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INSTITUTIONAL AND CULTURAL DRIVERS OF REFORESTATION AWARENESS AMONG COFFEE FARMERS: A CASE STUDY IN PALINTANG VILLAGE, WEST JAVA

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Abstract

This study investigates the influence of the Microlot Coffee Program and coffee production culture on farmers' reforestation awareness in Indonesia. The research is motivated by increasing concerns over deforestation, land degradation, and the need for sustainable agriculture in rural coffee-producing areas. Based on these environmental challenges, the study hypothesizes that both the microlot program and production culture significantly enhance reforestation awareness among smallholder coffee farmers. A quantitative research approach using Partial Least Squares Structural Equation Modeling (SEM-PLS) was employed to test the proposed relationships. Data were collected from 100 coffee farmers in Palintang Village, West Java, through structured questionnaires developed based on validated constructs. The analysis revealed that the microlot coffee program has a positive and significant effect on reforestation awareness ($\beta = 0.45$, $p < 0.01$), as does coffee production culture ($\beta = 0.38$, $p < 0.01$). The model explains 60% of the variance in reforestation awareness ($R^2 = 0.60$). The novelty of this study lies in its interdisciplinary integration of sustainability practices with cultural production norms in coffee farming—an area rarely examined in the context of agroforestry awareness. The findings offer both theoretical insight into the socio-cultural drivers of environmental behavior and practical recommendations for agro-environmental policy and program implementation. By highlighting the combined impact of institutional programs and local traditions, this study contributes to a broader understanding of sustainable rural development in agrarian communities.

Keywords: Microlot Coffee Program, Production Culture, Reforestation Awareness, SEM, Coffee Farmers.

1. Introduction

The In recent decades, deforestation and climate change have become major global concerns, particularly in countries like Indonesia, which heavily relies on the agricultural sector. Unsustainable farming practices have led to the destruction of tropical forests, resulting in less effective ecosystems and an increased risk of natural disasters and environmental degradation. Among various agricultural industries, Indonesia's coffee industry has a direct impact on the surrounding environment and plays a significant role in the nation's economy. Therefore, to maintain ecological balance, coffee farmers must adopt sustainable farming practices such as reforestation (Perfecto & Vandermeer, 2015).

One effective method to mitigate the effects of deforestation, restore biodiversity, and combat climate change is reforestation, which involves the replanting of degraded or deforested areas (Chazdon, 2008). However, the

importance of reforestation is often underappreciated within coffee farming communities. Factors such as farmers' education levels, environmental awareness, and economic incentives influence their reforestation awareness. The microlot coffee program, implemented by various agricultural organizations and foundations in Indonesia, is one initiative with the potential to enhance reforestation awareness.

Through the microlot coffee program, farmers can produce high-quality coffee by adopting more controlled and sustainable agricultural practices (Bacon, 2005). This program adds value to farmers' coffee by enabling them to sell it at premium prices in international markets. In addition to increasing income, the program educates farmers on environmentally friendly farming techniques, such as tree planting, enabling them to maintain sustainable and eco-friendly coffee production (Philpott et al., 2008). The program not only enhances the quality of coffee products but also raises awareness about the importance of preserving local ecosystems.

Besides the microlot coffee program, local culture also influences farmers' environmental awareness in managing coffee production, including tree planting activities. Production management culture encompasses norms, practices, and traditions passed down through generations in coffee plantation management. In many farming communities, traditional practices have the potential to be integrated with modern sustainability principles (Altieri & Toledo, 2011). Therefore, an organizational culture of coffee production that supports sustainability can be a key factor in improving coffee farmers' awareness of reforestation.

In recent decades, deforestation and climate change have emerged as pressing global concerns, with severe implications for countries like Indonesia, where the agricultural sector plays a crucial economic role. Indonesia lost over 9 million hectares of tree cover between 2001 and 2021, contributing significantly to greenhouse gas emissions and ecosystem degradation (Global Forest Watch, 2022). Within this context, the coffee industry holds strategic importance—not only economically, as Indonesia ranks among the world's top coffee exporters—but also environmentally, as coffee plantations are often located in highland ecosystems vulnerable to deforestation.

Despite increasing awareness of sustainable agriculture, many smallholder coffee farmers continue to adopt practices that degrade land and forest cover. Reforestation, defined as the process of replanting trees in deforested areas, is a proven strategy for restoring ecological balance, enhancing biodiversity, and sustaining long-term agricultural productivity (Chazdon, 2008). Yet, among rural farming communities, reforestation awareness is often low due to socioeconomic constraints and limited access to environmental education.

This research seeks to investigate the factors that influence reforestation awareness, focusing specifically on the Microlot Coffee Program and coffee production culture in Palintang Village, West Java. The village represents a critical site for study due to its active participation in community-based agroforestry programs and its proximity to conservation zones that are under ecological pressure. The Microlot Coffee Program—initiated by the Tani Layangsari Foundation—aims not only to improve coffee quality and income but also to promote environmentally friendly practices. Similarly, local coffee production culture, which reflects inherited values and customary practices, may play a key role in shaping farmers' environmental attitudes.

Although several studies have examined the socioeconomic benefits of

microlot programs (Bacon, 2005; Arifin, 2018), few have explored how these initiatives intersect with cultural norms to influence environmental behaviors such as reforestation. Moreover, existing literature has yet to establish a comprehensive framework linking programmatic interventions, production culture, and ecological awareness using robust empirical methods.

This study addresses these gaps by analyzing how participation in microlot programs and adherence to traditional coffee production culture influence farmers' reforestation awareness. Using Structural Equation Modeling (SEM-PLS), the research draws on survey data from 100 coffee farmers in Palintang Village to test hypothesized relationships between these variables. The findings are expected to offer both theoretical and practical insights into how agricultural policy and community-based programs can support environmental sustainability in rural Indonesia.

2. Literature Review

Reforestation is a critical component in addressing climate change and restoring degraded landscapes, particularly in regions with high rates of deforestation such as Indonesia. Reforestation not only contributes to carbon sequestration and biodiversity conservation, but also enhances the long-term viability of agriculture-based livelihoods (Chazdon, 2008; Anderson et al., 2016). However, the motivation of smallholder farmers to engage in reforestation efforts often depends on economic incentives, education, and institutional support.

In the context of smallholder coffee production, the **Microlot Coffee Program** is a sustainability-driven initiative designed to enhance both the quality and market value of coffee through precision farming and traceability. More importantly, it promotes sustainable practices including agroforestry, shade-grown systems, and soil conservation (Philpott et al., 2008; Bacon, 2005). Previous studies have shown that farmers participating in microlot or specialty coffee programs often exhibit greater environmental awareness and willingness to adopt agroecological methods (Perfecto & Vandermeer, 2015). However, most of these studies emphasize economic outcomes, and there is limited empirical work examining how such programs influence environmental behaviors—particularly reforestation awareness—in the Indonesian context.

Another critical but often overlooked factor is the **production culture** embedded in local farming practices. Culture, in this sense, encompasses the traditional norms, values, and practices inherited through generations of agricultural management. As Altieri & Toledo (2011) argue, integrating agroecology with local knowledge systems can lead to more resilient and ecologically sound farming models. In many agrarian communities, these traditional beliefs may include spiritual or customary obligations to preserve forest cover and practice mixed-cropping with perennial species. Yet, the influence of production culture on behavioral outcomes like reforestation awareness remains underexplored in empirical studies.

Studies from other regions, such as Latin America and East Africa, have found that cultural institutions can significantly shape land-use decisions (Dewees et al., 2011; Pretty, 2003). For example, in Rwanda and Ethiopia, community coffee cooperatives that emphasize traditional land ethics have been linked to better forest cover outcomes. These comparative insights underscore the need to understand how

cultural production norms interact with formal sustainability programs like microlot initiatives. Based on this theoretical background, the present study proposes an integrated framework that combines institutional program participation (Microlot Coffee Program) and socio-cultural context (Production Culture) to explain variations in reforestation awareness among coffee farmers. The framework addresses a notable **research gap** by examining whether and how cultural and programmatic factors jointly influence pro-environmental behavior in the Indonesian agricultural sector.

Hypotheses:

- **H_1**: Participation in the Microlot Coffee Program has a positive and significant influence on coffee farmers' reforestation awareness.
- **H_2**: Coffee production culture has a positive and significant influence on coffee farmers' reforestation awareness.

3. Research Methods

This study employs a causal quantitative research design to analyze the influence of the Microlot Coffee Program and coffee production culture on farmers' reforestation awareness. The objective is to test the hypothesized structural relationships between the variables using a Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The research was conducted in Palintang Village, Cipanjalu, Cilengkrang District, Bandung Regency, West Java—an area actively involved in coffee cultivation and home to a microlot program initiated by the Tani Layangsari Foundation.

The population consists of 150 coffee farmers actively participating in the microlot program. A simple random sampling technique was applied to minimize bias and ensure generalizability within the community. The sample size of 100 was determined using Slovin's formula with a 10% margin of error. The sample size was determined using the Slovin formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- **n** = sample size
- **N** = population size
- **e** = margin of error (set at 10% in this study).

Using the Slovin formula with a 10% margin of error, the required sample size was calculated to be 100 respondents. The research instrument was a closed-ended questionnaire with a 5-point Likert scale, where respondents were asked to rate their responses from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was divided into three main sections measuring the variables: Microlot Coffee Program (X1), Coffee Production Culture (X2), and Reforestation Awareness (Y). The questionnaire was tested for validity and reliability before being used to collect primary data.

Validity testing was conducted using Confirmatory Factor Analysis (CFA) to ensure that the factor loadings for each questionnaire item exceeded 0.5, indicating that the items were valid. Reliability testing was performed using the Cronbach's alpha method, and each variable achieved an alpha value greater than 0.7, indicating good consistency. Data were collected by distributing the questionnaires directly to coffee farmers participating in the microlot coffee program in Palintang Village. Before filling out the questionnaires, respondents were informed about the purpose of the study and provided with guidance on how to correctly complete the questionnaires. The data collection process lasted for one month, with respondents independently completing the questionnaires. Respondents who had difficulty understanding certain points were provided with additional clarification by the researchers. The collected data were analyzed using Structural Equation Modeling (SEM) with SEM-PLS software. SEM was chosen as it allows for the analysis of causal relationships between latent variables measured by multiple indicators.

4. Results and Discussions

This section presents the results of the SEM-PLS analysis, including descriptive statistics, measurement model evaluation, structural path analysis, model fit, and theoretical discussion. The structural model was tested using SmartPLS 3.3.9 with 5,000 bootstrap resamples. These results indicate that farmers generally have high awareness of reforestation and a favorable perception of microlot coffee programs and traditional production practices.

Table 1. Research Description

Variabel	Mean	Standar Deviasi
Program Kopi Mikrolot (X1)	4.10	0.63
Budaya Penataan Produksi Kopi (X2)	3.95	0.68
Kesadaran Reforestasi (Y)	4.25	0.55

Source: Processed by the Researcher

From the table above, respondents indicated that, on average, the microlot coffee program and the culture structuring coffee production positively impacted their awareness of tree planting. The higher mean value for the tree planting awareness variable (4.25) suggests that the majority of respondents have a high level of awareness regarding the importance of tree planting. To test the validity and reliability of the research instruments, Confirmatory Factor Analysis (CFA) and Cronbach's alpha tests were conducted. The results of the CFA showed that the loading coefficients for all indicators were greater than 0.50, indicating that all indicators are valid. The reliability test results using Cronbach's alpha for each variable are as follows:

Table 2. Validity and Reliability

Variabel	Cronbach's Alpha
Program Kopi Mikrolot (X1)	0.81
Budaya Penataan Produksi Kopi (X2)	0.79
Kesadaran Reforestasi (Y)	0.84

Source: Processed by the Researcher

A Cronbach's alpha value greater than 0.7 for each variable indicates good internal consistency of the instrument. Structural Equation Modeling (SEM) analysis was conducted to assess how well the proposed model explains the relationships between variables. The R^2 value of 0.60 for reforestation awareness indicates that both independent variables explain 60% of the variance in the dependent variable. This represents a strong explanatory model within the behavioral science domain (Hair et al., 2020). No evidence of multicollinearity was found (all VIF values < 3), supporting the model's robustness.The results of the goodness-of-fit test for the estimated model are as follows:

Table 3. SEM Model Test and Goodness of Fit

Indeks Fit	Nilai	Kriteria Fit
Chi-square/df	1.85	< 3
Goodness of Fit Index (GFI)	0.92	> 0.90
Adjusted Goodness of Fit Index (AGFI)	0.89	> 0.80
Root Mean Square Error of Approximation (RMSEA)	0.05	< 0.08
Comparative Fit Index (CFI)	0.95	> 0.90

Source: Processed by the Researcher

The test results indicate that the SEM model has a good fit, meaning that the model is suitable for analyzing the causal relationships between the microlot coffee program and the culture of coffee production management on plantation awareness. After confirming the SEM model's suitability, a path analysis was conducted to examine the direct effects of the microlot coffee program (X1) and the structured coffee production culture (X2) on tree planting awareness (Y). The results of the path analysis are as follows:

Table 4. Path Analysis

Hubungan	Koefisien Jalur	t-value	p-value
Program Kopi Mikrolot (X1) -> Kesadaran Reforestasi (Y)	0.45	5.67	< 0.01
Budaya Penataan Produksi Kopi (X2) -> Kesadaran Reforestasi (Y)	0.38	4.21	< 0.01

Source: Processed by the Researcher

Based on the path analysis results, the two independent variables—Structured Coffee Production Culture and the Microlot Coffee Program—positively and significantly influence reforestation awareness. A path coefficient of 0.45 indicates that the Microlot Coffee Program has a greater influence than Structured Coffee Production Culture, which has a coefficient of 0.38. The coefficient of determination (R^2) was used to determine how much of the variation in the dependent variable (Y) can be explained by the independent variables (X1 and X2).

The results show that the R^2 value for Reforestation Awareness is 0.60, indicating that 60% of the variation in Reforestation Awareness can be explained by the Microlot Coffee Program and Structured Coffee Production Culture.

5. Conclusions and Recommendations

This study concludes that both the Microlot Coffee Program and the culture of coffee production significantly contribute to enhancing reforestation awareness among coffee farmers in Palintang Village, West Java. The results indicate that the Microlot Coffee Program has a stronger influence ($\beta = 0.45$, $p < 0.01$) than production culture ($\beta = 0.38$, $p < 0.01$), with both variables collectively explaining 60% of the variance in farmers' awareness of reforestation ($R^2 = 0.60$). These findings affirm that sustainable behavior in rural agricultural communities is shaped not only by external institutional interventions but also by the internalized values rooted in local culture.

Theoretically, this research offers an original contribution by synthesizing institutional development with socio-cultural traditions in the context of environmental sustainability. While previous studies have often examined these factors in isolation, this study demonstrates that their interaction is critical in shaping ecological awareness and behavioral change. This hybrid model serves as an important addition to the academic discourse on agroecology, particularly in developing country settings where traditional knowledge systems remain strong.

On a practical level, these findings call for a more holistic approach to rural environmental programs. Policymakers and program implementers should not only focus on technical training or market integration but also embed sustainability messages within the cultural narratives that farmers already recognize and respect. Strengthening the microlot model by integrating it with community-led traditions of land stewardship can create a more durable and community-owned pathway to ecological restoration.

Nevertheless, the study has several limitations that should be addressed in future research. The analysis was conducted in a single village, limiting the generalizability of the findings to broader contexts. Furthermore, while the model explains 60% of the variation in reforestation awareness, the remaining 40% suggests that other factors—such as environmental education, government policy incentives, media exposure, or the influence of NGOs—may also play important roles. Additionally, the cross-sectional design of the study does not allow for tracking long-term behavioral changes over time.

To advance this area of research, future studies should consider expanding the geographic coverage to include other regions with different ecological and cultural characteristics, and incorporate qualitative approaches to explore deeper motivational factors behind reforestation behavior. Longitudinal research designs could also help assess the enduring effects of microlot programs on land-use practices. Moreover, exploring additional predictors, such as spiritual values, peer influence, or digital environmental literacy, may enrich the explanatory power of future models.

From a policy perspective, the study recommends that sustainability initiatives in agricultural communities be designed in participatory ways that leverage local traditions. Programs should provide not only financial incentives such as price premiums for environmentally friendly coffee but also cultural

incentives that align with traditional land ethics. Training programs that combine technical agroforestry methods with storytelling and indigenous knowledge may prove especially effective. Additionally, governments and NGOs should consider creating enabling environments through supportive policy frameworks, reforestation subsidies, and recognition of farmer innovation.

In summary, this study affirms that reforestation awareness can be strengthened through the synergistic combination of structured institutional programs and local cultural capital. The microlot coffee model, when contextualized within traditional norms and values, emerges as a promising strategy for promoting ecological resilience and sustainable agricultural landscapes in Indonesia and beyond.

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