot go down again. The $\frac{AC}{TU}$ lowest cost is the purchase period.

Create an inventory control table

Table 4. Inventory of raw materials for feed stock

Month	Acceptance (Kg)	Needs (Kg)	Remain-der (Kg)	Order-ing cost (IDR)	Holding cost (IDR)	Purchase Cost (IDR)	Total inven-tory cost (IDR)
January	346.800	346.800	0	340.000	0	834.900.000	835.240.000
February	351.000	351.000	0	340.000	0	801.320.000	801.660.000
March	342.100	342.100	0	340.000	0	788.210.000	788.550.000
April	350.100	350.100	0	340.000	0	839.500.000	839.840.000
May	355.900	355.900	0	340.000	0	794.650.000	794.990.000
June	346.600	346.600	0	340.000	0	798.790.000	799.130.000
July	347.800	347.800	0	340.000	0	792.580.000	792.920.000
August	344.300	344.300	0	340.000	0	806.840.000	807.180.000
September	351.300	351.300	0	340.000	0	796.260.000	796.600.000
October	348.300	348.300	0	340.000	0	809.830.000	810.170.000
November	349.500	349.500	0	340.000	0	789.820.000	790.160.000
December	354.000	354.000	0	340.000	0	807.760.000	808.100.000
			Total				9.664.540.000

In Table 4, the total cost of raw material supply for Feed Stock for one year is Rp. 9,664.540.000.

Table 5. Inventory of base oil raw materials

Month	Ac-ceptance (Kg)	Needs (Kg)	Remain-der (Kg)	Order-ing cost (IDR)	Holding cost (IDR)	Purchase Cost (IDR)	Total inventory cost (IDR)
January	400.000	400.000	0	860.000	0	1.945.800.000	1.946.660.000
February	408.800	408.800	0	860.000	0	2.011.130.000	2.011.990.000
March	413.000	413.000	0	860.000	0	1.920.420.000	1.921.280.000
April	412.000	412.000	0	860.000	0	1.944.390.000	1.945.250.000
May	408.700	408.700	0	860.000	0	1.926.060.000	1.926.920.000
June	413.500	413.500	0	860.000	0	1.933.110.000	1.933.970.000
July	400.300	400.300	0	860.000	0	1.883.760.000	1.884.620.000
August	408.400	408.400	0	860.000	0	1.912.900.000	1.913.760.000
September	416.000	416.000	0	860.000	0	1.951.440.000	1.952.300.000
October	411.800	411.800	0	860.000	0	1.936.870.000	1.937.730.000
November	407.300	407.300	0	860.000	0	1.918.540.000	1.919.400.000
December	405.000	405.000	0	860.000	0	1.910.080.000	1.910.940.000
			Total				23.204.820.000

In Table 5, the total cost of raw material supply for Feed Stock for one year is Rp. 23,204,820,000.

Table 6. Inventory of raw material additives

Month	Acceptance (Kg)	Needs (Kg)	Remainder (Kg)	Ordering cost (IDR)	Holding cost (IDR)	Purchase Cost (IDR)	Total inventory cost (IDR)
January	144.800	144.800	0	500.000	0	1.623.840.000	1.624.340.000
February	147.500	147.500	0	500.000	0	1.486.140.000	1.486.640.000
March	143.200	143.200	0	500.000	0	1.451.460.000	1.451.960.000
April	146.200	146.200	0	500.000	0	1.661.580.000	1.662.080.000
May	145.700	145.700	0	500.000	0	1.412.700.000	1.413.200.000
June	142.900	142.900	0	500.000	0	1.330.080.000	1.330.580.000
July	147.400	147.400	0	500.000	0	1.581.000.000	1.581.500.000
August	142.100	142.100	0	500.000	0	1.403.520.000	1.404.020.000
September	140.600	140.600	0	500.000	0	1.445.340.000	1.445.840.000
October	143.000	143.000	0	500.000	0	1.461.660.000	1.462.160.000
November	141.900	141.900	0	500.000	0	1.347.420.000	1.347.920.000
December	140.900	140.900	0	500.000	0	1.456.560.000	1.457.060.000
			Total				17.667.300.000

In Table 6, the total cost of raw material supply for Feed Stock for one year is IDR. 17,667,300,000. So the total cost of inventory using the Heuristic Silver Meal (TCB) Method from January to December:

1. *Feed Stock* IDR 9.664.540.000
2. *Base Oil* IDR 23.204.820.000
3. *Additives* IDR 17.667.300.000 +

IDR 50.536.660.000

Comparison of the total cost of inventory company method with heuristic silver meal method

Comparing the total inventory cost of the company's method and the Heuristic Silver Meal method can be seen in Table 7.

Table 7. Inventory cost comparison proposed method

Total inventory cost Company's Method	Total inventory cost *Heuristic Silver Meal* Method
IDR. 50.722.980.000	IDR. 50.536.660.000

In Table 7, the total cost of the company's inventory method is IDR. 50,722,980,000 while the Heuristic Silver Meal method is IDR. 50,536,660,000 with a saving of IDR. 186.320,000, so the Heuristic Silver Meal method can be proposed in planning inventory control for the next period.

Conclusion

From the calculation of the total cost of inventory with the company method (TCA) of IDR. 50,722,980,000 while the Heuristic Silver Meal (TCB) method is IDR. 50,536,660,000. The Heuristic Silver Meal method produces a total cost of inventory that is cheaper than the company's method of IDR. 50,722,980,000, - with a savings of IDR. 186.320.000. The optimal number of

orders for raw materials for Feed Stock raw materials is 348,697 kg per month, Base Oil raw materials are 408,733 kg per month, and Additives raw materials are 141,783 kg per month.

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