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Optimizing rice inventory in a micro culinary enterprise using economic order quantity

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ABSTRACT

Purpose: to optimize rice inventory management using the economic order quantity (EOQ) method to minimize costs and improve operational efficiency.
Method: a quantitative descriptive approach with a case study method was used at Warung Makan Dapi. Data were collected through interviews and analyzed using the economic order quantity (EOQ) model to determine optimal order quantity, safety stock, reorder point, and inventory cost efficiency.
Findings: the EOQ method reduces rice inventory costs from IDR 15,520,000 to IDR 682,184 per year, achieving 95.6% cost efficiency. The optimal order quantity is 455 kg with a reorder point of 12 kg, providing a more effective inventory control system for Warung Makan Dapi.
Implications: implementing EOQ provides a simple and effective inventory management strategy for micro culinary enterprises by reducing costs, improving procurement efficiency, and supporting production continuity.
Originality: lies in applying the EOQ model to a micro culinary enterprise with a highly frequent purchasing pattern, demonstrating significant inventory cost optimization through a simple data-driven approach.

Introduction

Effective inventory control is a fundamental component of operations management because it ensures production continuity while minimizing operational costs (Tao et al., 2024). Excessive inventory increases storage and capital holding costs, whereas insufficient inventory may interrupt production and reduce firms' ability to satisfy customer demand (Alsoussi & Tahboub, 2026; Marlina et al., 2024; Wardani et al., 2023). These challenges are particularly relevant for micro and small culinary enterprises, which generally operate with limited financial resources and simple managerial practices (Charisma et al., 2025). As an important contributor to local economic development and employment, micro culinary businesses require efficient operational management to maintain their competitiveness and business sustainability (Purba et al., 2022; Rabbani et al., 2025; Widajanti et al., 2022). Since rice is the primary raw material used daily in Indonesian food businesses, maintaining its availability at an optimal level is essential for ensuring uninterrupted production and customer satisfaction (Juliawan et al., 2025).

Warung Makan Dapi, a micro culinary enterprise located in Tanjung Redeb, Berau regency, East Kalimantan, serves approximately 60 meals per day and relies heavily on rice as its main production input. Currently, rice procurement is conducted based on habitual purchasing practices rather than systematic inventory planning. The business purchases approximately 10 kg of rice every two days, following the supplier's delivery schedule, without considering ordering costs, holding costs, or the optimal order quantity. Although this practice maintains raw material availability, it requires frequent purchasing throughout the year, resulting in accumulated ordering costs that may substantially increase total inventory expenses. Such conditions indicate that inventory decisions are made intuitively rather than analytically, limiting operational efficiency and increasing the potential for unnecessary costs. As emphasized by Ningrat & Gunawan (2023), procurement decisions should be based on quantitative analysis to achieve cost efficiency while ensuring production continuity.

The economic order quantity (EOQ) method has been widely recognized as an effective inventory management approach for determining the optimal order quantity that minimizes the total inventory cost, consisting of ordering and holding costs (Tiloly et al., 2022; Wardani et al., 2023). Furthermore, EOQ provides a comprehensive inventory control framework through the calculation of safety stock and reorder point, enabling businesses to reduce the risks of stock shortages and overstocking (Dagi et al., 2023). Previous studies have demonstrated the effectiveness of EOQ in various small-scale industries, including cracker manufacturing (Ningrat & Gunawan, 2023), tofu production (Burhanuddin & Said, 2022), snack businesses (Marlina et al., 2024), bakeries (Wardani et al., 2023), and restaurants (Katiandagho & Trisyanto, 2022). These studies consistently reported reductions in inventory costs and improvements in inventory efficiency after implementing EOQ. However, most previous research has focused on manufacturing-oriented SMEs or larger food-processing businesses, while empirical evidence regarding the application of EOQ in micro culinary enterprises that depend on high-frequency consumption of staple raw materials such as rice remains limited. Moreover, few studies have examined inventory optimization in small family-owned food stalls that operate with highly simplified procurement systems. This study addresses this gap by applying EOQ, safety stock, and reorder point analysis to optimize rice inventory management in a micro culinary enterprise.

Based on these considerations, this study aims to determine the optimal rice order quantity, the appropriate level of safety stock, the reorder point, and the resulting total inventory cost for Warung Makan Dapi using the economic order quantity approach. In addition, the study compares the existing procurement practice with the proposed EOQ-based inventory policy to evaluate potential cost savings and improvements in inventory efficiency. Through this analysis, the study seeks to provide an evidence-based inventory management strategy that can support more effective operational decision-making in micro culinary businesses.

This research is important because inventory costs represent a significant proportion of operational expenses in small food-service businesses, while many micro enterprises continue to rely on experience-based purchasing decisions rather than analytical methods. Optimizing inventory management can improve cost efficiency, strengthen production continuity, and enhance business sustainability without requiring substantial financial investment. The findings are expected to contribute both theoretically and practically. Theoretically, this study extends the empirical literature on inventory management by providing evidence of EOQ implementation in micro culinary enterprises, a context that has received limited scholarly attention. Practically, the results offer a simple and applicable inventory planning model that can assist micro food businesses in minimizing inventory costs, improving procurement decisions, and enhancing operational performance through systematic inventory control.

Literature review

Micro culinary enterprises and supply chain management

Micro, small, and medium enterprises (MSMEs) play a significant role in Indonesia's economy by contributing substantially to employment generation and regional economic growth (Saputri et al., 2024). Despite their importance, many micro enterprises continue to operate with limited managerial capabilities and informal decision-making processes, particularly in inventory planning and raw material procurement (Ideue, 2026). In culinary businesses, the continuity of operations depends heavily on the timely availability of essential ingredients (Sutar et al., 2026). Consequently, even small food-service businesses require effective supply chain management to coordinate procurement activities, ensure uninterrupted production, and control operational costs (Widajanti et al., 2022). Supply chain management in micro culinary enterprises involves coordinating the flow of raw materials from suppliers to production activities and ultimately to customers (Akhiroh et al., 2025). Although these businesses generally have relatively simple organizational structures, inefficient procurement practices may increase operational expenses and reduce service quality (Gurgun et al., 2024). Therefore, inventory management becomes a critical component of operational management because it directly influences production continuity, customer satisfaction, and business sustainability (Purba et al., 2022).

Inventory management

Inventory management refers to the process of planning, controlling, and monitoring raw materials, work-in-process, and finished goods to ensure that production requirements are fulfilled while minimizing inventory-related costs (Opoku, 2022). According to Anwar et al. (2024), inventory control is an essential function of operations management because it balances production requirements with the costs incurred in maintaining inventory. Proper inventory management prevents both excessive stock, which increases holding costs and capital investment, and insufficient stock, which may interrupt production and reduce customer satisfaction (Panigrahi et al., 2024). Within supply chain management, inventory serves as a buffer that accommodates differences between supply and demand (Aslam et al., 2026). Chopra & Meindl (2020) explain that inventory management aims to regulate the movement of materials throughout the supply chain so that customer demand can be fulfilled in the right quantity, at the right time, and at the lowest possible cost. Consequently, businesses need an inventory policy that determines not only how much inventory should be purchased but also when replenishment should occur (Gupta & Mishra, 2024). Such decisions become particularly important in micro culinary enterprises where staple raw materials, such as rice, are consumed continuously and directly affect daily production activities (Bannor et al., 2025).

Economic order quantity (EOQ)

Economic order quantity (EOQ) is one of the most widely applied quantitative inventory models for determining the optimal order quantity that minimizes total inventory costs (Alnahhal et al., 2024). These costs consist primarily of ordering costs and holding costs. According to Tiloly et al. (2022), EOQ provides a simple yet effective decision-support tool for determining economically efficient purchasing quantities while reducing unnecessary inventory expenses. Likewise, Rahman (2025) emphasize that quantitative inventory management methods improve resource utilization and operational efficiency by replacing intuitive purchasing decisions with analytical approaches. The classical EOQ model is based on several assumptions: demand remains relatively constant throughout the planning period, unit purchase price is fixed, lead time is known and constant, inventory replenishment occurs instantaneously, and quantity discounts are not available. Under these assumptions, the optimal order quantity is calculated using:

$$EOQ = \sqrt{(2DS / H)}$$

Where D represents annual demand, S denotes ordering cost per order, and H represents annual holding cost per unit. The EOQ value can subsequently be used to determine several operational indicators, including the optimal ordering frequency: ($\mathrm{N} = D/EOQ$), the order cycle: (T = operating days / N), and the minimum total inventory cost: $\mathrm{TC} = \sqrt{(2\mathrm{DSH})}$. These indicators provide managers with practical guidance for scheduling procurement activities while minimizing inventory costs. While EOQ determines the optimal order quantity, effective inventory management also requires determining the appropriate timing for replenishment. Therefore, EOQ is commonly integrated with safety stock (SS) and reorder point (ROP). Safety stock represents additional inventory maintained to protect businesses from uncertainties such as demand fluctuations or supplier delivery delays. The amount of safety stock depends on the desired service level, demand variability, and lead time. It can be calculated as: $\mathrm{SS} = \mathrm{Z} \times \sigma\mathrm{d} \times \sqrt{\mathrm{L}}$, where Z is the service level factor, σd is the standard deviation of demand, and L represents lead time. The reorder point (ROP) identifies the inventory level at which a new order should be placed before inventory reaches zero. It is calculated as: ROP=dL+SS, where d is the average daily demand. Together, EOQ, Safety Stock, and Reorder Point establish a comprehensive inventory control system that determines the optimal order quantity, the timing of replenishment, and the reserve inventory required to maintain uninterrupted production.

Previous studies and research positioning

Numerous studies have demonstrated the effectiveness of EOQ in improving inventory performance across various small and medium enterprises. Ningrat & Gunawan (2023) reported that EOQ significantly reduced inventory costs in a cracker manufacturing enterprise by determining the optimal purchasing quantity. Similarly, research on Zukhruf et al. (2024) showed that integrating EOQ with ABC analysis improved inventory prioritization and purchasing efficiency. Dagi et al. (2023) further found that combining EOQ, safety stock, reorder point, and inventory cost analysis enhanced inventory control and reduced stock shortages in a spicy meatball MSME. Comparable findings have also been reported in food-service businesses. Katiandagho &

Trisyanto (2022) demonstrated that EOQ integrated with safety stock and reorder point effectively reduced inventory costs while maintaining raw material availability in a restaurant. Likewise, Juwita & Rahmiyatun (2023) confirmed that EOQ improved inventory efficiency in a culinary MSME. More recently, Kurnia et al. (2025) compared EOQ with the Just-in-Time (JIT) approach and observed that many small restaurants still relied on intuition rather than analytical inventory policies, particularly because reorder point calculations had not been implemented.

Although previous studies consistently demonstrate the benefits of EOQ across manufacturing and food-processing MSMEs, empirical evidence concerning its application in micro culinary enterprises that consume rice as their primary raw material remains limited. In addition, most existing studies focus on businesses with relatively structured inventory systems, whereas family-owned food stalls often rely entirely on habitual purchasing practices. This study addresses these limitations by applying an integrated EOQ, Safety Stock, and Reorder Point framework to optimize rice inventory in a micro culinary enterprise. Accordingly, the study contributes to the literature by extending EOQ implementation to a business context that has received limited empirical attention while providing a practical inventory management model that can be readily adopted by similar small-scale food-service enterprises.

Method

This study employed a quantitative descriptive approach using a single case study design to evaluate the application of the economic order quantity (EOQ) method in optimizing raw material inventory. The research was conducted at Warung Makan Dapi, a micro culinary enterprise located in Tanjung Redeb, Berau regency, East Kalimantan, Indonesia. The unit of analysis was limited to rice inventory, as rice constitutes the primary raw material used in daily operations, has a relatively long storage life, and represents a substantial proportion of the business's raw material expenditure. Focusing on a single critical inventory item allows a more in-depth evaluation of the effectiveness of EOQ in improving inventory control within a micro food-service business. The study utilized primary data collected directly from the business owner through structured interviews and field observations. The collected information included the average number of meals served per day, daily rice consumption, purchasing frequency, procurement practices, unit purchase price, ordering costs, storage-related costs, and supplier lead time. These operational data were subsequently compiled to estimate annual rice demand, ordering cost per order, annual holding cost per kilogram, average daily demand, and lead time required for inventory analysis.

The inventory optimization model was developed using the economic order quantity (EOQ) approach integrated with safety stock (SS) and reorder point (ROP) analysis. Annual rice demand (D) was estimated based on the average daily consumption multiplied by the number of operating days in one year. Ordering cost (S) included all expenses incurred each time an order was placed, such as transportation costs and the estimated labor or time required for procurement. Holding cost (H) represented the annual cost of storing one kilogram of rice, including storage space, handling, and inventory carrying costs. These variables formed the basis for calculating the optimal inventory policy. Data analysis was conducted sequentially. First, the annual demand for rice (D) was determined from average daily consumption. Second, the ordering cost per order (S) and annual holding cost per kilogram (H) were estimated based on the observed procurement practices. Third, the optimal order quantity was calculated using the economic order quantity (EOQ) model. Based on the EOQ value, the optimal ordering frequency, ordering cycle, and minimum total inventory cost were subsequently determined. Fourth, inventory control parameters consisting of safety stock (SS) and reorder point (ROP) were calculated to determine the minimum reserve inventory and the appropriate timing for replenishment. Safety stock was estimated using a 95% service level (Z = 1.65), taking into account the variability of daily demand and supplier lead time. To evaluate the robustness of the proposed inventory policy, a sensitivity analysis was performed by comparing total inventory costs under several ordering quantity scenarios around the EOQ value. Finally, the total inventory cost generated by the EOQ model was compared with the inventory cost resulting from the enterprise's existing purchasing practice. This comparison enabled an assessment of the potential cost savings and operational improvements that could be achieved through the implementation of a systematic inventory management approach.

Results and discussion

Business profile and research data

Warung Makan Dapi is a family-owned micro culinary enterprise located on Pulau Semama Street, Tanjung Redeb, Berau regency, East Kalimantan, Indonesia. The business specializes in serving rice-based meals accompanied by a variety of side dishes and operates every day throughout the year. On average, the enterprise serves approximately 60 customers per day, making rice the most critical raw material supporting its daily production activities. As the primary ingredient in almost every menu item, the continuous availability of rice directly influences production continuity, customer service, and overall business performance. Despite its stable daily operations, the enterprise manages rice procurement using a conventional purchasing practice that relies primarily on experience rather than systematic inventory planning. Rice is purchased from the same supplier in fixed quantities of approximately 10 kg every two days, following the supplier's delivery schedule. This purchasing policy has been maintained for several years without considering analytical inventory control parameters such as ordering costs, holding costs, safety stock, or reorder point. Consequently, procurement decisions are based solely on maintaining sufficient inventory for short-term production needs, without evaluating whether the purchasing quantity is economically optimal.

To evaluate the effectiveness of the existing inventory policy, primary operational data were collected through direct interviews with the business owner and field observations. The collected information included average daily rice consumption, annual operating days, purchase price, ordering cost, holding cost, supplier lead time, and the current procurement policy. These variables constitute the essential parameters required for the economic order quantity (EOQ) model and subsequent inventory control analysis. Based on the interview results, the enterprise purchases 10 kg of rice every two days, indicating an average rice consumption of approximately 5 kg per day. Assuming continuous business operations throughout the year (365 operating days), the estimated annual rice demand reaches 1,825 kg. Additional information regarding procurement costs indicates that each purchase incurs an ordering cost of IDR 85,000, including transportation expenses, administrative costs, and the opportunity cost of the owner's procurement time. Meanwhile, the annual holding cost is estimated at IDR 1,500 per kilogram, equivalent to approximately 12% of the purchase price (IDR 12,500 per kilogram). Furthermore, the supplier requires an average lead time of two days to deliver the ordered rice.

The operational data used throughout this study are summarized in Table 1. These data provide the basis for calculating the optimal order quantity, ordering frequency, safety stock, reorder point, and total inventory cost under the EOQ model.

Table 1 operational data for rice inventory analysis

Parameter	Value	Description
Average meals served	±60 meals/day	Interview with the owner
Average daily rice consumption (d)	5 kg/day	Derived from the existing purchasing pattern (10 kg every two days)
Operating days	365 days/year	Business operates every day
Annual demand (D)	1,825 kg/year	5 kg × 365 days
Rice purchase price	IDR 12,500/kg	Supplier's selling price
Ordering cost (S)	IDR 85,000/order	Transportation, administration, and procurement time
Holding cost (H)	IDR 1,500/kg/year	Approximately 12% of the purchase price
Lead time (L)	2 days	Supplier delivery time
Standard deviation of daily demand (σd)	≈1 kg/day	Estimated from daily consumption variability
Current purchasing policy	10 kg every two days	Approximately 182.5 orders/year

Source: primary data, processed (2026).

Table 1 indicates that the enterprise experiences relatively stable daily demand while maintaining an exceptionally high purchasing frequency. Under the current procurement policy, rice is ordered approximately 182.5 times per year, reflecting very small order quantities combined with frequent replenishment. Such a policy substantially increases cumulative ordering costs, even though the average inventory level and holding costs remain relatively low. This condition illustrates a common inventory management issue among micro enterprises, where purchasing decisions are driven by routine practices instead of quantitative analysis. From an inventory management perspective, the data suggest a considerable imbalance between ordering cost and holding cost. While maintaining small inventories minimizes storage expenses, the resulting ordering frequency generates disproportionately high procurement costs over the course of a year. Therefore, the existing inventory policy provides a suitable context for evaluating the economic order quantity (EOQ) approach, which seeks to balance these two cost components by determining the economically optimal order quantity. The operational characteristics presented in Table 1 consequently serve as the primary input variables for the EOQ, safety stock, and reorder point analyses discussed in the following section.

Inventory optimization using economic order quantity (EOQ)

The inventory optimization analysis was conducted using the economic order quantity (EOQ) model to identify the most economical ordering policy for rice procurement at Warung Makan Dapi. The analysis aimed to determine the optimal order quantity, ordering frequency, inventory cycle, safety stock, reorder point, and total inventory cost. These calculations were based on the operational data presented in Table 1, including annual demand, ordering cost, holding cost, and supplier lead time. Before implementing the EOQ model, the enterprise followed a fixed purchasing policy of 10 kg every two days, regardless of inventory cost considerations. Because the business operates continuously throughout the year, this policy results in approximately 182.5 purchase orders annually, representing an exceptionally high procurement frequency for a relatively stable level of demand. The annual inventory cost under the existing policy consists of ordering cost and holding cost. Ordering cost was calculated by multiplying the number of annual orders by the ordering cost incurred for each transaction.

$$\text{Ordering frequency} = 365 / 2 \approx 182{,}5 \text{ orders/year}$$

$$\text{Annual ordering cost} = 182{,}5 \times \text{IDR}85.000 \approx \text{IDR}15.512.500/\text{year}$$

The average inventory maintained under this policy equals half of the order quantity (10/2 = 5 kg). Consequently, the annual holding cost is calculated as:

$$\text{Annual holding cost} = (10/2) \times \text{IDR}1.500 = \text{IDR}7.500/\text{year}$$

Therefore, the total annual inventory cost under the current purchasing policy is:

$$\text{TC} = \text{IDR}15.512.500 + \text{IDR}7.500 = \text{IDR}15.520.000/\text{year}$$

These results indicate that the current inventory policy is characterized by extremely low holding costs but excessively high ordering costs. Frequent procurement activities substantially increase annual inventory expenses despite the relatively small amount of inventory being stored.

Economic order quantity (EOQ)

To identify the economically optimal purchasing quantity, the EOQ model was applied using the operational data summarized in Table 1. The optimal order quantity was calculated as follows:

$$\text{EOQ} = \sqrt{(2 \times 1.825 \times 85.000 / 1.500)} = \sqrt{206.833{,}3} \approx 455 \text{ kg}$$

The calculation indicates that the economically optimal purchasing quantity is approximately 455 kg per order. Since rice is commercially packaged in 10-kg sacks, the recommended procurement quantity may be rounded to 450 kg (45 sacks) without materially affecting inventory cost. Based on the EOQ value, the optimal ordering frequency becomes:

$$\text{N} = \frac{\text{D}}{\text{EOQ}} = \frac{1.825}{455} \approx 4{,}01 \approx 4 \text{ times/year}$$

Thus, the enterprise only needs to place approximately four purchase orders per year, compared with approximately 183 orders under the existing policy. The corresponding ordering cycle is:

$$\text{T} = \frac{\text{operating days}}{\text{ordering frequency}} \approx \frac{365}{4} \approx 91 \text{ days}$$

This result suggests that rice procurement should occur approximately once every three months, representing a substantial reduction in procurement frequency while maintaining sufficient inventory availability.

Safety stock and reorder point

Determining the optimal order quantity alone is insufficient for effective inventory control because replenishment timing must also be established. Therefore, safety stock (SS) and reorder point (ROP) were calculated to prevent stockout during supplier lead time. Using a 95% service level (Z = 1.65), an estimated daily demand standard deviation of 1 kg, and a supplier lead time of two days, the safety stock is calculated as:

$$\text{SS} = \text{Z} \times \sigma\text{d} \times \sqrt{\text{L}} = 1{,}65 \times 1 \times \sqrt{2} \approx 2 \text{ kg}$$

The reorder point is subsequently calculated as:

$$\text{ROP} = (\text{d} \times \text{L}) + \text{SS} = (5 \times 2) + 2 = 12 \text{ kg}$$

The calculated ROP indicates that a new purchase order should be placed whenever rice inventory declines to 12 kg. At this inventory level, the newly ordered rice will arrive before existing inventory is depleted, ensuring uninterrupted production throughout the supplier's lead time. Accordingly, the recommended maximum inventory level becomes: Maximum Inventory = EOQ+SS = 455+2 = 457kg. This inventory policy establishes a systematic replenishment mechanism that replaces the enterprise's previous experience-based purchasing practice.

Comparison of inventory costs

To evaluate the effectiveness of the EOQ policy, the resulting inventory costs were compared with those generated under the enterprise's existing purchasing practice. The comparison is presented in Table 2.

Table 2 comparison of existing inventory policy and EOQ policy

Cost component	Existing policy	EOQ policy
Number of orders/year	182.5	≈4
Average order quantity	10 kg	455 kg
Annual ordering cost	IDR 15,512,500	IDR 528,085
Annual holding cost	IDR 7,500	IDR 528,750
Total inventory cost	IDR 15,520,000	IDR 682,184

Source: primary data, processed (2026).

Table 2 demonstrates that implementing the EOQ policy dramatically changes the cost structure of inventory management. Ordering cost decreases from IDR 15.51 million to approximately IDR 528 thousand because procurement frequency is substantially reduced. Although holding cost increases as a consequence of maintaining larger inventory quantities, the increase is relatively small compared with the reduction in ordering cost. Overall, the EOQ policy reduces annual inventory cost by IDR 14,837,816, representing an efficiency improvement of approximately 95.6%. To further illustrate the relationship between ordering quantity and inventory cost, Figure 1 presents the inventory cost curve generated by the EOQ model.

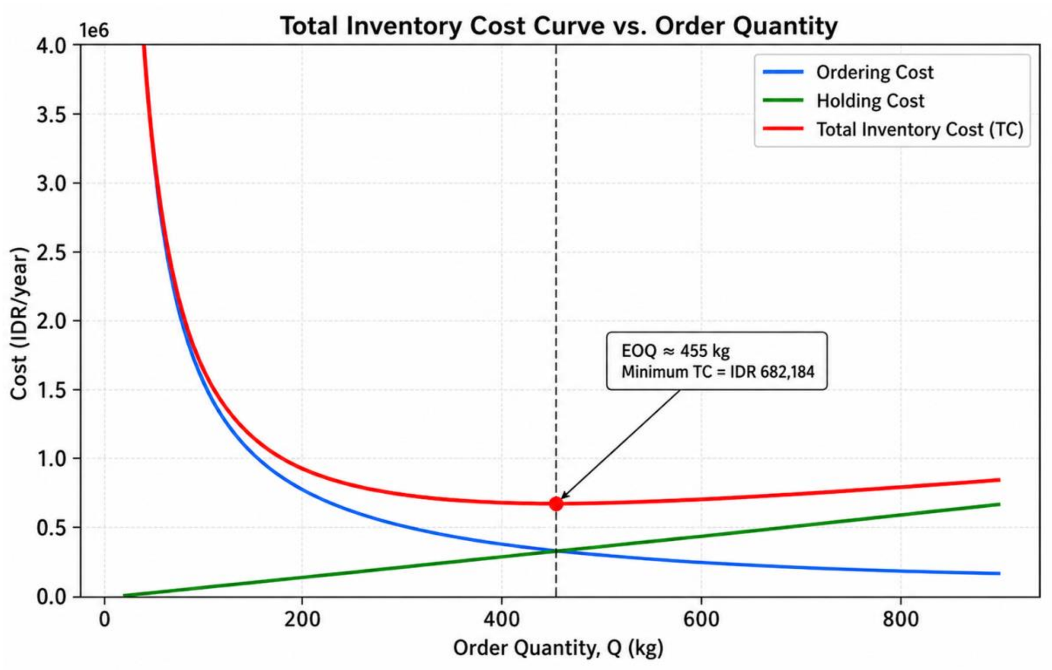

Figure 1 relationship between order quantity and total inventory cost
Source: primary data, processed (2026).

As illustrated in Figure 1, ordering cost decreases as the order quantity increases because fewer purchase orders are required annually. Conversely, holding cost increases proportionally with larger inventory levels. The total inventory cost forms a convex curve whose minimum point occurs at approximately 455 kg, confirming the optimal order quantity obtained from the EOQ calculation. The existing purchasing policy (Q = 10 kg) lies far to the left of the optimum point, indicating that the enterprise incurs unnecessarily high inventory costs due to excessive purchasing frequency. The findings clearly demonstrate that the enterprise's current inventory policy is highly inefficient because it overemphasizes minimizing inventory holdings while neglecting the cumulative impact of ordering costs. The EOQ approach successfully balances these two cost components by increasing the order quantity to an economically optimal level, thereby minimizing total inventory cost while ensuring uninterrupted production. These results provide quantitative evidence that systematic inventory planning can substantially improve operational efficiency in micro culinary enterprises without requiring additional investment or changes to production capacity.

Sensitivity analysis of ordering quantity

To evaluate the stability of the EOQ solution and examine the effect of deviations from the optimal ordering quantity, a sensitivity analysis was conducted by comparing the total inventory cost under several ordering quantity scenarios. Although the EOQ model identifies 455 kg as the optimal order quantity, practical implementation in micro culinary enterprises may require adjustments due to supplier packaging standards, storage capacity, or cash flow limitations. Therefore, this analysis evaluates whether alternative order quantities around the EOQ value can still provide comparable cost efficiency. The total inventory cost was calculated for different ordering quantities ranging from the current purchasing practice (10 kg) to quantities above the EOQ level. The results of the sensitivity analysis are presented in Table 3.

Table 3 sensitivity analysis of total inventory cost based on ordering quantity

Ordering quantity, Q (kg)	Total inventory cost (IDR/year)	Difference from minimum TC
10 (existing policy)	15,520,000	+2,175.0%
100	1,626,250	+138.4%
200	925,625	+35.7%
300	742,083	+8.8%
455 (EOQ)	682,184	0% (minimum)
500	685,25	+0.4%
600	708,542	+3.9%
700	746,607	+9.4%

Source: primary data, processed (2026).

As shown in Table 3, the EOQ value of 455 kg generates the minimum annual inventory cost of approximately IDR 682,184. However, the sensitivity analysis reveals that the total inventory cost remains relatively stable within a reasonable range around the optimal point. For example, increasing the order quantity from 455 kg to 500 kg only increases the total inventory cost by 0.4%, while increasing it to 600 kg results in an additional cost of only 3.9%. Similarly, reducing the order quantity to 300 kg increases the cost by only 8.8% compared with the minimum cost. This finding indicates that the EOQ solution is not a rigid value that must be followed exactly, but rather a strategic reference point for inventory decisions. In practical terms, Warung Makan Dapi can adjust the recommended order quantity to approximately 450 kg (45 sacks of 10 kg) according to supplier packaging conditions without significantly reducing the economic benefits of the EOQ policy. This flexibility is particularly important for micro enterprises, where purchasing decisions may also be influenced by available storage space, supplier arrangements, and financial capability. Conversely, the existing purchasing practice of 10 kg per order produces a substantially higher total inventory cost. The cost difference reaches more than 2,175% above the EOQ-based policy, primarily due to excessive ordering frequency. Although purchasing small quantities reduces inventory holding requirements, the accumulated ordering expenses become significantly higher over the year. Therefore, the sensitivity analysis confirms that the current purchasing practice is economically inefficient and that increasing the order quantity provides substantial cost advantages.

Discussion of EOQ implementation and operational implications

The results of this study demonstrate that implementing the economic order quantity (EOQ) model significantly improves rice inventory management performance at Warung Makan Dapi. The existing inventory policy, which relies on purchasing 10 kg of rice every two days, generates a very high procurement frequency of approximately 182.5 orders per year. Although this approach allows the business to maintain a low average inventory level and minimize storage requirements, it creates a substantial accumulation of ordering costs. The annual ordering cost under the existing policy reaches IDR 15,512,500, which represents the dominant component of total inventory cost. This condition indicates that the current purchasing practice prioritizes short-term inventory availability without considering the economic consequences of repeated procurement activities.

After applying the EOQ model, the optimal purchasing quantity was identified at approximately 455 kg per order, with an ordering frequency of only four times per year. This adjustment reduces annual ordering costs from IDR 15,512,500 to approximately IDR 528,085. Although the EOQ policy increases holding costs due to the larger average inventory level, the additional storage expense remains considerably lower than the savings obtained from reducing procurement frequency. Consequently, the total annual inventory cost decreases from IDR 15,520,000 under the existing policy to IDR 682,184 under the EOQ policy, generating cost savings of IDR 14,837,816 or approximately a 95.6% efficiency improvement. These findings indicate that the main inefficiency in Warung Makan Dapi's inventory system does not originate from excessive stock accumulation but from an excessive number of purchasing transactions.

This result confirms the fundamental principle of EOQ, which seeks to balance ordering and holding costs rather than simply minimizing inventory quantity. In the case of Warung Makan Dapi, maintaining very small inventory quantities appears economical from a storage perspective; however, frequent ordering creates a hidden operational burden that is significantly greater than the cost of holding additional inventory. Therefore, the EOQ approach provides a more rational decision-making framework by identifying the optimal trade-off between these two cost components. This finding supports the argument of Tiloly et al. (2022), who stated that EOQ enables organizations to determine economical purchasing quantities by simultaneously considering ordering and storage costs, rather than relying on subjective purchasing habits.

The findings are also consistent with previous studies examining EOQ implementation in small and medium-sized enterprises. Ningrat & Gunawan (2023), in their study of UMKM Kerupuk Nusa Sari, found that conventional purchasing practices based on experience generated higher inventory costs compared with EOQ-based planning. Their research emphasized that many small businesses tend to focus on avoiding inventory shortages while overlooking the cumulative impact of repeated ordering activities. Similar findings were reported by Wardani et al. (2023) in UMKM Jessica Bakery Banyuwangi, where EOQ implementation successfully reduced raw material inventory costs by establishing a more structured purchasing policy. These studies reinforce the finding that inventory inefficiency in small businesses often arises not from inaccurate demand estimation, but from the absence of systematic decision-making methods.

Furthermore, the integration of EOQ with safety stock and reorder point calculations in this study provides a more comprehensive inventory control mechanism. The calculated reorder point of 12 kg provides a clear operational indicator for when the next purchase should be initiated, while the safety stock of approximately 2 kg protects against uncertainty in demand fluctuations and supplier delays. This result is in line with Itsna et al. (2023), who demonstrated that combining EOQ, safety stock, and reorder point calculations improved inventory reliability by reducing the possibility of stock shortages during the production process. Similarly, Katiandagho & Trisyanto (2022) found that applying EOQ, reorder point, and safety stock analysis in a restaurant environment helped establish a more effective raw material control system because purchasing decisions were no longer based solely on managerial intuition.

Compared with previous studies, the efficiency improvement identified in this research is relatively substantial. Many previous EOQ applications in MSMEs reported moderate cost reductions because the businesses already maintained relatively organized procurement practices. In contrast, Warung Makan Dapi represents a micro-scale culinary enterprise where inventory decisions were still strongly influenced by routine purchasing habits. The business purchased rice in extremely small quantities despite having stable and predictable demand. This operational characteristic created a large gap between actual purchasing behavior and the economically optimal condition. Therefore, the 95.6% cost efficiency obtained in this study provides additional evidence that even very small culinary enterprises can achieve significant operational improvements through the adoption of simple quantitative inventory techniques.

The implications of this research extend beyond financial efficiency. Implementing EOQ also improves operational productivity by reducing unnecessary procurement activities. Under the existing system, the owner must spend time coordinating or receiving rice purchases almost every two days. After implementing the EOQ-based policy, procurement activities are reduced to approximately once every three months, allowing business resources to be redirected toward other value-adding activities, such as food preparation, customer service improvement, and menu development. This finding supports the perspective of Purba et al. (2022), who emphasized that effective operational management involves optimizing the utilization of resources, including time, labor, and materials, to improve overall business performance.

From a managerial perspective, the proposed EOQ policy provides Warung Makan Dapi with a practical inventory management system that is simple, measurable, and easy to implement. Unlike complex inventory information systems that may be difficult for micro enterprises to adopt due to financial and technological limitations, EOQ only requires basic operational information such as demand, ordering cost, holding cost, and lead time. Therefore, the approach is highly suitable for small culinary businesses that require efficient but uncomplicated decision-making tools. This finding expands previous EOQ research by demonstrating that quantitative inventory methods are not only applicable to manufacturing or larger-scale businesses but can also provide substantial benefits in household-based culinary enterprises.

Nevertheless, implementing EOQ should consider the operational characteristics and limitations of micro culinary businesses. The EOQ model assumes relatively stable demand, constant purchasing prices, and predictable supplier lead times. In practice, demand may fluctuate due to seasonal events, holidays, promotional activities, or changes in customer behavior. Therefore, although the EOQ calculation provides an optimal baseline, business owners should periodically review demand patterns and adjust inventory parameters when significant operational changes occur. Future research may further develop this approach by integrating EOQ with demand forecasting methods, Just-In-Time (JIT) systems, or dynamic inventory models to accommodate greater uncertainty in micro culinary supply chains. Overall, this study confirms that transforming inventory decisions from experience-based purchasing into data-driven management can significantly improve operational efficiency. The EOQ model not only minimizes inventory costs but also establishes a structured procurement strategy that supports production continuity. The findings highlight the importance of introducing simple analytical tools to micro enterprises, as even basic inventory optimization practices can generate substantial economic and operational benefits.

Theoretical and practical contributions

Theoretically, this study contributes to the inventory management literature by extending the application of the EOQ model to a micro culinary enterprise context. Previous studies have predominantly focused on manufacturing SMEs, food-processing businesses, or larger restaurants, while limited attention has been given to small family-operated food stalls that depend on daily consumption of staple ingredients. By demonstrating the effectiveness of EOQ in optimizing rice inventory, this research strengthens the understanding that quantitative inventory models remain relevant even in businesses with simple operational structures. Practically, this study provides a simple and applicable inventory management framework for micro culinary enterprises. The recommended policy does not require sophisticated technology or expensive systems; instead, it relies on basic operational data such as demand, ordering cost, holding cost, and lead time. The findings suggest that micro businesses can improve profitability not only by increasing sales but also by reducing avoidable operational inefficiencies through better inventory planning.

Nevertheless, several limitations should be considered. The EOQ model assumes relatively stable demand, constant purchasing prices, and predictable lead times. In reality, culinary businesses may experience demand fluctuations during holidays, special events, or seasonal changes. Additionally, EOQ is more suitable for non-perishable materials such as rice and may not be directly applicable to highly perishable ingredients such as vegetables, meat, or seafood. Therefore, future research may consider integrating EOQ with demand forecasting methods, Just-In-Time (JIT) approaches, or dynamic inventory models to address greater uncertainty in micro culinary operations. Overall, the findings confirm that the transition from experience-based purchasing to data-driven inventory management can significantly improve operational efficiency. The EOQ-based policy provides Warung Makan Dapi with a more systematic approach to managing rice inventory while maintaining production continuity and minimizing unnecessary costs.

Conclusions

This study concludes that implementing the economic order quantity (EOQ) method significantly improves rice inventory management efficiency at Warung Makan Dapi, a micro-scale culinary enterprise. The existing purchasing policy, based on the routine practice of ordering 10 kg of rice every two days, resulted in an excessive ordering frequency of approximately 182.5 times per year and generated a total annual inventory cost of IDR 15,520,000. Through the EOQ approach, the optimal order quantity was identified at approximately 455 kg per order, with an optimal purchasing frequency of only four times per year. The EOQ-based policy reduced the total annual inventory cost to approximately IDR 682,184, resulting in cost savings of IDR 14,837,816 or an efficiency improvement of 95.6%. In addition, integrating safety stock and reorder point calculations established a more systematic inventory control mechanism, with a safety stock level of approximately 2 kg and a reorder point of 12 kg to ensure production continuity during supplier lead time.

This research contributes both theoretically and practically to inventory management practices in micro culinary enterprises. Theoretically, this study extends the application of EOQ by demonstrating that quantitative inventory control methods remain relevant and beneficial even in very small businesses with simple operational structures. Practically, the findings provide a low-cost and easily applicable inventory management framework that enables micro enterprises to replace experience-based purchasing decisions with data-driven planning. The results indicate that operational efficiency improvement does not always require significant technological investment; rather, better utilization of basic inventory information can substantially reduce unnecessary costs, improve resource allocation, and support business sustainability. However, this study has several limitations. The analysis was conducted on a single business object with one primary raw material, namely rice, and the EOQ model was applied under assumptions of relatively stable demand, constant purchasing price, and predictable supplier lead time. Therefore, the findings may not fully represent other culinary businesses with different demand patterns, product characteristics, or supply chain conditions.

Future research is recommended to expand the scope of analysis by involving multiple micro culinary enterprises with different operational characteristics to improve the generalizability of findings. Further studies may also integrate EOQ with other quantitative approaches, such as demand forecasting, Just-In-Time (JIT), dynamic inventory models, or probabilistic inventory systems, to address greater uncertainty in demand fluctuations and supplier variability. In addition, future research could examine inventory optimization for other types of raw materials, particularly perishable ingredients such as meat, vegetables, and seafood, where storage limitations and product deterioration require different inventory strategies. Such developments would provide a more comprehensive understanding of how inventory management models can support the sustainability and competitiveness of micro culinary enterprises.

References

Akhiroh, P., Utami, H. D., Al Awwaly, K. U., Febrianto, N., & Hartono, B. (2025). Synergizing Halal Compliance with Balanced Scorecard Approach: Implications for Supply Chain Performance in Indonesian Fried Chicken MSMEs. *Sustainability*, *17*(21), 9814. https://doi.org/10.3390/su17219814

Alnahhal, M., Aylak, B. L., Al Hazza, M., & Sakhrieh, A. (2024). Economic Order Quantity: A State-of-the-Art in the Era of Uncertain Supply Chains. *Sustainability*, *16*(14),

5965. https://doi.org/10.3390/su16145965

Alsoussi, A., & Tahboub, K. (2026). Inventory Management Practices and Challenges: An Exploratory Study. *An-Najah University Journal for Research - A (Natural Sciences)*, *40*(1), 43–58. https://doi.org/10.35552/anujr.a.40.1.2381

Anwar, A., Satriawan, S., Hariyanti, H., Adi, R. K., Soenhadji, I. M., Paryanto, E., Valentin, A. D., Reke, J. S. U., Shofia, A., Misbahuddin, M., Soesilo, R., & Putri, R. M. (2024). *Pengantar Manajemen Operasional*. Seval Literindo Kreasi.

Aslam, M. A., Li, Z., Shabbir, M. S., PĂUNESCU, L. M., Jaradat, M., Nazir, H., & SINISI, C.-I. (2026). Synergistic effects of supplier resilience, information sharing, inventory management, and flexibility on supply chain resilience: a PLS-SEM and NCA approach. *Humanities and Social Sciences Communications*. https://doi.org/10.1057/s41599-026-06801-3

Bannor, R. K., Kyeremeh, H. O., Boateng, A. O., Bold, E., & Gruzah, B. (2025). Short supply chain choice and impact amongst rice processors in rural Ghana. *Journal of Agribusiness in Developing and Emerging Economies*, *15*(1), 150–172. https://doi.org/10.1108/JADEE-03-2023-0049

Burhanuddin, B., & Said, R. (2022). Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode EOQ Pada Industri Tahu Mekar Kelurahan Liabuku Kecamatan Bungi Kota Baubau. *Bongaya Journal of Research in Management*, *1*(2), 60–69. https://ojs.stiem-bongaya.ac.id/MARS/article/view/399

Charisma, D., Hermanto, B., Purnomo, M., Herawati, T., & Charina, A. (2025). Sustainable Business Through Local Strength: A Qualitative Study of Financial, Social, and Cultural Strategies in Bandung's Culinary Micro-Enterprises. *Sustainability*, *17*(11), 5028. https://doi.org/10.3390/su17115028

Chopra, S., & Meindl, P. (2020). *Supply Chain Management: Strategy, Planning, and Operation* (7th ed.). Pearson.

Dagi, T. F., Morasa, J., & Tirayoh, V. Z. (2023). Raw Material Inventory Analysis Using the Economic Order Quantity (EOQ) Method To Maximize Profits at UD. Panca Putra. *Indonesian Journal of Business Analytics*, *3*(1), 85–98. https://doi.org/10.55927/ijba.v3i1.3307

Gupta, S., & Mishra, V. K. (2024). Multi-item stochastic inventory model for deteriorating items with power demand pattern under partial backlogging and joint replenishment. *Annals of Operations Research*, *341*(2–3), 963–991. https://doi.org/10.1007/s10479-024-05997-4

Gurgun, A. P., Kunkcu, H., Koc, K., Arditi, D., & Atabay, S. (2024). Challenges in the Integration of E-Procurement Procedures into Construction Supply Chains. *Buildings*, *14*(3), 605. https://doi.org/10.3390/buildings14030605

Ideue, K. (2026). Entrepreneurial capabilities under credit and institutional constraints: Evidence from informal metalworking enterprises in Kenya. *Journal of Global Entrepreneurship Research*, *16*(1), 74. https://doi.org/10.1007/s40497-026-00549-5

Itsna, N., Nirwana, I., Widya, R., & Bastomi, M. (2023). Analisis Metode Economic Order Quantity, Safety Stock, Reorder Point, dan Cost of Inventory dalam Mengoptimalkan Manajemen Persediaan Umkm Bakso Pedas. *Indonesian Journal of Contemporary Multidisciplinary Research*, *2*(1), 29–44. https://doi.org/10.55927/modern.v2i1.2750

Juliawan, D., Syarief, R., & Findi, M. (2025). Performance Analysis of Premium and Medium Rice Supply Chain of Bulog in Bogor. *Amkop Management Accounting Review (AMAR)*, *5*(1), 148–165. https://doi.org/10.37531/amar.v5i1.2447

Juwita, J., & Rahmiyatun, F. (2023). Penerapan Metode Economic Order Quantity (EOQ) Dan Reorder Point (ROP) Pada Pengendalian Persediaan Bahan Baku Di UMKM Dapur Bunga Berbintang. *Jurnal Maneksi*, *12*(4), 818–827. https://doi.org/10.31959/jm.v12i4.1833

Katiandagho, I. G., & Trisyanto, R. (2022). Analisis dan Perancangan ROP, EOQ, Safety Stock Sistem Pengendalian Persediaan Bahan Baku Pada Rumah Makan Bubur Ayam Citarasa. *Indonesian Accounting Literacy Journal*, *2*(1), 45–65. https://doi.org/10.35313/ialj.v2i1.3231

Kurnia, A., Amaro, C., Patricia, A. A., Hasanah, N., Khaira, D. A., & Anggreani, N. (2025). Analisis Efektivitas Penerapan Metode EOQ Dan JIT Dalam Mengendalikan Persediaan Bahan Baku Pada Umkm Rumah Makan Padang Ujuang Pulau. *Jurnal Akuntansi Dan Bisnis*, *5*(1), 97–110. https://doi.org/10.51903/jiab.v5i1.984

Marlina, W., Sarahita, V. D. A., & Febriyanti, R. (2024). Analisis persediaan dengan Economic Order Quantity di UMKM Kacang Atom di Tanah Datar, Sumatera Barat. *Jurnal Teknik Industri Terintegrasi*, *7*(4), 2193–2203. https://doi.org/10.31004/jutin.v7i4.25104

Ningrat, N. K., & Gunawan, S. (2023). Pengendalian Persediaan Bahan Baku Untuk Meningkatkan Efisiensi Biaya Persediaan Dengan Menggunakan Metode Eoq (Economic Order Quantity) Di Umkm Kerupuk Nusa Sari Kecamatan Cimaragas Kabupaten Ciamis. *Jurnal Industrial Galuh*, *5*(1), 18–28. https://doi.org/10.25157/jig.v5i1.3058

Opoku, R. K. (2022). Inventory management strategies of manufacturing industries: evidence from food processing firms in Ghana. *International Journal of Value Chain Management*, *13*(3), 258. https://doi.org/10.1504/IJVCM.2022.125855

Panigrahi, R. R., Shrivastava, A. K., & Nudurupati, S. S. (2024). Impact of inventory management on SME performance: a systematic review. *International Journal of Productivity and Performance Management*, *73*(9), 2901–2925. https://doi.org/10.1108/IJPPM-08-2023-0428

Purba, B., Hasibuan, A., Sari, O. H., Kurniawati, E., Sudarso, A., Sandy, S., Lie, D., Widarman, A., Hariningsih, E., Kuswandi, S., Oetomo, D. S., Handy Nur Cahya, & Defidelwina, D. (2022). *Pengantar Manajemen Operasional*. Yayasan Kita Menulis.

Rabbani, J., Saputra, A., & Wahjono, S. I. (2025). The Influence of Operational Constraints of Culinary Tourism Centers on The Sustainability of UMKM and Socio-Economic Impacts. *Golden Ratio of Data in Summary*, *5*(4), 939–942. https://doi.org/10.52970/grdis.v5i4.1314

Rahman, M. M. (2025). Data Analytics For Strategic Business Development: A Systematic Review Analyzing Its Role In Informing Decisions, Optimizing Processes, And Driving Growth. *Journal of Sustainable Development and Policy*, *1*(1), 285–314. https://doi.org/10.63125/he1tfg25

Saputri, Y., Gomas, S. J., Alifah, N., Ghiffari, I. A. Al, & Saridawati, S. (2024). Peran Strategis Usaha Mikro, Kecil, Dan Menengah (UMKM Dalam Perekonomian Indonesia: Tantangan Dan Peluang). *Jurnal Studi Multidisipliner*, *8*(10), 205–208. https://oaj.jurnalhst.com/index.php/jsm/article/view/5413

Sutar, P. S., Kolte, G. C., & Yamini, S. (2026). Food supply chain disruptions and its resilience: a framework and review for resilience strategies in the digital era. *OPSEARCH*, *63*(1), 164–198. https://doi.org/10.1007/s12597-025-00915-z

Tao, S., Liu, S., Zhou, H., & Mao, X. (2024). Research on Inventory Sustainable Development Strategy for Maximizing Cost-Effectiveness in Supply Chain. *Sustainability*, *16*(11), 4442. https://doi.org/10.3390/su16114442

Tiloly, F. M., Vikaliana, R., & Irwansyah, I. (2022). Analisis Rencana Implementasi dengan Metode EOQ Pada Manajemen Persediaan Material. *Journal of Business and Economics Research (JBE)*, *3*(2), 238–246. https://doi.org/10.47065/jbe.v3i2.1753

Wardani, E. A., Yekti A, R. P., Pratama, F. E. A., & Retnowati, N. (2023). Analisis Pengendalian Persediaan Bahan Baku dengan Menggunakan Metode EOQ (Studi Kasus pada UMKM Jessica Bakery Banyuwangi). *Jurnal Ilmiah Inovasi*, *23*(3), 240–250. https://doi.org/10.25047/jii.v23i3.3985

Widajanti, E., Nugroho, M., & Riyadi, S. (2022). Sustainability Of Competitive Advantage Based On Supply Chain Management, Information Technology Capability, Innovation, And Culture Of Managers Of Small And Medium Culinary Businesses In Surakarta. *The Journal of Modern Project Management*, *10*(2), 83–93. https://journalmodernpm.com/manuscript/index.php/jmpm/article/view/523

Zukhruf, A. A., Syukrina, E., Atsilanti, D. P. A., Riyadi, A., Hibatullah, L., Hidayat, A. P., & Safitri, A. (2024). Analisis Manajemen Persediaan Bahan Baku Dengan Metode Economic Order Quantity (EOQ) Pada UMKM Osha Snack. *Jurnal Bisnis Kreatif Dan Inovatif*, *1*(2), 44–52. https://doi.org/10.61132/jubikin.v1i2.92