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Research Paper

Implementation of Heuristic Silver Meal Method in Planning and Control Scrap Supplies in Growth Sumatra Industry Company

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Abstract

The raw materials used in the form of scrap are obtained from local suppliers and importers. In the management of scrap so far still apply traditional patterns that have not been scientific. This condition is actually less profitable for companies in market conditions and competition is increasingly competitive. To ensure the smooth process and optimization of production in this study Implementation of Heuristic Silver Meal Method in Planning and Control Scrap Supplies. Selection of this method is based on From the research result obtained safety stock for local scrap as much as 306 Ton/Month, while for imported scrap as much as 186 ton/month. Based on the calculation of lot size using heuristic silver-meal method in obtaining a lot of 12 bookings for local scrap as well as time of re-ordering of raw materials (reorder point) of 399 Ton. While for scrap import 6 times the order and reorder (reorder point) of 267 Ton. With the application of this method obtained savings of Rp. 496.560.000 in 2018, a significant amount.

Keywords: *Safety stock, Heuristic Silver-Meal, reorder point*

1. Introduction

Raw materials is one factor that is vital for the ongoing process of production[1], [2]. The availability of raw materials exceeds. The availability of raw materials that exceeds the need will incur extra costs or high storage costs, while too little inventory will cause losses, it will disrupt the production process and also result in loss of opportunity to gain profit if it turns out the demand on the actual condition expected demand. In order to survive in such a tight market competition situation, the company needs to place emphasis on inventory costs as well as cost savings for raw material purchases[3][4].

The company located in Medan - Belawan road uses scrap (old iron) as raw material in the field of melting and rolling steel[5]. In conducting scrap inventory by ordering it in an uncertain amount. And sometimes there is also lack of supplies scrap when needed, which resulted in production blocking[6][7].

With the existence of the problem then conducted research with Silver Meal Heuristic Method so that it can do the optimal scrap inventory planning so as to guarantee the need and smoothness of company production activity. The objectives that can be silent from this research are as follows:

Planning local and import scrap raw materials at PT. Growth Sumatra Industry from January to December 2018. To find out the number of security issues (safety stock) scrap raw materials needed PT. Growth Sumatra Industry. Determining the time or time of the company must reorder the reorder point.

2. Theory

a. Forecasting

Forecasting is the process of estimating future needs that include needs in quantity size, quality, time and location required in order to meet the demand of goods or services[8]–[14]. Data patterns can be divided into 4 types:

1) Patter Trend
2) Trend Season Pattern
3) Season Cycle
4) Cycle Patterns

b. Inventory

Inventory can be defined as items stored for use or sale in the future or period[15]. Inventory consist of raw material inventories, inventories of semi-finished materials and finished goods. Inventory control needs to be considered because it is directly related to the cost to the company as a result of inventory[16], [17].

c. Inventory Costs

Storage costs (holding cost or carrying cost) consist of costs vary directly with inventory quantity.

d. Ordering cost

The cost of the order is the cost incurred in connection with the goods to suppliers.

e. Out of Stock Costs

The cost of running out of inventory is the costs incurred by the availability of inventories that are less than the required amount.

f. Setup Cost

Set up costs are costs incurred in preparing machinery and equipment for use in the conversion process.

g. Safety Stock

Safety stock or often referred to as safety stock is inventory conducted to anticipate the element of demand uncertainty and provision. If the security company is not able to anticipate the uncertainty, it will be stock out.
The general formula of safety stock (SS) for variable demand levels and constant lead time is:

$SS = z \sqrt{LT} (\sigma d)$

Where:
SS = Safety Stock
z = Service Level
LT = Lead Time
(σd) = Standard Deviation

2.1 Heuristic Silver Meal Method

The Heuristic settlement provides a simpler solution. There are several heuristic approaches, but the silver meal approach is easier to use and produces the best buy-out pattern than any other heuristic approach [18]–[20].
The Silver Meal approach is similar to the EOQ approach, but the count is based more on the variable of the buying period and not on the total demand during the plan. Silver-Meal method or often also called the SM method developed by Edward Silver and Harlan Meal based on the cost period.
The general formula that can be used is:
K (m) = 1/m (A + hD_2 + 2hD_3 + .. + (m-1) hD_m)
Calculate K (m), m = 1,2,3, ..., m, and stop count if K (m + 1)> K (m)
Information:
Dm = Demand in the period (D1, D2, D3, ..., Dm)
K (m) = Average cost of inventory per unit of time
m = Period
A = Booking fee
h = Cost saving per unit/period

a. Reorder Point
Reorder point (ROP) responds per time when starting a reservation. ROP model occurs when the amount of inventory contained in the stock decreases steadily. Thus we must determine how much the minimum level of inventory should be considered so that there is no shortage of inventory. The general formula of ROP for the variable request level and the constant lead time are::

$ROP = \bar{d}LT + SS$
Where:
d= Average level of demand
LT= constant lead time
SS= Safety Stock

b. Scrap Demand Data for 2017 Period
Local scrap demand and import scrap during January - Dec 2017 can be seen in Table 1.

Table.1: Local Scrap Requests

Period (Month)	Local (Tons)	Import (Tons)
Jan	3.355	1.964
Feb	4.398	1.878
Mar	5.169	1.540
Apr	4.601	1.762
May	4.926	1.580
Jun	5.380	1.780
Jul	4.004	1.625
Aug	4.817	1.274
Sep	5.483	1.597
Okt	5.444	1.370
Nov	5.511	1.880
Dec	5.693	2.150
Total	53.401	20.400

c. Booking Fee
The booking fee is all costs incurred from the reservation goods until the availability of goods in gu dang. Data is processed from the amount of costs incurred by the company per one message.

Table.2: Breakdown of booking fees

Type of Cost	Local (Rp)	Import (Rp)
Telephone	100.00	250.000
Administration Contract	1.450.00	1.600.000
Invoice	1.260.00	1.310.000
Loading and unloading	15.200.00	17.000.000
Transportation (Shipping)	75.700.00	62.600.000
Total	93.710.00	82.760.000

d. Raw Material Storage Cost
The cost of storage is the sum of the costs incurred to handle the storage of raw materials. Be included details of the cost of storage of local and imported scrap.

Table.3: Details of scrap storage costs

Cost Type	Local (Rp.000)	Import (Rp.000)
Electricity	9.500,0	9.500,0
Labor	237.600,0	237.600,0
Warehouse Maintenance	25.900,0	25.900,0
Insurance	405.870,5	382.870,0
Depreciation	55.670,0	55.670,0
Inventory Handling	395.900,0	389.900,0
Total	1.130.400,5	1.101.440,0

Average local scrap storage cost = Rp 21,169 per ton
Average storage cost of scrap import = Rp 53.992 per ton

e. Waiting Time (Lead Time)
Waiting time is the time interval between when the ordering of scrap is implemented with the arrival of raw materials ordered. Based on the cooperation agreement is known that the lead time ordering of local scrap is 7 days. While the lead time of the raw material of import scrap is 15 days.

f. Forecasting
Based on scrap, local and import demand data during 2017. So in this study using two methods of forecasting, namely Weighted Moving Average method and Exponential smoothing method. In order to select the best method of the two methods, we can measure the error between the actual demand of 2017 and the forecasting result using Mean Absolute Deviation (MAD) and Mean Forecast Error (MFE) [21]–[27].
The following can be seen the comparison of MAD and MFE values on each of the forecasting methods used.

Table.4: Comparison of MAD and MFE Methods With WMA Method

Type of scrap	WMA	MAD	MFE
Local Scrap	2 months	886	595
	3 months	410	179
	5 months	544	268
Import Scrap	2 months	234	24
	3 months	222	55
	5 months	252	64

WMA (*Weighted Moving Average)*
Data Forecasting Single Exponential Smoothing (SES) Before performing forecasting calculations on this method, then the first step is to determine α (smoothing constant). Determination of the magnitude of the value of α is done with the proviso that the more volatile, the value of α selected should be higher toward the value of one. Because the demand data for 1 year slag tend to be volatile hence selected the selected value of α is 0.1; 0.5; 0.9.

Table.5: Comparison of MAD Methods and MFE With ES Method

Type of scrap	ES	MAD	MFE
Local Scrap	α = 0,1	693	570
	α = 0,5	822	822
	α = 0,9	515	153
Import Scrap	α = 0,1	289	-172

	α = 0,5	239	-3
	α = 0,9	268	26

ES (*Exponential smoothing)*

From the table it can be seen that the forecasting meta de selected Exponential Smoothing is because it gives smaller MAD and MFE values (close to zero) compared to other methods. And the results of the action are:

Table.6: Forecasting Results Demand for scrap (Jan - Dec 2018)

No	Period	Type of Scrap	
		Scrap Local	Scrap Import
1	Jan	5.540	1.909
2	Feb	4.448	1.937
3	Mar	4.423	1.907
4	Apr	4.796	1.724
5	May	4.698	1.743
6	June	4.812	1.661
7	July	5.096	1.721
8	Aug	4.550	1.673
9	Sep	4.684	1.473
10	Okt	5.083	1.535
11	Nov	5.264	1.453
12	Dec	5.388	1.666
Total		58.788	20.402
Average		4.899	1.700
Standard Deviation		371	162

g. Safety Stock

To reduce the risk of running out of stocks then carried out the calculation of safety stock. In this study, the company set the risk of raw material supply cannot be more than 5%. So, the amount of local safety stock scrap is: $SS = z\sqrt{LT}\ (\sigma d)$

Lead Time (LT) = 7 days = ($\frac{1}{4}$ month) = 0,25

Service Level (z) = 100% - risk = 95% = z for 95% = 1.65 (see normal distribution table z) $SS = 1{,}65\sqrt{0{,}25}$ (371) = 306 ton/month.

While the amount of imported safety stock scrap is as follows:

Lead Time (LT) = 15 days = ($\frac{1}{2}$ month) = 0.5

Service Level (z) = 100% - risk = 95%= z

for 95% = 1,65 (see normal distribution table z) $SS = 1{,}65\sqrt{0{,}5}\ (162)$=186 ton/month

h. Size Heuristic Silver-Meal Size Calculation

Based on the plot of data obtained from forecasting a suitable method to do lot sizing is by using the Silver-Meal heuristic method. The use of Silver-Meal Method later in order to determine the optimal number of local scrap order and import so as to minimize the company's expenditure to purchase raw materials and avoid the problem of delayed raw materials resulting in cessation of the production process**.**

Table.7: Frequency of Ordering for local scrap and import

Local Scrap		Import Scrap	
Order	Tons	Order	Tons
1	5.540	1	1.909 + 1.937 = 3.846
2	4.448		
3	4.423	2	1.907 + 1.724 =3.631
4	4.796		
5	4.698	3	1.743 + 1.661 =3.404
6	4.812		
7	5.096	4	1.721 + 1.673= 3.394
8	4.550		
9	4.684	5	1.473 + 1.535 =3.008
10	5.083		
11	5.264	6	1.453 + 1.666 =3.119
12	5.387		
		-	-

i. Reorder Time Calculation

In this study used Reorder Point model or reorder time where the demand level is variable and Lead Time is constant. Lead time for local scrap is 7 days.

Safety Stock = 306 ton/month

Average demand rate (d) = 371 ton/month

d LT = 371 (1/4) = 93 Ton

ROP = d LT + SS = 93 + 306

= 399 tons

Thus the company must re-order at least what local bi la stock scrap to live 399 Ton.

While the time of re-ordering import scrap with lead time for the type of local scrap is 15 days.

Safety Stock = 186 Ton/month

Average demand rate (d) = 162 Tons/month

d LT = 162 (1/2) = 81 Ton

ROP = d LT + SS = 81 + 186 = 267 Ton

Thus the company must re-order at least if import scrap reaches 267 Ton.

3. Conclusion

Based on the results of research that has been done then obtained conclusion:

Safety Stock of local scrap as much as 306 tons/month and scrap import as much as 186 tons/month. Total cost of ordering local scrap per once order Rp. 93,710,000, for the total cost of importing scrap as much as Rp. 82,760,000. While the cost of storing local scrap is Rp. 21,169 per ton and for storage cost of import scrap Rp. 53,992 per ton.

Order size (Lot size) for local scrap 12 times in the period January, February, March, April, May, June, July, August, September, October, November, and December with a booking fee that is equal to 12 x Rp . 93,710,000 = Rp. 1,124,520,000.

As for the size of orders in the period 2018 type of import scrap that is as much as 6 in the period January, March, May, July, September, and November with a booking fee of 6 x Rp. 82,760.000 = Rp. 496,560,000,-.

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