

Soybean Raw Material Inventory Control Using EOQ Method at Pabrik Tahu Sutra Galih Dabeda

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Abstract

The tofu industry in Indonesia continues to experience growth, leading to increased demand for soybean as its primary raw material. However, inefficient inventory management has caused excessive storage costs and overstock issues, especially in small-scale producers such as Tahu Sutra Galih Dabeda in Bandung. This study aims to analyze soybean raw material inventory control using the Economic Order Quantity (EOQ) and Total Inventory Cost (TIC) methods to improve operational efficiency. The research uses a qualitative case study approach, supported by quantitative calculations. Data were collected through interviews, documentation, and direct observation. Findings indicate that the factory's current purchasing method, which relies on estimates, leads to irregular procurement patterns and rising costs. Applying EOQ allows the company to determine optimal order quantities, minimize total inventory costs, and avoid stockouts or surpluses. The TIC method further identifies the most cost-efficient balance between ordering and holding expenses. This research offers practical recommendations to enhance supply chain performance and reduce waste in raw material management, thereby supporting the business sustainability of tofu manufacturers.

Keywords: Inventory Control, Economic Order Quantity (EOQ), Total Inventory Cost, Soybean Raw Materials

Introduction

The tofu industry in Indonesia plays a central role in supporting both local economies and national food security. Tofu, a widely consumed soy-based product, is a staple in Indonesian households due to its affordability, nutritional value, and versatility in traditional cuisine. The increasing demand for tofu has led to the rapid expansion of tofu-producing enterprises, particularly small- and medium-scale businesses. However, this growth has not been accompanied by a parallel increase in local soybean production. In fact, over the last four decades, domestic soybean output has experienced notable fluctuations and an overall downward trend. This imbalance between rising demand and insufficient supply has made

Indonesia increasingly reliant on imported soybeans, creating supply chain vulnerabilities and cost pressures for producers.

According to data from the Ministry of Agriculture, Indonesia consumes approximately 2.8 million tons of soybeans annually to meet the needs of tofu and tempeh producers. Yet, domestic production is unable to match this demand, leading to dependence on imported soybeans, primarily from countries such as the United States and Argentina. This situation affects tofu producers at all scales, but particularly smaller factories that lack access to advanced inventory management systems. These producers often face erratic supply patterns, unpredictable costs, and inefficiencies in procurement and storage processes.

One such example is the *Tahu Sutra Galih Dabeda Factory*, located in Cibuntu, Bandung City. The factory specializes in producing soft tofu (tahu sutra), a premium product favored for its smooth texture and delicate flavor. Despite the popularity of its products, the factory has been facing operational inefficiencies, particularly in managing its raw material inventory. Procurement decisions are made based on rough estimates rather than systematic calculations, often resulting in excessive stockpiles of soybeans. This not only inflates storage costs but also increases the risk of raw material degradation, ultimately affecting product quality and profitability.

Inventory overstocking leads to a cascade of problems. It ties up working capital that could otherwise be used for productive investment, increases utility and maintenance costs for storage, and elevates the risk of waste due to the perishable nature of raw soybeans. Conversely, understocking can halt production, cause delivery delays, and result in customer dissatisfaction. Thus, finding an optimal balance in inventory levels is essential for sustaining operations and ensuring the competitiveness of tofu producers.

To address these challenges, the application of analytical tools in inventory management is necessary. One of the most widely used and effective models for optimizing inventory decisions is the Economic Order Quantity (EOQ) method. EOQ is a classical inventory control

approach used to determine the optimal order quantity that minimizes the total cost of inventory namely ordering and holding costs. By applying this model, tofu producers can develop a more accurate and cost-efficient procurement strategy, reducing unnecessary expenses and improving overall operational efficiency.

Additionally, the Total Inventory Cost (TIC) framework offers a complementary approach to assessing inventory performance. TIC accounts for the aggregate of all inventory- related costs, providing a broader perspective on the financial implications of stock management decisions. When applied together, EOQ and TIC offer a comprehensive and data-driven solution to inventory control, allowing businesses to maintain an uninterrupted production flow while minimizing waste and cost.

In the case of *Tahu Sutra Galih Dabeda*, the absence of a structured inventory control system has led to unregulated procurement patterns. For instance, purchasing records from January to December 2024 show frequent discrepancies between the amount of soybeans purchased and actual consumption. These discrepancies indicate the lack of a forecasting mechanism and emphasize the need for a more analytical approach to raw material planning. The adoption of EOQ and TIC models could transform procurement practices in such enterprises by enabling precise calculation of order quantities and frequency, based on annual demand, ordering costs, and storage expenses.

Furthermore, research into the application of EOQ and TIC in small food manufacturing businesses is still limited in the Indonesian context. While large-scale industries often employ these models as part of their standard operations, micro and small enterprises frequently lack the awareness, resources, or training to implement them. This gap in application presents both a challenge and an opportunity: a challenge in terms of operational risk and inefficiency, and an opportunity to introduce scalable solutions that are both simple and impactful.

This study is therefore significant not only for its practical implications at the factory level but also for its contribution to academic discourse on inventory management in small- scale

food production. The research employs a case study method, drawing on primary data collected through interviews, observations, and documentation from *Tahu Sutra Galih Dabeda*. By analyzing this data through the lens of EOQ and TIC, the study seeks to provide actionable recommendations that can be adopted by similar tofu producers throughout the region.

In explicit, the tofu industry in Indonesia, while rich in potential, faces notable challenges in the management of soybean supply chains. With fluctuating availability and growing demand, it becomes increasingly important for tofu producers especially those operating on smaller scales to adopt effective inventory control methods. Through the implementation of EOQ and Total Inventory Cost approaches, these businesses can enhance their procurement planning, reduce unnecessary expenses, and improve sustainability in their operations. The findings of this study are expected to serve not only as a practical tool for *Tahu Sutra Galih Dabeda* but also as a reference for similar enterprises seeking to optimize their inventory practices in the face of market and supply uncertainties

Methods

This research employed a qualitative descriptive approach with a case study design, conducted at *Tahu Sutra Galih Dabeda*, a tofu production factory located in Cibuntu, Bandung City. The qualitative approach was chosen to explore in-depth how raw material inventory in specifically soybean stock which is managed in a small-scale manufacturing context. The study also integrated quantitative data analysis to support the application of the Economic Order Quantity (EOQ) and Total Inventory Cost (TIC) methods, both of which were used to evaluate inventory efficiency and optimize procurement decisions.

Results and Discussion

Result

The results of this study reveal critical insights into the inventory management practices at *Tahu Sutra Galih Dabeda*, specifically concerning the procurement and control of soybean

stock. Data collected from January to December 2024 show that the factory relied heavily on estimation-based purchasing without a standardized calculation method. Soybeans were frequently overstocked, resulting in high storage costs and inefficient use of warehouse space. In some months, no purchases were made despite ongoing production activities, indicating an irregular procurement cycle and poor forecasting.

Table 1. Production Activities

No	Month	Soybean purchase (kg)	Purchase frequency	Soybean usage (kg)
1	January	400	2	346
2	February	478	1	350
3	March	300	1	410
4	April	500	2	200
5	May	0	0	240
6	June	300	1	260
7	July	300	1	240
8	August	560	2	470
9	September	500	2	520
10	October	300	1	270
11	November	430	1	348
12	December	500	2	480
Total		4.568	16	4.134

From the factory's internal records, it was found that the frequency of procurement varied widely ranging from no orders in May to as many as two orders per month in peak periods like April and August. Meanwhile, actual soybean consumption fluctuated based on production volume, but the lack of a systematic method for aligning purchases with consumption led to recurring inventory surpluses. For instance, in April, the factory ordered 500 kg of soybeans but used only 200 kg, leading to a surplus of 1272 kg an overstock of over 600%. These findings suggest that the factory incurred unnecessary costs due to excessive purchasing and underutilized stock.

Using the Economic Order Quantity (EOQ) model, calculations were performed to determine the optimal quantity of soybeans that should be ordered each time. Based on the average annual demand, ordering cost, and holding cost, the EOQ result was significantly lower than the factory's usual procurement volume. This indicates that the factory could reduce storage costs and order more efficiently by adopting EOQ principles. The EOQ calculation also

revealed an optimal procurement frequency that was less than the current practice, which would lead to fewer orders annually and greater control over inventory levels.

Table 2. Cost of Production

No	Type of Cost	Total
1	Telephone cost	Rp. 600.000
2	Transportation cost	
	a. Fuel cost	Rp. 1.500.000
	b. Delivery fee	Rp. 750.000
	c. Handling cost	Rp. 650.000
	Jumlah	Rp. 3.500.000
	Average	Rp. 219.000

Further analysis using the Total Inventory Cost (TIC) model compared the cost implications of the current procurement system versus the EOQ-based approach. The current system, which involves irregular and often excessive ordering, resulted in higher total costs due to inflated storage and waste management expenses. In contrast, applying the EOQ model would significantly reduce total inventory costs by balancing ordering and holding expenses. The factory could potentially save a substantial portion of its operational budget by simply shifting to EOQ-based ordering.

Table 3. Savings Production

No	Type of Cost	Total
1	Warehouse rental cost	Rp. 10.000.000
2	Warehouse electricity cost	Rp. 1.500.000
3	Water supply cost	Rp. 800.000
	Total	Rp. 12.300.000
	Average	Rp. 1.025.000

These results align with findings from previous studies in similar tofu-producing industries, which also showed that EOQ implementation led to improved efficiency and lower costs. The case of *Tahu Sutra Galih Dabeda* confirms that even in small-scale manufacturing settings, structured inventory control methods such as EOQ and TIC can produce tangible operational and financial benefits. Furthermore, integrating these models does not require high investment or technology only basic calculations and recordkeeping, making them ideal for small businesses in developing economies.

$$Total\ Inventory\ Cost = \frac{D}{EOQ}S + \frac{EOQ}{2}H$$

$$Total\ Inventory\ Cost = \frac{4.134}{258} 219.000 + \frac{258}{2} 3.000$$

$$Total\ Inventory\ Cost = 3.509.093 + 387.000$$

$$Total\ Inventory\ Cost = 3.896.093$$

Discussion

Table 4. Usage

No	Month	Soybean Usage (kg)
1	January	346
2	February	350
3	March	410
4	April	200
5	May	240
6	June	260
7	July	240
8	August	470
9	September	520
10	October	270
11	November	348
12	December	480
Total		4134
Average		344.5

It is evident that Pabrik Tahu Sutra Galih Dabeda has not yet implemented a raw material inventory control approach and continues to place orders based solely on estimation, which often results in both shortages and surpluses of raw materials in the warehouse.

Forecasting

The researcher conducted forecasting with the aim of predicting the amount of raw materials needed for the following year. In this study, the researcher used soybean raw material usage data from 2024 to forecast the soybean requirements for 2025 using the trend moment method as follows:

(untitled) Solution			
Measure	Value	Future Period	Forecast
Error Measures		13	406,909
Bias (Mean Error)	0	14	416,511
MAD (Mean Absolute Deviation)	91,234	15	426,112
MSE (Mean Squared Error)	9289,524	16	435,713
Standard Error (denom=n-2=10)	105,581	17	445,315
MAPE (Mean Absolute Percent Error)	29,101%	18	454,916
Regression line		19	464,518
Pemakaian Kedelai 2024 = 282,091		20	474,119
+ 9,601 * Time(x)		21	483,72
Statistics		22	493,322
Correlation coefficient	,325	23	502,923
Coefficient of determination (r ²)	,106	24	512,525
		25	522,126
		26	531,727

Figure 1. Result Forecasting

Based on the analysis using the trend moment method, the researcher conducted forecasting to estimate the soybean raw material needs for the year 2025. The calculation was carried out using soybean usage data from January to December 2024. This data served as the foundation to determine future trends in raw material consumption at Tahu Sutra Galih Dabeda.

The trend moment method involves identifying the pattern of demand over time and projecting that pattern into the future. The results of the forecasting indicate an upward trend in soybean usage, which suggests that production volume is expected to increase or remain stable in the coming year. This implies that the factory must prepare for higher or at least consistent demand for raw materials.

By forecasting the required quantity of soybeans for 2025, the factory can more accurately plan procurement schedules and avoid issues such as stock shortages or overstocking. The forecasted data provides a basis for further calculations, including the Economic Order Quantity (EOQ) and Total Inventory Cost (TIC), to ensure that inventory control decisions are data-driven and aligned with actual needs. Overall, the forecasting result serves as a strategic tool for improving inventory planning and supports the transition from estimation-based procurement to a more systematic, efficient approach.

Table 5. Forecasting

No	Month	Forecasting (kg)
1	January	407
2	February	417
3	March	426
4	April	436
5	May	445
6	June	455
7	July	465
8	August	474
9	September	484
10	October	493
11	November	503
12	December	513
Total		5518
Average		460

It shows that by using the trend moment forecasting method, the amount of soybean raw material required by *Pabrik Tahu Sutra Galih Dabeda* in 2025 is estimated to be 5,518 kilograms, with an average monthly usage of 460 kilograms of soybeans. The management of soybean raw material stock plays a crucial role, as it represents a major component in the overall cost of stock management. If the ordering of raw materials can be minimized, then the expenses incurred for managing the inventory of basic materials can be optimally reduced.

After calculating the stock control for soybean raw materials, a comparison can be made between the system currently used by the Tahu Sutra Galih Dabeda Factory and the Economic Order Quantity (EOQ) and Total Inventory Cost methods, as proposed by Heizer et al. This comparison can be seen in the following tableThe results.

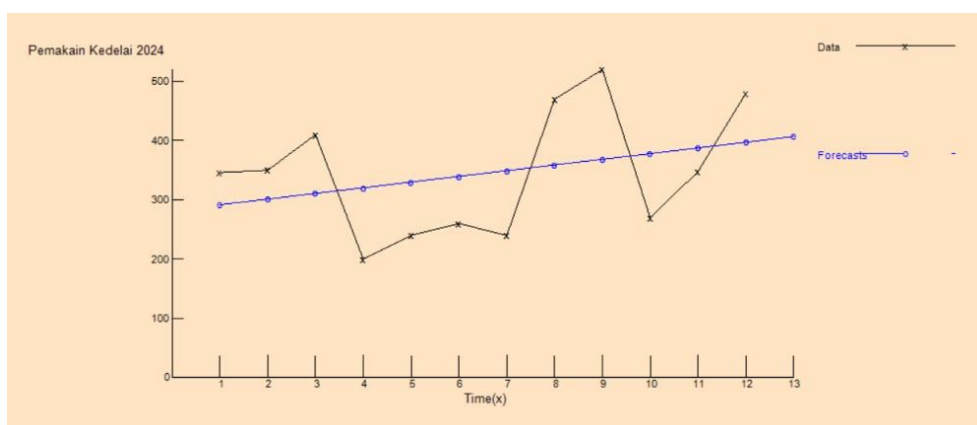


Figure 2. Soybean Graphic

Economic Order Quantity

Based on the data obtained by the researcher from the Tahu Sutra Galih Dabeda Factory, the total procurement of raw soybean material in 2025 amounted to 4,134 kilograms, with a purchase frequency of 1 to 2 times per month. Therefore, the total procurement frequency within a year was 16 times. The total ordering cost for the year amounted to IDR 3,500,000, while the annual storage cost was IDR 12,300,000. As a result, the total inventory cost incurred by the Tahu Sutra Galih Dabeda Factory reached IDR 3,896,093. The forecasting result for raw soybean materials required in 2025 is 5,518 kilograms.

$$\text{Economic Order Quantity} = \sqrt{\frac{2 \cdot D \cdot S}{H}}$$

$$\text{Economic Order Quantity} = \sqrt{\frac{2 \cdot (5.518) \cdot (219.000)}{3.000}}$$

$$\text{Economic Order Quantity} = \sqrt{805,628}$$

$$\text{Economic Order Quantity} = 897,56 \sim 898$$

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

$$\text{Purchasing Frequency} = \frac{5.518}{898}$$

$$\text{Purchasing Frequency} = 6 \text{ kali}$$

$$\text{Total Inventory Cost} = \frac{D}{EOQ} S + \frac{EOQ}{2} H$$

$$\text{Total Inventory Cost} = \frac{5.518}{898} 219.000 + \frac{898}{2} 3.000$$

$$\text{Total Inventory Cost} = 1.345.703 + 1.347.000$$

$$\text{Total Inventory Cost} = 2.692.703 \sim \text{Rp. } 2.700.000$$

The Tahu Sutra Galih Dabeda Factory applied the Economic Order Quantity (EOQ) and Total Inventory Cost methods to analyze the frequency of purchases, the quantity of soybean raw materials, and the total inventory costs incurred.

In the actual method currently used by the factory, the procurement frequency of raw materials within one period is 16 times, with a total quantity of soybean raw materials amounting to 4,134 kilograms and a total inventory cost of IDR 3,896,093. This high purchase frequency indicates that the factory makes purchases in small quantities but frequently, which leads to increased purchasing and inventory expenses.

In contrast, the Economic Order Quantity and Total Inventory Cost methods result in a procurement frequency of only 6 times within the same period, with a total quantity of 898 kilograms of soybean raw materials and a significantly lower total inventory cost of IDR 2,692,703. The EOQ and Total Inventory Cost methods aim to determine the optimal order quantity of raw materials while reducing the overall inventory budget, which includes ordering and storage costs.

Referring to the analysis results, it can be concluded that the EOQ and Total Inventory Cost approach offers substantial savings in soybean material inventory management at the Tahu Sutra Galih Dabeda Factory. Reducing the purchase frequency minimizes ordering costs, while procuring materials in larger quantities per order still remains within optimal storage limits. This is evidenced by the total inventory cost savings of IDR 13,107,297 that the factory could achieve by implementing the EOQ and Total Inventory Cost techniques.

Table 6. Frequency Quantity

Method	Frequency	Quantity (kg)	Ordering Cost	Holding Cost	Total Inventory Cost
Pabrik Tahu Sutra Galih Dabeda	16 times	4.134	Rp. 3.500.000	Rp. 12.300.000	Rp. 3,896,093
EOQ	6 times	898	Rp. 1.345.703	Rp. 1.347.000	Rp. 2.692.703

The comparison highlights the differences between the actual method used by the Tahu Sutra Galih Dabeda Factory and the Economic Order Quantity (EOQ) and Total Inventory Cost methods in terms of purchase frequency, quantity of soybean raw materials, and total inventory costs incurred.

In the actual method currently applied by the Tahu Sutra Galih Dabeda Factory, the frequency of raw material procurement within one period is 16 times, with a total quantity of 4,134 kilograms of soybeans and total inventory costs amounting to IDR 15,800,000. This high purchasing frequency indicates that the factory tends to make purchases in small quantities but at a high frequency, which leads to increased ordering and inventory costs.

In contrast, the Economic Order Quantity and Total Inventory Cost methods result in a procurement frequency of only 6 times within the same period, with a total raw material quantity of 898 kilograms and significantly lower total inventory costs of IDR 2,692,703. The EOQ and Total Inventory Cost methods aim to determine the optimal order quantity of basic materials while minimizing the overall inventory budget, which includes both ordering and holding costs.

Based on the analysis, it can be concluded that the EOQ and Total Inventory Cost approach can provide substantial savings in the inventory management of soybean materials at the Tahu Sutra Galih Dabeda Factory. Reducing the frequency of purchases helps minimize ordering costs, while procuring raw materials in larger quantities per order still remains within the optimal storage capacity. This is evident from the difference in total inventory costs, amounting to IDR 13,107,297, which the factory could potentially save by implementing the EOQ and Total Inventory Cost techniques

Conclusion

This research was conducted to evaluate the effectiveness of inventory control management at Pabrik Tahu Sutra Galih Dabeda, particularly focusing on the procurement and storage of raw soybean materials, which serve as the primary input for tofu production. Through a comparative analysis between the actual inventory practices used by the factory and the Economic Order Quantity (EOQ) method integrated with the Total Inventory Cost approach, this study has revealed significant findings that have important implications for cost efficiency and inventory strategy in small to medium-scale manufacturing enterprises.

The data gathered showed that the factory currently procures raw soybean material 16 times a year, with a total annual quantity of 4,134 kilograms. This procurement pattern, characterized by frequent purchases in small quantities, has led to a relatively high total inventory cost of IDR 15,800,000. These frequent orders may offer some advantages in terms of reducing overstocking and spoilage, but they also contribute to increased ordering costs and may not be the most cost-effective method in the long run.

In contrast, when applying the EOQ and Total Inventory Cost models, the research calculated that the factory could reduce its procurement frequency to only 6 times a year. The optimal order quantity determined through the EOQ method was 898 kilograms per order, which balances ordering costs and holding costs more efficiently. With this approach, the total inventory cost was reduced to IDR 2,692,703 annually. This indicates a potential savings of IDR 13,107,297—an amount that is highly significant for a small-scale enterprise.

The EOQ method, in its fundamental principle, seeks to determine the most economical order quantity that minimizes the total cost of inventory, combining both the ordering costs and the carrying (storage) costs. The findings of this research confirm that when this method is properly applied, it can lead to considerable cost reductions while maintaining the supply of raw materials at an optimal level to meet production demands.

Furthermore, the results of this research highlight a critical point in inventory management—namely, that more frequent purchasing does not always equate to greater efficiency. In fact, the opposite may be true. When the costs of ordering and storing inventory are not carefully balanced, a business may unknowingly incur substantial losses that could have otherwise been avoided through strategic inventory planning.

It is important to note that adopting the EOQ and Total Inventory Cost methods also requires organizational discipline and accurate forecasting of future demand. Based on trend moment forecasting, it was predicted that the factory would require approximately 5,518 kilograms of soybeans in 2025. This figure supports the feasibility of bulk purchasing as long

as the storage infrastructure is sufficient and spoilage risks are mitigated.

Another key takeaway from this study is the need for small manufacturing businesses like Pabrik Tahu Sutra Galih Dabeda to be open to the application of scientific management techniques. While such techniques are often associated with large-scale industries, this research proves that they can be equally beneficial when applied on a smaller scale. By embracing a data-driven approach, the factory can make more informed decisions, optimize its operations, and improve its financial performance.

This research contributes not only to the academic understanding of inventory control in small manufacturing enterprises but also provides a practical model that can be replicated by other tofu producers or similar businesses facing comparable challenges. It serves as a reminder that efficient inventory management is a cornerstone of operational success and financial sustainability.

In conclusion, the implementation of the Economic Order Quantity and Total Inventory Cost methods at Pabrik Tahu Sutra Galih Dabeda demonstrates a clear advantage in terms of cost savings and inventory efficiency. The comparison between the factory's current method and the EOQ-based model underscores the importance of adopting systematic and quantitative approaches in managing procurement and storage. With a reduction in purchase frequency and total inventory costs, the factory stands to improve its overall productivity and profitability. Therefore, it is strongly recommended that Pabrik Tahu Sutra Galih Dabeda consider adopting these methods as part of their long-term inventory strategy to enhance operational effectiveness and maintain competitiveness in the tofu production industry.

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