

OPTIMIZATION STRATEGY FOR COFFEE FARMERS HOUSEHOLD INCOME THROUGH GOAT FARMING INTEGRATION MODEL

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ABSTRACT

This study evaluates the income diversification strategy of coffee farmers in Bondowoso Regency through goat farming integration as a solution to economic vulnerability caused by price fluctuations and climate change. Using a quantitative descriptive method with purposive sampling of 60 respondents, the study applied farm business and SWOT analysis. The results revealed that this integration significantly boosted farmers' income by 116.49% per year. Furthermore, the use of livestock waste as organic fertilizer has been shown to reduce production costs by up to 35% and open up opportunities for coffee-goat-based agrotourism. As a policy implication, government support is needed in the form of technical assistance, easier access to capital, and strengthening farmer institutions.

Keywords: income diversification, coffee, goat livestock integration, agribusiness, farming

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INTRODUCTION

Indonesia maintains its position as a major global coffee producer, ranking fourth after Brazil, Vietnam, and Colombia. According to data from the Directorate General of Plantations (2023), national coffee production in 2022 reached 794.8 thousand tons, with smallholder plantations contributing over 95% to the production structure. Despite their crucial role at the macro level, smallholder coffee farmers remain trapped by various structural constraints that significantly limit their prosperity.

The fundamental problem facing smallholder coffee farmers is their heavy dependence on a single source of income, coffee bean sales. This income structure creates high economic vulnerability to often unpredictable fluctuations in coffee prices on the global market. According to data from the International Coffee Organization (ICO, 2023), the global coffee market has exhibited significant volatility over the past decade, peaking in 2018–2020, when drastic price declines directly impacted the welfare of coffee farmers in developing countries, including Indonesia.

In addition to price fluctuations, the coffee plantation sector now faces systemic threats from increasingly extreme climate change. Weather anomalies such as El Niño and La Niña not only trigger uncertainty in harvest calendars but also lead to drastic productivity declines and an escalation in attacks by Plant Pest Organisms (OPT) (Arifin, 2021). High reliance on monoculture

systems leaves farmers with limited room for resilience, amplifying their economic vulnerability when crop failures occur.

Income diversification is a proven effective strategy for reducing farmers' economic vulnerability. The concept of farm diversification refers to efforts to diversify production activities undertaken by farmers to generate income from various sources. One promising form of diversification that has been widely developed in various countries is crop-livestock integration.

Integrating goat farming with coffee plantations is a model of integrated farming that has significant potential for development. Goats are relatively easy to raise, adapt well to various environmental conditions, and require a relatively low initial investment. Goat manure can be used as an excellent organic fertilizer for coffee plants, reducing the ever-increasing cost of chemical fertilizers. Conversely, the coffee plants and the vegetation beneath them can provide green fodder for the goats.

Bondowoso Regency is one of Indonesia's leading Arabica coffee production centers, its reputation strengthened by obtaining Geographical Indication (GI) certification (Mulyono et al., 2020). However, this global recognition of quality has not been directly proportional to the standard of living of its farmers; the average income of farming households tends to stagnate and only barely covers subsistence needs. Given this situation, research on income diversification through goat farming integration has become an urgent agenda to create more stable and sustainable economic resilience for farmers (Hasan & Suciati, 2022).

The study aims to identify the profile of coffee farming in Bondowoso Regency and assess the feasibility of goat farming integration in the region. Furthermore, this study aims to analyze the contribution of the integration model to farmer income diversification and formulate a development strategy for its widespread adoption as a solution to improve coffee farmer welfare.

Based on the background outlined above, this study aims to comprehensively examine five key issues, including identifying the existing conditions of coffee farming and the structure of farmer incomes in Bondowoso Regency, analyzing the potential and economic feasibility of integrating goat farming into the coffee farming system, and evaluating the impact of this diversification on increasing total income and farmer welfare. Furthermore, this study explores the supporting and inhibiting factors in implementing the coffee-goat integration model to formulate an optimal strategy for developing a sustainable integrated farming system in the region. All of these issues are interrelated and will be addressed through a series of empirical analyses that integrate field data with relevant literature reviews.

RESEARCH METHODOLOGY

Research Location

This research took place in Bondowoso Regency, East Java, focusing on three coffee production centers: Sempol, Sumberwringin, and Sukosari Districts. These locations were selected purposively due to their position as the largest Arabica coffee production base in Bondowoso Regency and their representative agro-climatic characteristics for a coffee plantation ecosystem. The entire research program was conducted over an eight-month period, from March to October 2025.

Types and Approaches of Research

This research employs a quantitative descriptive method with a survey approach to generate an objective and measurable picture of farmer income profiles and the economic impact of

goat integration. To complement this data, this study also integrates a qualitative approach through in-depth interviews. The synergy of these two approaches aims to comprehensively explore the supporting factors and structural barriers to implementing the integration model in the field.

Population and Sample

The population of this study included all coffee farmers who were members of farmer groups at the research location, with a total of 320 farmer households. The sample was determined using a *purposive sampling technique* based on the following inclusion criteria: (1) having at least 5 years of coffee cultivation experience; (2) managing at least 0.5 hectares of land; and (3) being willing to actively participate as respondents. Based on these criteria, a sample of 60 farmers was determined, divided proportionally into two groups for comparative analysis purposes: 30 farmers who implemented an integrated coffee-livestock system and 30 farmers who implemented a monoculture system as a control.

Data Collection Techniques

Primary data was collected through structured interviews using a questionnaire that had passed validity and reliability tests. The questionnaire covered sociodemographic profiles, biophysical land conditions, coffee cultivation techniques, livestock management, and farm cost and income structures. Farmers' perceptions of the integration model were also explored to supplement the data. Secondary data was collected through documentation studies from relevant agencies such as the Department of Agriculture, the Agricultural Extension Center (BPP), the Central Statistics Agency (BPS), and relevant scientific literature.

Data Analysis

Data analysis in this study was conducted through four comprehensive stages: (1) farm business analysis to evaluate the cost structure, income, and efficiency through calculating the R/C ratio and B/C ratio; (2) comparative analysis using an independent t-test to dissect the significance of income differences between integrated and non-integrated farmers; (3) SWOT analysis to map the strategic position of implementing the integrated model based on internal and external factors; and (4) multiple linear regression analysis to identify determinants that significantly influence farmers' income levels.

RESULTS AND DISCUSSION

Respondent Characteristics

Based on the survey results, the demographic profile of respondents was dominated by the productive age group between 35–55 years (68.33%) with a relatively low educational background, namely the majority of elementary school graduates to junior high school (73.33%). Nevertheless, respondents have mature farming experience with an average duration of 18.5 years. In terms of land resources, the average land ownership was recorded at 1.2 hectares with a range of 0.5–3.5 hectares. In terms of land legality, the majority of respondents (58.33%) were tenants or cultivators, while the remaining 41.67% were landowners.

Existing Conditions of Coffee Farming

productivity of between 650–750 kg of dry coffee beans (green beans) per hectare, farmers earned a selling price of between Rp 27,000 and Rp 30,000 per kilogram for premium-quality Arabica varieties. However, profit margins remained depressed due to an inefficient production cost structure. cost dominated by purchases fertilizer (42%) and energy work (35%), while

pesticides and other costs contributed 12% and 11% respectively. The high dependence on fertilizers chemistry become determinant main thing that erodes profitability business farmer the .

Impact of Goat Farming Integration

The integration of goat farming with coffee plantations has had a significant impact on diversification and increased farmer incomes. Table 1 compares the income structure of coffee farmers before and after implementing the integration model.

Table 1. Comparison of Coffee Farmers' Income Before and After Goat Farming Integration

Component Income	Beforeb Integration (Rp/ year)	After Integration (Rp/ year)	Increase (%)
Sale Coffee beans	18,500,000	22,750,000	22.97%
Sale Goat / Products Cattle	-	9,600,000	100% (new)
Utilization Waste (Fertilizer) Organic)	0	3,200,000	100% (new)
Ecotourism / Agrotourism	0	4,500,000	100% (new)
Total Revenue	18,500,000	40,050,000	116.49%

Source : Processed primary data , 2023

Based on the data in Table 1, the implementation of goat farming integration has had a significant impact on the farmers' economic structure, with a 116.49% increase in total income—from IDR 18,500,000 to IDR 40,050,000 per hectare per year. This accumulated added value is the result of diversified income sources encompassing four main pillars: optimizing coffee productivity through independent organic fertilizer intake, livestock sales, commercializing surplus organic fertilizer, and utilizing the land's aesthetic value through agrotourism activities.

Financial Feasibility Analysis

Based on the results of the financial feasibility analysis, it shows that the coffee-goat integration model is feasible to be developed with an R/C ratio of 2.87 (more than 1), which means that every Rp1,000 of invested costs generates income of Rp2,870. The B/C ratio of 1.87 and the Net Present Value (NPV) of Rp124,500,000 at a discount rate of 12% indicate that investment in this integration model provides significant benefits. The average payback period is 2.3 years.

DISCUSSION AND RESULT

Ecological Synergy of Coffee-Goat Integration

The findings of this study confirm that the ecological synergy between the integration of goat farming and coffee farming has a significant positive impact on both production systems. The application of goat manure compost has been shown to increase soil organic matter content by an average of 28.5% within a single growing season. This transformation in soil quality directly improves physical structure, water retention capacity, and the availability of essential macro- and micronutrients for plants. These results reinforce the findings of Wibowo et al. (2021), who stated that substituting chemical fertilizers with organic fertilizers based on goat manure can accelerate Arabica coffee productivity by up to 23%.

On the other hand, the shady and humid microclimate of coffee plantations creates an ideal environment for the growth and health of goats. The use of legumes as intercrops under the coffee shade not only serves to conserve land but also provides a source of high-quality, protein-rich feed, thereby reducing operational costs. Furthermore, the diverse vegetation within the coffee plantation ecosystem plays a crucial role in reducing heat stress in livestock, which directly contributes to increased goat productivity.

Socio-Economic Dimension

From a socio-economic perspective, coffee-goat integration significantly strengthens the economic resilience of farming households through diversification of income sources. In the context of market volatility, income from the livestock sector plays a crucial role as an economic buffer when coffee prices fluctuate. This phenomenon validates the concept of livelihood diversification proposed by Ellis (2000), which asserts that diversification is a rational, adaptive strategy for rural communities to mitigate economic risk.

The implementation of this integration model has proven to have a significant impact on de-accelerating the migration of young workers from rural to urban areas. By increasing the economic profitability of coffee farming and livestock farming, the agricultural sector now has a competitive appeal for the younger generation. This phenomenon is a crucial instrument in ensuring the long-term sustainability of the coffee sector, while also mitigating the risk of a farmer regeneration crisis currently threatening rural areas.

Opportunities for Agrotourism Development

Therefore, one of the most interesting aspects of this research is the underexplored potential for developing coffee agrotourism based on livestock integration. The combination of coffee plantation landscapes with goat farming activities creates a unique educational tourism attraction, especially for urban tourists seeking to understand the coffee production process from start to finish. Several farmers who have developed agrotourism packages are able to generate an average additional income of Rp 4,500,000 per year from these activities.

Implementation Challenges and Barriers

Although this integrated model offers promising profitability, its implementation still faces several fundamental obstacles. Limited initial capital for procuring calf cattle is a primary obstacle for smallholder farmers with limited land area. Based on a SWOT analysis, the main weaknesses lie in low technical competency in livestock management, limited accessibility to veterinary services, and a fragmented supply chain that separates farmers from potential livestock markets. In this context, strengthening institutional support through farmer groups and cooperatives is a crucial instrument for systematically mitigating these obstacles.

Policy Recommendations

Based on the research findings, several policy recommendations can be proposed, including: optimizing existing potential. This study proposes four pillars of policy recommendations. This begins with financial support in the form of flexible soft loans, followed by strengthening extension materials that are more inclusive of livestock management aspects. Furthermore, facilitating the formation of solid farmer groups is needed to facilitate collaboration and strengthen farmers' bargaining position in the market. As a long-term measure, developing organic coffee certification integrated with the coffee-cattle model is highly recommended to increase global competitiveness and product selling value internationally.

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