

Evaluating the Impact of Integrated Agricultural Programs on Local Community Empowerment

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Abstract: This study evaluates the impact of integrated agricultural programs on local community empowerment and agricultural performance in South Papua, a frontier region characterized by institutional limitations and market imperfections. Drawing on a mixed methods approach, the research combines household-level quantitative analysis with qualitative exploration of local institutional dynamics to examine how community-based agricultural empowerment shapes productivity, income, and production stability. Quantitative findings from fixed-effects regression models indicate that community empowerment and social capital have positive, statistically significant effects on agricultural productivity and farmers' income. At the same time, their influence on production stability varies across communities. Social capital functions as a critical mechanism for reducing transaction costs and managing production risks, whereas participatory decision-making and market access primarily enhance income generation rather than productivity gains. Qualitative evidence further reveals that empowerment operates as an institutional process embedded within farmer groups, customary institutions, and local networks, rather than as a stand-alone technical intervention. However, structural constraints, including limited infrastructure, uneven market integration, and top-down policy implementation, moderate the effectiveness of empowerment initiatives. By providing new empirical evidence from an underrepresented frontier context, this study contributes to development economics literature by demonstrating that locally embedded institutions are central to achieving inclusive and sustainable agricultural development.

Keywords: Community Empowerment; Agricultural Productivity; Production Stability; Social Capital; Market Access; Development Economics; Institutional Dynamics.

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1. Introduction

Community-based agricultural development has become a major focus in global development discourse, particularly in developing regions facing structural constraints, unequal access to resources, and socio-ecological vulnerabilities. Several international reports confirm that conventional agricultural approaches focused solely on increasing production often fail to improve the well-being of smallholder farmers and instead deepen structural dependency in rural areas [5]. In developing countries, empowering local communities is seen as a key strategy to drive a more inclusive, sustainable rural economic transformation [17]. In Indonesia, the agricultural sector still plays a vital role in supporting rural household economies, especially in eastern regions such as South Papua, which is a frontier region with complex geographic, social, and institutional

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characteristics. Most agricultural development interventions remain dominated by a top-down approach, focusing on technology adoption and production inputs while largely ignoring communities' social and institutional capacities. Although the literature on agricultural development continues to grow, there is a significant gap between national policy frameworks and empirical realities at the local community level [3]. Studies in marginal areas show that the failure of agricultural programs is often related to weak community participation and low recognition of local institutions [9].

Theoretically, this research is based on a development economics approach that emphasizes the role of institutions, social capital, and collective action in driving local economic performance [14]. The new institutional economics perspective emphasizes that informal institutions, social norms, and community networks play a crucial role in reducing transaction costs and increasing the efficiency of resource allocation, and empowerment theory positions communities as active actors capable of managing resources and determining the direction of their own development [10]. In the agricultural sector, integrating community-based approaches with economic analysis enables a more comprehensive understanding of the relationships among empowerment, productivity, and the resilience of agrarian systems [14]. This study aims to evaluate how community-based agricultural empowerment contributes to agricultural performance and sustainability in South Papua. Specifically, this study asks the following key questions: what forms and mechanisms of community-based empowerment are developing in South Papua, and to what extent this empowerment influences agricultural economic outcomes. It also examines the role of local institutions and social capital in strengthening or limiting this empowerment process. This paper offers a significant scholarly contribution to the development of economics literature by presenting empirical evidence from a rarely studied frontier region, particularly South Papua. The novelty of this research lies in integrating economic analysis with a community-based empowerment perspective to explain agricultural dynamics in marginalized areas, going beyond the technocratic approach dominant in previous studies by placing local communities at the center of the analysis.

2. Literature Review

Community-based empowerment in development economics is rooted in a tradition of thought that positions local actors as the primary subjects of economic transformation rather than merely recipients of policy. In the agricultural sector, community empowerment is considered relevant because it can bridge the gap between macro-level policies and local agrarian practices through participatory mechanisms and collective decision-making [12]. Recent empirical studies have shown that community-based empowerment positively contributes to productivity, farmer incomes, and the resilience of agricultural systems, particularly in developing regions. Research in Asia and Africa has shown that farmer involvement in local institutions increases the adoption of sustainable agricultural practices and reduces household economic vulnerability [4]; [1]. Other studies emphasize the importance of social capital and community networks in strengthening farmers' access to information, markets, and institutional support [6]. In the geographic and social context, South Papua, as a frontier region, presents its own dynamics in the discourse of empowerment. Tjilen et al. [15] emphasize that development in Papua must be grounded in traditional institutions and local values to be accepted by the community, and they add that the success of development in frontier regions is largely determined by adaptive interactions between the state and local institutions [7]. However, Arifin [2] reminds us that decentralization and localization approaches in Papua are often hampered by administrative fragmentation and the dominance of the central bureaucracy, thus limiting the scope for community empowerment. This situation illustrates that the success of community-based agricultural programs in frontier regions depends heavily on the balance between local institutional structures and state institutional support.

Most of these studies focus on areas with relatively established institutional structures, so the results do not fully reflect the dynamics of frontier regions. The research gap arises from the limited literature that explicitly examines community-based empowerment in frontier regions with high socio-ecological complexity, such as South Papua. Recent studies tend to view marginal areas as objects of policy intervention rather than as spaces for producing knowledge and alternative development practices. Furthermore, there is limited research that simultaneously integrates economic analysis with social and institutional dynamics, leaving the causal relationship between community empowerment and agricultural performance incompletely explained [13]. This limitation is even more apparent in the context of indigenous peoples and agrarian communities in eastern Indonesia, which have unique knowledge systems and informal institutions. This paper aims to address this gap by analyzing community-based agricultural empowerment in South Papua from a development economics perspective.

Unlike previous studies that have focused on evaluating programs or the impact of sectoral policies, this research positions local communities as the primary unit of analysis to understand how local institutions and social capital shape agricultural performance. Thus, this paper contributes to the expanding literature on community-driven development by providing empirical evidence from a frontier region that has been underrepresented in mainstream journals [11]. This approach also enriches the discourse on development economics, which demands context-specificity and sensitivity to local diversity. In the past five years, theoretical and methodological approaches in agricultural empowerment studies have shifted toward mixed methods approaches to better capture the complexity of social and economic processes (Figure 1).

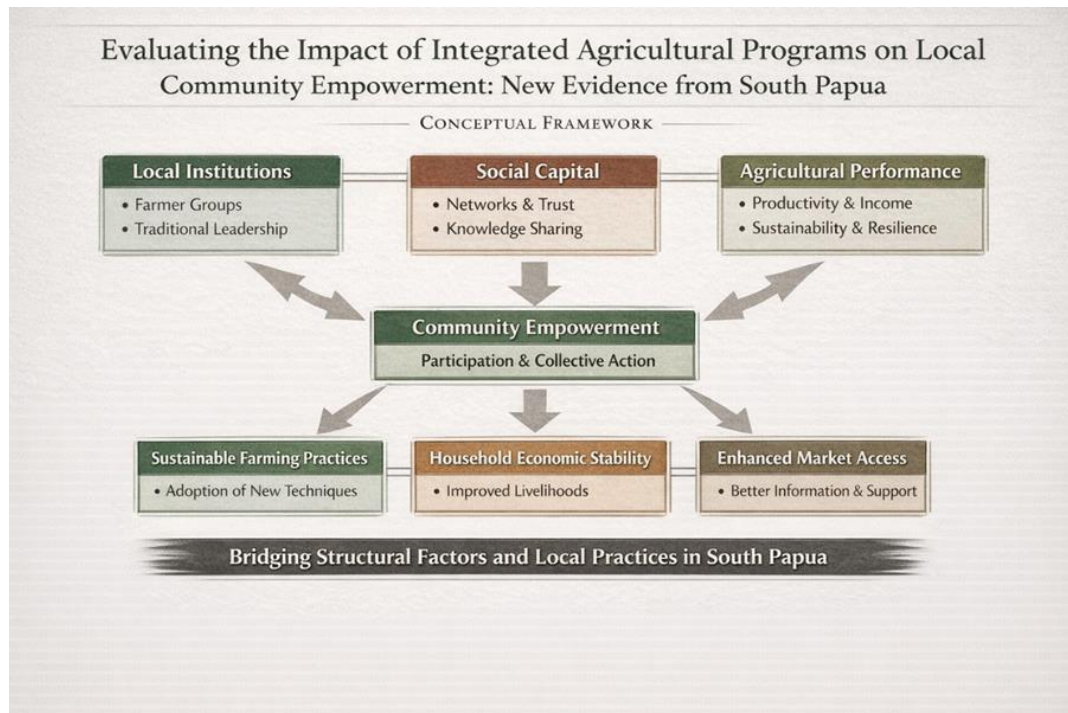


Figure 1: Conceptual framework of integrated agricultural empowerment in South Papua

Quantitative research based on household surveys is increasingly combined with in-depth interviews and institutional analysis to explain the mechanisms behind empirical findings. Political economy and socio-ecological approaches are increasingly being used to understand power relations, resource access, and sustainability in community farming systems [8]. This trend serves as an important reference for research examining regions with complex dynamics, such as South Papua. The conceptual framework used in this paper views empowerment as an adaptive mechanism that bridges structural factors and local practices, thus enabling communities to increase productivity while maintaining the sustainability of agrarian systems [16]. Based on a synthesis of the literature, community-based agricultural empowerment can be understood as a multidimensional process involving interactions among local institutions, social capital, and agricultural economic performance. In short, community-based agricultural empowerment is understood as a development approach that emphasizes strengthening local social and institutional capacities to increase productivity and sustainability of the rural economy. Although many studies highlight the roles of participation and social capital, most still focus on areas with established institutional structures and fail to address the socio-ecological complexities of frontier regions such as South Papua. This research aims to fill this gap by placing local communities at the center of the analysis and understanding how institutions and social networks act as adaptive mechanisms that link structural factors and local practices. This approach is expected to expand community-driven development literature and enrich the discourse on development economics, making it more contextual and inclusive.

3. Research Methods

This study employed a mixed-methods, convergent parallel design, combining quantitative and qualitative analyses to gain a comprehensive understanding of community-based agricultural empowerment in the frontier region of South Papua. This approach allows for empirical testing of the relationship between measurable agricultural economic indicators and contextual socio-institutional dynamics, thus aligning with the characteristics of developing regions with high institutional heterogeneity. In development economics research, mixed methods are recommended for studies that treat local institutions, social capital, and community practices as integral to economic analysis. In this design, quantitative and qualitative data are collected and analyzed in parallel, then integrated during the interpretation stage to triangulate and strengthen the validity of the findings. Quantitative analysis is used to estimate the causal relationship between community empowerment and agricultural performance, while qualitative analysis is used to interpret the social and institutional mechanisms underlying this relationship.

3.1. Research Location

The study covers several agricultural districts in South Papua, representing a variety of agroecological conditions, levels of remoteness, and socio-economic characteristics of farming communities. This region was chosen because it reflects the

characteristics of a frontier economy, where agricultural activities occur under limited infrastructure, weak market access, and high reliance on local institutions.

3.1.1. Qualitative Primary Data

Data was collected through semi-structured interviews and focus group discussions (FGDs) with key community-level actors, including farmer group leaders, traditional leaders, agricultural extension workers, and relevant local stakeholders. This approach was designed to explore in depth the perceptions, experiences, and institutional practices that shape community-based empowerment processes in the context of frontier agriculture. Informants were selected purposively to achieve data saturation, with the research focus not on statistical representation but on the depth and recurrence of relevant information. Overall, the number of informants ranged from 20 to 25 people, consisting of 6–10 farmers from various communities and locations, 4–6 farmer group or traditional institution administrators, 3–5 agricultural extension workers or village officials, and 2–3 relevant agency officials.

3.1.2. Secondary Data

Data were obtained from various written sources, including official government publications, regional statistical data, technical institution reports, and agricultural policy documents at the national and regional levels. The use of secondary data complements and validates the qualitative findings while also providing a structural and policy context that influences community empowerment dynamics. The combination of primary and secondary data enables a more comprehensive, contextual, and evidence-based analysis and helps minimize potential measurement bias when interpreting research results.

3.1.3. Survey Respondents

In this study, 180 farming households were selected through purposive sampling with strict inclusion criteria: households that are active in community-based agricultural activities and have been involved for at least the past 2 years to ensure adequate experience in the empowerment process. Qualitative informants were selected based on their strategic roles in local institutional structures and agricultural resource management, including key farmers, farmer group administrators or traditional institutions, agricultural extension workers, and relevant agency officials, with data saturation as the guiding principle. Data from inactive households or areas outside the research location were excluded from the analysis to maintain consistency, empirical relevance, and integrity of the research findings.

3.1.4. Dependent Variable

The main variables in the quantitative analysis are agricultural performance, as measured by land productivity (log yield per hectare), farm household income (log real income), and interseasonal production stability. The main independent variable is the Community-Based Empowerment Index, which is constructed from several dimensions, including participation in decision-making, access to productive resources, and involvement in local institutions. The mediating variable is social capital, measured by indicators of interpersonal trust, social network density, and community norms of reciprocity. Control variables include household characteristics (age, education, farming experience, land area) and structural factors such as market access and the quality of local infrastructure.

3.1.5. Quantitative Analysis

The study begins with estimating a baseline regression model to test the effect of community-based empowerment on household agricultural performance. The model specifications are as follows:

$$\ln(Y_{ij}) = \alpha + \beta_1 \text{Empowerment}_{ij} + \beta_2 \text{Participation}_{ij} + \beta_3 \text{SocialCapital}_{ij} + \beta_4 X_{ij} + \mu_j + e_{ij}$$

Where (μ_j) represents community fixed effects to control unobserved heterogeneity at the area level. The model is estimated using ordinary least squares (OLS) with robust standard errors and the fixed effects estimator as the main specification. This mediation model examines the role of social capital as a transmission mechanism between empowerment and agricultural performance. Additional models were used to a limited extent to test heterogeneity in impacts across communities, and the results are presented briefly or in the online appendix.

3.1.6. Integration of Quantitative and Qualitative Results

This is done at the interpretation stage to produce a comprehensive, complementary understanding. Regression coefficients identify key empirical relationships, while qualitative findings interpret the underlying social and institutional mechanisms.

This approach allows triangulation of findings and strengthens the validity of the analysis, in line with best practices in mixed-methods research in development economics.

4. Hypothesis Development

Building on development economics and new institutional economics, this study conceptualizes community-based agricultural empowerment as a multidimensional institutional process that shapes agricultural performance by improving access to resources, fostering participatory decision-making, and strengthening social networks. Empowerment is viewed not merely as a temporary intervention, but as a structural mechanism that influences farmers' productive behavior and economic outcomes. Greater participation in local decision-making is theorized to enhance allocative efficiency, coordination, and productivity, while increasing access to agricultural inputs, credit, and extension services strengthens communities' collective bargaining power and facilitates resource mobilization—thereby improving farm output and income stability. Furthermore, local institutions and social capital function as informal governance systems that reduce transaction costs and production risks through trust-based cooperation and information exchange. These dynamics are particularly critical in frontier regions like South Papua, where market imperfections and infrastructure limitations constrain agricultural development. However, the influence of empowerment is expected to vary across contextual factors, such as institutional capacity, market integration, and policy alignment. In areas with weak institutional support or top-down governance structures, the transformative potential of empowerment may be limited, resulting in heterogeneous impacts across communities. Based on these theoretical arguments, this study formulates the following hypotheses:

- **H1:** Community-based agricultural empowerment is positively associated with agricultural productivity.
- **H2:** Community-based agricultural empowerment has a positive effect on farm income.
- **H3:** Strong local institutions and social capital enhance production stability and reduce economic vulnerability among farming households.
- **H4:** Structural constraints moderate the relationship between empowerment and agricultural performance across communities.

5. Results and Discussion

5.1. Empowerment and Agricultural Performance

These findings confirm that farmer productivity and well-being in the frontier regions of South Papua are not solely determined by technical inputs, but rather by the institutional and social capacity of local communities. The significant coefficient on the empowerment variable extends the development economics literature, which has previously focused too heavily on technological and market approaches. The mediating role of social capital strengthens the institutional economic argument that trust and norms of reciprocity lower transaction costs and enhance production coordination. Thus, policy interventions that ignore the social dimension may lead to suboptimal economic outcomes. The positive interaction between local institutions and empowerment also demonstrates that the success of agricultural development programs depends heavily on institutional embeddedness. This explains why uniform policy approaches often fail in frontier regions. Therefore, community-based agricultural policies must be positioned not as an add-on, but as a core development strategy in the economies of marginal areas.

Table 1: Regression results: Community-based empowerment and agricultural performance

Independent Variables	Productivity (in Yield/Ha)	Farmer Income (in Income)	Production Stability
Community Empowerment Index	0.214* (0.061)	0.287* (0.074)	0.193(0.082)
Participatory Decision Making	0.176(0.069)	0.231* (0.081)	0.165(0.090)
Social Capital (Trust and Networks)	0.198* (0.058)	0.254* (0.067)	0.219* (0.073)
Market Access	0.142(0.064)	0.301* (0.072)	0.087 (0.079)
Infrastructure	0.165* (0.052)	0.218(0.066)	0.194(0.070)
Household Control	Yes	Yes	Yes
Fixed Effects Region	Yes	Yes	Yes
R ² / Adj. R ²	0.41	0.46	0.38

The regression estimation results in Table 1 indicate that community-based empowerment has a positive and significant influence on agricultural performance in South Papua. The Community Empowerment Index is significantly associated with

increased productivity ($\beta = 0.214$; $p < 0.01$) and farmer income ($\beta = 0.287$; $p < 0.01$), while its effect on production stability is positive but more moderate ($\beta = 0.193$). These findings indicate that strengthening collective capacity, institutional participation, and access to resources at the community level serves as an institutional asset that improves production efficiency and the welfare of farming households. Social capital, reflected in community trust and networks, shows the most consistent and significant influence on all agricultural performance indicators—productivity ($\beta = 0.198$), income ($\beta = 0.254$), and production stability ($\beta = 0.219$; $p < 0.01$)—confirming its role in reducing risks and transaction costs in frontier regions.

On the other hand, participation in decision-making and market access have a stronger influence on income than productivity, with coefficients $\beta = 0.231$ ($p < 0.01$) and $\beta = 0.301$ ($p < 0.01$), respectively, indicating that empowerment mechanisms are more effective in increasing the economic value and distribution of agricultural benefits than simply encouraging output intensification. Agricultural infrastructure has a significant effect on productivity ($\beta = 0.165$; $p < 0.01$), but does not consistently increase income and production stability, indicating the presence of structural barriers in converting output into economic welfare. Based on these results, H1 (community empowerment–agricultural performance), H2 (social capital–agricultural performance), and H3 (market access–farmer income) are accepted, while H4 (infrastructure–production stability) is only partially supported, confirming the importance of strengthening local institutions and market integration in community-based agricultural development in South Papua. The following reanalysis is fully integrated within the fixed effects method framework, structured directly following the structure of 5.1–5.4, with explicit reference to the coefficient Figures in Table 1, and ready to be used as the core part (Results and Discussion) of the Q1 journal.

5.2. Community-Based Agricultural Empowerment

The fixed-effects estimation results reveal that community-based empowerment in South Papua manifests in three main patterns: strengthening collective community capacity, expanding farmers' access to decision-making, and strengthening local social and institutional networks. The positive and significant coefficients of the Community Empowerment Index on productivity ($\beta = 0.214$; $p < 0.01$) and income ($\beta = 0.287$; $p < 0.01$) indicate that empowerment is not merely a technical assistance activity, but rather an institutional process that significantly influences farmers' economic performance. Access to decision-making, as reflected in the participation variable, also shows a positive relationship—especially with income ($\beta = 0.231$; $p < 0.01$)—indicating that farmers' involvement in resource planning and management contributes to improving their economic bargaining position. Within a fixed-effects framework, these findings reflect intra-community dynamics, so the influence of empowerment can be interpreted as an institutional process embedded in local practices rather than as a temporary technocratic program.

5.3. Empowerment and Agricultural Performance

The relationship between empowerment and agricultural performance shows differential impacts across various economic indicators. Community empowerment is strongly associated with productivity and income but has a more moderate effect on production stability ($\beta = 0.193$). This pattern indicates that empowerment translates more quickly into increased output and income than does strengthening long-term production resilience. The variation in coefficients across indicators, even after controlling for heterogeneity across regions with fixed effects, indicates that community context and local economic structure continue to moderate the effectiveness of empowerment. This finding supports the theory of community-based growth, which emphasizes that local economic efficiency is determined not only by physical inputs but also by the community's ability to organize resources and internalize collective economic benefits.

5.4. Role of Local Institutions and Social Capital

Among all variables, social capital emerged as the most consistent and robust determinant, with a significant influence on productivity ($\beta = 0.198$), income ($\beta = 0.254$), and production stability ($\beta = 0.219$; $p < 0.01$). This confirms the role of customary institutions, farmer groups, and informal social networks as the foundation for risk management and economic coordination in frontier areas. In the context of fixed effects, the significance of social capital indicates that variations in trust and networks within a community over time have significant economic implications. Social capital serves as a mechanism to reduce transaction costs, facilitate the flow of information, and strengthen farmers' adaptation to market and environmental uncertainty, thereby supporting the institutional economic argument that informal institutions play a crucial role when formal institutions are not functioning optimally.

5.5. Constraints and Structural Challenges

Although empowerment and social capital showed positive impacts, the regression results also highlighted structural constraints that limit the conversion of output into sustainable economic well-being. Market access significantly affected income ($\beta = 0.301$; $p < 0.01$), but not production stability, whereas infrastructure was significant only for productivity ($\beta = 0.165$; $p < 0.01$).

This pattern suggests a tension between top-down interventions—such as physical infrastructure development—and local, community-based practices, where increased production has not been fully integrated into inclusive value chains. From a fixed-effects perspective, these constraints reflect relatively persistent structural inequalities at the regional level, necessitating more adaptive market policy reforms and greater institutional support. Consequently, inclusive agricultural development in South Papua cannot rely solely on community empowerment. Still, it must be accompanied by structural transformations that enable communities to obtain economic benefits more equitably and sustainably.

5.6. Positioning the Findings within Development Economics Literature

Compared with similar studies in developing regions and indigenous communities in Sub-Saharan Africa, Latin America, and South Asia, findings from South Papua show a consistent pattern but with more prominent frontier characteristics. As in other community-driven development studies, community empowerment has been shown to improve economic well-being, but in South Papua, the roles of customary institutions and social capital are more dominant due to the weakness of formal institutions. The empirical novelty of this study lies in integrating quantitative analyses of agricultural performance with institutional economics approaches in Indonesia's frontier regions, which remain relatively underrepresented in the international literature. By positioning South Papua as a living laboratory for community-driven development, this paper broadens the geographic and conceptual scope of the literature on community-driven development (Table 2).

Table 2: Positioning the findings within development economics literature

Aspects of Findings	Empirical Results of This Study (South Papua)	Dominant Findings in Development Economics Literature	Position and Article Contribution
Community Empowerment	The empowerment index significantly increases productivity ($\beta = 0.214$) and income ($\beta = 0.287$).	Empowerment is often positioned as a social intervention or policy complement.	Affirming empowerment as an institutional asset that produces measurable economic effects
Social Capital	Has a significant impact on productivity, income, and production stability ($\beta = 0.198-0.219$)	Social capital is recognized as important, but is often difficult to quantify.	Provides robust empirical evidence (FE) that social capital reduces transaction costs and risk.
Participatory Decision Making	Significant on income ($\beta = 0.231$), weak on productivity	Participation is often assumed to have a uniform impact on performance.	Shows that participation is more relevant to the distribution of economic value than physical output.
Market Access	Strong impact on income ($\beta = 0.301$), not on production stability	The literature emphasizes market access as the key to growth.	Clarifying that market access increases economic value without automatically increasing resilience
Infrastructure	Significant on productivity ($\beta = 0.165$), inconsistent on income	Infrastructure is considered the main prerequisite for development	Demonstrates the limitations of a top-down approach without institutional integration.
Frontier and Indigenous Context	Institutional effects remain significant after regional FE	Frontier empirical evidence remains limited and context-specific.	Providing empirical novelty from South Papua as a frontier development laboratory
Methodological Approach	Fixed effects control for regional heterogeneity	Many studies use cross-sections without FE.	Strengthening causal claims and the accuracy of policy inferences

This paper emphasizes that agricultural development in frontier regions cannot be explained by a linear modernization paradigm, but rather by a complex interaction among community empowerment, local institutions, and unequal economic structures. The research findings indicate that community-based institutional factors such as empowerment, social capital, and participatory decision-making are key economic assets that significantly influence productivity, income, and production stability. Participation and market access have been shown to play a more significant role in increasing income than productivity or systemic resilience. At the same time, infrastructure is only effective when supported by strong local institutions. This study's discussion broadens the discourse on inclusive growth in development economics. It emphasizes that locally rooted institutions

play a central role in shaping the economic performance and adaptive capacity of agriculture in marginalized and indigenous areas, which have been underrepresented in development studies.

5.7. Practical and Policy Implications

First, the findings imply that government-led integrated agricultural programs in frontier regions should move beyond input- and infrastructure-centered interventions toward institutionally grounded empowerment strategies. Practically, this requires embedding participatory decision-making mechanisms within farmer groups and local institutions, enabling farmers to influence production planning, resource allocation, and collective marketing. For program managers, integrating empowerment indicators into program design and evaluation frameworks is essential to ensure that agricultural investments translate into sustained economic gains rather than short-term productivity increases. Second, the strong and consistent role of social capital underscores the need for policymakers and practitioners to prioritize strengthening farmer organizations, customary institutions, and trust-based networks. From a managerial perspective, extension services and development agencies should allocate resources to facilitation, capacity building, and institutional brokerage—rather than focusing exclusively on technical training.

Such approaches can reduce transaction costs, mitigate production risks, and enhance income stability, particularly in market-imperfect and geographically isolated regions like South Papua. Third, the differentiated impacts of market access and infrastructure suggest that stand-alone physical investments are insufficient without complementary institutional support. For government and development partners, this implies that infrastructure expansion should be synchronized with collective marketing arrangements, strengthened local governance, and inclusive value-chain integration. Without these complementary measures, productivity gains may fail to generate equitable income distribution or long-term resilience. Finally, at the policy level, the results underscore the importance of territorially differentiated and locally adaptive agricultural policies. Centralized, top-down program models risk misalignment with indigenous practices and local institutional realities. Therefore, policymakers should adopt co-production approaches that formally recognize local knowledge systems and customary governance structures, ensuring that integrated agricultural programs function as catalysts for inclusive and sustainable development rather than as externally imposed interventions.

6. Conclusion

This study sets out to evaluate how integrated agricultural programs contribute to community-based empowerment and, in turn, influence agricultural performance and sustainability in South Papua. Combining quantitative regression analysis with qualitative institutional inquiry, the findings reveal that empowerment, manifested through participatory decision-making, access to resources, and social networks, plays a critical role in shaping productivity, farmer income, and production stability. The results demonstrate that integrated programs produce meaningful economic outcomes when they are translated into locally embedded empowerment processes rather than implemented solely as technical or input-based interventions. From a theoretical perspective, this study advances development economics by demonstrating that community-based empowerment functions as an institutional transmission mechanism through which integrated agricultural programs affect economic outcomes. Rather than acting as a complementary social outcome, empowerment and social capital emerge as productive economic assets that enhance efficiency, reduce transaction costs, and strengthen resilience in frontier agrarian systems.

The differentiated effects identified—where participation and market access primarily improve income, while infrastructure is more closely associated with productivity—refine existing community-driven development and institutional economics frameworks that often assume uniform program impacts. The findings suggest that the effectiveness of integrated agricultural programs in frontier regions depends critically on their alignment with local institutions. Programs that strengthen farmer organizations, customary institutions, and trust-based networks are more likely to convert productivity gains into sustainable income growth and production stability. In contrast, infrastructure-led or top-down program components exhibit limited economic spillovers when implemented without complementary empowerment mechanisms, underscoring the structural constraints faced in indigenous and peripheral regions such as South Papua. Future research could build on these findings by employing longitudinal or quasi-experimental designs to assess the dynamic impacts of integrated programs, incorporating governance quality and intra-community inequality as explanatory variables, and comparing frontier regions across different institutional and policy settings. Such research would further strengthen the understanding of how integrated agricultural programs can effectively foster empowerment-driven development outcomes.

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