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Analysis of Soybean Raw Material Inventory Control Using the Economic Order Quantity (EOQ) Method at the Terang Tofu Factory

Kusno Hadidjija [1]✉, Dina Fitriana [1], Lazuardi Lazuardi [1]

1 Faculty of engineering and science, Universitas PGRI Wiranegara Pasuruan , Indonesia

kusnohadi@uniwara.ac.id, ftrdinana23@gmail.com, atingthok99@gmail.com

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ABSTRACT

Kebonagung Terang Tofu Factory is one of the famous tofu industries in Pasuruan City. This business produces raw tofu. This research aims to determine the optimal amount of soybean raw material inventory that the Kebonagung Terang Tofu Factory must have, the right time for repurchasing soybean raw materials, the optimal purchase frequency, and the optimal total ordering costs for procuring soybean raw materials at the Terang Tofu Factory. Kebonagung, Pasuruan City. This research is quantitative descriptive, which describes how the company controls raw material inventories through analysis of the data obtained. The analysis methods used include Economic Order Quantity (EOQ) to determine the optimal amount of raw material purchases, Re-Order Point (ROP) to determine the right time for repurchasing raw materials, annual purchase frequency, Safety Stock (SS) to determine the amount safety stock that the company must have, and Total Inventory Cost (TIC) to determine the company's total storage costs. The results of the analysis using the EOQ method show that the Kebonagung Terang Tofu Factory should order 62,740 kg of soybean raw materials in 2024 with an order frequency of 7 times, ROP of 7.956 kg, Safety Stock of 5,874 kg, and total storage costs of Rp. 172.535.

Keywords: Economic Order Quantity (EOQ), inventory control, Re-Order Point (ROP), Safety Stock, Total Inventory Cost (TIC)

1. INTRODUCTION

Raw material inventory plays an important role in the sustainability of industrial companies, both large, medium, and small scale. The level of inventory varies according to the scale and production results, and requires effective management to ensure smooth production processes. Insufficient inventory can cause production to stop, sales to decline, and financial losses [1]. On the other hand, excess inventory can increase storage costs and the risk of damage, so optimal inventory management is needed to minimize losses [2]. Inventory is defined as an important asset stored for future needs, including raw materials that will be processed into semi-finished goods [3]. Proper inventory management can maintain a balance between production needs and storage costs, thus supporting the company's operational efficiency [4]. Strategy-based inventory control allows companies to achieve optimal operational performance [5]. Thus, structured inventory management can reduce the risk of excess or shortage of raw materials, as well as avoid disruption to the production process [6].

Companies need to manage and plan raw material inventory strategically to ensure smooth production, prevent operational disruptions, and reduce potential financial losses. This step includes decision-making regarding the amount and timing of raw material orders, which directly affect storage and ordering costs. One method that is often used is the Economic Order Quantity (EOQ), which is designed to determine the optimal amount of raw material purchases by considering cost efficiency. The EOQ approach allows companies to reduce total inventory costs, including ordering and storage costs, while still meeting production needs [7], [8]. This strategy is very relevant in various industrial scales, from large manufacturers to small and medium enterprises, where raw material management is a key element in the supply chain [9]. In addition, the application of EOQ also supports companies in achieving operational efficiency through more measurable and systematic stock control [10]-[11].

Soybean is one of the main food sources in Indonesia after rice and corn, and has a crucial role in the production of various food and non-food products. Along with population growth, domestic demand for soybeans is increasing [12]. However, tofu producers often face challenges in obtaining sufficient soybeans, which can disrupt smooth production and reduce their profits [13]. Therefore, effective soybean inventory control is very important to avoid raw material shortages and ensure smooth production [14]. One method that can be applied to soybean inventory management is Economic Order Quantity (EOQ), which aims to determine the amount and frequency of raw material orders optimally [15]. The application of EOQ focuses on minimizing inventory costs, including ordering costs and storage costs, while ensuring that raw material needs can be met on time

[16]. Various studies have shown that the use of the EOQ method can improve inventory management efficiency and reduce the risk of raw material shortages that can disrupt the production process [17][18].

Total Inventory Cost (TIC) includes all costs associated with inventory management, including holding costs, ordering costs, and shortage costs. Effective TIC management is essential to ensure operational efficiency and profitability of a company [19]. In the context of a tofu factory such as Terang Tofu Factory, TIC plays a crucial role because soybeans are the main raw material that must always be available to maintain production sustainability [20].

The Economic Order Quantity (EOQ) method is one approach that can be used to optimize TIC. By determining the economical order quantity, EOQ helps companies minimize ordering and storage costs simultaneously [21]. Research shows that the application of EOQ to raw material management can reduce TIC by up to 30%, especially in small and medium industries [22]. In addition, TIC analysis using EOQ can also help companies anticipate fluctuations in raw material prices in the global market [23].

By integrating EOQ into inventory management, Tofu Factory can identify the optimal point that minimizes TIC without sacrificing raw material availability. This approach not only improves operational efficiency but also provides a competitive advantage in the industry [24].

Inventory control is an important aspect of supply chain management, especially in industries that are highly dependent on raw materials such as tofu factories. Inefficiencies in inventory management can lead to high operational costs, raw material shortages, or even production disruptions [25]. The Economic Order Quantity (EOQ) method has been proven to be an effective approach to determine the optimal amount and frequency of raw material orders [26]. By implementing this method, companies can minimize storage and ordering costs, while ensuring the availability of raw materials to support the smooth running of the production process [27].

On the application of EOQ in controlling soybean inventory at Tahu Terang Factory. The position of EOQ as an important analysis tool in inventory management is increasingly relevant amidst the fluctuations in soybean prices and supplies in the global market [28]. The application of EOQ can help companies identify economical ordering levels, optimize storage space, and reduce the risk of raw material waste [29]. This study also provides insight for similar industries on how data-based inventory management strategies can improve operational efficiency and competitiveness [30].

2. RESEARCH SIGNIFICANCE

The research entitled "Analysis of Soybean Raw Material Inventory Control Using the Economic Order Quantity (EOQ) Method at the Terang Tofu Factory" has important significance in efforts to improve the efficiency of soybean raw material inventory management in the tofu industry. The results of tofu production using traditional methods in Pasuruan City, East Java, Indonesia can be seen in Fig 1.

Fig 1. Results of tofu production using traditional methods in Pasuruan City, East Java, Indonesia

The Economic Order Quantity (EOQ) method applied in this study aims to determine the amount and frequency of ordering soybean raw materials optimally, so as to reduce storage costs and ordering costs. With the increasing demand for soybeans that is not always balanced with the availability of stable supplies, proper inventory control is very important to maintain smooth production. This study contributes to the understanding of how the application of EOQ can reduce the risk of raw material shortages and increase operational efficiency and profits at the Tahu Terang Factory. These findings are expected to be a reference for other tofu industry players in managing their raw material inventory more effectively.

3. RESEARCH METHODS

This study was conducted to analyze the control of soybean raw material inventory at the Kebonagung Bright Tofu Factory using the Economic Order Quantity (EOQ) method. The research method used includes a quantitative approach, where quantitative data related to soybean raw material inventory is analyzed to determine the optimal order quantity. The type of research used in this study is quantitative descriptive used to describe the actual state of raw material inventory. The purpose of this descriptive research with a quantitative approach is to provide a detailed explanation of the situation under study. The data analysis framework can be seen in Fig 2.

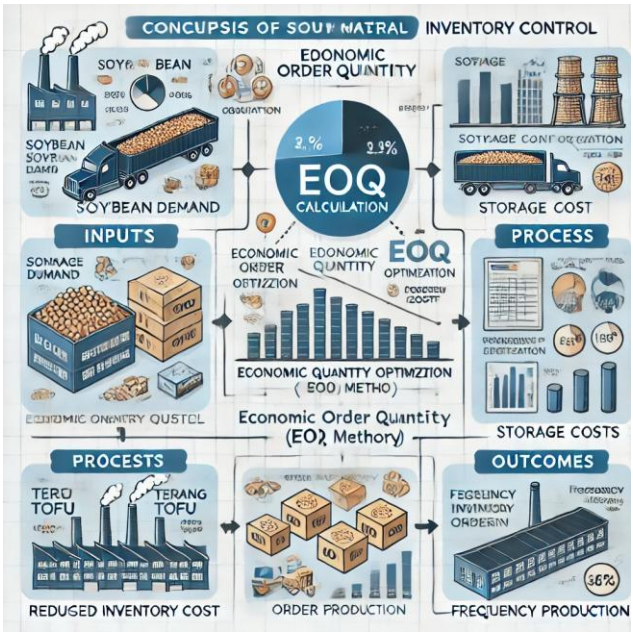

Figure 2 Soybean inventory data analysis framework for tofu production

The population used in this study is data on purchases and use of soybean raw materials owned by the Kebonagung Bright Tofu Factory. The sample used is data on purchases and use of soybean raw materials during 2023. The research instrument used is an interview to obtain additional relevant information. Data collection techniques used are interviews, observation, documentation, secondary data.

4. RESULTS AND DISCUSSION

4.1 Analisis Economic Order Quantity (EOQ).

$$\text{Cost of each order} = \frac{Total\ Cost\ Each\ time\ you\ order}{Order\ Frequency}$$

$$\text{Cost of each order} = \frac{600{,}000}{24}$$
$$\text{Cost of each order} = Rp.\ 25.000$$

Based on the calculation above, the cost of ordering raw materials in the form of soybeans is Rp. 25,000 for each order. The calculation of the storage cost of soybean raw materials is as follows:

$$\text{Raw Material Storage Costs} = \frac{Total\ Cost\ Each\ time\ you\ order}{Amount\ of\ Material\ Inventory}$$

$$\text{Raw Material Storage Costs} = \frac{600{,}000}{218{,}000}$$
$$\text{Raw Material Storage Costs} = Rp.\ 2{,}75/\text{kg}$$

Based on the calculation above, it can be seen that the storage of soybean raw materials per kg is Rp. 2.75. The calculation of the number of economical orders using the Economic Order Quantity (EOQ) method is as follows:

$$\text{EOQ} = \sqrt{\frac{2.(D).(OC)}{(CC)}}$$
$$\text{EOQ} = \sqrt{\frac{2.(216.500).(25.000)}{2{,}75}}$$
$$\text{EOQ} = \sqrt{\frac{(433.000).(25.000)}{2{,}75}}$$

$$\text{EOQ} = \sqrt{\frac{10.825.000.000}{2{,}75}}$$
$$\text{EOQ} = \sqrt{3.936.363.636{,}363}$$
$$\text{EOQ} = 62.740 Kg$$

By calculating using the Economic Order Quantity (EOQ) method, the most economical order quantity obtained is 62,740 kg. The calculation to calculate the average inventory of soybean raw materials in a year that can be done by the Kebonagung Bright Tofu Factory is as follows:

$$Average\ inventory = \frac{62.740}{2}$$
$$Average\ inventory = 31.370\ Kg$$

The average inventory obtained from the calculation above is 31,370 kg. Calculation for the estimated ordering frequency in each order according to the Economic Order Quantity (EOQ) method:

$$\text{Estimated order frequency} = \frac{D}{Q}$$
$$\text{Estimated order frequency} = \frac{216.500}{31.370}$$
$$\text{Estimated order frequency} = 7\ Kali$$

The results of the EOQ analysis show that the factory should place orders 7 times a year with an optimal order quantity of 31,370 kg. Calculation of annual ordering costs using the Economic Order Quantity (EOQ) method:

$$\text{Booking Fee} = \frac{D}{Q} \times s$$
$$\text{Booking Fee} = \frac{216.500}{62.740} \times 25.000$$
$$\text{Booking Fee} = Rp.\ 86.268$$

The calculation shows that the total annual ordering cost for the Bright Tofu Factory is Rp. 86,268. The calculation of annual storage costs using the Economic Order Quantity (EOQ) method can be done as follows:

$$\text{Storage Costs} = \frac{Q}{2} \times H$$
$$\text{Storage Costs} = \frac{62.740}{2} \times 2{,}75$$
$$\text{Storage Costs} = Rp.\ 86.267$$

The EOQ method shows that for an order quantity of 62,740 kg and with a storage cost of Rp. 2.75/kg, the Bright Tofu Factory will incur an annual storage cost of Rp. 86,267

4.2 Analisis Safety Stock

To anticipate the shortage of soybean raw materials and maintain the smooth production process, Terang Tofu Factory Kebonagung needs to determine safety stock. With the following calculations:

$$Safety\ stock = (\text{maximum usage} - \text{average usage}) \times Lt$$
$$Safety\ stock = (20.000 - 18.042) \times 3$$
$$Safety\ stock = 5.874\ Kg$$

Terang Tofu Factory Kebonagung needs to set a safety stock of 5,874 kg of soybeans based on the EOQ method calculation. By having this stock, the company can avoid disruptions in production caused by shortages of raw materials.

4.3 Analisis Reorder Point (ROP)
Calculation for the rate of demand per unit time (ROP):

$$a = \frac{D}{number\ of\ working\ days}$$
$$a = \frac{216.500}{312}$$
$$a = 693{,}91\ Kg$$

Based on the calculation results above, the level of need per unit of time is 693.91 kg. Calculations to calculate ROP:

$$ROP = d \times L + SS$$

$$ROP = 693{,}91 \times 3 + 5.874$$
$$ROP = 7.956\ Kg$$

From the reorder point (ROP) calculation above, it can be seen that the inventory of soybean raw materials will decrease every day. When the amount of raw material inventory reaches the reorder point (ROP) set at 7,956 kg

4.4 Analisis Total Cost
The purpose of this total cost calculation is to prove that when implementing the Economic Order Quantity method, the total cost of raw inventory is minimal. The calculation of total cost (TC) is as follows:

$$\text{Total Cost (TC)} = \frac{D}{Q} \times s + \frac{Q}{2} \times s$$
$$\text{TC} = \frac{216.500}{62.268} \times 25.000 + \frac{62.740}{2} \times 2{,}75$$
$$\text{Total Cost (TC)} = 86.268 + 86.267$$
$$\text{Total Cost (TC)} = Rp.\ 172.535$$

The total inventory cost incurred by the Kebonagung Bright Tofu Factory using the Economic Order Quantity (EOQ) method is Rp. 172,535. After calculating the total inventory cost using the EOQ method, the next step is to calculate the total inventory cost incurred by the Kebonagung Bright Tofu Factory using the following formula:

$$TIC = (Total\ pemakaian\ rata - rata \times C) + (P \times F)$$
$$TIC = (18.042 \text{ x } 2{,}75) + (25.000 \text{ x } 24)$$
$$TIC = 49.615{,}5 + 600.000$$
$$TIC = \text{Rp. } 649.615{,}5$$

The calculation of the total inventory of soybean raw materials using the method applied by the Kebonagung Bright Tofu Factory in 2023 reached IDR 649,615.5. It can be seen that the total cost incurred by the Kebonagung Bright Tofu Factory according to company policy is IDR 649,615.5, while the total cost generated using the Economic Order Quantity (EOQ) method is IDR 172,535. The difference between the two costs shows a difference of IDR 477,080.5. This shows that the control of raw material inventory at the Kebonagung Bright Tofu Factory is not yet effective in terms of costs, because inventory costs based on company policy are higher than the costs calculated using the EOQ method. By implementing the EOQ method, the company can save inventory costs and increase profit potential. Can be seen in table 1 below:

Table 1. Difference between inventory costs according to company policy and total costs according to the method

Total Cost According	Raw Material Soybean
Company Policy	Rp. 649.615,5
EOQ	Rp. 172.535
Difference	Rp. 477.080,5

From the results of the analysis, it can be concluded that the soybean raw material inventory control system at the Tahu Terang Kebonagung Factory is not yet effective. On the other hand, the Economic Order Quantity (EOQ) method is more efficient in managing soybean raw material inventory at this factory. With the EOQ method, the company can determine the optimal inventory quantity and reduce total inventory costs. This method also helps in determining safety stock and reorder points, which allows the company to avoid shortages or excesses of soybean raw materials and maintain a smooth production process while reducing inventory costs.
Based on the calculation above, there is a comparison between the soybean raw material inventory method used by the Terang Kebonagung Tofu Factory and the Economic Order Quantity (EOQ) method. The results of the comparison are shown in the following table 2:

Table 2. Comparison of calculations based on company policy using the EOQ method

Calculation	Company Policy	EOQ
Purchase Amount	18.167	62.740
F	24	7
SS	-	5.874
ROP	-	7.956
Total Cost	Rp. 649.615,5	Rp. 172.535

Based on the table above, it is obtained that if the Economic Order Quantity (EOQ) method is applied, the Tahu Terang Kebonagung Factory must order soybean raw materials if the stock in the warehouse has reached 7,956 kg. So that when the raw materials are received with a lead time of 3 days. Safety stock in the warehouse is still available 5,874 kg, so that the smoothness of the production process will be smooth and unimpeded.

5. CONCLUSIONS

Based on the results of the analysis using the Economic Order Quantity (EOQ) method at the Kebonagung Bright Tofu Factory, the optimal order quantity was 62,740 kg, which resulted in a decrease in ordering costs and inventory costs, thus minimizing the costs incurred by the Kebonagung Bright Tofu Factory and maximizing the company's profits. With an order frequency of 7

times in 1 year with a total inventory cost of Rp. 172,535 indicates that the Economic Order Quantity method is more effective to maximize company profits. From the results of the analysis using the Economic Order Quantity (EOQ) method, it shows that the safe stock that must be in the warehouse is 5,874 kg, while the reorder point is 7,956 kg, so if the inventory in the warehouse has reached the reorder point, the company must immediately purchase raw materials so that the production process can run smoothly

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7. AUTHOR CONTRIBUTIONS

Conception and design: Dina Fitriana
Methodology: Dina Fitriana, Kusno Hadidjija
Data acquisition: Dina Fitriana, Kusno Hadidjija
Data analysis and interpretation: Dina Fitriana, Lazuardi
Publishing writing: Lazuardi
Final publication approval: Dina Fitriana, Kusno Hadidjija
Resources, technical and material support: Dina Fitriana, Kusno Hadidjija, Lazuardi Lazuardi
Supervisor: Kusno Hadidjija

8. REFERENCES

[1] F. Sulaiman and Nanda, "Pengendalian Persediaan Bahan Baku dengan Menggunakan Metode EOQ pada UD. Adi Mabel," Jurnal Teknovasi, vol. 2, no. 1, 2015.
[2] "Management Analysis Journal," Universitas Negeri Semarang, 2016. [Online]. Available: https://journal.unnes.ac.id/sju/maj/article/view/7751/5346. [Accessed: 06-Jan-2025].
[3] Z. Maulida, "Pengendalian Persediaan Bahan Baku pada PT. Aceh Rubber Industries Kabupaten Aceh Tamiang," Jurnal Manajemen dan Keuangan, vol. 7, no. 2, pp. 157-165, 2018.
[4] W. F. Mufti and Z. Zulhamidi, "Pengendalian Persediaan Bahan Baku Penolong Menggunakan Metode Economic Order Quantity di Industri Makanan Olahan," Jurnal Inventory, vol. 1, no. 2, pp. 77-85, 2020.
[5] J. Puspita and D. Anita, "Inventory Control dan Perencanaan Persediaan Bahan Baku Produksi Roti pada Pabrik Roti Bobo Pekanbaru," Jurnal Ekonomi, vol. 21, no. 3, pp. 105-119, 2013.
[6] P. Wijayanti and S. Sunrowiyati, "Analisis Pengendalian Persediaan Bahan Baku guna Memperlancar Proses Produksi dalam Memenuhi Permintaan Konsumen," *Jurnal BisBisnis dan Kewirausahaan*, vol. 15, no. 2, pp. 92-102, 2019.
[7] S. D. Saraswati, "Analisis Perhitungan Economic Order Quantity (EOQ) Sebagai Pengendalian Persediaan Bahan Baku (Studi pada PT Iskandar Indah Printing Textile)," Jurnal Teknovasi, vol. 2, no. 1, 2018.
[8] A. S. Sunhal and D. Mangal, "Analysis of Inventory Management in a Supply Chain by Using Economic Order Quantity (EOQ) Model," International Journal of Engineering Sciences and Research Technology, vol. 6, no. 10, pp. 303-309, 2017.
[9] T. Supit and A. H. Jan, "Analisis Persediaan Bahan Baku pada Industri Mebel di Desa Leilem," Jurnal EMBA, vol. 3, no. 1, pp. 1230-1241, 2015.
[10] C. I. Gunawan, Basic Theory of Production and Operational Management. Purwokerto: CV. IRDH (Research & Publishing), 2016.
[11] I. N. Gusniar, M. M. Albuhori, and D. A. Puspita, "Analysis of the Application of the Economic Order Quantity (EOQ) and Just In Time (JIT) Methods in Raw Material Inventory Control Management at PT. XYZ," Wahana Pendidikan Scientific Journal, vol. 8, no. 7, pp. 387-396, 2022.
[12] E. P. Lahu, O. Enggar, P. Lahu, and J. S. B. Sumarauw, "Analysis of Raw Material Inventory Control to Minimize Inventory Costs at Dunkin Donuts Manado," EMBA Journal: Journal of Economics, Management, Business and Accounting Research, vol. 5, no. 3, pp. 4175-4184, 2017.
[13] N. Aida, S. Kantun, and Tiara, "Analisis Pengendalian Persediaan Bahan Baku Kedelai Menggunakan Metode EOQ Pada Pabrik Tahu Di Kabupaten Jember," ADI Bisnis Digital Interdisiplin Jurnal, vol. 4, no. 1, pp. 9–16, 2023. https://doi.org/10.34306/abdi.v4i1.890.
[14] A. L. Andries, "Analisis Persediaan Bahan Baku Kedelai Pada Pabrik Tahu Nur Cahaya Di Batu Kota Dengan Metode Economic Order Quantity (EOQ)," Jurnal Manajemen dan Bisnis Arimbi, vol. 16, no. 1, pp. 1–10, 2019. https://doi.org/10.33019/jumabedi.v16i1.91.
[15] E. Sulistyaningsih, S. S. Utami, and D. P. Sari, "Penerapan Metode Economic Order Quantity (EOQ) Dalam Pengendalian Persediaan Bahan Baku Pada CV Syahdika," Jurnal Ekonomi dan Manajemen Akademi Bina Sarana Informatika, vol. 19, no. 2, pp. 160–170, 2018. https://doi.org/10.31294/jema.v19i2.160.
[16] I. W. S. Utama and N. L. P. Suryani, "Pengendalian Persediaan Bahan Baku Kedelai Menggunakan Metode Economic Order Quantity (EOQ) Pada Pabrik Tahu HR Kepuh," Jurnal Ilmiah Manajemen Bisnis dan Kewirausahaan, vol. 4, no. 2, pp. 1–10, 2019. https://doi.org/10.23887/jimbk.v4i2.3433.
[17] A. L. Andries, "Analisis Persediaan Bahan Baku Kedelai Pada Pabrik Tahu Nur Cahaya Di Batu Kota Dengan Metode Economic Order Quantity (EOQ)," Jurnal Manajemen dan Bisnis Arimbi, vol. 16, no. 1, pp. 1–10, 2019. https://doi.org/10.33019/jumabedi.v16i1.91.
[18] N. Aida, S. Kantun, and Tiara, "Analisis Pengendalian Persediaan Bahan Baku Kedelai Menggunakan Metode EOQ Pada Pabrik Tahu Di Kabupaten Jember," ADI Bisnis Digital Interdisiplin Jurnal, vol. 4, no. 1, pp. 9–16, 2023. https://doi.org/10.34306/abdi.v4i1.890.
[19] A. Bhardwaj, "Inventory control practices in manufacturing industries," Int. J. Prod. Econ., vol. 220, pp. 183–197, 2020.
[20] J. Smith and K. Johnson, "EOQ-based inventory management: A case study," J. Oper. Manag., vol. 34, no. 2, pp. 45–53, 2019.
[21] S. Lee et al., "Optimizing inventory levels with EOQ under demand uncertainty," Eur. J. Oper. Res., vol. 292, no. 1, pp. 94–107, 2021.
[22] M. Gonzalez, "Economic order quantity applications in small businesses," Small Bus. Econ., vol. 57, pp. 125–139, 2022.
[23] P. Kumar and R. Gupta, "Reducing inventory costs using EOQ models," Supply Chain Manag. Rev., vol. 23, no. 3, pp. 12–18, 2020.
[24] L. Zhang and Y. Wang, "EOQ optimization in food supply chains," J. Food Eng., vol. 291, pp. 67–78, 2023.
[25] J. Lee et al., "Optimizing inventory cost in manufacturing systems," Eur. J. Oper. Res., vol. 290, no. 2, pp. 45–59, 2021.
[26] M. Kumar and A. Singh, "Inventory cost management in SMEs," J. Small Bus. Strateg., vol. 31, no. 1, pp. 12–25, 2020.
[27] L. Zhang, "Application of EOQ in food production industries," J. Oper. Res. Soc., vol. 71, pp. 78–90, 2022.
[28] R. Gupta, "Reducing total inventory cost through EOQ models," Supply Chain Manag. Rev., vol. 25, no. 4, pp. 102–115, 2021.
[29] S. Chen and Y. Huang, "Inventory cost analysis under uncertain demand," Int. J. Prod. Econ., vol. 231, pp. 85–97, 2020.
[30] A. Bhardwaj, "Inventory control and cost optimization," Int. J. Prod. Manag., vol. 38, no. 3, pp. 123–140, 2023.