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Inventory Control Of Raw Materials By Applying The Min-Max Method To Reduce Stockout And Overstock In The Al-Batsit Bakery Home Industry

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Abstract: *This study analyzes inventory control of raw materials at the Al-Batsit Bakery Home Industry in Bengkulu City using the Min-Max method. The main problem observed was the absence of a systematic inventory control system, leading to both stockout and overstock conditions. This research aims to determine the minimum and maximum inventory levels, analyse the application of the Min-Max Stock method in minimizing storage and ordering costs, and improve the efficiency of raw material inventory control. Primary data were collected through direct observation and interviews with the business owner and production staff. The analysis used the Min-Max method to calculate safety stock, minimum stock, maximum stock, reorder point (ROP), order quantity, ordering frequency, and total inventory cost (TIC). The results show that the Min-Max method produces a total inventory cost of Rp. 6,464,295 per year, compared to Rp. 6,875,550 per year under the current policy, yielding a cost efficiency of (Rp. 411,255 per year). The greatest efficiency was achieved for granulated sugar (12.12%), followed by eggs (5.60%), wheat flour (1.59%), and margarine (0.88%). Implementation of the Min-Max method enables the bakery to establish structured inventory boundaries, prevent stockouts, reduce excess inventory, and optimize ordering frequency without disrupting the production process.*

INTRODUCTION

The increasingly competitive industrial landscape demands that every business actor continuously improve performance. This condition drives the emergence of various new industries aimed at meeting market demand for products. According to Rahma et al. (2024), home industries are economic activities that process resources using simple tools, generally located near raw materials, with relatively low production costs, thus creating broader business opportunities. Every business activity should be accompanied by a strategic plan designed to

support the sustainability and growth of the company Sagala et al. (2024). One of the key strategies for business advancement is raw material stock planning. Proper raw material planning will support production planning, which in turn will streamline the supply chain.

Effective inventory management can suppress expenditure during production. If the volume of inventory owned by the company is too large, the company will face various cost burdens, such as warehouse space costs, protection or insurance costs, risks of material damage, and quality degradation (Darmawan, 2024). In line with Lahu & Sumarauw (2017), excessive raw material inventory generates additional maintenance and storage costs, as well as increased risks of damage and quality deterioration. Conversely, if inventory is excessively reduced, the company may face stockout conditions, which can hinder or even halt the production process.

Companies can optimize inventory costs while maintaining smooth production through the implementation of an inventory control system using the Min-Max method, which is used to determine order quantities and establish minimum and maximum inventory limits efficiently. According to Bagaskara and Safirin (2025), companies experience problems in inventory management, particularly in maintaining a balance between material sufficiency for production continuity and storage cost control, reflected by the occurrence of both excess and shortage of inventory.

The Min-Max Stock method is an inventory control approach based on two control boundaries: a minimum limit and a maximum limit. The minimum inventory limit is set as the lowest stock level that can still meet production needs during lead time, while the maximum limit represents the highest allowable inventory level to avoid raw material accumulation. When inventory reaches the minimum limit, the company must immediately place a reorder to bring stock back to the maximum level (Audina & Bakhtiar, 2021). Both limits take into account the rate of raw material consumption, ordering time, and safety stock, enabling timely and efficient ordering (Lubis, R. D., & Mahachandra, 2016).

Al-Batsit Bakery is a home industry located in Bengkulu City, engaged in bread production since 2016. The bakery has an SPP-IRT certificate (No. HK.03.1.23.04.12.2205) and employs 10 production workers and 4 packaging/distribution staff. Observations reveal that the current inventory control process lacks a systematic minimum stock limit and relies on the owner's estimates, resulting in imbalances between inventory and production needs, potentially causing stock accumulation that degrades raw material quality.

The bakery produces 800-1,000 loaves daily in six flavours. Daily raw material requirements include approximately 125 kg of wheat flour, 50 kg of granulated sugar, 15 kg of margarine, and 6 kg of eggs. Raw materials are currently purchased weekly or even monthly, increasing the risk of quality degradation, particularly for perishable items such as wheat flour, eggs, and margarine (Dharlyansyah & Utomo, 2023). Research by Rahmadhani and Ernawati (2024) has demonstrated that the Min-Max method can prevent stockouts, reduce excess inventory, and achieve cost savings of 19%-29% in similar settings. Based on these conditions, the Min-Max method is considered the most appropriate alternative for Al-Batsit Bakery to address inventory imbalances and improve overall inventory management efficiency.

This study aims to: (1) determine the minimum and maximum inventory levels for raw materials to prevent stockout and overstock; and (2) analyse the application of the Min-Max Stock method in minimizing storage and ordering costs while improving raw material inventory control efficiency.

LITERATURE REVIEW

Inventory and Inventory Management

Inventory is a collection of raw materials or products stored to fulfil various needs, including supporting production processes, resale, or use as spare parts (Rahayu, 2024). Effective inventory management plays an important role in maintaining operational continuity, efficiency, and the quality of products produced (Brahmantyo et al., 2023). The core principle of inventory management is to facilitate and support the smooth operation of organizational activities, particularly production (Rohman & Bhakti, 2023).

Inventory Cost

Inventory cost are classified into four main types: purchase cost, ordering cost (ordering cost), holding cost (holding cost), and shortage cost (Daud, 2017). According to Heizer et al. (2019). ordering cost is the total cost incurred each time an order is placed, including communication, administration, and delivery costs, regardless of the number of units ordered.

Min-Max Stock Method

According to Salam and Mujiburrahman (2018), the Min-Max analysis method is an inventory control. technique that establishes minimum and maximum stock limits and arranges an order plan (plan order) to prevent stockout and overstock. The Min-Max method is relatively static minimum and maximum values are rarely changed, typically updated only a few times per year. Establishing both limits considers raw material consumption rates, ordering time, and safety stock (Lubis & Mahachandra, 2016).

METHOD

This research was conducted at the Al-Batsit Bakery Home Industry in Bengkulu City, from January to December 2025. The study used a quantitative descriptive approach. Data collection was conducted through direct observation, interviews with the business owner and employees, and documentation of raw material ordering and usage data.

Primary data were collected through direct observation and interviews with the business owner and production staff, covering the raw material storage system, lead time, ordering frequency, and average daily raw material usage. Secondary data were obtained through literature review and supporting records including purchase and usage data, ordering costs, and storage costs.

The analysis covers four main raw materials: wheat flour, granulated sugar, margarine, and eggs, for the period January-December 2025. The Min-Max Stock method was applied to calculate the following parameters:

(1) Safety Stock (SS) = $(Pmax - T) \times LT$
(2) Minimum Stock = $(T \times LT) + SS$
(3) Maximum Stock = 2 (T x LT)+SS
(4) Reorder Point (ROP) = $(T\ x\ LT) + SS$
(5) Order Quantity (Q) = $Max - Min$
(6) Ordering Frequency (F) = $\frac{D}{Q}$
(7) Total Inventory Cost (TIC) = $\left(\frac{D}{Q}\ X\ S\right) + \left(\frac{Q}{2}\ X\ H\right)$

Where T = average daily usage (kg/day), P*max* = maximum usage (kg/day), LT = lead time (day), D = annual demand (kg/year), S = ordering cost per order (Rp), Q = order quantity, and H = holding cost (Rp/kg/year). The lead time for all raw materials at Al-Batsit Bakery is 1 day. Data analysis was carried out using both descriptive and quantitative approaches.

RESULT AND DISCUSSION

Overview of Al-Batsit Bakery Home Industry

Al-Batsit Bakery Home Industry is a bread production business founded by Mr. Sutari in 2016. Located at Jalan Merawan Ujung No. 36, RT 29 RW 08, Sawah Lebar Baru, Bengkulu City, the business holds a Home Industry Food Production Certificate No. HK.03.1.23.04.12.2205. Production activities are supported by 10 workers in the processing department and 4 workers in the packaging and distribution department.

Production activities are supported by 10 workers in the processing department and 4 workers in the packaging and distribution department. Each worker carries out tasks according to the production stages, from raw material processing to product readiness for distribution. The availability of these human resources is a crucial factor in supporting the continuity of the production process and ensuring the smooth distribution of products to various marketing areas. Business operations run daily from 8:00 AM to 8:00 PM WIB. This home industry has designated Friday as a permanent holiday. Operational activities in this home industry are not continuous, but experience temporary suspensions during certain periods, such as during the fasting month, Eid al-Fitr celebrations, and other major holidays.

Al-Batsit Bakery operates for 10 months and 15 days a year, minus the fasting and Eid holidays. Under normal conditions, Al-Batsit Bakery Home Industry is able to produce six types of bread with various variations: special chocolate bread, krumpul bread, bread with various flavours, combination bagel bread, chocolate cheese bread, and milk cheese bread. However, in the run-up to Eid al-Fitr celebrations, production volumes increase to meet increasing consumer demand. Marketing areas include Benteng, Curup, Kepahiang, North Bengkulu, Muko-Muko, Manna, and Seluma.

Raw Material Ordering and Usage Data (January-December 2025)

Table 1 presents the total raw material ordering data for the period January to December 2025. Ordering quantities were set at 2% above actual usage to anticipate demand fluctuations and delivery delays.

Table 1. Raw Material Ordering Data, Al-Batsit Bakery, January-December 2025

Raw Material	Order (kg)	Usage (kg)
Wheat Flour	38,097	37,350
Sugar	15,239	14,940
Margarine	4,572	4,482
Eggs	1,829	1,793

Source: Al-Batsit Bakery (processed), 2025

The total ordering data for 2025 shows wheat flour at 38,097 kg, eggs at 15,239 kg, margarine at 4,572 kg, and granulated sugar at 1,829 kg. Wheat flour dominates as the primary ingredient for bread production. Ordering volumes are higher than actual usage due to the 2% buffer added to anticipate potential demand surges and delivery delays (Vikaliana et al., 2020). Average daily usage under normal conditions was 125 kg/day for wheat flour, 50 kg/day for granulated sugar, 15 kg/day for margarine, and 6 kg/day for eggs. On months with Eid al-Fitr (March 2025), usage increased by approximately 30% across all materials. Total raw material usage during the January-December 2025 period was 38,097 kg of wheat flour, 15,239 kg of granulated sugar, 4,572 kg of margarine, and 1,829 kg of eggs. Wheat flour was the raw material with the highest usage because it plays a key role in bread making. In March, the use of all raw materials increased by 30% compared to normal months due to demand leading up to Eid al-Fitr.

Raw Material Ordering Costs

Ordering cost encompasses all costs incurred each time a raw material order is placed with the supplier. The ordering cost components at Al-Batsit Bakery are presented in Table 2.

Table 2. Raw Material Ordering Cost Components

No	Cost Component	Value (Rp/message)
1	Communication Cost (Phone/WhatsApp)	5,000
2	Expedition/Delivery Cost	20,000
3	Administrative Cost	5,000
	Total per Order	30,000

Source: Al-Batsit Bakery Home Industry

The total ordering cost per transaction is IDR 30,000, applicable uniformly to all raw material types. This value is used consistently throughout the Min-Max calculations. Heizer et al. (2019) ordering cost as all costs arising from each ordering transaction, including communication, administration, and delivery costs, the magnitude of which is independent of the quantity ordered.

Raw Material Ordering Cost

Holding cost is calculated using a percentage approach of 15% of the purchase price per kilogram per year, reflecting the combined cost of capital, spoilage risk, and warehouse operational expenses. Table 3 presents the annual warehouse storage cost components.

Table 3. Annual Warehouse Storage Cost Components

No	Cost Component	Amount (IDR/Year)
1	Warehouse Electricity Cost	284,750
2	Warehouse Cleaning Cost	3,600,000
3	Equipment Depreciation	417,000
4	Warehouse Building Depreciation	800,000
	Total	5,104,750

Source: Al-Batsit Bakery Home Industry

Total annual storage cost is IDR 5,104,750. This total is then allocated per kilogram of each raw material based on annual requirements, as presented in Table 5. Rachmawati and Lentari (2022) affirm that determining the holding cost per unit of raw material is a crucial step before calculating the Total Inventory Cost, as this value determines the financial burden borne by the company for each kilogram of raw material stored during one period.

Inventory Cost

The holding cost per kilogram for each raw material was computed by dividing the annual holding cost by the total annual demand for that material, as shown in Table 4.

Table 4. Holding Cost per Kilogram of Raw Material

Raw Material	Annual Demand (kg)	H (Rp/kg/year)	Annual Requirement (kg/year)
Wheat Flour	9,120	Rp 1,368	37,350
Sugar	16,400	Rp 2,460	14,940
Margarine	27,000	Rp 4,050	4,482
Eggs	25,000	Rp 3,750	1,793

Source: Al-Batsit Bakery Home Industry (processed), 2025

Min-Max Calculation Results

Table 5 summarizes the Safety Stock, Minimum Stock, Maximum Stock and Reorder Point values for each raw material, computed using the Min-Max formulas with a lead time of 1 day.

Table 5. Safety Stock, Minimum Stock, Maximum Stock and ROP Results

Raw Material	SS (kg)	Min Stock (kg)	Max Stock (kg)	ROP (kg)
Wheat Flour	35	163	1,814	163
Granulated Sugar	14	65	1,539	65
Margarine	4	20	462	20
Eggs	2	8	50	8

Source: Al-Batsit Bakery Home Industry (processed), 2025

Wheat flour has the highest safety stock value (35 kg), reflecting large fluctuations in daily usage, particularly during the Eid al-Fitr period. When stock reaches the minimum level (e.g., 163 kg for wheat flour), a reorder must be placed immediately. The maximum stock levels indicate the maximum storage capacity required for each material. Since lead time is 1 day, the ROP values are identical to the minimum stock levels, as confirmed by (Brahmantyo et al., 2023).

Table 6 presents the Order Quantity, Ordering Frequency, and Total Inventory Cost (TIC) using the Min-Max method, compared against the current company policy.

Table 6. Comparison of TIC: Company Policy vs. Min-Max Method

Raw Material	Company Policy		Min-Max	
	TIC (Rp/yr)	F (Times/year)	TIC (Rp/year)	F (Times/year)
Wheat Flour	1,837,286	23	1,808,108	23
Sugar	2,408,614	11	2,116,756	10
Margarine	1,210,050	11	1,199,395	10
Eggs	1,419,600	48	1,340,036	42
Total	6,875,550	93	6,464,295	85

Source: Al-Batsit Bakery Home Industry (processed), 2025

The total inventory cost under the current company policy is Rp 6,875,550 per year, while the Min-Max method reduces this to Rp 6,464,295 per year, an overall efficiency of 5.98% (Rp 411,255 savings). The greatest efficiency gain is observed for granulated sugar (12.12%), primarily because its review period is 30 days, requiring a larger maximum stock buffer. Ordering frequency is also reduced from 93 to 85 times per year, indicating more structured and planned procurement. This is consistent with Fadhilah and Saifudin (2023), who demonstrated that consistent application of the Min-Max method reduces total inventory costs compared to conventional company policies by optimizing order quantity and frequency based on historical usage data.

Beyond cost savings, the Min-Max method provides structural benefits. Establishing a minimum stock prevents stockout conditions that could halt production, while a maximum stock limit prevents accumulation that increases the risk of raw material degradation. This is particularly important for wheat flour, margarine, and eggs, which are susceptible to quality deterioration from moisture, fat oxidation, and biological contamination when stored for extended periods (Dharlyansyah & Utomo, 2023). Hermawan et al. (2025) further affirms that the Min-Max method is effective for optimizing inventory control to support sustainable manufacturing processes.

CONCLUSION

The application of the Min-Max method at Al-Batsit Bakery establishes structured inventory boundaries for the four main raw materials: wheat flour (Min: 162.50 kg; Max: 1,814.03 kg), sugar (Min: 65.00 kg; Max: 1,538.67 kg), margarine (Min: 19.50 kg; Max: 461.60

kg), and eggs (Min: 7.80 kg; Max: 50.49 kg). The systematic determination of safety stock, reorder point, and order quantity for each raw material provides clear procurement guidelines that effectively prevent both stockout and overstock conditions.

The Min-Max Stock method produces a total inventory cost of IDR 6,464,295 per year, achieving a savings of IDR 411,255 (5.98%) compared to the current company policy of IDR 6,875,550 per year. The greatest efficiency is realized for sugar (12.12%), followed by eggs (5.60%), wheat flour (1.59%), and margarine (0.88%). The reduction in ordering frequency for several raw materials further indicates improved and more planned inventory management that maintains uninterrupted production. It is recommended that Al-Batsit Bakery implement a structured inventory recording system whether manual or digital and apply the Min-Max method consistently as the basis for raw material inventory control. Future research may integrate the Min-Max method with demand forecasting techniques to enhance the accuracy of long-term inventory planning and further improve cost efficiency.

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