Journal of Agri Socio Economics and Business
Available online at : https://ejournal.unib.ac.id/index.php/jaseb/index
DOI: 10.31186/jaseb.07.2.137-150 2025

KAIZEN COSTING IN DAIRY-BASED BEVERAGE MSMES AS A STRATEGY FOR COST EFFICIENCY AND PRODUCT QUALITY *(A Case Study)*

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How to Cite :
Akhiroh, P., N Febrianto., D Masyithoh, 2025. Kaizen Costing in Dairy-Based Beverage MSMEs as a Strategy for Cost Efficiency and Product Quality Improvement (A Case Study). *Journal of Agri Socio Economics and Business*. 7 (2): 137-150. DOI: https://doi.org/10.31186/jaseb.07.2.137-150

ARTICLE HISTORY
Received [24 May 2025]
Revised [13 November 2025]
Accepted [20 November 2025]

KEYWORDS
Kaizen costing
Plan-Do-Check-Act (PDCA)
MSMEs
cost efficiency
product quality
dairy beverage

ABSTRACT

This empirical case study aims to examine the implementation of Kaizen Costing in improving cost efficiency and product quality in micro, small, and medium enterprises (MSMEs) engaged in dairy-based beverage production. Through an in-depth single-case study approach, this research documents the implementation process, challenges, and outcomes of Kaizen methodology application in an MSME setting in Malang City, East Java, Indonesia. The case study focuses on the MSME's challenges in production cost control, quality consistency, and limited operational resources. A qualitative research approach was employed using a case study method involving participatory observation, in-depth interviews, and document analysis. The findings show that applying the Plan-Do-Check-Act (PDCA) cycle within the Kaizen Costing framework successfully reduced total production costs by 13% per cycle, increased work time efficiency, and reduced defective products. Process innovations such as manual pasteurization tool modifications and the use of quality control tools like the fishbone diagram also contributed significantly to improving flavor stability and product shelf life. This strategy also positively impacted consumer perception, as reflected in an 18% increase in customer satisfaction scores. Therefore, Kaizen Costing proves to function not only as a cost control method but also as a strategic approach to creating added value within the MSME supply chain. The study recommends similar MSMEs to adopt the Kaizen approach systematically to support business sustainability and enhance competitiveness in the functional dairy beverage sector.

INTRODUCTION

The dairy industry is witnessing a notable transformation primarily fueled by consumer preferences for healthy, nutrient-rich dairy-based beverages such as pasteurized milk, yogurt, kefir, and fermented products. This shift is partly driven by the growing health consciousness and demands for functional foods that provide tangible health benefits such as protein, calcium, and probiotics (Adesogan & Dahl, 2020). In this context, micro, small, and medium enterprises (MSMEs) serve a crucial role by bridging the gaps in supply chains, especially in underserved markets where large-scale operations may not thrive (Haachilala & Mwange, 2024).

Despite their strategic importance, dairy-based beverage MSMEs in Indonesia face significant operational challenges that directly impact their sustainability and competitiveness. A recent survey reveals that 65% of dairy MSMEs experience production cost overruns of 15-25% above planned budgets, primarily due to inefficient resource utilization and waste (Indonesian Ministry of Cooperatives and SMEs, 2024). Specifically in the dairy beverage sector:

- Material waste reaches 12-18% of total raw milk procurement due to spoilage, contamination, and processing errors (Dairy Industry Association of Indonesia, 2023)
- Energy consumption inefficiency accounts for 20-30% of operational costs, particularly in pasteurization and cooling processes (Setiawan & Pratama, 2023)
- Labor productivity gaps result in 25-40% longer production cycles compared to industry standards, primarily due to lack of standardized procedures (MSME Development Agency, 2024)
- Product defect rates range from 8-15%, leading to significant revenue loss and customer dissatisfaction (Local MSME Survey, Malang, 2024)

A study by Kusuma et al. (2023) on 50 dairy MSMEs in East Java found that only 23% maintain systematic cost recording, and fewer than 15% implement any form of continuous improvement methodology. This lack of structured management leads to:

- Unpredictable profit margins (coefficient of variation >30%)
- Inconsistent product quality affecting customer retention
- Limited capacity to compete with larger producers
- Difficulty in obtaining financial access due to unclear cost structures

Furthermore, interviews with 30 MSME owners in Malang revealed that 78% identify "production cost control" and "quality consistency" as their top two operational challenges, yet only 12% have implemented structured improvement initiatives beyond ad-hoc problem-solving (Preliminary Survey, 2024).

These inefficiencies create a critical need for accessible, low-cost improvement methodologies specifically adapted for resource-constrained MSME environments, which forms the rationale for investigating Kaizen Costing implementation in this sector.

However, despite their significance, MSMEs in the dairy sector face substantial challenges that impede their growth and efficiency. These challenges include limited access to advanced production technologies, poor regulatory frameworks for quality control, and an over-reliance on manual processes, which can contribute to inconsistencies in product quality (Begum et al., 2015). Furthermore, MSMEs may struggle with effectively managing costs, often lacking structured systems for cost management and process optimization (Somtiya et al., 2024).

To navigate these challenges, the implementation of sustainable cost management strategies such as Kaizen Costing can prove beneficial. Originating from Japanese principles of continuous improvement, Kaizen focuses on regular, incremental advancements in operational practices. This methodology is particularly advantageous in sectors like dairy processing, where production processes are often labor-intensive and sensitive to small variations in quality and efficiency (Xingkai, 2015). The core of Kaizen Costing revolves around the Plan-Do-Check-Act (PDCA) cycle, which facilitates systematic monitoring and refining of cost-efficiency measures and quality controls. Tools like fishbone diagrams further aid in identifying the root causes of inefficiencies, thus enabling targeted interventions (Cecchini et al., 2016).

The selection of Kaizen Costing over alternative improvement methodologies is strategically justified by the specific operational and resource constraints faced by dairy MSMEs. A comparative analysis of improvement methodologies demonstrates Kaizen's superior suitability:

1) Low Barrier to Entry: Unlike Six Sigma requiring Black Belt certification or Lean Manufacturing demanding comprehensive system overhaul, Kaizen begins with simple, operator-level observations and incremental changes (Imai, 2012; Arya & Choudhary, 2015).
2) Worker-Centric Approach: In MSMEs where owners and operators work side-by-side, Kaizen's bottom-up philosophy aligns naturally with existing organizational culture, unlike top-down methodologies like TQM (Suárez-Barraza et al., 2011).
3) Immediate Cost Impact: The Kaizen Costing variant specifically targets cost reduction through small daily improvements, generating immediate financial benefits crucial for cash-constrained MSMEs (Monden & Lee, 1993).
4) Flexible Implementation: The PDCA cycle can be applied to single processes without disrupting entire operations—critical for MSMEs unable to halt production for system-wide changes (Singh & Singh, 2009).
5) No Specialized Equipment: Unlike Lean's requirement for specific tools (kanban systems, automation) or Six Sigma's statistical software needs, Kaizen relies primarily on human observation and simple recording methods (Glover et al., 2011).
6) Proven in Similar Contexts: Studies in Indian small-scale industries (Arya & Choudhary, 2015) and Japanese SMEs (Bessant et al., 2001) demonstrate

Kaizen's effectiveness in resource-limited environments with cost reduction rates of 10-20% within first year.

For dairy processing specifically, Kaizen addresses the industry's unique challenges:

- Temperature-sensitive processes: PDCA enables gradual optimization without risking entire batches
- Perishable materials: Focus on waste reduction directly impacts profitability
- Manual operations: Operator-driven improvements enhance tacit knowledge capture
- Quality variations: Incremental standardization suits small-batch production

Therefore, Kaizen Costing represents not merely a cost management tool, but a comprehensive operational philosophy aligned with MSME realities—combining affordability, accessibility, and adaptability absent in alternative methodologies.

Evidence from various studies supports the efficacy of Kaizen Costing in improving production efficiencies across different agricultural contexts (Yan, 2015; , Opoola et al., 2019; , Bai et al., 2022). For instance, a study by Diyanahsari indicated significant reductions in production costs through the adoption of activity-based Kaizen Costing in dairy processing plants, highlighting its role in enhancing both cost-effectiveness and product quality (Asghar et al., 2021). Moreover, research has shown that sustained application of these principles can lead to heightened competitiveness and customer loyalty among MSMEs, ultimately fostering long-term sustainability in the dairy sector (Kumar et al., 2018).

Despite the promising benefits of Kaizen Costing, there remains a gap in scholarly research directly addressing its impacts within the context of dairy-based beverage MSMEs. This proposal aims to fill that gap by not only evaluating the effectiveness of Kaizen principles in dairy processing but also providing concrete guidelines for MSME operators aiming to enhance their operational performance under the constraints typical of this industry. Such empirical insights can contribute significantly to developing an evidence-based framework for other MSMEs seeking similar improvements.

Research Benefits

This research is expected to provide the following benefits:

Theoretical Benefits

- Contributing to the development of cost and production management knowledge in the context of agro-industrial MSMEs.
- Enriching the literature on Kaizen Costing application in the functional beverage industry, particularly dairy-based products.

Practical Benefits

- Providing a systematic guide for MSME actors on how to implement the PDCA cycle in managing dairy beverage production.
- Offering a replicable model for measuring cost and quality efficiency among similar MSMEs.
- Offering insights into how quality analysis tools such as fishbone diagrams can be applied simply but effectively.
- Increasing awareness of the importance of continuous improvement in daily MSME operations.

Research Objectives

The general objective of this study is to evaluate the application of the Kaizen Costing method in dairy-based beverage processing by MSMEs. Specifically, the objectives are to:

1. Analyze the production process and key cost components in dairy-based beverage MSMEs.
2. Identify sources of inefficiency in production processes that contribute to high costs and inconsistent quality.
3. Apply Kaizen principles through the PDCA cycle to increase cost efficiency and improve product quality.
4. Measure the impact of Kaizen Costing on production cost reduction and quality stability.
5. Provide practical and strategic recommendations tailored to MSME capacity in implementing continuous improvement.

RESEARCH METHODS

In this section, we explain the time and place selected to conduct the research; the types and sources of data and information collection techniques, research variables and data analysis methods.

Research Design

The research methodology applied in this study is grounded in a qualitative approach, employing a case study method to gain a nuanced understanding of cost efficiency and product quality management within dairy-based beverage micro-enterprises. This approach enabled us to explore the complex dynamics and managerial strategies that micro, small, and medium enterprises (MSMEs) implement in their operations, focusing on real-life contexts rather than statistical analysis. The method selection was particularly relevant given the exploratory nature of the research objectives, which aim to delve into the operational realities of Kaizen Costing within the specific setting of a micro-enterprise.

The qualitative case study design allowed for a rich, detailed analysis of the practices surrounding cost and quality management in an MSME

environment. According to Yin, case studies facilitate the examination of phenomena within their real-world contexts, providing depth and insight that quantitative measures cannot capture. This methodology is particularly suitable for understanding the intricacies of Kaizen principles as they were applied in the dairy production cycles, where production, managerial decisions, and labor dynamics converge. This approach aligns well with the descriptive nature of qualitative research, focusing on detailed observations and narratives, which can highlight the subtleties of operational practices (Shintia, 2023).

Methodological Justification:

Each research objective was addressed through triangulated data sources to ensure validity and reliability:

- **Objective 1-2** (Diagnostic phase): Combines qualitative observation with quantitative cost data to establish baseline conditions
- **Objective 3** (Intervention phase): Action research approach enabled real-time documentation of Kaizen implementation process
- **Objective 4** (Evaluation phase): Pre-post comparison with control period ensured attribution of outcomes to intervention
- **Objective 5** (Synthesis phase): Integrates findings through qualitative synthesis to generate actionable insights

This multi-method approach aligns with case study research best practices (Yin, 2018) and action research protocols (Coghlan & Brannick, 2014), ensuring both academic rigor and practical relevance.

Research Site and Subjects

The research was conducted at the end of the year 2024 in a purposively selected MSME located in Malang City, East Java, tasked with producing pasteurized milk and yogurt. This setting was chosen due to its operational history of over two years, indicative of its sustainability amid the challenges faced by small enterprises. The business was actively developing systems for cost efficiency and internal quality management, making it an ideal candidate for studying Kaizen implementation. The subjects involved in this research included the business owner, who was also the decision-maker, alongside two production operators stemming from their hands-on experience in daily operational tasks. This selection strategy was crucial as it ensured that the collected data portrayed individuals who were directly engaged in the production process.

This research implemented Kaizen Costing at two operational levels within the MSME:

1) Business-Level Implementation (Macro Scope):
   - Overall production cost management system
   - Enterprise-wide PDCA cycle adoption (planning, budgeting, monitoring)
   - Organizational culture shift toward continuous improvement
   - Integration of Kaizen principles into daily operations across all products

2) Product-Level Implementation (Micro Scope):
   - Primary focus: Pasteurized fresh milk (60% of production volume)
   - Secondary application: Yogurt (40% of production volume)

Rationale for Dual-Level Approach:

The MSME produced two main product categories sharing 85% common processes (milk reception, pasteurization, cooling) but differing in fermentation and packaging. Kaizen implementation strategy:

- Shared processes: Business-level improvements (e.g., pasteurization efficiency, energy management, raw milk handling)
- Product-specific processes: Product-level adaptations (e.g., yogurt fermentation temperature control, packaging optimization)

Table 1. Kaizen Implementation Scope Matrix

Process Stage	Implementation Level	Primary Product Focus	Expected Impact
Milk Reception & Storage	Business-level	Both products	Raw material waste reduction
Pasteurization	Business-level	Pasteurized milk (primary)	Energy cost reduction
Cooling	Business-level	Both products	Time efficiency
Fermentation	Product-level	Yogurt only	Quality consistency
Packaging	Product-level	Product-specific	Defect rate reduction
Quality Control	Business-level	Both products	Overall quality improvement

This dual-level approach ensured:

- Comprehensive cost impact: Captures 90%+ of total production costs
- Replicability: Demonstrates scalability from product to business level
- Resource efficiency: Prioritizes high-volume product (pasteurized milk) while benefiting entire operation
- Generalizability: Provides insights applicable to single-product and multi-product MSMEs

Data Collection Method

Data collection for this study involved participatory observation, in-depth interviews, and document review to ensure comprehensive capturing of the operational landscape. The participatory observation method aimed at documenting workflow inefficiencies and the actual practice of improvements in situ. This direct engagement provided a granular view of the production environment, facilitating a better understanding of challenges faced (Rajan, 2022). Structured, semi-structured interviews were conducted with key personnel to uncover insights regarding their comprehension of Kaizen principles, experiences with cost management, and the evaluation of product

quality (Saputra, 2023). Meanwhile, document analysis through scrutiny of production logs, cost records, and standard operating procedures (SOPs) added another layer of credibility via source triangulation, ultimately validating the collected data.

Data Analysis Method

For data analysis, the interactive model proposed by Miles and Huberman was employed, which consisted of data reduction, data display, and conclusion drawing. The initial reduction phase involved thematic coding, focusing on key issues pertaining to Kaizen Costing, such as "energy efficiency," "quality variation," and "waste processes" (Yuska et al., 2022). Following this, the data display stage organized findings into descriptive narratives and visual representations, enabling clearer explanation of results and facilitating logical interpretation. This analytical framework supports the identification of operational trends and ultimately guides the development of actionable recommendations for MSMEs engaged in the dairy beverage sector (Shintia, 2023).

RESULTS AND DISCUSSION

Table 2. Summary of Kaizen Implementation Impact

Performance Indicator	Before Kaizen	After Kaizen	Improvement
Cost Efficiency (per production cycle)			
Total production cost	IDR 1,530,000	IDR 1,330,000	-13.1%
Cost per liter produced	IDR 16,105	IDR 13,300	-17.4%
Material costs	IDR 927,000	IDR 922,000	-0.5%
Labor costs	IDR 205,000	IDR 160,000	-22.0%
Energy & utilities	IDR 218,000	IDR 199,500	-8.5%
Waste & defect costs	IDR 83,000	IDR 34,000	-59.0%
Production output volume	95 liters	100 liters	+5.3%
Time Efficiency			
Total production time	385 minutes	340 minutes	-11.7%
Idle/non-productive time	45 minutes	18 minutes	-60.0%
Rework time per week	4.5 hours	1.2 hours	-73.3%
Quality Metrics			
Defect rate	8.2%	3.3%	-59.8%
Product shelf life (refrigerated)	3 days	5 days	67%
Organoleptic score (taste & aroma)	3.2 / 5.0	4.1 / 5.0	+28.1%

Performance Indicator	Before Kaizen	After Kaizen	Improvement
Overall product acceptability	3.4 / 5.0	4.2 / 5.0	+23.5%
Customer Response			
Customer satisfaction score	3.2 / 5.0	4.1 / 5.0	+28.1%
Repurchase intention	68%	94%	+26 pp
Customer complaints per month	8-10 cases	1-2 cases	-85%

Table 3. Root Causes and Kaizen Solutions Implemented

Problem Identified	Root Cause (Fishbone Analysis)	Kaizen Solution	Investment Required	Result Achieved
High energy costs	Manual heating without timer control; operators relied on visual estimation	Installed digital timer; created heating SOP with specific time targets	IDR 250,000 (one-time)	8% energy reduction; consistent pasteurization
Inconsistent product taste	Variable pasteurization temperature (±3.2°C); no temperature monitoring	Implemented temperature logging; trained operators on critical control points	IDR 150,000 (thermometer + logbook)	Temperature deviation reduced to ±1.1°C
High defect rate (8.2%)	Lack of written procedures; inconsistent operator practices	Developed visual SOPs; daily quality checks	IDR 50,000 (printing materials)	Defect rate dropped to 3.3%
Short shelf life (3 days)	Inadequate cooling area maintenance; contamination risk	Weekly cleaning schedule; sealed storage containers	IDR 300,000 (containers)	Shelf life extended to 5 days
Excessive overtime	Poor production scheduling; frequent rework due to defects	Implemented production planning board; reduced defects	IDR 0 (internal process)	100% overtime elimination
Material waste	No raw milk quality inspection; poor packaging techniques	Basic raw milk testing (visual + smell); packaging training	IDR 100,000 (testing supplies)	5% improvement in material utilization

The implementation of Kaizen Costing through the PDCA cycle generated measurable improvements across three dimensions: cost efficiency, operational performance, and product quality.

a) **Cost Impact:** The 13% reduction in total production costs (from IDR 1,530,000 to IDR 1,330,000 per cycle) primarily resulted from non-material improvements—specifically waste reduction (59%) and labor efficiency gains (22%). Critically, these savings were achieved without workforce reduction or major capital investment; instead, they stemmed from process optimization, defect elimination, and better time management.

b) **Quality Enhancement:** The organoleptic score improvement from 3.2 to 4.1 indicates a shift from "acceptable" to "good" product quality, directly translating to consumer satisfaction gains (also 3.2 to 4.1). The 67% shelf-life extension (3 to 5 days) represents a significant competitive advantage for the MSME, reducing product returns and expanding distribution possibilities.

c) **Root Cause Resolution:** The fishbone diagram analysis identified temperature control inconsistency as the primary quality issue. Simple interventions—a digital timer (IDR 250,000) and temperature logging protocol—eliminated human error in the pasteurization process, demonstrating that effective solutions need not be expensive or complex.

d) **Business Viability:** With total implementation costs of only IDR 850,000 and monthly savings of IDR 400,000, the Kaizen initiative achieved payback in just 2.1 months. This rapid return on investment validated the methodology's suitability for resource-constrained MSMEs.

The results confirm that Kaizen Costing functions as both a cost management tool and a quality improvement framework, creating synergistic benefits that enhance overall business competitiveness.

The implementation of Kaizen Costing at the micro-enterprise level reflects a commitment to advancing both cost efficiency and product quality, exemplified through systematic application of the PDCA (Plan–Do–Check–Act) cycle. This strategy represents a framework that fosters continuous improvement, as demonstrated by the identification of waste sources, such as excessive electricity consumption and inconsistencies in pasteurization results during the Plan stage of the process (Arya & Choudhary, 2015). As Khorasani et al. (2020) emphasize, recognizing operational waste is paramount in manufacturing, where waste reduction can significantly boost efficiency. The subsequent Do phase involved testing revised production schedules and modifying the water heating system to include a timer, which contributes to consistent output during production (Al-Hyari et al., 2019). The benefits of standardizing operations align with the research findings that indicate such modifications can yield substantial operational improvements without incurring significant capital investments.

Following adjustments, the Check phase engaged in rigorous monitoring of production durations and electricity consumption to evaluate the effectiveness of implemented changes. This strategy aligns with Carneiro et al. (2023), who point out that a data-driven approach to management facilitates continuous improvement and operational excellence. The Act phase focused on institutionally embedding new procedures, ensuring that systematic practices—such as the utilization of timers in heating processes—were standardized to promote long-term sustainability and reliability in production outcomes.

To dissect quality issues, a fishbone diagram proved effective in identifying potential root causes contributing to inconsistencies, such as variations in flavor and shelf life. Critical factors highlighted by this analysis included operator skill gaps (manpower), inconsistent operational procedures (method), variable raw milk quality (material), and environmental contaminants due to inadequate maintenance of cooling areas. These systematic problem-solving techniques resonate with Bubber et al. (2022), who acknowledge the efficacy of structured methods like fishbone diagrams for unearthing root causes and fostering subsequent resolution.

The resultant Cost Efficiency, post-Kaizen implementation, indicates that while raw material costs remained stable, enhanced waste reduction strategies led to improved production utilization. Specifically, electricity usage decreased by 8% due to better control mechanisms in the heating process, while labor efficiency improved by 11%—outcomes that illustrate the dual advantages of effective Kaizen practices in operational cost management. Furthermore, the notable reduction in defective products illustrates the substantial improvements in process control achieved through these systematic enhancements.

In terms of Quality Improvement, organoleptic tests highlighted an increase in taste and aroma scores from 3.2 to 4.1 on a five-point scale, indicating improved consumer acceptability. Additionally, shelf-life extension from three to five days in refrigeration conditions exemplifies advancements in product preservation techniques. Correspondingly, an increase in customer satisfaction, derived from post-implementation surveys, substantiates the holistic benefits achieved through this Kaizen initiative (I.I. et al., 2019). Such findings correspond with (Maziriri & Chinomona, 2016), asserting that interlinking operational excellence with product quality delivers enhanced customer value, critical for sustaining competitiveness in the marketplace.

The role of micro-enterprises in economic terms cannot be understated, particularly regarding poverty alleviation and welfare improvement, as outlined by Maulida and Almadina (2023). These enterprises create employment opportunities and facilitate entrepreneurship, consequently contributing to broader societal welfare. Furthermore, aligning Kaizen principles with the operational dynamics of micro-enterprises aligns with findings by (Arya & Choudhary, 2015), who advocate for the adoption of Kaizen to tackle inefficiencies arising from competitive pressures in small industries. The Kaizen philosophy not only emphasizes quality improvement but also fosters a culture

of shared responsibility, which is crucial in navigating the challenges faced by micro-enterprises in the current economic climate. Cost Efficiency Post-Kaizen implementation results show:

- Raw material costs remained constant, but reduced waste improved utilization.
- Electricity usage dropped by 8% due to heating control.
- Labor efficiency improved by 11% through reduced rework and idle time.
- Defective products declined by 40%, reflecting better process control. Overall, total production costs per cycle decreased, boosting the enterprise's profit margin.

Quality Improvement

- Organoleptic tests showed improved taste and aroma (from 3.2 to 4.1 on a 5-point scale).
- Shelf life extended from 3 to 5 days under basic refrigeration.
- Customer satisfaction increased by 18%, based on post-improvement surveys. These results support the alignment of cost efficiency with enhanced product quality.

CONCLUSIONS

Implementation of Kaizen Costing in this MSME context illustrates substantial benefits in both efficiency and quality. The methodology adopted, particularly the PDCA cycle, facilitated a structured examination of the production process leading to impactful changes. This study underscores the effectiveness of continuous improvement frameworks in driving significant enhancements in small-scale manufacturing settings.

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