

IMPLEMENTATION OF RAW MATERIAL INVENTORY CONTROL THROUGH THE MATERIAL REQUIREMENT PLANNING (MRP) METHOD TO ENHANCE COST EFFICIENCY (CASE STUDY AT LESTARI TOFU FACTORY, MADIUN REGENCY)

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Abstract. *This study aims to examine the practice of controlling raw material inventory at Lestari Tofu Factory and to evaluate the potential for increasing cost efficiency through the application of the Material Requirement Planning (MRP) method. The type of research used is qualitative, with data collected through in-depth interviews conducted with factory owners, who act as key informant. The findings show that the factory uses the conventional method to manage soybean inventory, which results in a total inventory control cost of IDR 481,715,000 in 2024 and a procurement frequency of 49 orders in that year. Through analytical simulation, the adoption of the MRP method—particularly the Lot-for-Lot (LFL) technique—demonstrated a potential cost savings of IDR 8,985,500, representing an efficiency improvement of approximately 2.07%. This improvement was achieved by reducing the ordering frequency to 12 times per year and limiting the quantity of raw material purchased to match the net requirement only, regardless of falling market prices. The study concludes that the application of the MRP method contributes to lowering costs and improving responsiveness to market demand variability.*

Keywords: *Inventory Control, Raw Materials, Material Requirement Planning, Lot Size, Cost Efficiency*

1. INTRODUCTION

Raw material inventory plays an important role in the production process. A shortage of raw materials can halt production activities and result in the company's inability to meet consumer demand. Conversely, excessive stock that is stored for too long may lead to spoilage or quality degradation, causing waste and inefficiency in production costs.

According to Wahyudi (2015), "Inventory is one of the important factors in business activities, both for trading and manufacturing companies. In supervising inventory, there needs to be an inventory recording and calculation system, because inventory can affect a company's financial statements. Trading and manufacturing companies each have different activities but share the same goal, which is to meet consumer needs. Inventory, as a primary operational element, is an asset that is constantly in a state of flux, undergoing continuous changes. The issue of determining the appropriate level of investment or capital allocation, which involves a certain amount of funds tied up in inventory, has a direct impact on the company's profitability." Therefore, a company should implement inventory control through systematic calculations.

The commonly used inventory control calculation method is the Material Requirement Planning (MRP) method. MRP can be defined as a method for planning and controlling materials (raw materials, parts, components, and subcomponents) tied to the production units to be produced, along with determining the schedule and units to be ordered, as well as determining when the orders must be received (Haming & Nurnajamuddin, 2017).

Lestari Tofu Factory, a tofu production company located in Madiun Regency, East Java, still relies on conventional methods to manage its soybean procurement. This

method results in irregular purchase quantities and ordering frequencies, which can potentially lead to an unwitting increase in inventory costs, especially in purchasing and ordering. Therefore, the application of the MRP method is considered relevant to improve the efficiency and effectiveness of raw material inventory control in the company. The results of this study are expected to provide practical recommendations to support more efficient operational decision-making.

2. LITERATURE REVIEW

2.1 Inventory Control

According to Wahyu Tri and Aftoni, inventory control is a managerial function that has a significant impact on companies, because large investments in companies will have an impact on the physical inventory of those companies (Sari, 2022).

According to Haming and Nurnajamuddin (2017), the objectives of inventory control include:

1. To maintain operational independence.
2. To meet varying levels of demand.
3. To reap economic benefits from ordering materials in certain quantities.
4. To provide protection against variations in the delivery time of raw materials.
5. To support production scheduling flexibility.

2.2 Raw Materials

According to Rera (2023), raw materials are materials used in manufacturing products that are fully visible in the finished product (or constitute the largest part of the product). Thus, raw materials can be defined as the materials or components that make up a product.

2.3 MRP (Material Requirement Planning) Method

According to Haming & Nurnajamuddin (2017), "MRP can be defined as a method of planning and controlling materials (raw materials, parts, components, and subcomponents) tied to the production units to be produced, accompanied by determining the schedule and units to be ordered, as well as determining when the orders must be received".

According to Eunike et al. (2018), the basic steps in processing MRP include:

1. Netting (net requirement calculation)

Netting is calculating the net requirement (NR) based on the gross requirement (GR) minus the scheduled receipt (SR) and on-hand inventory (OI). The net requirement is considered zero if NR is less than or equal to zero. The formula for netting is as follows:

$$NR(t) = GR(t) - SR(t) - OI(t-1) + \text{Safety Stock}$$

2. Lotting (determining lot size)

This step aims to determine the size of the purchase lot (planned order receipt) based on the results of the net requirement calculation, considering storage costs and order costs to achieve efficiency. This step is determined based on the appropriate lotting/lotsizing technique.

3. Offsetting (determining the order release time/planned order release)

This step aims to project material requirement so they are available exactly when needed by calculating the lead time for procuring the material. The formula for offsetting is as follows:

$$PoRel(t) = PoRec(t+LT)$$

4. Exploding

This step is the process of calculating the gross requirement for item levels (components) at a lower level than the available product structure.

Within the MRP method, there are several lot sizing techniques used to determine the

quantity of raw materials to be ordered. Some of these techniques include Lot-For-Lot (LFL) and Fixed Order Quantity (FOQ). The explanations of each technique are as follows:

1. Lot Sizing Technique: Lot-For-Lot (LFL)

"This is the simplest lot sizing technique, which involves setting the order lot size equal to the net requirement. This method aims to minimise storage costs per unit to zero, as the lot size is adjusted to the requirement. Advantages: This method has no inventory, so there are no storage costs. Disadvantages: if there is a sudden order that exceeds the estimated demand, the company will have difficulty meeting that demand" (Eunike et al., 2018).

2. Lot Sizing Technique: Fixed Order Quantity (FOQ)

Haming and Nurnajamuddin (2017) state, "FOQ is a method intended to maintain a constant number of units ordered. The quantity ordered can be determined intuitively, meaning it is based on the production manager's experience over the past few years".

2.4 Cost Efficiency

"Cost efficiency means not wasting time and energy, and working precisely according to plans and objectives. In order to generate large profits and maintain the company's existence, the company must operate efficiently. The term "efficiency" has a very specific meaning; it is often associated with the ratio of output to input, where a higher ratio of output to input indicates greater efficiency in a business", (Nabila & Jalaluddin, 2021). Improving cost efficiency can be achieved through better planning systems (Rusindiyanto & Ngatilah, 2019).

3. RESEARCH METHODS

This research uses a qualitative approach that aims to understand and analyse the control of soybean raw material inventory at Lestari Tofu Factory. In addition, this study also compares the control method used by the factory with the Material Requirement Planning (MRP) method to assess cost efficiency.

The data used in this study consists of quantitative and qualitative data. Quantitative data includes purchase quantities, requirement, remaining inventory, and order frequency for raw materials. Qualitative data consists of general information about the company and its operational practices. Data sources were obtained from primary data collected through direct and indirect interviews with the owner of Lestari Tofu Factory as a key informant. The instruments used in data collection are voice recorder applications and WhatsApp applications.

The data analysis technique used in this study was carried out through three stages, namely Data Reduction, Data Display, and Conclusion Drawing/Verification (Miles and Huberman in Sugiyono, 2018), followed by analysing cost efficiency using the MRP method, which consists of several basic steps, namely Netting, Lotting, Offsetting, and Exploding. However, Exploding was not conducted because the scope of this study is limited to one raw material, namely soya beans.

4. RESULTS AND DISCUSSION

RESULTS

4.1 Raw Materials Inventory Control Implemented by Lestari Tofu Factory

4.1.1 Purchase Cost

For each procurement of soybean raw materials, the factory owner purchases soybeans from a local supplier in Ponorogo Regency. The quantity purchased is based on the demand for tofu. Table 1 presents the soybean procurement data of Lestari Tofu Factory in 2024.

Table 1. Soybean Raw Material Purchase Data for 2024

Month	Soybean Purchases (kg)	Soybean Requirements (kg)	Remaining Soybeans (kg)
1	4.500	4.420	80
2	4.300	4.300	0
3	4.500	4.490	10
4	5.500	5.300	200
5	4.700	4.620	80
6	3.800	3.800	0
7	4.700	4.700	0
8	4.200	4.150	50
9	5.000	4.980	20
10	4.300	4.200	100
11	4.450	4.430	20
12	4.800	4.795	5
Total	54.750	54.185	

(Source: Processed Primary Data, 2025)

According to Table 1, in the fourth month, the high quantity of remaining soybeans was due to the low market price at the time, prompting the owner of Lestari Tofu Factory to purchase a large amount without considering actual needs. This highlights the need for consistent raw material purchasing plans, regardless of price fluctuations, as excess inventory ties up capital that could be used elsewhere. Therefore, setting a fixed quantity of soybean purchases each period is a recommended solution for the factory.

In this study, the average assumed price of soybeans is IDR 8.700 per kilogram, as soybean prices often fluctuate between approximately IDR 7.000 and IDR 10.000/kg. Table 2 below presents the total cost incurred by Lestari Tofu Factory for soybean procurement.

Table 2. Total Soybean Purchase Cost in 2024

Month	Purchase Quantity (kg)	Price (IDR)	Total Cost (IDR)
1	4.500	8.700	39.150.000,00
2	4.300	8.700	37.410.000,00
3	4.500	8.700	39.150.000,00
4	5.500	8.700	47.850.000,00
5	4.700	8.700	40.890.000,00
6	3.800	8.700	33.060.000,00
7	4.700	8.700	40.890.000,00
8	4.200	8.700	36.540.000,00
9	5.000	8.700	43.500.000,00
10	4.300	8.700	37.410.000,00
11	4.450	8.700	38.715.000,00
12	4.800	8.700	41.760.000,00
Total			476.325.000,00

(Source: Processed Primary Data, 2025)

Based on Table 2 above, the total cost incurred for purchasing soybeans is IDR 476.325.000.

4.1.2 Ordering Cost

Soybean ordering carried out by Lestari Tofu Factory aims to meet production needs.

Table 3. Soybean Orders in 2024

Month	Soybean Orders (kg)	Ordering Frequency (times)
1	4.500	5
2	4.300	4
3	4.500	4
4	5.500	5
5	4.700	4
6	3.800	4
7	4.700	4
8	4.200	3
9	5.000	4
10	4.300	4
11	4.450	4
12	4.800	4
Total	54.750	49

(Source: Processed Primary Data, 2025)

According to Table 3, the total ordering frequency in 2024 was 49 times. Lestari Tofu Factory uses its own open-bed vehicle for soybean procurement, so there are no delivery service costs involved. The factory sources soybeans from two suppliers, both located in Ponorogo Regency. The Lestari Tofu Factory also conducts product marketing activities in the district. This means that in one trip (there and back), they can carry out two important activities for the company at the same time.

The costs incurred from the ordering process include distribution and communication expenses. The breakdown of these costs is presented below:

Table 4. Soybean Ordering Cost per Order

No	Type of Cost	Amount (IDR)
1	Distribution Cost (Fuel)	100.000
2	Communication Cost	10.000
Total		110.000

(Source: Processed Primary Data, 2025)

According to the owner of Lestari Tofu Factory, the estimated cost for diesel fuel is IDR 100.000, and communication expenses are IDR 10.000 for each soybean order. So the total cost is approximately IDR 110,000/order. The table below shows the total ordering cost incurred by Lestari Tofu Factory in 2024.

Table 5. Total Ordering Cost in 2024

Ordering Cost per Order (IDR)	Ordering Frequency (times)	Total (IDR)
110.000	49	5.390.000

(Source: Processed Primary Data, 2025)

Based on Table 5, the total ordering cost incurred by the Lestari Tofu Factory in 2024 is IDR 5.390.000.

4.1.3 Total Inventory Cost

The total inventory cost calculation aims to determine the overall expenses incurred by Lestari Tofu Factory for soybean procurement throughout 2024. The calculation is as follows.

$$\text{Purchase Cost} = 54.750 \text{ kg} \times \text{IDR } 8.700 = \text{IDR } 476.325.000$$

Ordering Cost = 49 times × IDR 110.000 = IDR 5.390.000
Total = IDR 481.715.000

Thus, the total raw material inventory cost incurred by Lestari Tofu Factory in 2024 amounted to IDR 481.715.000.

4.2 Raw Material Inventory Control Using the MRP (Material Requirement Planning) Method

4.2.1 Soybean Raw Material Inventory Control Using the MRP Method with Lot-For-Lot (LFL) Lot Sizing Technique

In this MRP method of the LFL technique, the procurement period of soybean raw materials is made monthly. The gross requirement is based on Lestari Tofu Factory's historical data. Table IV.6 below presents the calculation results using the MRP method with the LFL lot sizing technique.

Table 6. MRP Method Chart Using LFL Technique

MRP Soybeans (kg)														
Lead Time : 1														
Lot Size : Lot-for-Lot														
Quantity On Hand : 0 kg														
Safety Stock : 0														
DESCRIPTION	PERIOD													
	0	1	2	3	4	5	6	7	8	9	10	11	12	Total
Gross Requirement (GR)		4.420	4.300	4.490	5.300	4.620	3.800	4.700	4.150	4.980	4.200	4.430	4.795	54.185
Scheduled Receipt (SR)														
On-Hand Inventory (OI)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Requirement (NR)		4.420	4.300	4.490	5.300	4.620	3.800	4.700	4.150	4.980	4.200	4.430	4.795	
Planned Order Receipt (PORec)		4.420	4.300	4.490	5.300	4.620	3.800	4.700	4.150	4.980	4.200	4.430	4.795	54.185
Planned Order Release (PORel)	4.420	4.300	4.490	5.300	4.620	3.800	4.700	4.150	4.980	4.200	4.430	4.795		

(Source: Processed Primary Data, 2025)

Based on the calculation results using the MRP method with the LFL technique, the total cost of soybean raw material inventory control is as follows.

Purchase Cost = 54.185 kg × IDR 8.700 = IDR 471.409.500
Ordering Cost = 12 times × IDR 110.000 = IDR 1.320.000
Total = IDR 472.729.500

Thus, the total soybean raw material inventory cost at Lestari Tofu Factory using the Lot-For-Lot (LFL) lot sizing technique amounted to IDR 472.729.500.

4.2.2 Soybean Raw Material Inventory Control Using the MRP Method with Fixed Order Quantity (FOQ) Lot Sizing Technique

The Fixed Order Quantity (FOQ) lot sizing technique in Material Requirement Planning (MRP) involves ordering the same quantity of raw materials in each period. In this study, the FOQ lot size was set at 5.300 kg, based on the highest monthly demand ever experienced by the Lestari Tofu Factory in 2024, which occurred in the fourth month. This approach aims to minimise the risk of raw material shortages. Therefore, the fixed order quantity for soybeans in this study is 5.300 kg. Table 7 presents the MRP chart using the FOQ lot sizing technique.

Table 7. MRP Method Chart Using FOQ Technique

MRP Soybeans (kg)														
Lead Time: 1								Lot Size: 5300 (FOQ)						
Quantity On Hand: 0 kg								Safety Stock: 0						
DESCRIPTION	PERIOD													
	0	1	2	3	4	5	6	7	8	9	10	11	12	Total
Gross Requirement (GR)		4.420	4.300	4.490	5.300	4.620	3.800	4.700	4.150	4.980	4.200	4.430	4.795	54.185
Scheduled Receipt (SR)														
On-Hand Inventory (OI)		880	1.880	2.690	2.690	3.370	4.870	170	1.320	1.640	2.740	3.610	4.115	
Net Requirement (NR)		4.420	3420	2610	2610	1930	430	0	3980	3660	2560	1690	1185	
Planned Order Receipt (PORec)		5.300	5.300	5.300	5.300	5.300	5.300	0	5.300	5.300	5.300	5.300	5.300	58.300
Planned Order Release (PORel)	5.300	5.300	5.300	5.300	5.300	5.300	0	5.300	5.300	5.300	5.300	5.300		

(Source: Processed Primary Data, 2025)

Based on the calculation results using the MRP method with the FOQ technique, the total cost of soybean raw material inventory control is as follows.

Purchase Cost = 58.300 kg × IDR 8.700 = IDR 507.210.000

Ordering Cost = 11 times × IDR 110.000 = IDR 1.210.000

Total = IDR 508.420.000

Thus, the total soybean raw material inventory cost at Lestari Tofu Factory using the Fixed Order Quantity (FOQ) lot sizing technique amounted to IDR 508.420.000.

4.2.3 Knowing the Cost Efficiency of Raw Material Inventory Control at the Lestari

Tofu Factory If Using the Material Requirement Planning (MRP) Method

After analysing the control of raw material inventory that has been carried out by Lestari Tofu Factory and inventory control using the MRP method, then analyse how much the cost efficiency of controlling raw material inventory at Lestari Tofu Factory if using the MRP method. The way to find out is to compare the method used by the Lestari Tofu Factory with the MRP method. The comparison aims to find out which raw material inventory control method can increase cost efficiency. The following is a comparison table between the conventional method of Tofu Factory Lestari with the MRP lot sizing method of LFL and FOQ techniques.

Table 8. Comparison of Inventory Control Costs

No.	Criteria	Conventional Method	MRP Method	
			Lot Sizing	
			LFL	FOQ
1	Ordering Frequency (times)	49	12	11
2	Purchase Cost (IDR)	476.325.000	471.409.500	507.210.000
3	Ordering Cost (IDR)	5.390.000	1.320.000	1.210.000
4	Total Inventory Cost (IDR)	481.715.000	472.729.500	508.420.000
Inventory Cost Difference (IDR)			8.985.500	-26.705.000

(Source: Processed Primary Data, 2025)

Based on Table 8, there is cost efficiency in controlling raw material inventory at the Lestari Tofu Factory when using the MRP method with the LFL lot sizing technique. Compared to the conventional method, there is an efficiency of IDR8.985.500 or around 2.07% (481.715.000 - 472.729.500).

DISCUSSION

4.3 Raw Material Inventory Control Implemented by Lestari Tofu Factory

4.3.1 Soybean Raw Material Purchases

Based on the results of the research, the owner of Lestari Tofu Factory buys soybeans from a supplier located in Ponorogo Regency. Purchases are made when soybean stocks are almost depleted, without a fixed schedule or a documented inventory control

system. In addition, purchasing decisions are also influenced by the price of soya; when the price drops, purchases are made even though there may not be a shortage of soya raw materials at the time. This type of inventory control results in irregular patterns and purchase quantities that are not always balanced with actual needs, sometimes exceeding production needs and causing stockpiling.

4.3.2 Soybean Raw Material Orders

Based on the results of the study, the frequency of soybean orders at the Lestari Tofu Factory is irregular and unsystematic. Due to the lack of a clear planning system, orders are placed quite frequently, resulting in relatively high distribution costs, such as fuel and communication, which could actually be reduced through a more regular and systematic method.

4.3.3 Total Inventory Cost of Soybean Raw Materials

Based on the analysis results, the total cost of soybean raw material inventory at the Lestari Tofu Factory is relatively high, including the cost of purchasing and ordering soybean raw materials. These high costs are mainly due to the purchase of soybean raw materials when prices are falling, even though production needs may already be met. Although this strategy is profitable in the short term, in practice, it leads to high accumulated costs.

4.4 Knowing the Cost Efficiency of Raw Material Inventory Control at the Lestari Tofu Factory Using the Material Requirement Planning (MRP) Method

4.4.1 MRP Method Can Improve the Cost Efficiency of Purchasing Soybean Raw Materials

From the results of this study, if Lestari Tofu Factory applies the Material Requirement Planning (MRP) method with the Lot-for-Lot (LFL) lot sizing technique, it will reduce the inventory of soybean raw materials, because the LFL technique only orders raw materials according to net needs. This is clearly more efficient, because if the raw materials ordered exceed the net needs, it will result in relatively higher costs. This is in contrast to the conventional method, which decides to make purchases when the price of soybeans drops, even though production needs may already be met.

4.4.2 MRP Method Can Increase the Cost Efficiency of Soybean Raw Material Ordering

The results of the study indicate that if Lestari Tofu Factory implements the MRP method with the LFL lot sizing technique, the frequency of soybean raw material orders is reduced to once a month, resulting in a more structured and efficient ordering schedule. The quantity of raw material orders is optimised, thereby saving costs and labour. This aligns with previous research conducted by Tanisri and Rye (2022). Although the ordering frequency is reduced to once a month, the quantity of soybean purchases does not exceed warehouse capacity.

4.4.3 MRP Method Can Improve the Efficiency of the Total Inventory Cost of Soybeans Raw Materials

The results of the study indicate that if Lestari Tofu Factory implements the MRP method with the LFL lot sizing technique, it can reduce the total cost of soybean raw material inventory. Inventory costs, which include purchasing and ordering costs, become more efficient. The total inventory costs using this method are proven to be lower than the conventional method previously used by the factory. This finding aligns with the research by Saptadi et al. (2023), which shows that the MRP method with the Lot-for-Lot (LFL) lot sizing technique results in lower inventory costs compared to the method applied by the Department Supply.

CONCLUSION

The results of this study indicate that Lestari Tofu Factory controls its soybean raw

material inventory using conventional methods. In 2024, the total inventory control cost reached IDR 481.715.000, with a relatively high order frequency of 49 times in that year. Inventory control is not based on systematic calculations, but sometimes decides to buy soya when the price drops, even though production needs may already be met.

Analysis shows that if Lestari Tofu Factory implements the MRP method, specifically the Lot-for-Lot (LFL) technique, the factory can improve cost efficiency by IDR 8.985.500 or approximately 2,07%, by reducing the order frequency to 12 times per year. MRP offers a more structured and planned approach to inventory control, enabling the Lestari Tofu Factory to reduce purchasing costs, ordering costs, and total soybean raw material inventory costs.

It is recommended to integrate a computerized information system and consistently update demand forecasts to achieve operational efficiency.

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