

Sustainability Analysis of Farmers' Social Capital in Clove Farming in Bone Subdistrict, Bone Bolango Regency

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Abstract

Clove farming in Bone District, Bone Bolango Regency, is the primary source of livelihood for the community and a pillar of the regional spice agribusiness. This study aims to analyze the contribution of social capital to clove farmer activities and assess the level of sustainability of the farming business using a Multi-Aspect Sustainability Analysis (MSA) approach that covers environmental, social, economic, network, norm, trust, and farmer activity aspects. Data were obtained through in-depth interviews and structured questionnaires involving the local government and agricultural experts from the Gorontalo BRMP. The results showed that farmers are still highly dependent on social relationships among farmers, while cross-group collaboration and access to external institutions have not been optimally developed. Overall, the sustainability of farmers' social capital is classified as low sustainable with an average validation score of 40.29. The environmental aspect received the highest score (58.25), while the social, network, norm, trust, and farmer activity aspects showed low sustainable performance (>25). The economic aspect showed the lowest performance (22.17), which is categorized as unsustainable. A sensitivity analysis identified 37 influential attributes, including the separation and utilization of clove waste. Improving the sustainability of clove farming requires strategic interventions, particularly in the economic aspect through the planting of intercropping commodities, diversification of income sources, increased climate mitigation adaptation, and the use of organic fertilizers and pesticides.

Keywords: Clove Farming, Sustainability, Social Capital, Multiaspect Sustainability Analysis (MSA)

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INTRODUCTION

Indonesia has tropical natural resources that support the development of the agricultural sector, including the plantation sub-sector as a pillar of the rural economy. Among strategic plantation commodities, cloves occupy an important position due to their role in diversifying high-value commodities and their absorption capacity in domestic and international markets. The stable and even increasing demand is reflected in national export trends, which contribute to foreign exchange earnings and the income of agricultural businesses (Habun et al., 2022). From a regional development perspective, the success of clove management is not

only measured by production quantity, but also by the ability of the farming system to maintain its performance sustainably in the long term.

Clove plantations also play a strategic role in the national economy because most of their yield is absorbed by the kretek cigarette industry, while the rest meets the needs of the food, health, and medicine industries. With around 90% of cloves being used as raw material for kretek cigarettes, cloves have become a commodity that supports a large value chain from upstream to downstream, meaning that changes in the cultivation system will have a broad impact on farmers' welfare and local economic stability (Pranata & Heryanda, 2023). In the context of Gorontalo Province, cloves are part of the potential spice commodities. Production data shows a significant contribution, namely 1,263 tons in 2022 (Gorontalo Province Central Statistics Agency, 2023), with a total of 548,365 trees at the provincial level and 209,921 trees in Bone Bolango (Gorontalo Province Central Statistics Agency, 2024). These figures confirm that cloves are a regional agribusiness asset that requires serious attention to the sustainability of its system.

The Bone subdistrict in Bone Bolango Regency is one of the centers of clove cultivation that has been going on for generations. The majority of the community depends on agriculture and plantations for their livelihood, accompanied by additional work as fishermen or mining workers. In this context, clove farming income is a crucial issue for the survival of farming households and the sustainability of cultivation. However, farmers' capacity to withstand price fluctuations, climate uncertainty, and limited access to support is determined not only by economic capital but also by social capital. Social capital is understood as goodwill and resources that arise from social relationships that can be invested to obtain future benefits (Yunus et al., 2021). It manifests itself in networks, norms, and trust that encourage cooperation and collective decision-making in farming communities.

Conceptually, social capital is a factor that strengthens agricultural sustainability because it supports coordination, knowledge transfer, and access to external resources. In agricultural networks, the relationships between farmers, the government, extension workers, and supply chain actors create a space for collaboration that increases the efficiency and resilience of the production system (Moghfeli et al., 2023; Xie et al., 2024). When social capital is high, the positive influence of individual social networks on farmer participation also increases, enabling the provision of rural public goods to run more effectively (F. Chen et al., 2023). In other words, a general solution to strengthen the sustainability of clove cultivation cannot be achieved through technological interventions or price policies alone, but must be accompanied by the strengthening of the social structure of farmer communities as the foundation for collective management.

Recent empirical studies show that social capital contributes through several important channels. First, social capital helps farming communities mitigate the impacts of environmental change, for example through shared practices of land stewardship and adaptation to resource degradation (Savari et al., 2023). Second, social capital supports the ability to adapt to climate change, both through information exchange and the strengthening of solidarity among farmers (F. Chen et al., 2023; Cishahayo et al., 2023). This pathway is important in clove cultivation,

which is vulnerable to weather disturbances, pest attacks, and seasonal uncertainties that directly affect production and income.

Third and fourth, social capital has been shown to influence farmers' behavior and the welfare of farming households. Strong social relationships play a role in shaping cultivation decisions, the adoption of innovations, and compliance with resource management norms (R. He et al., 2022; Mahaarcha & Sirisunhirun, 2023; Zhang et al., 2020). At the same time, the accumulation of trust and healthy networks opens up opportunities for market access, institutional support, and social protection that encourage increased income and quality of life for farmers (K. He et al., 2016; Putra et al., 2017). Thus, specific solutions from the literature place social capital as a key variable that not only ensures ecological sustainability but also the socio-economic sustainability of farming.

However, in Gorontalo Province, studies on clove farmers have so far focused on economic dimensions such as commodity marketing (Suaib et al., 2018), marketing chains (Rauf et al., 2023), and the distribution of potential and marketing of spices (Yusup & Murtisari, 2024). Studies that explicitly analyze the social capital aspects of clove farmers have yet to be found. In fact, agricultural sustainability, especially for plantation commodities, requires an understanding of multiple dimensions, namely ecology, economy, and society, so that the sustainability status of the area can be measured comprehensively and used as a basis for policy formulation. This research gap emphasizes the urgency of studies on sustainability in terms of social capital in clove cultivation in Bone District.

Based on these conditions, this study aims to describe the social capital factors that shape the activities of clove farmers and analyze the sustainability status of social capital in environmental, economic, and social dimensions in Bone District, Bone Bolango Regency. The novelty of this research lies in its focus on sustainability analysis, which specifically places social capital through networks, norms, and trust as the main lens for understanding the resilience of the clove farming system in Gorontalo, an area that has not been extensively explored from a social institutional perspective. The scope of the research is limited to the clove farmer community and related actors in Bone Subdistrict, with an emphasis on how social capital contributes to the sustainability of cultivation activities and the direction of policy strengthening in the future.

METHODOLOGY

This study uses mixed methods that integrate qualitative and quantitative approaches to obtain a comprehensive picture of social capital and the sustainability of clove farming (Sugiyono, 2015). The study was conducted purposively in Bone District, Bone Bolango Regency, from July to September 2025.

Research Population and Sample

This study used snowball sampling. The target population was determined based on the characteristics of respondents who had a direct connection with the research object and variables. Sampling began with farmers and then continued with references from policy makers and local government officials in Bone Subdistrict who met the criteria, so that the sample was able to cover various perspectives related to clove farming practices and policies. The sampling process continued until

a sufficient number of respondents was obtained to support the Multiaspect Sustainability Analysis (MSA). The research respondents consisted of local government officials, representatives of relevant agencies, experts (social, economic, and environmental), and farmers (± 10 people).

Data Collection Techniques

Primary data was collected through structured in-depth interviews, field observations, and focus group discussions. The interview guide was compiled in written statements to ensure consistency between informants (Sugiono, 2018). Observations were conducted to capture actual cultivation practices and social relationships (Poerwandari, 1998). Secondary data was obtained from journals, reports, and related documents.

Data Analysis Techniques

Qualitative data was analyzed using Miles and Huberman's interactive model (Sugiyono, 2015): reduction, presentation, and verification. Sustainability status is calculated using Multiaspect Sustainability Analysis based on seven aspects; this method is suitable for attribute assessment by experts and is capable of measuring multi-dimensional sustainability (Santoso et al., 2023; Widatmaka et al., 2015). Sensitivity analysis produced leverage factors and improvement scenarios, following the procedure described by Firmansyah (2022).

RESULTS AND DISCUSSION

Contribution of Social Capital Factors to Farmers' Activities

The results of the study show that social capital plays a strategic role in determining the quality and sustainability of clove farmers' activities in Bone District, Bone Bolango Regency. Social capital, which includes social networks, norms, and trust, not only supports the production process but also influences farmers' access to information, institutional support, and markets.

In terms of social networks, relationships between farmers are still dominated by informal networks based on kinship and social proximity. These networks function in the exchange of technical information, labor, and cultivation experience, but have not been able to optimally encourage market access and innovation. This condition is in line with the findings of Said (2012) and Ali et al. (2023), which confirm the strength of bonding social capital and the weakness of bridging and linking social capital in traditional farming communities. Pada aspek norma sosial, praktik gotong royong dan musyawarah masih menjadi mekanisme utama dalam pengelolaan kelompok, meskipun partisipasi anggota belum merata. Norma tradisional mampu memperkuat solidaritas sosial, tetapi belum sepenuhnya membentuk tata kelola kelembagaan yang adaptif tanpa dukungan struktur formal, sebagaimana ditunjukkan oleh Wulandari & Kurniati (2025) dan Ketaren (2015). In terms of trust, farmers show a high level of trust in internal interactions, such as tool lending and knowledge exchange, but trust in formal institutions and external partners remains low. Overall, the social capital of clove farmers is still dominated by bonding social capital, while bridging and linking capital have not developed optimally, thus failing to drive agricultural transformation towards a more modern, adaptive, and market-connected system.

Multiaspect Sustainability Analysis Results

Sustainability evaluation using Multiaspect Sustainability Analysis (MSA) on seven aspects: environment, social, economy, network, norms/values, trust, and farmer activities. Factor classification shows that all indicators are in the “good” category, but the level of sustainability differs between aspects. MSA rating scale: 0–25 unsustainable; 25–50 low sustainability; >50–75 sustainable; >75–100 highly sustainable. Table 1 below summarizes the validation results and sustainability status for the seven aspects.

Table 1. Validation and Sustainability Status

Aspect	Validation status	Sustainability status
Environment	58.25	Sustainable
Sosial	44.33	Low sustainable
Economy	22.17	Unsustainable
Networks	31.13	Low sustainable
Norms/Values	47.17	Low sustainable
Trust	45.75	Low sustainable
Farmer Activities	33.2	Low sustainable
Average	40.29	Low sustainable

Source: Primary data after processing, 2025

Based on Table 1 above, the average validation score for the seven dimensions reached 40.29, indicating that overall the system falls into the Low Sustainable category. The social, network, norms/values, trust, and farmer activities aspects have low sustainable validation scores (>25), which still fall into the Low Sustainable category. Although above the unsustainability threshold, these aspects still require improvement, such as farmer cooperation, connections with extension workers, market access, and capital/labor assistance.

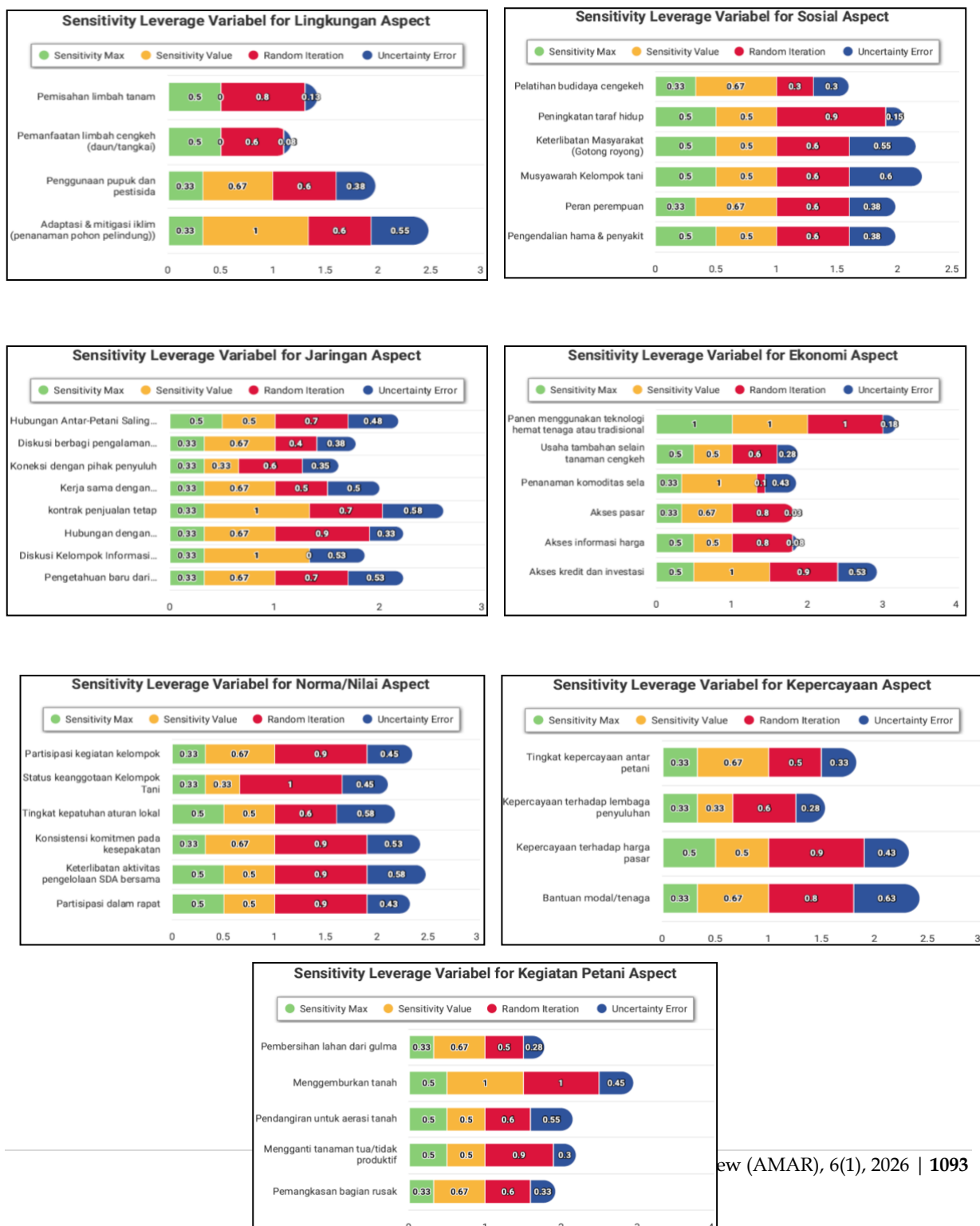
The economic aspect has the lowest validation score (22.17), categorizing it as Unsustainable. This indicates that the economic aspect still requires more attention, particularly in improving intercropping practices and additional businesses besides cloves to support sustainability. Meanwhile, the environmental aspect obtained a validation score of 58.25. The environmental dimension recorded the highest validation score of 58.25, which falls into the Sustainable category. This shows that there is fairly good potential for sustainability, but more optimal natural resource management and more effective environmental impact mitigation measures are still needed.

Plantation agriculture needs to apply the principles of sustainable development to ensure sustainable production, farmer welfare, and natural resource conservation. Sustainable plantation agriculture is a management system that is able to meet current economic and social needs without compromising the ability of future generations. This concept encompasses seven key aspects, namely the environment, society, economy, networks, norms/values, trust, and farmer activities, which must be implemented in an integrated and mutually supportive manner. Fulfilling these seven aspects aims to create a balance between productivity, ecosystem sustainability, and the welfare of plantation farmers. Sensitivity analysis is used to identify the key factors that most influence sustainability in each

dimension, which can then be used as a basis for determining priorities for intervention and policy development for sustainable plantation agriculture.

Sensitivity Leverage

Using sensitivity analysis, an evidence-based approach can be applied to design more effective development policies and strategies that are oriented towards long-term sustainability. The results of the sensitivity analysis can be seen in Figure 1 below.



Source: Primary Data After processing, 2025

Figure 1. Sensitivity Analysis of Sustainability Aspects

Based on Figure 1, the results of the multi-aspect sustainability status show two major patterns. First, the environmental aspect is in the sustainable category, indicating that farmers are relatively capable of maintaining the ecological function of clove gardens. This is understandable because traditional clove cultivation practices tend to be in harmony with natural cycles, coupled with climate adaptation and mitigation through shade trees. The literature supports this finding: social capital often supports community adaptation in maintaining resources and responding to environmental change (Savari et al., 2023). In addition, adaptive capacity through internal information exchange has been shown to help farmers cope with climate uncertainty (H. Chen et al., 2014; Cishahayo et al., 2023; Yameogo et al., 2018). Therefore, environmental sustainability is a strength of the Bone clove farming system.

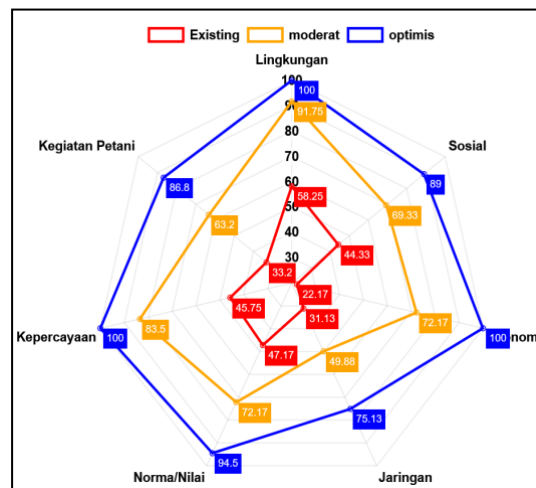
Second, the social, economic, network, norms/values, trust, and farmer activity aspects are still in the low/vulnerable sustainability category. This indicates that the socio-economic dimension is not yet as strong as the ecological dimension. The emerging leverage factors—improved living standards, labor-saving harvesting technology, fixed sales contracts, joint natural resource management, price transparency, and soil loosening—are substantially consistent with the theory of sustainable agriculture, which emphasizes a balance between productivity, social inclusion, and economic efficiency. The economic driver of harvesting technology indicates that the biggest problem is not just production, but labor and cost efficiency. Without the appropriate technology, clove farming will continue to be costly and vulnerable to labor shortages during the harvest season, resulting in low economic status despite significant opportunities for improvement (high possible value in the future).

In terms of networks, fixed sales contracts as a leverage factor confirm that the sustainability of the value chain is greatly influenced by market stability. Marketing studies of cloves in Gorontalo have highlighted dependence on middlemen and a long supply chain structure (Rauf et al., 2023; Suaib et al., 2018; Yusup & Murtisari, 2024). The results of this study expand on these findings by showing that the root of the problem is also social in nature: weak formal networks and low market trust. Thus, improvements to the marketing network must be designed as improvements to bridging/linking social capital, not merely price interventions.

Scenario

Used as the basis for analysis to assess the direction of change in the sustainability of the system if policy interventions are implemented. The principle is that the value of the scenario must show a gradual increase: the moderate scenario

must have a value at least twice as high as the initial scenario. The visualization of the achievements of each aspect is shown in the following diagram.



Source: Primary Data After processing, 2025

Figure 2. Sustainability Scenario Analysis

The modeling results based on Figure 2 show that the scenario underwent significant changes in aspects with the lowest performance. This means that any form of intervention, action, or change in these factors can improve the sustainability of clove farming, from low sustainability to highly sustainable. Overall, the scenario analysis results indicate that the sustainability of the clove farming system in Bone District is not only determined by technical aspects of cultivation, but is also greatly influenced by organized social capital mechanisms.

CONCLUSION

The scientific contribution of this study lies in the integration of social capital analysis with Multiaspect Sustainability Analysis in the clove commodity in Gorontalo, which has previously been studied more from an economic perspective, thereby enriching the understanding that the sustainability of plantation agribusiness is largely determined by the type and quality of social capital at work in the farming community. In the future, further research needs to examine more quantitatively the causal relationship between social capital components and improvements in farmers' economic performance, test the effectiveness of institutional models or market partnerships that encourage bridging/linking capital, and explore specific climate adaptation strategies for cloves so that good ecological sustainability can be linked to simultaneous socio-economic strengthening.

Based on the results of the Multiaspect Sustainability Analysis (MSA), the economic aspect showed the lowest index value and was categorized as

unsustainable compared to the aspects of networks, farmer activities, social norms, and trust. This condition indicates that the economic dimension is still the main limiting factor in supporting the sustainability of the system under study.

The environmental aspect is a dimension that falls under the category of sustainability based on the results of sensitivity leverage analysis in Multiaspect Sustainability Analysis (MSA). This shows that the environmental management practices implemented are relatively supportive of system sustainability, although they still need to be strengthened in order to support improvements in other dimensions in an integrated manner.

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