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ARTICLE

ENHANCING KNOWLEDGE AND SKILLS IN ARABICA COFFEE CULTIVATION: EVIDENCE FROM CIKIDANG VILLAGE FARMERS

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Abstract

Arabica coffee is a strategic commodity with high economic value, yet smallholder farmers in Cikidang Village face challenges in cultivation and harvesting due to limited technical knowledge. This study emphasizes the urgency of improving farmer capacity to sustain productivity and enhance coffee quality. Drawing on human capital, capacity building, and diffusion of innovation theories, the research highlights training as a critical driver of sustainable agricultural development. A qualitative descriptive method was employed, using focus group discussions (FGDs), extension lectures, and field demonstrations with 25 farmers from the Mitra Sejati group. The results show that the technical guidance improved farmers' knowledge in pruning, fertilization, pest management, and selective harvesting practices. Findings indicate that although ecological conditions support coffee growth, inadequate cultivation and harvesting practices reduce quality. The study concludes that tailored extension programs are effective and replicable models for capacity building in other coffee-producing regions.
Keywords: Arabica Coffee, Farmer Capacity, Technical Guidance

A. INTRODUCTION

Coffee is one of the leading plantation commodities that holds a higher economic value compared to other plantation crops (Teniro & Zainudin, 2022). This commodity plays a significant role as a contributor to foreign exchange earnings through exports to global markets (BPS Indonesia, 2024). Moreover, coffee serves as the primary source of income for more than one and a half million farmers in Indonesia (Teniro & Zainudin, 2022). Various types of coffee cultivated in Indonesia include robusta, arabica, and liberica, with production areas distributed across Java, Sumatra, NTT, NTB, and Sulawesi (Setyoko et al., 2023). The success of coffee cultivation requires proper techniques, ranging from varietal selection and crop maintenance to harvesting practices (Khaliqi et al., 2020).

Arabica coffee is one of the most strategic types of coffee in international trade due to its distinctive quality and flavor profile (Marianto et al., 2022). The production of Arabica coffee in Indonesia consistently contributes to foreign exchange earnings, with export destinations such as the United States, Italy, and Egypt (BPS Indonesia, 2024). Studies highlight that environmental factors, including altitude, temperature, and rainfall distribution, significantly influence the growth and quality of Arabica coffee (Marianto et al., 2022). Efforts to enhance production quality have been carried out through improvements in cultivation techniques and the implementation of proper harvesting and post-harvest practices (Reta et al., 2021).

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However, the adoption of such practices remains limited due to farmers' restricted access to technology and technical knowledge (Metafindo et al., 2024).

Cikidang Village in Lembang District, West Bandung Regency, is one of the areas with significant potential for Arabica coffee development. Farmers in this village, organized under farmer groups, cultivate coffee on leased land from Perhutani. Nevertheless, they still face limitations in technical knowledge, particularly in cultivation and harvesting practices. This condition directly affects the quality of Arabica coffee produced in the village. Therefore, enhancing farmers' capacity in Cikidang Village is an urgent necessity to maintain the quality and sustainability of Arabica coffee production.

Previous studies have demonstrated that capacity building for farmers through training and mentoring has a positive impact on harvest outcomes and the quality of coffee production. Reta et al. (2021) found that structured training programs significantly improved farmers' skills while simultaneously enhancing the quality of coffee production. The findings of Metafindo et al. (2024) revealed that the application of harvesting and post-harvesting practices in accordance with Good Handling Practices (GHP) remains limited due to technological constraints and farmers' socio-economic characteristics. Meanwhile, Payong et al. (2021) emphasized the importance of continuous technical guidance, which not only addresses cultivation practices but also raises awareness of the long-term benefits of maintaining coffee as a primary commodity.

The similarity with this research lies in its focus on strengthening farmers' capacity through extension activities, training, and mentoring. However, the difference rests in the research locus and methodological focus. While previous studies have emphasized more general aspects of cultivation and post-harvest practices in various regions, this study specifically concentrates on Arabica coffee farmers in Cikidang Village who are members of the LMDH Mitra Sejati, with a particular emphasis on improving technical skills in cultivation and harvesting.

This distinction highlights the originality of the study, which provides extension activities tailored to the specific needs of Arabica coffee farmers in Cikidang Village, who have not previously received such programs. Thus, this research not only extends previous scholarly work but also broadens the perspective by incorporating local contexts and farmers' wisdom in managing coffee as a regional flagship commodity.

The urgency of this study lies in the necessity of improving farmers' knowledge and technical skills to maintain the quality of Arabica coffee, which is a strategic commodity at both national and global levels. The limited understanding of farmers in Cikidang Village directly affects harvest quality, making extension programs an essential instrument in sustaining productivity and enhancing the competitiveness of Arabica coffee. Therefore, the implementation of this activity is expected to serve as a model for farmer capacity development that can be replicated in other coffee-producing regions. Based on the above background, the purpose of this study is to enhance the knowledge and skills of Arabica coffee farmers in Cikidang Village in cultivation and harvesting practices, thereby supporting improvements in production quality and ensuring the sustainability of Arabica coffee development in the region.

B. LITERATURE REVIEW

Human Capital

Human capital theory explains that individuals' skills, knowledge, and competencies are critical assets that determine their productivity and economic performance (Becker, 1993). This theory emphasizes the role of education, training, and experience as investments that enhance individual capabilities and contribute to better outcomes. In the agricultural context,

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human capital development through technical training can directly influence the quality of production and income of farmers (Schultz, 1961). The theory also highlights that the accumulation of knowledge and skills is a long-term process that requires continuous reinforcement (Sweetland, 1996). Therefore, improving farmers' capacity in cultivation and harvesting is aligned with the notion of human capital as a driver of sustainable productivity. Indicators:

- Education and training level
- Technical skills in cultivation and harvesting
- Work experience and farming practices
- Productivity and income outcomes

Capacity Building

Capacity building theory refers to the process of strengthening the abilities, skills, and resources of individuals and groups to achieve sustainable development (Eade, 1997). It emphasizes empowerment, learning, and institutional support as central elements for improving organizational or community effectiveness (Lusthaus et al., 1999). In the agricultural sector, capacity building aims to equip farmers with the necessary knowledge and practices to enhance their resilience and competitiveness. This theory views training and mentoring as tools to improve both technical competencies and long-term awareness of sustainable farming. Hence, capacity building ensures that interventions are not merely short-term but lead to enduring change and self-reliance. Indicators:

- Knowledge enhancement
- Technical skills improvement
- Institutional support and mentoring
- Sustainability of practices

Diffusion of Innovation

Diffusion of innovation theory explains how new ideas, practices, or technologies spread within a social system over time (Rogers, 2003). The theory identifies innovation adoption as a process influenced by communication channels, time, and social structures. In agricultural communities, diffusion often occurs through farmer-to-farmer interactions, training programs, and institutional support. The adoption of improved cultivation and harvesting practices depends on farmers' perceptions of the relative advantage, compatibility, and simplicity of the innovations. This theory is relevant in understanding how training programs can accelerate the dissemination of good practices among Arabica coffee farmers. Indicators:

- Awareness and knowledge of innovation
- Perceived benefits and advantages
- Adoption rate among farmers
- Communication and peer influence

C. RESEARCH METHODOLOGY

This study employed a qualitative descriptive method, which is appropriate for capturing the complexity of social phenomena and providing in-depth understanding of specific contexts (Creswell, 2014). The use of a qualitative descriptive approach is relevant because the research focuses on exploring farmers' knowledge, skills, and perceptions regarding Arabica coffee cultivation and harvesting. Moreover, this method is suitable for community-based studies where the aim is to identify challenges and design practical solutions for capacity building. The choice of this method aligns with the research objective, which is not to generalize findings but to obtain rich insights into the local practices of farmers in Cikidang Village. Therefore, the qualitative descriptive approach allows the study

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to highlight the relevance of technical training interventions in enhancing farmers' competence.

Data Collection Techniques. The primary data collection was conducted through Focus Group Discussion (FGD) and extension lectures (ceramah/penyuluhan). The FGD was held with members of the Mitra Sejati farmer group to capture shared experiences, constraints, and expectations related to coffee cultivation and harvesting. In addition, structured lectures were delivered to provide theoretical knowledge, followed by interactive discussions and question-and-answer sessions. This approach allowed researchers to obtain both collective perspectives and individual reflections from participants.

Sampling Technique**.** The sampling technique used was purposive sampling, as the study specifically targeted Arabica coffee farmers in Cikidang Village who are members of the Mitra Sejati farmer group (Patton, 2015). This technique was chosen because the farmers involved were directly relevant to the research objectives and represented the population facing the identified challenges. In this context, purposive sampling ensured that participants had practical experience in cultivation and harvesting, thereby increasing the validity of the information collected.

Data Analysis Technique. Data analysis was carried out using thematic analysis, which is suitable for identifying, analyzing, and reporting patterns within qualitative data (Braun & Clarke, 2006). The process included data reduction, data display, and conclusion drawing, which enabled the researcher to systematically interpret participants' insights. Themes such as knowledge gaps, technical challenges, and perceived benefits of training were identified and categorized. Thematic analysis thus provided a structured approach to highlight how training and mentoring interventions could enhance farmers' capacities in coffee cultivation and harvesting.

D. RESULTS & DISCUSSION

Conducting a Survey in Cikalong Village as an Initial Step

Figure 1. Community Service Al-Ghifari University Team

Source: Personal Documentation, (2025)

The first step of this activity was conducting a survey in Cikidang Village, Lembang District, with the aim of identifying the community's potential and challenges, particularly among coffee farmers. The survey revealed that the village possesses favorable natural conditions such as suitable altitude, climate, and soil fertility for Arabica coffee cultivation (Marianto et al., 2022). However, despite this ecological potential, the socioeconomic conditions of farmers showed limitations in access to knowledge, training, and farming innovation (Setyoko et al., 2023). This gap indicated that natural advantages alone are insufficient without adequate technical capacity and continuous support (Schultz, 1961). Therefore, the survey highlighted the urgent need to strengthen human capital to maximize agricultural outcomes.

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The results further indicated that farmers had limited knowledge of cultivation practices, particularly in nursery management, pruning, fertilization, and pest control. Such limitations have been noted in previous studies, where inadequate cultivation knowledge directly correlated with lower yields and declining product quality (Reta et al., 2021). Farmers also reported difficulties in identifying and managing common coffee pests and diseases, which often resulted in crop losses. This condition reflects broader challenges faced by smallholder coffee farmers in Indonesia, where lack of extension services exacerbates production inefficiencies (Metafindo et al., 2024). These findings suggest that technical training is essential to bridge the knowledge gap in cultivation.

Another key problem identified was the farmers' lack of skills in implementing proper harvesting practices. Most respondents admitted that harvesting was often carried out without considering the maturity level of coffee cherries, leading to inconsistencies in quality. Improper harvesting methods have been shown to significantly reduce the market value of Arabica coffee (Teniro & Zainudin, 2022). Furthermore, low awareness of post-harvest handling standards resulted in reduced competitiveness in both domestic and international markets (BPS Indonesia, 2024). This reinforces the argument that improving harvesting practices is crucial for enhancing the overall quality of Arabica coffee.

The survey also found that farmers' access to information and technology remains limited, with most relying solely on traditional knowledge and peer-to-peer learning. While local wisdom contributes to maintaining cultural identity in farming, the absence of scientific and technical integration often constrains productivity (Payong et al., 2021). Farmers expressed a need for structured extension programs that combine theoretical knowledge with practical demonstrations. Previous research emphasized that participatory approaches such as focus group discussions and field training are effective in encouraging farmer adoption of best practices (Di & Belantih, 2024). This indicates that extension models tailored to local contexts may yield more sustainable outcomes.

Overall, the survey findings confirmed that Cikidang Village has both strengths and weaknesses in developing Arabica coffee. Its natural potential positions it as a promising coffee-producing area, yet farmers' limited technical knowledge, insufficient pest management, and poor harvesting practices hinder productivity and quality. These challenges are consistent with prior studies on smallholder coffee farming in Indonesia, yet they also reveal specific local barriers unique to Cikidang Village (Widiyanto et al., 2024). Consequently, this research emphasizes the importance of targeted training and mentoring programs to improve farmers' skills in both cultivation and harvesting. Addressing these challenges is essential not only for enhancing farmer welfare but also for ensuring the sustainability of Arabica coffee as a strategic commodity.

Figure 2. Survey conducted by the Community Service Team with coffee farmers in Cikidang Village

Source: Researcher's Documentation, (2025)

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As a follow-up to the survey results, coordination was carried out with the Agricultural Extension Agency (BPP) of Lembang District to formulate a responsive intervention program. Agricultural extension institutions play a critical role in bridging the knowledge gap between farmers and modern agricultural practices (Anderson & Feder, 2007). The discussion with BPP highlighted the need for a participatory approach that not only transfers knowledge but also builds farmers' confidence in applying improved techniques (Davis et al., 2020). Such coordination ensured that the intervention program would align with both institutional resources and local needs. Thus, the planning stage was crucial to guarantee that the program would be accepted and effectively implemented in Cikidang Village.

Based on the discussion, an agreement was reached to conduct Technical Guidance (Bimbingan Teknis/Bimtek) and a Focus Group Discussion (FGD) involving the Mitra Sejati Farmer Group. Bimtek is widely recognized as an effective extension method for enhancing farmers' technical skills through structured instruction and field demonstrations (Rivera & Qamar, 2003). Meanwhile, FGDs serve as a participatory forum that allows farmers to share experiences, articulate problems, and co-develop solutions (Krueger & Casey, 2014). The combination of these two approaches reflects a holistic model of farmer empowerment that integrates both knowledge transfer and collective problem-solving. Therefore, the agreed intervention was designed not only as a top-down activity but also as a collaborative process.

The implementation of the technical guidance was carried out in the coffee plantation owned by one of the Mitra Sejati farmer group members, with 25 Arabica coffee farmers participating. The activity included a structured presentation on cultivation and harvesting practices, followed by interactive discussions and question-and-answer sessions. Holding the training in a real plantation setting enabled farmers to immediately relate theory to practice, thereby increasing relevance and applicability. The participation of 25 farmers demonstrated strong community interest, as well as the potential for wider diffusion of knowledge within the group. This activity marked the first structured technical guidance specifically tailored for Arabica coffee farmers in Cikidang Village, making it a milestone in local capacity-building efforts.

Methods Used in Technical Guidance

Figure 3. Coordination with the Agricultural Extension Agency of Lembang Sub-district

Source**:** Researcher's Documentation, (2025)

The methods employed in the technical guidance consisted of lectures, discussions, and field demonstrations. The lecture method is considered effective in delivering structured knowledge and theoretical concepts to participants (Brookfield, 2013). Meanwhile, the discussion method allows farmers to exchange experiences, clarify misunderstandings, and collectively build understanding on agricultural practices (Bryman, 2016). Field demonstrations, on the other hand, provide opportunities for farmers to directly observe and practice techniques, thus enhancing their learning outcomes (Anderson & Feder, 2007). By

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combining these three approaches, the Bimtek activity aimed to address different learning styles and maximize the effectiveness of knowledge transfer.

The main resource person in the Bimtek was Mr. Djamaludin, SP., from the Agricultural Extension Agency (BPP) of Lembang District, who presented materials specifically related to Arabica coffee cultivation techniques. The use of professional extension agents as facilitators is crucial, as they possess both technical expertise and the ability to communicate effectively with local farmers (Davis et al., 2020). The material was designed not only to provide information but also to stimulate critical thinking about sustainable agricultural practices. This approach reflects the principle that effective agricultural extension requires both expert knowledge and the ability to contextualize it within the farmers' local conditions (Rivera & Qamar, 2003). Thus, the choice of facilitator strengthened the credibility and relevance of the program.

The topics covered during the session included the selection of superior coffee varieties, proper pruning techniques, balanced fertilization, pest and disease control, and harvesting methods. In addition, the trainer emphasized the importance of managing shade trees to maintain microclimate stability, which is vital for Arabica coffee. A significant highlight was the selective harvesting technique known as petik merah (red-picking), which ensures that only ripe cherries are harvested to preserve coffee quality. Delivering such technical guidance in a field setting enabled participants to immediately connect theory with practice. This integration of knowledge and practice made the Bimtek more applicable and directly beneficial to the farmers in Cikidang Village.

Figure 4. Implementation of Technical Guidance on Arabica Coffee Cultivation and Harvesting Techniques

Source: Researcher's Documentation, (2025)

The implementation of technical guidance provided practical insights for coffee farmers in Cikidang Village regarding proper Arabica coffee cultivation practices. Farmers were introduced to various essential aspects of cultivation, ranging from land preparation, pruning, fertilization, pest and disease management, to selective harvesting techniques. This comprehensive exposure was designed to ensure that participants not only understood theoretical concepts but also gained practical skills applicable to their farming activities (Anderson & Feder, 2007). The emphasis on participatory learning helped farmers to relate new knowledge with their existing practices. Consequently, the activity served as both an educational and motivational tool for improving farming techniques.

Based on discussions and field observations, it became evident that the majority of participants had not previously applied optimal cultivation practices. Common issues included improper pruning, irregular fertilization, and lack of awareness regarding integrated pest management. These findings are consistent with studies that indicate limited technical knowledge as a primary constraint in smallholder coffee farming systems (Byrareddy et al.,

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2019). The technical guidance thus functioned as a corrective measure, bridging knowledge gaps that had directly impacted productivity and coffee quality. Furthermore, the process revealed that farmers were highly receptive to practical demonstrations, particularly in pest control and harvesting techniques.

The session also underscored the importance of continuous guidance to ensure sustainability of the introduced practices. While the one-day technical guidance was effective in raising awareness, long-term improvement requires consistent mentoring and follow-up interventions (Davis et al., 2020). Without ongoing support, there is a risk that farmers may revert to traditional methods that are less effective in ensuring productivity and quality. Therefore, the Bimtek activity highlighted not only the immediate benefits of technical training but also the need for an integrated extension system tailored to the specific context of Arabica coffee farmers in Cikidang Village. This aligns with previous research stressing the role of localized extension programs in sustaining agricultural innovation (Rivera & Qamar, 2003).

Technical Aspects of Arabica Coffee Farming

The technical guidance (Bimtek) conducted in Cikidang Village revealed several key aspects of Arabica coffee cultivation that are essential to improving both productivity and quality. Farmers' limited knowledge and inconsistent practices in cultivation, fertilization, pest management, and harvesting were identified as the main challenges affecting the sustainability of coffee farming in the region. Therefore, the training sessions focused on three fundamental components of Arabica coffee management, namely cultivation practices, fertilization and pest control, and harvesting techniques. These three elements are interrelated, as proper cultivation ensures healthy plant growth, adequate fertilization and pest control sustain productivity, and appropriate harvesting techniques determine the quality and market value of the coffee. The following discussion elaborates on each component in detail, supported by theoretical perspectives and empirical findings from the field.

Figure 5. Arabica Coffee in Cikidang Village

Source: Researcher's Documentation, (2025)

1. Cultivation of Arabica Coffee

The cultivation of Arabica coffee requires careful attention to the selection of varieties, initial treatment, and pruning practices. According to Subantoro and Aziz (2019), pruning techniques in coffee plants are divided into three categories: form pruning, maintenance or production pruning, and rejuvenation pruning. Maintenance pruning is essential to maintain a balanced plant structure while removing non-productive branches. This method helps to maximize sunlight penetration and nutrient distribution within the tree canopy, thereby supporting productivity. As reinforced by the technical guidance delivered by Djamaludin,

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SP., in Cikidang, pruning practices were emphasized as a critical foundation for sustainable Arabica coffee cultivation.

2. Fertilization and Pest Control

Fertilization and integrated pest management (IPM) were also key issues addressed during the training. Haryanto et al. (2019) state that Arabica coffee should ideally be fertilized twice a year, incorporating both inorganic and organic fertilizers. During the technical guidance, local solutions such as the use of compost derived from coffee husks were introduced, which aligns with sustainable agricultural practices. At the same time, the presence of coffee leaf rust (Hemileia vastatrix) in several local farms highlighted the need for IPM as a preventive and curative measure. This dual approach—sustainable fertilization and IPM was presented as essential for maintaining plant health and ensuring stable yields.

3. Harvesting Techniques

Harvesting is another determinant of coffee quality, particularly in Arabica varieties. According to Badrudin and Lu (2019), proper harvesting requires preparation such as cleaning the ground area under coffee trees to ensure fallen cherries can be identified and collected efficiently. Moreover, the Indonesian National Standard (SNI 01-2907-2008) emphasizes the importance of selective harvesting using the "red cherry picking" method, which ensures high-quality coffee beans. As noted by Reta et al. (2021), cherry ripeness can be identified through color changes, from green to yellow to bright red at full maturity, and finally black when overripe. In practice, farmers in Cikidang previously conducted mixed harvesting—collecting both red and green cherries which significantly reduced coffee quality. The technical guidance highlighted that selective harvesting not only improves bean quality and market value but also enhances the sensory profile of Arabica coffee.

The integration of cultivation practices, fertilization and pest control, and harvesting techniques represents a holistic approach to improving the quality and productivity of Arabica coffee farming in Desa Cikidang. Proper cultivation ensures healthy plant growth, while balanced fertilization and integrated pest management safeguard the sustainability of the crop against biotic and abiotic stresses. Selective harvesting, particularly the "red cherry" method, adds significant value by enhancing both the taste profile and market price of the coffee produced. Together, these practices not only address the challenges faced by local farmers but also strengthen their capacity to compete in the specialty coffee market. Thus, the adoption of these technical improvements becomes a critical pathway for enhancing farmer livelihoods and advancing rural economic development.

E. CONCLUSION

This study concludes that the technical guidance conducted in Cikidang Village successfully enhanced farmers' knowledge and skills in Arabica coffee cultivation and harvesting, thereby addressing the initial problems of limited technical understanding and inconsistent farming practices. The findings demonstrate that interventions such as structured training, participatory discussions, and field demonstrations are effective in bridging knowledge gaps and improving coffee quality, which confirms that the research objectives have been achieved. The originality of this study lies in its localized approach, tailored to the specific needs of Cikidang farmers, thus contributing new insights to community-based capacity-building models in coffee farming. Practically, it is recommended that agricultural extension agencies and farmer groups continue regular technical training and mentoring to sustain improvements in cultivation and harvesting practices. For future research, longitudinal studies using mixed methods are suggested to evaluate long-term adoption and impact, while acknowledging the limitation of this study which only involved a one-day intervention. Policy implications include the need for local governments to support farmer

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capacity-building programs as part of rural development strategies to strengthen the competitiveness of Indonesia's Arabica coffee in global markets.

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