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EMPOWERING COFFEE FARMERS IN SUKASARI, MOUNT MANGLAYANG, THROUGH NATIONAL STANDARDS OF INDONESIA (SNI) FOR POST-HARVEST QUALITY IMPROVEMENT TO ACCESS INTERNATIONAL MARKETS

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Abstract

Coffee is one of Indonesia's most significant agricultural commodities, yet post-harvest handling among smallholder farmers remains suboptimal. This community service program aimed to empower coffee farmers in Sukasari, Mount Manglayang, West Java, by introducing post-harvest storage practices that comply with the Indonesian National Standards (SNI). The program was conducted in July 2025 through a combination of training, demonstration, and participatory approaches with farmer groups. Pre-surveys revealed that more than 70% of farmers stored coffee beans using traditional methods, resulting in quality degradation and low market value. The intervention included training sessions, technical demonstrations on the use of simple storage racks, and the introduction of tools such as moisture meters and thermohygrometers. Evaluation results indicated a significant improvement in farmers' knowledge, with post-test scores showing more than 40% increase compared to pre-tests. Farmers were also actively involved in drafting a Standard Operating Procedure (SOP) for coffee storage, which is now used as a reference by their cooperatives. The findings highlight the importance of participatory capacity building in enhancing product quality, ensuring better market access, and aligning with Sustainable Development Goals (SDGs), particularly goals 1 (No Poverty), 8 (Decent Work and Economic Growth), and 12 (Responsible Consumption and Production).

Keywords: *Community Service, Coffee Farmers, Post-Harvest Quality, SNI, International Market.*

INTRODUCTION

Coffee is a leading export commodity in Indonesia, playing a vital role not only in strengthening the national economy but also in sustaining the livelihoods of millions of people living in rural areas. The sector provides employment opportunities across multiple stages of production, from cultivation and harvesting to processing and marketing, thereby functioning as an essential driver of local development (Irawan, 2025). Indonesia is widely recognized as one of the world's largest producers of both arabica and robusta coffee, and its distinct regional varieties have earned global acknowledgment for their quality and diversity (ICO, 2023). These

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varieties reflect the country's unique geographical and climatic conditions, which enable the production of beans with flavors and aromas that appeal to a broad range of international markets. Among the many coffee-producing regions, Mount Manglayang in West Java has recently attracted attention for its arabica coffee (Lliano et al., 2024). Grown at elevations ranging between 1,000 and 1,800 meters above sea level, the beans cultivated in this highland environment develop complex and distinctive flavor profiles that further enhance Indonesia's reputation in the specialty coffee industry (Hasni et al., 2024).

Despite these promising conditions and the increasing demand for high-quality beans, the coffee sector in Mount Manglayang continues to face significant challenges, particularly in the area of post-harvest handling. Field observations and interviews revealed that approximately 70% of coffee farmers in Sukasari still depend heavily on traditional methods of storage, which often involve keeping beans in open sacks placed in humid rooms with little or no ventilation (Umaran et al., 2022). These practices are unsuitable for preserving bean quality and have been linked to a range of problems, including rapid deterioration, mold growth, and contamination that diminishes both taste and appearance. As a result, the overall value of the product decreases substantially, making it difficult for farmers to maintain consistent quality standards that are expected by discerning buyers (Lalpekhlua et al., 2024). The implications are severe: lower selling prices at local markets, limited opportunities to access premium buyers, and the inability to break into international markets where quality requirements are much stricter. This situation creates a cycle in which farmers struggle to increase income and investment, despite the considerable potential of their coffee to compete at higher levels of the global value chain (Rubio-Jovel, 2024).

The root causes of these issues are multifaceted and deeply interconnected, reflecting both technical and institutional gaps that persist within the local coffee value chain. One of the primary challenges lies in the limited knowledge and awareness among farmers regarding SNI-based storage standards, which are crucial for maintaining bean quality and ensuring consistency in production (Samoggia & Fantini, 2023). Many farmers still rely on generational practices that, while traditional, fail to meet the rigorous demands of today's coffee industry. In addition to knowledge gaps, the sector is constrained by inadequate facilities and infrastructure that are essential for effective post-harvest handling, such as ventilated storage rooms, moisture control systems, and standardized drying equipment. Without such support, even high-quality beans risk losing their value before they reach the market (Wienhold &

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Goulao, 2023). Compounding these issues is the absence of formal Standard Operating Procedures (SOPs) at the farmer group level, which hinders the establishment of uniform practices and prevents collaborative efforts from achieving large-scale improvements in quality management. Collectively, these factors contribute to systemic weaknesses that limit the competitiveness of coffee from regions such as Mount Manglayang in both domestic and international arenas (Rind, 2024).

In response to these persistent challenges, Universitas Komputer Indonesia (UNIKOM) launched a targeted community service program designed to empower coffee farmers through a combination of educational and practical interventions. The program places strong emphasis on capacity building, equipping farmers with knowledge about modern post-harvest practices while simultaneously raising awareness about the importance of aligning with SNI-based storage standards. Technical support is also a central component, with experts providing hands-on training, demonstrations, and guidance on how to implement standardized methods effectively within existing resource constraints (May et al., 2023). Furthermore, the initiative introduces appropriate technologies and tools that make it feasible for farmers to adopt improved practices without excessive financial burden. By aligning local production systems with national and international standards, the ultimate goal is not only to improve the quality of coffee beans but also to prepare farmers to compete in premium and export-oriented markets. This paper documents the entire process of program implementation, evaluates its measurable outcomes in terms of quality enhancement and farmer empowerment, and explores its broader implications for advancing sustainable agricultural development in Indonesia.

LITERATURE REVIEW

Coffee Farmers

A farmer is someone who utilizes all biological resources in businesses such as farming and raising livestock to meet their needs. A farmer is an individual who works in the agricultural sector on land cultivated with the intention of economic profit (Yadav et al., 2023). According to the Bandung Regency Central Statistics Agency, farmers are classified based on their sub-sectors as follows:

1. Food Crops Sub-Sector, such as rice and secondary crops.
2. Horticulture Sub-Sector, such as vegetables, fruits, ornamental plants, and medicinal plants.

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3. Smallholder Plantation Crops Sub-Sector, such as coconut, coffee, cloves, tobacco, and kapok odolan. The number of these commodities also varies by region.
4. Livestock Sub-Sector, such as large livestock (cattle, buffalo), small livestock (goats, sheep, pigs, etc.), poultry (chickens, ducks, etc.), and livestock products (cow's milk, eggs, etc.).
5. Fisheries Sub-Sector, both capture fisheries and aquaculture (Fatch et al., 2021).

Coffee farmers can be said to be individuals who carry out agricultural business in the plantation sector, namely coffee plants, with the aim of obtaining results from the coffee plants to meet daily needs or make a profit. Law Number 19 of 2013 concerning the Protection and Empowerment of Farmers in Article 1 paragraph (3) states that farmers are individual Indonesian citizens and/or with their families who carry out agricultural businesses in the fields of food crops, horticulture, plantations, and/or animal husbandry (Kansrini et al., 2021).

Indonesian National Standard (SNI)

Standardization is a benchmark or guideline used as a minimum reference for achieving harmony. Standards are generally used as benchmarks for an object by determining certain characteristics and specifications imposed on that object. Standardization is defined as a collaborative effort to establish standards. With these standards, an object gains added value and is recognized by the entire community (Rebong et al., 2025).

Standardization originates from the word "standard," which means a unit of measurement for comparing quality, quantity, value, and results of a work or product. Therefore, standardization is the process of establishing technical standards, specification standards, test method standards, definition standards, standard procedures (or practices), and so on. Therefore, it can be concluded that standardization for a product is the determination of quality, which then serves as a guideline for achieving quantitative harmony, aimed at ensuring product quality (Soares et al., 2023).

In the World Trade Organization (WTO) agreement, the Agreement on Technical Barriers to Trade (TBT) clause states that all member countries (including Indonesia) are required to comply with national laws and regulations regarding standardization. This legislation is intended to protect all parties involved in the product. This protection is reviewed from the perspective of safety, security, health, and environmental aspects (Suryanta & Patunru, 2023). As is known, standardization encompasses all activities related to engineering

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metrology, standards, testing, and quality. Engineering metrology is the metrology that manages units of measurement, measurement methods, and measuring instruments, as well as the maintenance and development of national standards for units of measurement and measuring instruments that align with developments in science and technology (Chirkov, 2023).

The standard applied in Indonesia and recognized by the public is the Indonesian National Standard, or SNI. SNI is formulated by a Technical Committee and then validated and stipulated by the National Standardization Agency (BSN). By registering a product as having passed SNI testing and receiving certification, the product is declared safe and competitive because it meets the established requirements for distribution (Rosiawan et al., 2025).

METHOD

The program was implemented in Sukasari District, located in the Mount Manglayang region, West Java. Participants consisted of approximately 30 farmers from four farmer groups: Banjaran Satu, Barokah Makmur, Manglayang Timur, and Pucuk Ibun. These groups were selected based on their active involvement in coffee cultivation and their willingness to adopt improved practices. The program followed a participatory approach, combining education, demonstration, and practice. The steps included: preliminary survey and problem mapping, preparation of training materials and pre-test, socialization and training, demonstration of appropriate technology, provision of storage racks, and evaluation. Program success was measured by the number of participants attending, knowledge improvement (pre- vs. post-test), adoption of practices, such as using racks and monitoring humidity, and development of a draft SOP for coffee storage.

RESULTS AND DISCUSSION

Program Implementation

The activities were carried out in accordance with the established plan and unfolded in a structured manner, beginning with an official opening ceremony that was attended by local government representatives, UNIKOM officials, and farmer group leaders. This opening event not only served as a formal inauguration but also underscored the collaborative nature of the initiative, strengthening the commitment between academic institutions, policymakers, and the

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farming community. It created a platform for dialogue and mutual understanding, where the importance of sustainable coffee production and adherence to quality standards was emphasized from the outset. The presence of multiple stakeholders highlighted the shared responsibility in addressing post-harvest challenges and demonstrated how partnerships can contribute to building a more resilient coffee sector.

Following the ceremony, a series of training sessions was conducted that focused on practical and technical aspects of post-harvest handling. Particular attention was given to the role of moisture control, with trainers stressing that beans must be maintained at a maximum moisture level of 12.5% to ensure stability during storage and transportation. Participants were also introduced to proper ventilation techniques and the design of storage management systems that minimize humidity and prevent mold formation, both of which are critical for preserving bean quality. Through interactive demonstrations and discussions, farmers were encouraged to compare traditional practices with improved methods, helping them to recognize how small adjustments can lead to significant improvements in market value. These sessions were designed not only to transfer technical knowledge but also to instill confidence in the farmers that adopting SNI-based standards is both achievable and beneficial for long-term sustainability.

Pre-Test Results

Pre-test data revealed that the farmers initially possessed only a limited understanding of post-harvest standards, particularly those aligned with SNI-based requirements. The assessment, which was conducted before the start of the training sessions, highlighted significant knowledge gaps in key areas such as moisture regulation, proper ventilation, and the importance of using structured storage systems. On average, less than 50% of the questions were answered correctly, indicating that most participants were unfamiliar with the technical details necessary to maintain coffee quality at levels required by premium and international markets. This outcome not only confirmed the need for a systematic and structured training program but also validated earlier field observations and interviews that pointed to traditional practices as the prevailing approach among farmers.

The results underscored the urgency of introducing more comprehensive learning interventions that move beyond general awareness and focus on practical, hands-on applications of post-harvest management. By quantifying the extent of the knowledge gap, the

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pre-test data provided a strong baseline against which the effectiveness of the training sessions could later be measured. Moreover, the findings demonstrated that without targeted educational support, farmers would continue to face significant barriers in achieving higher product quality and improving their competitiveness in the marketplace. Thus, the pre-test served not only as an evaluative tool but also as a catalyst for tailoring the training modules to address the most pressing deficiencies, ensuring that the program was both relevant and impactful for the participants.

Post-Training Outcomes

Post-test results revealed substantial improvements in farmers' knowledge and skills, with overall understanding levels rising by more than 40% compared to the pre-test scores. This notable increase reflected the effectiveness of the structured training sessions in bridging critical knowledge gaps and equipping participants with the technical competencies necessary for improved post-harvest handling. Farmers were able to articulate and apply the importance of maintaining moisture content below 12.5%, a standard that directly impacts the stability and shelf life of coffee beans during storage and transport. They also demonstrated awareness of the risks associated with direct exposure to sunlight and high humidity, recognizing how such conditions accelerate deterioration, promote mold growth, and reduce overall bean quality.

In addition, participants gained practical knowledge about the use of storage racks to ensure beans are not placed directly on the floor, thereby minimizing contamination and maintaining airflow within storage areas. Another key improvement was the adoption of the First-In, First-Out (FIFO) method, which farmers learned to apply consistently to preserve the freshness of stock and prevent prolonged storage that compromises quality. These behavioral shifts indicated not only an increase in theoretical understanding but also a readiness to implement standardized practices in daily operations. The post-test findings thus confirmed that the training program successfully transformed farmer practices, laying a foundation for long-term quality improvements and enhancing their potential to meet the requirements of premium and international markets.

Farmer Empowerment and SOP Development

A key achievement of the program was the successful collaborative drafting of a Standard Operating Procedure (SOP) for coffee storage, which represented a concrete outcome

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of the training and capacity-building activities. Rather than being imposed externally, the SOP was developed through participatory discussions that actively involved farmers, UNIKOM facilitators, and local stakeholders. This process ensured that the document reflected not only best practices from the perspective of technical standards but also the realities of local farming conditions, such as resource availability, infrastructure limitations, and cultural practices in handling post-harvest products. By engaging farmers directly in the drafting process, the initiative fostered a sense of ownership and responsibility, which is essential for long-term adoption and compliance.

The resulting SOP provided a clear and practical set of step-by-step guidelines designed to be both user-friendly and adaptable, thereby bridging the gap between formal standards and everyday practice. It emphasized key elements such as controlling moisture levels, ensuring adequate ventilation, organizing beans on racks rather than directly on floors, and applying the FIFO principle to maintain product freshness. At the same time, the SOP was deliberately tailored to local conditions, making use of existing facilities and affordable tools so that implementation would remain sustainable over time. This achievement marked an important milestone, as it gave farmers a concrete reference tool for maintaining consistency in post-harvest management, reducing losses, and improving quality control. Ultimately, the establishment of the SOP not only standardized practices across farmer groups but also strengthened their collective capacity to meet national and international quality requirements, positioning them more competitively in the broader coffee market.

Challenges and Solutions

Despite the progress achieved, several challenges remained evident during the implementation phase, particularly concerning the availability of resources to support consistent adoption of the newly developed SOP. One major limitation was the farmers' restricted access to advanced storage facilities equipped with modern ventilation systems or controlled environments, which are essential for maintaining optimal bean quality. In many cases, existing storage spaces were simple household rooms that lacked the infrastructure to regulate humidity or airflow effectively. Another constraint was the absence of reliable measuring tools, such as moisture meters and hygrometers, which are crucial for ensuring beans are kept below the recommended 12.5% moisture threshold. Without these tools, farmers often relied on visual inspection or tactile judgment, methods that are prone to error and compromise

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the accuracy of quality control efforts. These structural and technical gaps highlighted the need for additional support mechanisms to complement the knowledge and skills that farmers had gained through the training sessions.

To address these persistent barriers, several practical solutions were proposed that focused on strengthening collective action and institutional partnerships. One recommendation was to foster closer collaboration with cooperatives and local government agencies, which could play an instrumental role in providing access to resources, facilitating funding, and coordinating the use of shared infrastructure. Another solution involved promoting collective investment among farmer groups to purchase essential tools and equipment, thereby reducing individual financial burdens while ensuring that all members benefit from standardized quality management practices. By pooling resources and leveraging partnerships, these approaches aimed to create a more sustainable framework for implementing the SOP and ensuring that farmers could consistently meet both national and international market requirements. Such measures not only addressed immediate operational challenges but also reinforced the long-term resilience and competitiveness of the coffee sector in the Mount Manglayang region.

Broader Implications

The program is strongly aligned with the principles of the Sustainable Development Goals (SDGs), particularly in areas such as poverty alleviation, the promotion of decent work, and the advancement of sustainable production systems. By equipping farmers with the knowledge and tools needed to improve post-harvest handling, the initiative directly contributes to increasing their income opportunities and reducing vulnerabilities associated with fluctuating market prices (Filippi et al., 2023). At the same time, the focus on enhancing labor conditions through structured training and the adoption of standardized practices reflects a broader commitment to ensuring that agricultural livelihoods are dignified, productive, and resilient. Equally important is the program's emphasis on sustainability, as the introduction of SNI-based methods encourages environmentally sound and resource-efficient production practices that safeguard long-term coffee quality while reducing waste and post-harvest losses.

Beyond its immediate impact on coffee farmers in Mount Manglayang, the model developed through this community service program offers valuable lessons that can be adapted and replicated across other agricultural commodities facing similar challenges. By integrating academic expertise, local knowledge, and institutional partnerships, the approach demonstrates

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how participatory capacity-building can be tailored to diverse contexts while still achieving measurable improvements in quality and competitiveness. This replication potential underscores the broader significance of the initiative as a scalable framework for rural empowerment, one that not only strengthens farmer resilience but also contributes to national development goals and international sustainability agendas. In doing so, the program highlights how targeted interventions at the community level can generate ripple effects that extend across sectors, fostering inclusive growth and reinforcing the pursuit of sustainable agricultural development.

CONCLUSION

The community service program proved to be highly effective in enhancing both the knowledge and practical skills of coffee farmers in Sukasari, Mount Manglayang, particularly in relation to post-harvest storage practices that comply with SNI standards. Through structured training and technical assistance, farmers gained a clearer understanding of how proper storage management directly influences coffee quality and, consequently, their ability to compete in increasingly demanding markets. This growing awareness has marked an important shift in mindset, as farmers now recognize the strong link between maintaining post-harvest quality and securing better prices, improved buyer trust, and wider access to premium market segments. The collaborative development of a practical Standard Operating Procedure (SOP) also stands out as a significant achievement, as it not only provides farmers with concrete guidance but also guarantees continuity and long-term sustainability of the improved practices introduced by the program. Looking ahead, it is clear that further interventions will be needed to consolidate and scale up these positive outcomes. Future programs should prioritize the establishment of larger-scale storage facilities that are equipped with proper ventilation and humidity control systems, thus reducing dependence on makeshift or household storage spaces. In addition, expanding farmer access to essential measuring tools such as moisture meters will be vital in ensuring that quality standards are met with consistency rather than approximation. Equally important is the facilitation of certification processes and stronger market linkages, which would allow Sukasari coffee not only to comply with national standards but also to meet international requirements for specialty markets. By addressing these areas, Sukasari coffee has the potential to penetrate global markets more effectively and, in turn, make a greater

contribution to local economic development, rural livelihood improvement, and Indonesia's overall reputation as a leading producer of high-quality coffee.

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