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Soybean Inventory Management in the Production Process of the Semoga Laris Tofu Factory

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A B S T R A C T

Semoga laris tofu factory is one of the food industry businesses, where the factory processes soybeans into tofu products. The problem that occurs in the management of inventory at the semoga laris tofu factory is that the factory tends to be unprepared for unexpected circumstances, which is caused by the fact that the value of safety stock on raw material inventory has not been determined. At the semoga laris tofu factory hopefully laris there are also capital restrictions on the purchase of raw materials, where the available capital is IDR 30,000,000. This study aims to evaluate the inventory management carried out by the factory by comparing the Min-Max Method, the Economic Order Quantity (EOQ) Method with the tofu factory policy, which after obtaining the optimal Q is then calculated using the working capital constraint method if the results of the optimal Q cannot be met by the available capital. Based on the results of calculations carried out in this study, calculations with the Basic EOQ method have more optimal Q results compared to other methods. However, the basic EOQ calculation exceeds the existing capital limit, because the cost of purchasing raw materials costs IDR 105,450,000. Based on the existence of capital-related restrictions, the calculation is continued with the capital constraint EOQ method. EOQ with this capital constraint has a quantity for one order of 52 bags with a capital cost of IDR 29,640,000.

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1. INTRODUCTION

Tofu is one of the most popular types of food, with an affordable price. The special quality value of tofu is seen from the nutrients contained, both protein, saturated fat content, minerals and vitamins. The processing method in making tofu is by processing soybeans into soybean porridge, then the protein that has been produced from the processing is coagulated with special ingredients. Soybean is the main raw material of tofu processing, however, based on the existing analysis, the projected soybean demand is higher than the soybean produced. This problem can potentially lead to the import of soybeans, to meet the demand for existing soybean needs. The increasing demand for soybeans is in line with the increase in population and food needs in Indonesia.

Therefore, a balanced supply of soybean raw materials is needed, so that there are no problems in supply. A balanced inventory can reduce the increase in soybean imports made. This is because imported soybeans will affect the selling value of tofu, which is caused by the varying prices of imported soybeans depending on the dollar to rupiah exchange rate (Mushollaeni et al., 2021).

Based on this explanation, it can be concluded that the purpose of inventory management is to determine the balance between inventory investment and meeting consumer demand (Wulandari and Indrianto, 2021). In the industrial world, increasingly fierce competition will encourage businesses to improve performance in their production processes so that they can meet consumer demand (Hidayati and Pulansari, 2023). A balanced supply raw materials plays an important role in a business to meet consumer demand, one of which is in consumer demand in the tofu food industry. Semoga laris tofu factory is one of the food industry businesses, where the factory processes soybeans into tofu products. Tofu is produced every day to meet the demand for consumer needs, using raw materials purchased from soybean distributors. The ordering of soybean raw materials is done on the basis of good quality soybeans and a storage period that lasts for some time. In the management of the tofu factory, semoga laris tofu factory has not set a safety stock for ordering raw materials to meet consumer demand for tofu, so the factory tends to be unprepared for unexpected circumstances. The situation is in the form of consumer demand that suddenly jumps up, so the factory often runs out of stock in the process of making tofu to meet consumer demand. In addition to experiencing stock-outs on soybean raw materials, semoga laris tofu factory may also often face the problem of soybean accumulation in the warehouse. This is due to ordering soybeans with too much quantity. At the tofu factory, hopefully there are also limits to the capital in purchasing soybean raw materials, where in each purchase of soybeans the existing capital is approximately IDR 30,000,000 for purchases in 2 weeks.

Based on the problems of this study, data processing from inventory management is taken into account with the constraints of available capital constraints. This inventory management is carried out by comparing the min-max method, EOQ method with the policy of semoga laris tofu factory to find the optimal order quantity. Research with the Min-Max method has a goal, namely to find out the assumptions of the inventory level at two levels, namely at the minimum level and the maximum level. The assumption of the two levels is that if the soybean inventory is at the minimum level then the soybean inventory must be reordered, so that the inventory will return to the maximum level.The maximum level and minimum level in the predetermined min-max method aim to avoid excess inventory that causes too large a total cost, and avoid too small inventory that can hamper the smooth production process (Hertanto, 2020). As for the EOQ method, it has the main objective of determining the number of orders and frequency of orders in order to obtain optimal inventory control results, using the amount of ordering costs and storage costs per year to minimize total costs. (Kadim, 2017). After obtaining the optimal order quantity, it is then developed using a method with working capital constraints, if the results that have been calculated cannot be met by the available capital. This research is expected to aim to determine the optimal order quantity at the factory, so as to minimize the total cost value at the semoga laris tofu factory.

2. LITERATURE REVIEW

Variability Test

Determination of the nature of demand on an inventory consists of 2, namely static and dynamic, where the nature of this demand can be known from the coefficient of variability. Provisions if the data has static demand properties, the variability coefficient value is < 0.25, while for dynamic demand properties, v is ≥ 0.25 (Aritantia et al., 2018).

Data Pattern

There are several types of data patterns in a forecast. Trend data pattern (T), this pattern occurs when there is a gradual increase or decrease in data from the existing data movement within a certain period of time. Seasonality data pattern (S), this pattern is also called a seasonal pattern where this pattern occurs if the data pattern repeats after a certain period such as days, weeks, months, quarters and years. Cycles data pattern (C), a cyclical pattern usually occurs in several years, where this data pattern is influenced by long-term economic fluctuations with the business cycle. Horizontal data pattern (H), is a data pattern that occurs when the data value fluctuates around a fixed average or commonly called stationary against its average value (Lusiana & Yuliarty, 2020).

Forecasting

Forecasting is the process of estimating future values related to what will happen in the future, based on the use of past data that has been collected. Forecasting is carried out because there is a time gap between the need for a new policy and the time of implementing the policy, if the time gap is long then forecasting will be very necessary. (Sucipto & Syaharuddin, 2018). The forecasting relationship with the time horizon is classified into 3 forecasting groups, namely long-term forecasting, medium-term forecasting and short-term forecasting (Indiyanto, 2008).

According to Heizer (2015) from Raja (2022), the measure of forecasting accuracy is a measure of the level of comparison between forecasting results and actual data, which consist of :

a. Mean Absolute Deviation (MAD)

$$MAD = \sum \left| \frac{A_t \times F_t}{n} \right| \quad (1)$$

b. Mean Square Error (MSE)

$$MSE = \sum \frac{(A_t - F_t)^2}{n} \quad (2)$$

c. Mean Absolute Percentage Error (MAPE)

$$MAPE = \left(\frac{100}{n}\right) \Sigma \left| A_t - \frac{F_t}{A_t} \right| \quad (3)$$

Min-Max Method

The Min-max method is an inventory control method that has 2 levels. In this method, if the inventory reaches the minimum level, then the inventory must be reordered to place the inventory at the maximum level. (Hertanto, 2020). Inventory at the minimum stock level, the company should suppress raw materials to keep raw materials under good control, so that there is a balance between demand and supply (Mail et al., 2018).

According to Indrajit & Djokopranoto (2011), the calculation of data processing using the min-max method is:

$$Min = (T \times C) + R \quad (4)$$

$$Max = 2\,(T \times C) \quad (5)$$

$$Q = Max - Min \quad (6)$$

Description:

T = average item usage per period
C = lead time
R = safety stock
Max = maximum inventory.
Min = minimum inventory.
Q = Reorder Quantity

EOQ Method

Economic Order Quantity (EOQ) is the size of the order required, with the amount of ordering costs and storage costs per year to minimize total costs. The EOQ method has the main objective of determining the optimal order quantity and order frequency (Kadim, 2017).

According to (Rozaq & Mahbubah, 2022), the following is the calculation formula using the EOQ method.

$$Q = \sqrt{\frac{2 \times D \times S}{H}} \quad (7)$$

Description:

Q = Reorder Quantity
D = Demand
S = Cost of each order
H = Holding cost per unit per periode

EOQ Method Capital Constraints

According to Siswanto (2007), in inventory models, working capital is a requirement needed to purchase raw materials used in the production process, therefore the purchase of inventory clearly requires a certain amount of working capital because working capital will continue to rotate. Therefore, in the EOQ model, the basis for determining the optimal Q is not necessarily able to be paid for the amount of additional inventory with available working capital. In this case, the capital invested in procuring inventory, which is equal to the average investment value of optimal inventory. Where the average inventory is Q/2. Thework that will be bound during one reorder cycle is

$$M = \frac{Q}{2} C \quad (8)$$

In accordance with this equation can be interpreted as the maximum working capital available at the time of inventory procurement, which is a limitation to minimize the total cost of inventory of the basic EOQ model. The EOQ model limited by capital constraints can be solved by the following linear functions:

$$L (Q, \lambda) = (\frac{D}{Q} \times S) + (\frac{Q}{2} \times C \times H) + \lambda (\frac{Q}{2} - M)$$

With minimum conditions $\frac{\partial L}{\partial Q} = 0$,

$$\frac{DS}{Q^2} + \frac{CH}{2} + \frac{\lambda C}{2} = 0$$

$$\frac{DS}{Q^2} = \frac{C (H+\lambda)}{2}$$

$$Q^2 = \frac{2DS}{C (H+\lambda)}$$

$$Q_{Optimal} = \sqrt{\frac{2 \times D \times S}{C (H+\lambda)}} \quad (9)$$

The calculation of the capital constraint EOQ method cannot be directly used to obtain the optimal Q. This is because λ is not yet known, therefore for calculations find the result λ using the derivative formula L (Q, λ).

$$L (Q, \lambda) = (\frac{D}{Q} \times S) + (\frac{Q}{2} \times C \times H) + \lambda (\frac{Q}{2} - M)$$

$$\frac{\partial L}{\partial Q} = 0$$

$$\frac{QC}{2} - M = 0$$

$$Q = \frac{2M}{C} \quad (10)$$

Then substituted Q into $Q_{optimal}$, then the formula is obtained to find λ:

$$\frac{2M}{C} = \sqrt{\frac{2DS}{C (H+\lambda)}} \quad (11)$$

Description:
M = Working capital in stock
Q = Reorder Quantity
D = Demand per year
C = Price of goods per unit
S = Booking Fee
H = Saving cost

3. RESEARCH METHOD

This research was conducted in several stages, including the preparation stage, data collection stage, data processing stage, and analysis and discussion stage. In the preparatory stage, preliminary studies are the initial activities carried out in the research, which are carried out by observation and interviews. Therefore, this research was conducted by forecasting to predict the need for soybeans in the future, as well as data processing for inventory management using company policy, the Min-Max method and the EOQ method. With the optimal results of data processing that has been done, it will be processed again, in accordance with the limitations available at factory in the form of capital to purchase raw materials if the optimal Q cannot be met by capital.

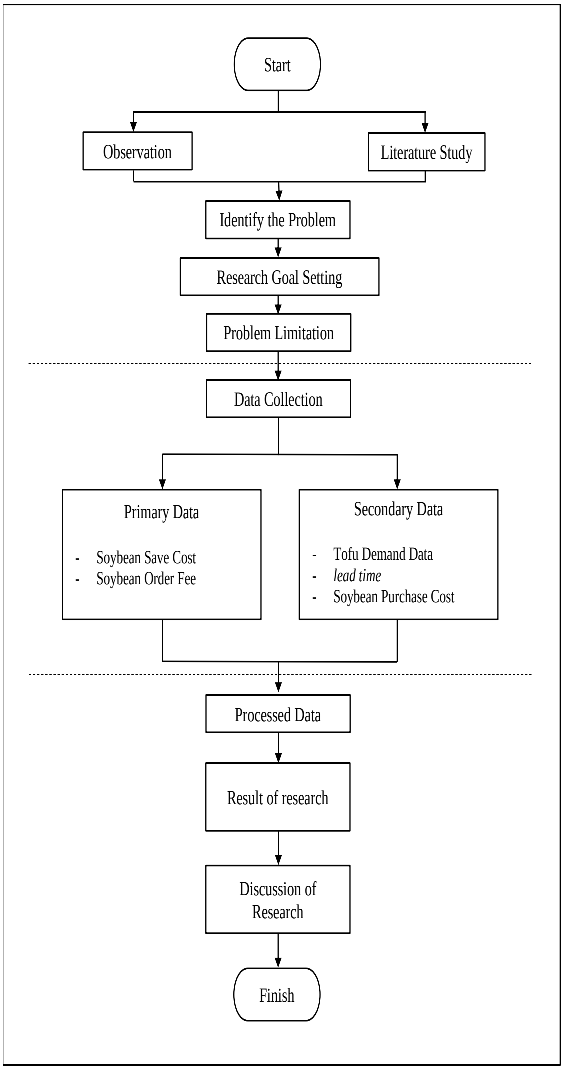

Figure 1. Research framework

4. RESULT AND DISCUSSION

This research was conducted by calculating company policy, min-max method and EOQ method so that the factory knows that it is in demand to determine the optimal order quantity. However, if the reorder quantity cannot be met by the raw material purchase capital, then the calculation is continued with the capital constraint EOQ method. This research was conducted with the aim of avoiding too little inventory of soybean raw materials, as well as too much in accordance with the purchase capital of raw materials.

The limitation of the problem in research on inventory management at the Tahu Hopefully Laris Factory is that this study uses historical data for 12 months, namely March 2022 – February 2023. This study is also expected to aim to minimize the total value of costs in accordance with the capital limit for purchasing raw materials owned by tofu factories that may sell well.

Tofu Demand Data

Tofu is produced every day to meet consumer demand for tofu, by using historical data on tofu demand, soybean demand data is obtained where to produce 35 pieces of tofu requires the use of 1 kg of soybeans. This tofu demand data is converted into soybean demand data for 12 months, tofu demand data, which is used as soybean demand data can be seen in table 1 below.

Table 1. Tofu and soybean demand

Period	Tofu Demand (per piece)	Soybean Usage	
		Per kg	Per kg
March 2022	245,175	7,005	140
April 2022	198,450	5,670	114
May 2022	231,700	6,620	132
June 2022	271,950	7,770	155
July 2022	257,250	7,350	147
August 2022	302,400	8,640	173
September 2022	220,500	6,300	126
October 2022	305,550	8,730	175
November 2022	256,900	7,340	147
December 2022	249,550	7,130	143
January 2023	324,450	9,270	185
February 2023	227,150	6,490	130
Total	**3,091,025**	**88,315**	**1,767**

Order Cost

Order cost in the continuity of inventory in this tofu factory consists of purchase preparation costs, administrative costs and unloading costs. The message cost data used in this study can be seen in table 2 below.

Table 2. Order cost

No	Details	Unit Cost	One-time Cost
1	Phone charges	IDR 23.3	IDR 11,184
2	Administration fee	IDR 128	IDR 128
3	Cost of Unloading	IDR 5,000	IDR 5,000
	Total	**88,315**	**1,767**

Holding Cost

Apart from the details of the order cost data, there are also holding costs where the total holding costs at the semoga laris tofu factory are IDR 769,841 for per year, the total is spent on details of electricity costs in the form of lighting costs and cctv costs.

Table 3. Holding cost

Details	Kwh Power (per month)	Cost/Month	Cost/Year
Lights (2, 24 hours, 15 watts)	21.6	IDR 29,203	IDR 350,438
CCTV (24 hours, 33,6 watts)	24.2	IDR 34,950	IDR 419,402
Total		**IDR 64,153**	**IDR 769,841**

After obtaining the results of the total holding cost of soybean raw materials in one year, it can be determined the holding cost per unit for one year at the.

Table 4. Holding per unit per year

Type	Total Holding Cost Per Year	Holding Area	Holding Cost Per Unit Per Year
Kedelai	IDR 769,841	0.002285 m^2	IDR 1,759

Based on the table above, the calculation of holding costs per unit of soybean raw material per year at the semoga laris factory amounting to IDR 1,759. The cost is obtained from the calculation of the holding area used to store raw materials as follows.

$$\text{Holding Area} = \frac{\text{Dimension of soybean bag}}{\text{Warehouse size}}$$

$$= \frac{0.7\text{ m} \times 0.37\text{ m} \times 0.12\text{ m}}{4\text{ m} \times 2\text{ m} \times 1.7\text{ m}}$$

$$= 0.002285\text{ m}^2$$

So, the holding cost per unit per year
= IDR 769,841 × 0.002285 = IDR 1,759

Variability Test

The following is a variability test for data on soybean raw material requirements at the semoga laris tofu factory, using the Peterson-Silver formulation.

$$\text{Variabilitas Test} = \frac{n \sum_t^n Dt^2}{(\sum_t^n Dt)^2} - 1$$

$$= \frac{12\ (265.267)}{(1.767)^2} - 1$$

$$= 0.019509$$

Based on the results of the above calculations, the value of the variability test results on the data shows the result of V = 0.019509, so it can be concluded that the data is static because the value of V <0.25.

Data Plot and Autocorrelation Test

In the data pattern graph of soybean raw material requirements for February 2022 - March 2023, can be seen in Figure 2 below.

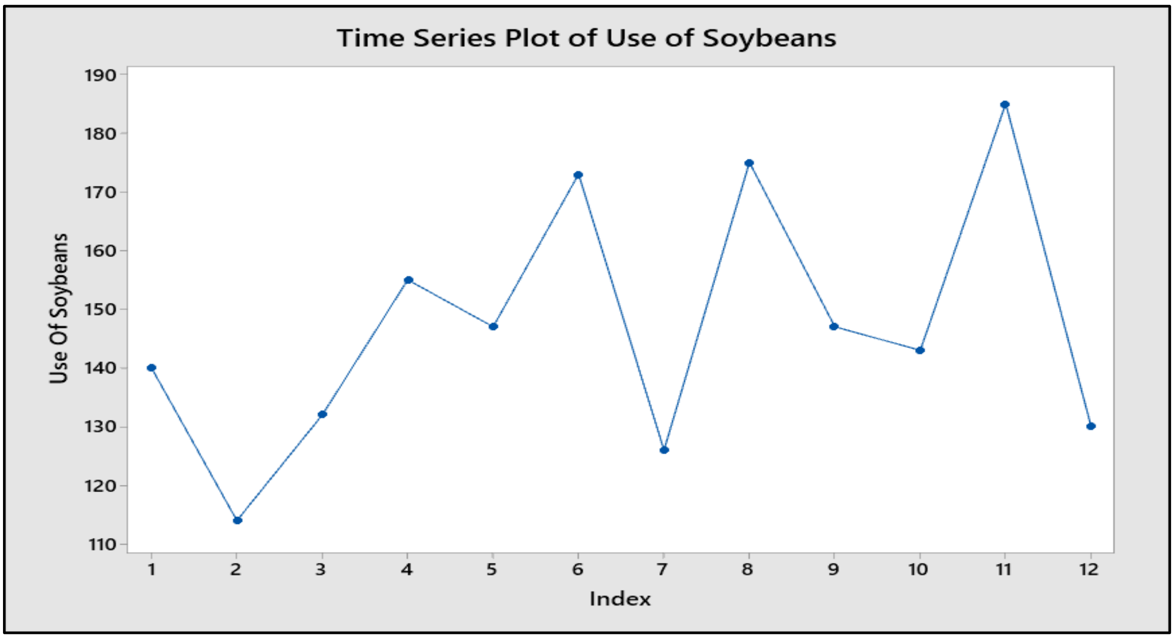

Figure 2. Time series plot
(Source: processed data, 2023)

Based on the results using Minitab software, there is a data pattern that moves up and down with fluctuations still around the average. Therefore, it can be concluded that the data pattern is a horizontal pattern. This is based on Lusiana & Yuliawarty (2020), that horizontal or stationary occurs when the data value fluctuates around a fixed or stable average value. After the time series plot is carried out, to ensure the absence of other pattern elements such as trend, seasonal or cyclical, an autocorrelation test is carried out on the data pattern. The following results of the autocorrelation test, using Minitab software can be seen in Figure 3.

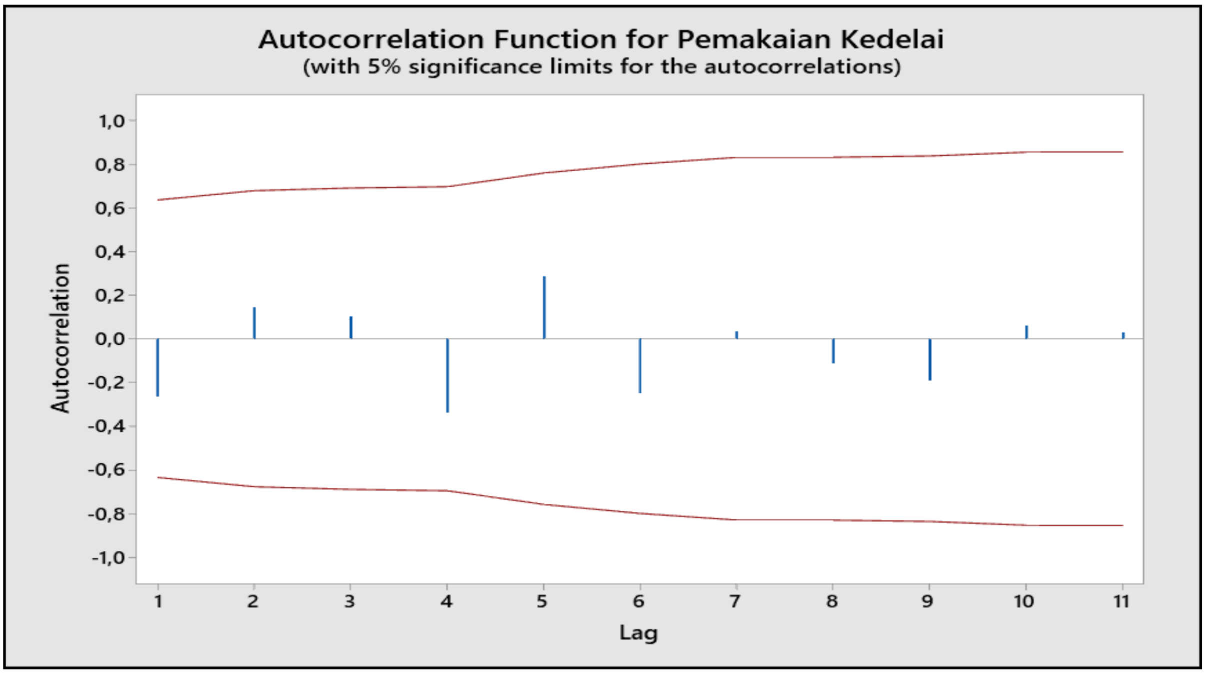

Figure 3. Autocorrelation test
(Source: processed data, 2023)

According to Heriansyah & Hasibuan (2018), in the autocorrelation graph, there are red and blue lines, the red lines are the upper and lower lines. A correlation number that does not indicate the presence of autocorrelation is indicated if the blue line does not exceed the red line above or below. Based on Figure 2, it is known that the autocorrelation value is within safe limits, thus it can be concluded that the data is stationary and it is proven that there is no trend element in the data pattern. Based on the time series plot and autocorrelation test that has been carried out, the data pattern on soybean demand is stationary (horizontal) and there is no element of a trend pattern. Therefore, the forecasting method for data processing in this study is carried out using methods namely moving average, weighted moving average, and single exponential smoothing forecasting methods.

Forecasting Methods

Data processing for forecasting using these 3 methods will be compared for the results of the forecasting error test based on the MAD, MSE and MAPE criteria. The following is a recapitulation of the results of the forecasting error test calculation which can be seen in Table 5.

Table 5. Recapitulation of forecasting error test calculation results

Forecasting Methods		MAPE	MAD	MSE
Moving Average Method	8 Months	11	17	488
Weighted Moving Average Method	8 Months	12	19	520
Single Exponential Smoothing Method	α = 0,1	12	19	513

Based on Table 6 data at the forecasting stage of the three methods, the selected forecasting method is the method with the smallest MAPE, MAD and MSE values compared to other methods.
Therefore, the forecasting method used to

forecast the needs for the next 12 months, namely using the Moving Average method (8 months).

Forecasting Validation

The following is the calculation of the results of data validation or verification on the results of calculations on forecasting using tracking signals which can be seen in table 6 below.

Table 6. Tracking signal

	F	e(t)	|e(t)|	Σe(t)	Σ|e(t)|	e^2(t)	Σe^2(t)	TS	BKA	BKB
1	-	-	-	-	-	-	-	-	4	-4
2	-	-	-	-	-	-	-	-	4	-4
3	-	-	-	-	-	-	-	-	4	-4
4	-	-	-	-	-	-	-	-	4	-4
5	-	-	-	-	-	-	-	-	4	-4
6	-	-	-	-	-	-	-	-	4	-4
7	-	-	-	-	-	-	-	-	4	-4
8	-	-	-	-	-	-	-	-	4	-4
9	145.25	1.75	1.75	1.75	1.75	3.06	3.06	1.00	4	-4
10	146.13	-3.13	3.13	-1.38	4.88	9.77	12.83	-0.56	4	-4
11	149.75	35.25	35.25	33.88	40.13	1242.56	1255.39	2.53	4	-4
12	156.38	-26.38	26.38	7.50	66.50	695.64	1951.03	0.45	4	-4

The following is a chart for forecasting validation with tracking signals in the 8-period moving average forecasting method which can be seen in Figure 4.

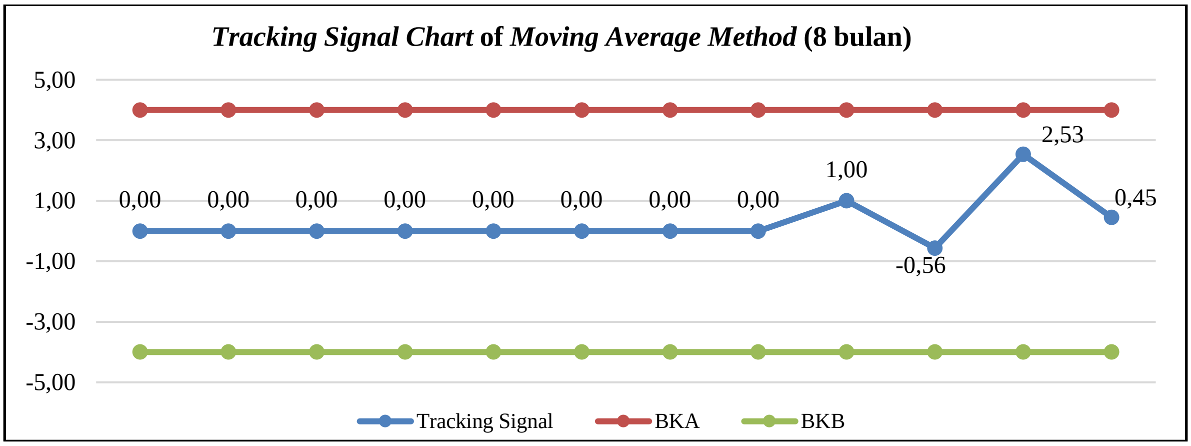

Figure 4. Tracking signal

Forecasting Result

Based on the selected forecasting method, namely the 8-period moving average forecasting method, the following are the results of forecasting the next 12 periods with this method which can be seen in table 7.

Table 7. Forecasting the next period

Month	Period	Next Period Forecasting (per bag)
April 2023	13	153
May 2023	14	154
June 2023	15	152
July 2023	16	155
August 2023	17	152
September 2023	18	153
October 2023	19	154
November 2023	20	151
December 2023	21	153
January 2024	22	153
February 2024	23	153
March 2024	24	153
Total		**1,836**

Inventory Planning at Semoga Laris Tofu Factory

The following is an inventory plan for tofu factories, which can be seen in the details of Table 8.

Table 8. Inventory planning at tofu factory

Information	Details
Booking Frequency	46 bookings
Order Quantity	2000 kg or 40 sacks
Point of Rebooking	600 kg or 12 Sacks
Purchase Cost	IDR. 1,046,520,000 in one year
Order Fee	IDR. 750.352 in one year
Soybean Save Cost	IDR. 39.570 in one year
Total Inventory Cost	IDR. 1.047.308.291 in one year

Min-Max Method

The following calculations using the Min-Max method on the management of soybean raw material inventory can be seen in the following explanation.

Average Usage = 153 sak
Standard Deviation = 1.04
Service level = 95%

Safety stock
= Standard deviation × Service level × $\sqrt{L}$
= 1.14 × 1.65 × $\sqrt{22}$
= 2.44 bags or rounded up to 3 bags

Minimum Inventory = (T × C) + R
= 306 + 3
= 309 bags

Maxsimum Inventory = 2 (T × C)
= 2 (306)
= 612 bags

Q = Max – Min
= 612 – 309
= 303 bags

Order Frequency = $\frac{D}{Q} = \frac{1.836}{303}$
= 6.05 or 7 orders

Purchase Cost
= p × D
= IDR 570,000 × 1,836
= IDR 1,046,520,000

Ordering Cost
= $(\frac{D}{Q} \times S)$
= $(\frac{1,836}{303} \times \text{IDR } 16,312)$
= IDR 114,184

Holding Cost
= Holding Quantity × Holding Cost
= $(165,491 \times \frac{\text{IDR } 1,759}{365})$
= IDR 797,531

Total Inventory Cost
= Purchase Cost + Ordering Cost + Holding Cost
= IDR 1,047,520,000 + IDR 114,184 + IDR 797,531
= IDR 1,047,416,372

Metode EOQ

Working on the EOQ method has the aim of being used as a determination of the quantity of inventory orders, which can minimize the cost of inventory used during inventory procurement. The following are the results of calculations using the EOQ method at the semoga laris tofu factory.

Average Usage = 153 bags
Standar Deviasi = 1.14
Service level = 95%

Safety stock
= Standard deviation × Service level × $\sqrt{L}$
= 1.14 × 1.65 × $\sqrt{22}$
= 2.44 bags or rounded up to 3 bags

ROP
= d × L + ss
= $(\frac{D}{\text{number of working days per year}} \times L) + ss$
= $(\frac{1,836}{365} \times 2) + 3$

= 13 bags

Q $= \sqrt{\frac{2 \times D \times S}{H}}$

$= \sqrt{\frac{2 \times 1{,}836 \times \text{IDR } 16{,}312}{\text{IDR } 1{,}759}}$

= 184.53 bags or 185 bags

Order Frequency $= \frac{D}{EOQ}$

$= \frac{1{,}836}{185}$

= 9.92 orders or 10 orders

Purchase Cost
= p × D
= IDR 570,000 × 1,836
= IDR 1,046,520,000

Ordering Cost
$= (\frac{D}{Q} \times S)$

$= (\frac{1{,}836}{185} \times \text{IDR } 16{,}312)$

= IDR 163,120

Holding Cost
= Holding Quantity × Holding Cost
$= (35{,}391 \times \frac{\text{IDR } 1{,}759}{365})$

= IDR 1,046,853,676

Total Inventory Cost
= Purchase Cost + Ordering Cost + Holding Cost
= IDR 1,047,520,000 + IDR 81,560 + IDR 170,556
= IDR 1,046,853,676

The EOQ method has the smallest total inventory cost compared to other inventory planning methods for future periods. Because the min-max method produces excess inventory, so the storage cost of the min-max method is greater than the EOQ method and the policies owned by the tofu factory. Therefore, the total cost of inventory in the min-max method is greater compared to other inventory policies. The EOQ method saves inventory costs by 0.0436% with a decrease of Rp. 456,247 from total inventory costs by using the tofu factory policy.

However, in this EOQ method it requires the purchase cost of soybean raw materials of Rp. 105,450,000 in one order. So because the factory knows that hopefully this sell-out has a maximum available capital, which is Rp. 30,000,000. Therefore, it can be concluded that the basic EOQ model of determining the optimal Q, cannot be paid for the amount of replenishment of its inventory with available working capital. So that in minimizing the total cost of inventory, further data processing is needed in the form of the EOQ method with capital constraints.

EOQ Method Capital Constraints

Based on data processing that has been carried out for inventory management using company policy, the Min-Max method and the EOQ method, the results of the most minimal inventory costs are using the EOQ method calculation. The EOQ method has a total inventory cost of IDR 1,046,853,676 per year with an optimal Q of 185 sacks. However, using the basic EOQ method requires capital for the purchase of raw materials of IDR 105,450,000, where the calculation of this capital is as follows.

Capital Required
= Q × C
= 185 bags × IDR 570,000
= IDR 105,450,000

In this study, there is a maximum working capital available at the tofu factory hopefully laris, which is as much as IDR 30,000,000. It can be concluded that the basic EOQ model of determining the optimal Q, cannot be paid for the amount of additional inventory with available working capital. Therefore, in minimizing the total cost of inventory, an EOQ model with capital constraints is needed, where the calculation can be seen in the following explanation.

Unknown:
D (demand per year)= 1,836 bags of soybeans
C (product price) = IDR 570,000 per bags
H (holding cost) = IDR 1,759 (0.309% of soybean price per bag)

S (order cost) = IDR 16,312
M (available working capital)
= IDR 30,000,000

However, when using the EOQ model with working capital constraints, the calculation cannot directly use equation 2.12 to get the optimal Q, first calculate to find λ using equation 2.13. Therefore, the calculation to find the result of λ uses the following formula.

$$\frac{2M}{C} = \sqrt{\frac{2DS}{C\ (H+\lambda)}}$$

$$\frac{2\ (30{,}000{,}000)}{570{,}000} = \sqrt{\frac{2\ (1{,}836)\ (16{,}312)}{570{,}000\ (0.00309+\lambda)}}$$

$$11{,}079.66 = \frac{105.08}{(0.00309 + \lambda)}$$

$$(0.00309 + \lambda) = \frac{105.08}{11{,}079.66}$$

$$(0.00309 + \lambda) = 0.0095$$

$$\lambda = 0.00641$$

After obtaining the result of λ then insert λ = 0.00876 into the optimal Q equation using equation 2.12 so that it is obtained.

$$Q = \sqrt{\frac{2DS}{C\ (H+\lambda)}}$$

$$= \sqrt{\frac{2\ (1{,}839)\ (16{,}312)}{570{,}000\ (0.00309+0.00641)}}$$

$$= \sqrt{\frac{59{,}995{,}536}{5{,}415}}$$

= 105.25 bags
= 105 bags

In this case, the capital invested in procuring inventory is equal to the average investment value of optimal inventory. Thus, to fulfill the optimal Q, capital is needed, namely

$$\text{Capital} = \frac{Q}{2} \times C$$

$$= \frac{105}{2} \times \text{IDR } 570{,}000$$

= IDR 29,640,000

$$\text{Order Frequency} = \frac{D}{EOQ}$$

$$= \frac{1{,}836}{52}$$

= 35.3 orders or 36 orders

Purchase Cost
= p × D
= IDR 570,000 × 1,836
= IDR 1,046,520,000

Ordering Cost
$= (\frac{1{,}836}{52} \times \text{IDR } 16{,}312)$
= IDR 587,232

Holding Cost
= Holding Qantity × Holding Cost
$= (10{,}759 \times \frac{\text{IDR } 1{,}759}{365})$
= IDR 51,850

Total Inventory Cost
= Purchasing Cost + Ordering Cost + Holding Cost
= IDR 1,047,520,000 + IDR 587,232 + IDR 51,850
= IDR 1,047,431,715

So, that the addition of inventory in the tofu factory that has been adjusted to the available working capital is 52 bags instead of 185 bags with a total inventory cost of IDR 1,047,431,715 per year. This capital-constrained EOQ calculation is done with an 11-day ordering interval, with 36 orders in one year.

In the EOQ method, this capital constraint has been adjusted to the available factory capital, so as to reduce the risks that will occur when procuring supplies. So the optimal Q result in accordance with the maximum capital is 52 sacks using a capital of Rp. 29,640,000 in one order. Although the capital constraint EOQ method has greater inventory costs than the basic EOQ method, the capital constraint EOQ method can save inventory costs by decreasing by Rp. 150,841 or 0.0144% of total inventory costs using tofu factory planning hopefully in demand. So it can be concluded that the use of capital constraint EOQ can be applied to tofu factories, with consideration of the maximum capital available at the factory capital constraint EOQ method is more optimal and efficient than the basic EOQ method.

However, if in the future the tofu factory to have an available capital of more than Rp. 30,000,000 by considering the existing risks, then the basic EOQ method can be used in tofu factories.

5. CONCLUSION

Based on the results of data analysis and processing that has been carried out, conclusions can be drawn, namely:. Comparison between the decrease in the total cost of inventory of the basic EOQ method and the EOQ method of capital constraints on factory policies, the results of the basic EOQ have a better decrease value. So, the basic EOQ method can be used if the semoga laris tofu factory can consider the available capital in one order. However, to solve the existing problems, the capital constraint EOQ method is obtained, which has been adjusted to the available capital at the tofu factory so that the results are more optimal and efficient than the basic EOQ method.

Based on the results of the analysis and data processing that has been carried out, the suggestion in this study is that the semoga laris tofu factory be able to review the activities of procuring raw material supplies. As well as the capital constraint EOQ method can be used as a reference by the semoga laris tofu factory in inventory management, which with this method has considered the available raw material purchase capital.

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