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ENHANCING AGRIBUSINESS ECOSYSTEMS FOR RURAL ECONOMIC GROWTH: INSIGHTS FROM PAPUA, INDONESIA

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ABSTRACT

The formation of a strong agribusiness ecosystem was a key driver of sustainable economic development in rural areas. This paper aims to examine the factors that support opportunities for strengthening the agribusiness ecosystem and its impact on rural economic performance. This paper used a survey to obtain responses from 200 respondents in various underdeveloped areas in Papua. Statistical evaluation of the collected data used PLS-SEM. The results showed that the correlations of all tested relationships were statistically significant ($p < 0.05$). Institutional support had a positive and significant effect on the agribusiness ecosystem ($\beta = 0.312$, $t = 4.865$, $p = 0.000$) and economic impact ($\beta = 0.215$, $t = 3.457$, $p = 0.001$). Market access also significantly influences the agribusiness ecosystem ($\beta = 0.287$, $t = 4.236$, $p = 0.000$) and economic impact ($\beta = 0.198$, $t = 3.015$, $p = 0.003$). Similarly, human resource quality shows a positive influence on the agribusiness ecosystem ($\beta = 0.225$, $t = 3.278$, $p = 0.001$) and economic impact ($\beta = 0.176$, $t = 2.865$, $p = 0.004$). Technology access significantly strengthens the agribusiness ecosystem ($\beta = 0.298$, $t = 4.574$, $p = 0.000$) and improves economic outcomes ($\beta = 0.203$, $t = 3.186$, $p = 0.002$). In addition, the agribusiness ecosystem itself has a significant and very high influence on economic outcomes ($\beta = 0.352$, $\beta = 5.012$, $\beta = 0.000$). The agribusiness ecosystem moderates the impact of institutional, technological, market, and human factors on economic performance.

INTRODUCTION

Agribusiness helps generate income and offers employment opportunities, and aligns with international initiatives to ensure sustainable growth (United Nations, 2015). The findings presented by FAO indicate that in most developing countries the agribusiness industry contributed up to 30 percent to the GDP, and about 70 percent of the rural population relies on agricultural activities as their main source of livelihood (FAO, 2023). Nevertheless, agribusiness remained under severe pressure due to instability of prices, reduced access to the market as well as the increased effects of climate change (Pawlak & Kołodziejczak, 2020).

Even within the Indonesian province, nearly all the provinces had villages that were officially disadvantaged. These kinds of villages had low standards of infrastructure, had low access to public services, low economic activity, and low human development indicators. One of the high-density areas of the villages that were disadvantaged was Papua Province. According to the statistics by the Ministry of Villages, Development of Disadvantaged Regions and Transmigration (Kemendes PDTT), the majority of the villages in Papua belonged to the group of the disadvantaged ones.

Poor infrastructure such as poor access to roads and a lack of transport were one of the primary problems as farmers found it challenging to transport their farm produce to the markets. This situation deprived farmers of the capability to sell their yields at comparatively better prices, and in most cases, they were compelled to sell their crop to local brokers at reduced prices (Junaidi & Hasan, 2021). Furthermore, there was a scarcity of access by most farmers in Papua to wider markets, in the sense of selling agricultural products on the one hand, and access to modern inputs such as seeds, fertilizers, and other sophisticated farming equipment, on the other.

Besides the limitation in the infrastructure, the fact that the farmers in the region were limited to a couple of products like coffee and cocoa rendered them vulnerable economically. These commodities were largely dependent on the changes in international trade and a decrease in prices abruptly decreased the income of farmers and threatened their possibility of covering basic needs. Additionally, climate change also helped make the weather patterns more unpredictable, hence negatively affecting agricultural productivity and crop yields. Floods and landslides are considered natural disasters that were common in the area and led to the destruction of agricultural systems and consequently, loss of harvests, which had a direct impact on the lives of farmers.

The other critical issue was the low level of education of farmers. This situation could not allow them to engage in better agricultural practices and apply the available technologies that would help to boost productivity. Knowledge transfer and training opportunities associated with sustainable agribusiness management were scarce, which also added to the inability of farmers to be innovative and competitive (Budiastuti & Dewi, 2020).

Under these circumstances, the application of agribusiness diversification techniques had become more significant (Pusvita et al., 2024). The diversification was regarded as a means of minimizing the risks of the economy and enhancing income stability. Barrett and Reardon (2000) emphasized that agricultural diversification was beneficial in enabling the rural households to overcome price volatility and climatic risks. They were supported by the work of Shiferaw et al. (2014), who concluded that

access to modern technology and the existence of solid policy support were the crucial factors in improving the agribusiness ecosystem, hence the agrarian production, and the household income. Moreover, the proactive governmental participation as well as the input of the actors of the non-governmental sphere and the private sector were also significant to assist in infrastructure development, improve human capacity, and increase access to the market (Perez-Lopez et al., 2020).

This research tried to determine the main factors that contributed to the success of the agribusiness ecosystem strengthening strategies especially in the case of disadvantaged villages in Papua Province. The four key variables that were analyzed were institutional support, technological development, market access and human resource capacity all of which are identified to be the core pillars in the creation of an agribusiness ecosystem that is resilient and sustainable. The research designed using a quantitative methodology and Structural Equation Modeling-Partial Least Squares (SEM-PLS) investigated the relationship between these variables and their cumulative impact on sustainable economic growth.

Furthermore, the study sought to come up with evidence-based recommendations that would guide the formulation of policies at both national and regional levels. The identification of factors that had the strongest influence on strengthening the ecosystem would allow policymakers to focus on those interventions with the highest impact. As an example, in case market access was the most significant determinant, the strategies may be directed at creating better transportation infrastructure, forming rural cooperatives, and advancing digital marketplaces. Equally, in case institutional support was a major determinant, initiatives can be made in strengthening farmer organizations, access to credit and coordination of policies amongst the government agencies.

This research had a significant impact on the body of literature related to rural development and sustainability in agribusiness. It was expected that the results of this research would be of significant value to the academic realm, as well as to the practical applications of the stakeholders who are interested in education and improvement of the economic growth of the rural areas and the further development toward the Sustainable Development Goals (SDGs).

Although the topic of the agribusiness ecosystems approach has drawn increased attention over recent years, the vast majority of empirical research has concentrated on the contexts of relatively stable infrastructure, available markets, and established institutions. Very little literature discusses the functioning of the ecosystem-based rural development models in geographically isolated, underdeveloped and socio-culturally different areas like Papua. Such a theoretical gap was essential because this limit may force ecosystem models to be implemented differently to be useful. The present study fulfilled this gap by looking at how the agribusiness ecosystem model can be modified to provide sustainable economic transformation in the underprivileged villages of Papua.

RESEARCH METHOD

This paper aimed to investigate and examine the agribusiness ecosystem empowerment in sustaining sustainable economic development in the underprivileged rural regions of Papua Province. The study was done from January to March 2024. The following were the research methods:

Research Design

This approach was chosen because it was the most effective in capturing and analysis of the intricate interrelationships between the many variables discussed in this research. It was selected because it can give a full picture of the interrelationship of these variables. Through SEM, the research not only tests the direct measures between variables but also tests an indirect route that might impact the agribusiness ecosystem becoming stronger and having an effect on economic growth. The model involved a number of factors including agribusiness diversification, productivity enhancement and development of infrastructure.

Based on the conceptual model and the literature sources, the hypotheses below were developed to be the guiding force of the study:

H1: There was a positive and significant impact of institutional support (Alpha) on the strengthening of the agribusiness ecosystem (Y1).

H2: The effect of institutional support (Alpha) was positive on economic impact (Y2).

H3: Market access (P) affects the strengthening of the agribusiness ecosystem (Y1) in a positive and significant way.

H4: There was a significant influence of market access (P) on economic impact (Y2).

H5: The quality of human resources (SD) influences ecosystem strengthening of the agribusiness (Y1).

H6: The quality of human resources (SD) influences the economic impact (Y2).

H7: The availability of technology (T) positively and significantly influences the enhancement of the agribusiness ecosystem (Y1).

H8: There was an economic effect (Y2) that was influenced by technology access (T).

H9: There was a positive significant positive influence of the agribusiness ecosystem (Y1) on economic impact (Y2).

Population and Sample

The population was 200 farmers in the underprivileged villages of several districts in Papua whose purposive selections were based on BPS. The selection of the location was done in relation to the groups of villages classified by the Central Statistics Agency (BPS) as disadvantaged considering the degree of access to agribusiness resources and the variety of products produced. Sampling was based upon commodity diversity, access and exposure to external support. Purposive sampling was carried out to make it representative and relevant to the aims of the research. The variables that were used to select the sample were the nature of the commodity grown, years in the farming activities and assistance offered by the Papua provincial government. All the respondents were willing to participate in the study and gave informed consent following an information briefing on the purpose, the process and confidentiality of the study.

Instrument/Procedure

There were a number of techniques through which data were collected. The initial measure was to conduct structured questionnaires so as to get information about the respondent characteristics, the access to the resources, the agribusiness activities that had been implemented and the thoughts on the government policies. The questionnaire involved the use of a Likert scale to produce quantitatively measurable data. Second, some farmers were interviewed in depth to discuss their

vision of the agribusiness issues and opportunities and their perception of the role played by the government in enhancing the agribusiness ecosystem. Third, field observations were conducted so as to have a first-hand look at the agricultural practices and the infrastructure within the villages. The purpose of these observations was to capture the real situation of the farmers and determine how modern technology was being used in the day-to-day farming operations. All the results were stored as confidential data and were utilized only for the needs of this study only after the process of data collection.

Data Analysis

In the analysis of the questionnaire data, Structural Equation Modeling (SEM) was applied with the use of the SmartPLS application, as presented in Section 2.4. The analytical process included several steps, among which were data preparation, validation of the measurement model, and the structural model evaluation (Hermawati et al., 2025; Oktarina et al., 2025). This was done through testing of the associations between variables and establishing the magnitude and statistical significance of the effect of each variable on the model of agribusiness ecosystem strengthening and economic development. The findings were then analyzed to identify trends of association between the constructs which can be used to develop evidence-based suggestions. The findings were to influence the concerned stakeholders such as the local governments, non-governmental organizations and agribusiness actors and assist in policy implementation efforts to enhance the livelihood and economic resilience of the communities in the underprivileged villages across the Papua Province.

Table 1. Variables, Codes, Indicators, and Types of Variables Used in Strengthening the Agribusiness Ecosystem for Economic Growth in Underdeveloped Villages

Variable Laten	Code Indicator	Indicator	Types of Variables
Institutional (K)	K1	Existence of government policies supporting agribusiness	Exogenous
	K2	Regulatory support for farming businesses	Exogenous
	K3	Effectiveness of farmer assistance programs	Exogenous
Technology (T)	T1	Adoption of modern agricultural technology	Exogenous
	T2	Availability of agricultural tools and machinery (alsintan)	Exogenous
	T3	Access to technology training for farmers	Exogenous
Market (P)	P1	Access to local and global markets	Exogenous
	P2	Sustainability of demand for agribusiness products	Exogenous
	P3	Stability of agricultural commodity prices	Exogenous
Human Resources (D)	SD1	Farmers' education level	Exogenous
	SD2	Managerial ability of agribusiness businesses	Exogenous
	SD3	Agribusiness skills training received	Exogenous
Agribusiness Ecosystem (Y1)	Y11	Collaboration between farmers, institutions, and markets	Exogenous
	Y12	Sustainability of agribusiness supply chain relationships	Exogenous
	Y13	Efficiency in production and distribution processes	Exogenous
Economic Impact (Y2)	Y21	Increasing farmer income	Exogenous
	Y22	Increasing the welfare of rural communities	Exogenous
	Y23	Reducing poverty rates in the region	Exogenous

SEM-PLS General Equation:

$$\eta = \beta\eta + \Gamma\xi + \zeta$$

Note: η = Variable endogenous; Bη = Path coefficient that shows the influence of exogenous variables on endogenous; Γξ = Variable excavation; ζ = error.

$$\eta 1 = \gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \gamma_{13}\xi_3 + \gamma_{14}\xi_4 + \zeta$$

$$\eta 2 = \beta_{21}\eta_1 + \gamma_{21}\xi_2 + \gamma_{22}\xi_2 + \gamma_{23}\xi_3 + \gamma_{24}\xi_4 + \zeta$$

Note: η_1 = Agribusiness Ecosystem (Y1); η_2 = Economic Impact (Y2); ξ_1 = Institutional support (Alpha / K); ξ_2 = Market access (P); ξ_3 = Human resources / HR capacity (SD); ξ_4 = Technology access (T); γ_{ij} = The path coefficient from the exogenous variable ξ_j to the endogenous variable η_i; β_{21} = The path coefficient from η_1 (Agribusiness Ecosystem) to η_2 (Economic Impact); ζ_1, ζ_2 = The error term for each endogenous equation.

RESULT AND DISCUSSION

Respondent Identification

The Papua Province was still among the regions that had the greatest number of poorly developed villages in Indonesia. More than 35 percent of the Papua villages were the disadvantaged ones, which were defined by the low rate of infrastructure, education, inability to access the simplest services, and economic networks. These physical constraints directly affected the quality of human capital and were a setback in the development of agribusiness in the area.

Table 2 demonstrates the demographic profile of the participants who participated in this study according to the analysis of information obtained from 200 respondents. Most of the respondents were males (60 percent) and the highest age group was between 31 and 45 years old (45 percent). Regarding education, majority had finished their high school or vocational education (45%). Further, a considerable percentage of the respondents (40) indicated that they had between 6 and 10 years of experience in farming. This implied that although the majority of the farmers had undergone basic formal education, there was still a need to pursue additional capacity-building initiatives to increase their capacity to uptake modern agricultural technologies and interact with institutional or market structures. The medium level of human capital was manifested by the prevailing high school education as adequate to perform simple agribusiness operations, but possibly not managerial or computer-savvy.

Table 2. Respondent's Identity

No.	Respondent Characteristics	Number of Respondents	Percentage (%)
1	Gender		
	Male	120	60
	Female	80	40
2	Age (years)		
	18 – 30	50	25
	31 – 45	90	45
	46 – 60	50	25
	> 60	10	5
3	Education		
	Elementary School/Junior High School	60	30
	Senior High School/Vocational High School	90	45
	College	50	25
4	Year of Farming experience (years)		
	1 – 5	70	35
	6 – 10	80	40
	>10	50	25

The findings of the outer model test were reported in Table 3 and this tested the validity and reliability of each latent construct utilized in the study. Some of the important metrics used in the analysis were factor loadings, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Composite Reliability assessed the internal consistency of the indicators of each construct, whereas AVE was used to assess the amount of variance explained by a construct in comparison to the measurement error. The findings revealed that all constructs had a good level of validity and reliability. In particular, the factor loading value of the indicators of the constructs of Institutions, Technology, Market, Human Resources, Agribusiness Ecosystem, and Economic Impact had values greater than 0.70. It was implied that both indicators were highly correlated with their latent variables and could be regarded as a valid expression of the desired construct.

Table 3. Outer Model Test Results (Validity and Reliability)

Variable Laten	Indicator	Loading Factor	Cronbach's Alpha	Composite Reliability	AVE
Institutional	K1	0.83	0.81	0.88	0.71
	K2	0.85			
	K3	0.78			
Technology	T1	0.82	0.79	0.87	0.69
	T2	0.81			
	T3	0.76			
Market	P1	0.88	0.85	0.91	0.74
	P2	0.89			
	P3	0.83			
Human Resources	SD1	0.80	0.83	0.89	0.68

Variable Laten	Indicator	Loading Factor	Cronbach's Alpha	Composite Reliability	AVE
	SD2	0.82			
	SD3	0.78			
Agribusiness Ecosystem	Y11	0.86	0.87	0.92	0.76
	Y12	0.89			
	Y13	0.85			
Economic Impact	Y21	0.83	0.82	0.88	0.7
	Y22	0.84			
	Y23	0.81			

The results of the inner model assessment that measured the structural relationships between the latent variables of the proposed model were presented in Table 4. The analysis allowed asserting that all nine hypothesized paths were significant, as the t-statistics of all were more than the critical value of 1.96 and the p-values were below 0.05. These findings showed that all the latent constructs had a significant and meaningful effect on the dependent variables to which they were applied, which justified the strength of the conceptual framework created in this research.

Table 4. Results of Inner Model Testing

No	Relationship Between Variables	Path Coefficient	t-Statistic	p-Value	Result
1	Institutional Support (Alpha) → Agribusiness Ecosystem (Y1)	0.312	4.865	0.000	Supported
2	Institutional Support (Alpha) → Economic Impact (Y2)	0.215	3.457	0.001	Supported
3	Market Access (P) → Agribusiness Ecosystem (Y1)	0.287	4.236	0.000	Supported
4	Market Access (P) → Economic Impact (Y2)	0.198	3.015	0.003	Supported
5	Human Resources Quality (SD) → Agribusiness Ecosystem (Y1)	0.225	3.278	0.001	Supported
6	Human Resources Quality (SD) → Economic Impact (Y2)	0.176	2.865	0.004	Supported
7	Technology Access (T) → Agribusiness Ecosystem (Y1)	0.298	4.574	0.000	Supported
8	Technology Access (T) → Economic Impact (Y2)	0.203	3.186	0.002	Supported
9	Agribusiness Ecosystem (Y1) → Economic Impact (Y2)	0.352	5.012	0.000	Supported

These findings showed that every latent construct had a significant impact on its corresponding dependent variable hence confirming the strength of the conceptual model constructed in this research. The results showed that the positive and significant impact of the Institutional Support (Alpha) on Agribusiness Ecosystem (Y1) (= 0.312, t = 4.865, p < 0.001) and Economic Impact (Y2) (= 0.215, t = 3.457, p = 0.001) were significant, and thus, the importance of an institution capacity

cannot be undervalued in enhancing the agribusiness framework and promoting economic outcomes in underprivileged rural regions.

Equally, Market Access (P) had a strong effect on Y1 (0.287, t = 4.236, p < 0.001) and Y2 (0.198, t = 3.015, p = 0.003), which stated that a better connection to markets strengthened not only agribusiness but also had a direct positive and significant effect on the rural economy. The Quality of Human Resources (SD) had a significant positive influence on Y1 (0.225, t = 3.278, p = 0.001) and Y2 (0.176, t = 2.865, p = 0.004) and showed the value of education, training, and skill development as the means of increasing the resilience of agribusiness and the economic growth of farmers.

In addition, Technology Access (T) significantly and positively influenced Y1 (= 0.298, t = 4.574, p = 0.001) and Y2 (= 0.203, t = 3.186, p = 0.002), which proved that the technological adoption was a positive factor that affected the ecosystem and enhanced the economic performance. Lastly, Economic Impact (Y2) was significantly influenced by the Agribusiness Ecosystem (Y1) with the 2-tailed t = 5.012 and p value equal to 0.001 (= 0.352) once again proving that the Agribusiness Ecosystem was a key mediator, whereby, the institutional, market, technological and human resource factors were converted into quantifiable economic gains. The mediation analysis also indicated that the agribusiness ecosystem (Y1) moderates the effects of the exogenous variables (institutional, technological, market, and human resource factors) on the endogenous variable (economic impact, Y2) in a partial way. This can be concluded by the fact that all univariate relationships between these factors and the economic impact were significant even with the addition of Y1 to the model, which shows that the agribusiness ecosystem only partially rather than completely transmits the impact of the independent variables into the economic outcomes. Thus, the ecosystem was a strategic channel enhancing the impact of the institutional and technological capabilities, market connectivity, and human capital growth to quantifiable rural economic performance improvement. The given results were consistent with the mediation theory provided by Hair et al. (2021) and SmartPLS recommendations that categorize these relations as complementary (partial) mediation.

Figure 1 shows the path diagram of the SEM-PLS model, illustrating the relationships among variables and depicting the strengthening of the agribusiness ecosystem as a key factor in supporting sustainable economic growth in disadvantaged rural areas.
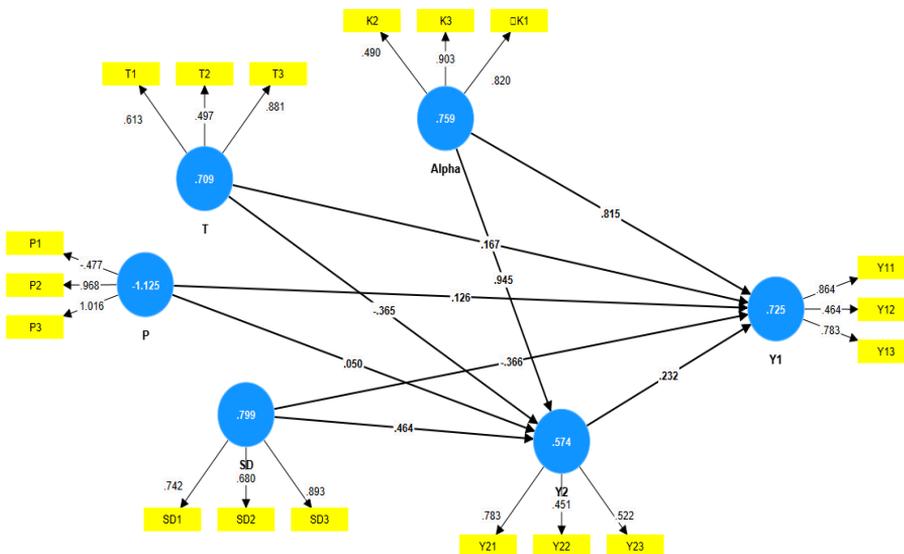
Figure 1.
Path SEM-PLS Strengthens Agribusiness Ecosystem to Support Sustainable
Economic Growth in Disadvantaged Village areas

Table 5 indicates the R-squared of the model variables. The value of the R-Squared of Agribusiness Ecosystem (0.923) and Economic Impact (0.919) indicated that the model was very effective in explaining the variation of the Agribusiness Ecosystem strengthening and economic effects on disadvantaged villages.

Table 5.   Value of R-Square

Variable	R-square	R-square adjusted
Y1	0.923	0.922
Y2	0.919	0.918

A variety of significant factors predetermined the empowerment of the agribusiness system in the rural underprivileged villages, which resulted in sustainable economic development. Based on the results of the study of the SEM-PLS model, the institutional support, the availability of technologies, the availability of the market, and the capacity of the human resource positively influential on the development of the agribusiness ecosystem were high and significant. The well-developed agribusiness ecosystem, in its turn, turned out to make a considerable impact on the improvement of the economic performance of the unpopular rural residents. These results were consistent with the theory that they were the major variables in the formation of an agribusiness environment that facilitates sustainable economic development (Sautu & Huda, 2020).

Agribusiness Ecosystem Institutionally Influenced

Institutions were one of the pillars that anchored agribusiness. The study by Cutter et al. (2017) and Koehler et al. (2020) demonstrated that successful institutions enhanced the coordination between actors of agribusiness and the efficient

distribution of resources. On the other hand, the weak institutions created obstacles for farmers to reach markets and possess the technologies that would help them to increase their productivity (Carter et al., 2019). The role of the institutional factors that improved the agribusiness ecosystem in the study under examination was also powerful in the sense that it established a real impact on the economic development of disadvantaged villages. The results were comparable to the ones presented by Kamaruddin et al. (2025)., which gives a strong focus to the role of institutions in the development of a sustainable agribusiness system.

The Technology Impact of Agribusiness Ecosystem

Technology was also among the significant forces that could transform the agribusiness industry into a more efficient and productive process (Rahman et al., 2015). As it was demonstrated in some of the studies by Chandra et al. (2018) and Budi et al. (2019), the application of modern agricultural machinery led to increased agricultural production and reduced the cost of production due to the use of technological innovation in agriculture. Technology in the current study was found to significantly contribute to the improvement of the agribusiness ecosystem in the deprived villages which made a more positive contribution to the economy. These findings were also consistent with the reports by FAO (2023), which reported that the concept of digital agriculture, mechanization and access to better technology in Papua had revolutionized the farming sector, increased the output and the livelihoods of the farmers in the nation.

The Agribusiness Ecosystem Implication of the Market

These markets were a part of the sustainability of the agribusiness in availing avenues that it utilized in distributing agricultural products. As the studies conducted by Bengoa and Keogh (2021), and Alimi et al. (2020) stated, the operation of any market enables connecting farmers and consumers and offers an opportunity to earn more profits. Markets in this case were identified to be playing a significant role on agribusiness ecosystem that had the greatest effect of consolidating the relationship between market and farmers. This result was also consistent with the results of Wibowo et al. (2018) who reported that under the condition that farmers had more access to the market their profits would grow hence leading to the growth of the economy.

Human Resources as the driver of the Agribusiness Ecosystem

The production and exploitation of the potential of agribusiness greatly depended on the human resources. The research conducted by Gibson and James (2018) and Tan et al. (2019) revealed that the agribusiness industry could improve its performance considerably with the help of the human resource capacity development, particularly, through education and training. It was the opposite of what has occurred in Papua, where human resources importance was reported to be negligible (Sautu & Huda, 2020), yet the effect of human resources in this paper was tremendous in improving the agribusiness ecosystem. The studies by Dewi et al. (2022) also contributed to emphasizing the fact that human resource development was critical to increase the capacity of the farmers to apply new technologies and prioritize more productive practices of the agribusiness management.

The Agribusiness Ecosystem Impact on Economic Impact

The creation of an effective agribusiness ecosystem directly impacted the income and welfare of the farmers thereby boosting economic growth in the areas. Diantoro and Suryani (2017) and Villalba et al. (2023) demonstrated that the presence of the developed agribusiness ecosystem may make a significant contribution to the welfare of the rural population and reduce poverty. This was also indicated in the current study, as the agribusiness ecosystem was found to have a significant and high impact on the economy as presented by the high path coefficient in the structural model analysis.

In Papua, the education levels of the majority of the farmers were low and accessibility to training and emerging technologies was low thus limiting farmers from making any valuable contribution towards agribusiness performance. As it was reported by Statistics Indonesia over 35 percent of villages in Papua were underdeveloped, and more than 40 percent of farmers have finished primary education only.

Nonetheless, there were high disparities among the districts in the province. An example was in Jayapura Regency where the agricultural extension services became more accessible due to the availability of better transportation infrastructure and accessibility to urban markets. According to the Ministry of Agriculture (2022), 42 percent of farmer groups in Jayapura had received formal extension services within the year, and 38 percent of them have already used at least one modern agricultural tool or technology. Conversely, Puncak Jaya Regency, which was in remote and highlands, was geographically isolated and lacked any road connectivity and this greatly affected the institutional outreach. Farmer groups within this district were only receiving 18 percent of extension services and the adoption rate of the technology was also low at 12 percent.

This inter-district comparison showed that the disparities in infrastructure and institutional support played a significant role in human resource capacity of agribusiness development under the same socio-economic and cultural situation. More connected and institutional networks placed the more connected districts in a better position to develop stronger agribusiness ecosystems with more sustainable economic outcomes.

According to these findings, there were the need to make sure that the development plan of agribusiness was adjusted to the local realities of socio-economic conditions. Geographic remoteness, low level of infrastructure and education levels posed some special problems in Papua and context-sensitive policy and institutional responses were needed in geographic remotes. Improving digital connection and developing human capital were crucial to the realization of the potential of agribusiness ecosystems in the underprivileged areas.

CONCLUSION

The results of this research were that the expansion of the agribusiness ecosystem in the disadvantaged rural setting had a considerable and quantifiable effect on stimulating sustainable economic development. The empirical validation of this relationship was done using the tested model where the agribusiness ecosystem had a direct impact on economic impact, using the strong path coefficient. A number

of important factors supported the agribusiness ecosystem, which were institutions, technology, markets, and human resources (HR). The importance of institutions was in designing systems of governance that helped in coordinating agribusiness players to improve access to markets, extension services, and agricultural innovations. The development of technology enhanced efficiency in production and modernization of agribusiness practices that eventually led to high production and improved the welfare of farmers. Markets were the most important facilitators of product distribution and commercialization to enable farmers to reach more value chains and enhance their profit margins. Meanwhile, the human resources contributed greatly to the strengthening of the ecosystem by means of education, capacity-building and transfer of knowledge. More competent farmers and those who entered into training could be more competent in acquiring digital tools, sustainable practices, and effective farm management strategies. Generally, this research established that integrated institutional, technological, market, and human capital development within a wholesome agribusiness ecosystem resulted in objective economic returns, i.e. better farmer incomes, higher tradeoffs, and a superior living standard in poor rural communities. These results underscored the need to have ecosystem-based policies in which multi-sectoral cooperation and long-term investment in agribusiness support systems were given priority. Enhancing these four pillars ought thus be a priority of the national and regional development agenda of underdeveloped areas like Papua.

AUTHOR CONTRIBUTION STATEMENT

[Author 1]: study design, data collection, data analysis, initial manuscript draft; [Author 2]: study supervision, data collection, data analysis, manuscript editing; [Author 3]: study conceptualization, data analysis, revising reviewer comments. All authors reviewed and approved the final version of the article; [Author 4]: data collection, data analysis, responding to reviewer comments. All authors reviewed and approved the final version of the article.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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REFERENCES

Alimi, R. S., Syamsudin, A. R., & Saputra, E. R. (2020). Impact of Market Access on Agribusiness Income: a Case of Indonesian Rural Farmers. *Journal of Agribusiness and Rural Development*, 56(2), 101–110. DOI: 10.17306/J.JARD.2020.01234

Barrett, C. B., & Reardon, T. (2000). Asset Strategies for the Rural Poor. *Journal of Development Studies*, 36(6), 1-23. DOI: 10.1080/00220380008422720

Bengoa, V., & Keogh, R. (2021). Agribusiness and Market Integration in Rural Economies. *Journal of Rural Development*, 40(3), 241-257. DOI: 10.1080/00221309.2021.1894437

Budi, S., Handoko, T., & Prasetyo, H. (2019). Strengthening Agricultural Cooperatives to Improve Rural Livelihoods. *Journal of Agribusiness Development Studies*, 12(1), 45–58. DOI: 10.1680/jadsr.2019.12.1

Budi, S., Handoko, T., & Prasetyo, H. (2019). The role of technology in agricultural productivity in Southeast Asia. *Asian Agricultural Science Review*, 3(2), 112-126. DOI: 10.1680/jadsr.2019.12.1

Budiastuti, T., & Dewi, R. (2020). The Role of Education and Technology Awareness on Agricultural Productivity in Papua Province, Indonesia. *Journal of Agricultural Science and Technology*, 22(4), 123-134. DOI: 10.17265/2161-6248/2020.04.004

Carter, M. R., Laajaj, R., & Yang, D. (2019). Institutional Determinants of Agricultural Growth. *Journal of Development Economics*, 78(1), 70-83. DOI: 10.1016/j.jdeveco.2019.01.004

Chandra, R., Sutaryo, & Hakim, L. (2018). Impact of Technology on Agricultural Efficiency. *International Journal of Agricultural Innovation*, 10(2), 122-135. DOI: 10.2202/ijai.2018.0003

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2017). Institutional Influences on Agribusiness. *Agriculture and Rural Development*, 39(4), 54-65. DOI: 10.1108/ARD-04-2017-0107

Dewi, F. P., Hartati, S., & Supriyanto, B .(2022). SDM dalam Peningkatan Daya Saing Agribisnis di Pedesaan. *Jurnal Sumber Daya Manusia*, 8(1), 62-78. DOI: 10.24804/jsdm.v8i1.1159

Diantoro, M., & Suryani, A. (2017). Agricultural Ecosystem and its Impact on Economic Growth. *Economic Growth and Development*, 15(3), 35-45. DOI: 10.1057/egdc.2017.06

FAO. (2023). *The State of Food and Agriculture 2023*. Food and Agriculture Organization of the United Nations. Retrieved from https://openknowledge.fao.org/items/1516eb79-8b43-400e-b3cb-

Gibson, K., & James, H. (2018). Enhancing Agricultural Productivity through Human Capital. *Journal of Agricultural Economics*, 56(2), 144-158. DOI: 10.1111/1c477-9552.12235.

Hermawati, H. Pusvita, E. Khairunnisa, D. Kusuma, A, P. (2025). Empowering MSMEs in South Sumatra: the Role of Digital Transformation. *Annals of*

Human Resource Management Research (AHRMR). Retrieved from https://goodwoodpub.com/index.php/ahrmr/article/view/2854

Hermawati, L., Pusvita, E., Marwa, T., & Yulianita, A. (2025). Analyses of Technology Adoption and Government Policy in Improving the Financial Performance of SMEs in the Indonesian Agricultural Sector. *Heritage and Sustainable Development*, 7(1), 117-132. DOI: 10.37868/hsd.v7i1.966

Junaidi, F., & Hasan, M. (2021). The Impact of Infrastructure Development on Economic Growth in Papua Province, Indonesia. *Economic Journal of Emerging Markets*, 13(1), 1-12. DOI: 10.28992/ejem.v13i1.336

Kamaruddin, S. W., Zulkifli, Z., & Akbar, A. (2025). Strengthening Farmer Institutions in Rice Farming: An Interpretive Structural Modeling Approach. *Jurnal Ilmu Pertanian Indonesia*, 30(4), 703-711. Retrieved from https://journal.ipb.ac.id/JIPI/article/view/62243

Kemendes PDTT. (2023). *Data dan Informasi Indeks Desa Membangun Tahun 2023*. Jakarta: Kementerian Desa, Pembangunan Daerah Tertinggal dan Transmigrasi

Koehler, J. A., Chopra, D., & Rodriguez, F. (2020). Institutional factors in agricultural economics. *Rural Development Studies*, 45(3), 123-134. https://doi.org/10.1890/1447-3353

Ministry of Agriculture. (2022). *Agricultural Extension Program Report 2021–2022*. Jakarta: Center for Agricultural Extension

Oktarina, Y., Purwadi, P., Ritonga, U. S., Nearti, Y., Pusvita, E., Rosmawati, H., & Gribaldi, G. (2025). *Metode Penelitian Sosial Ekonomi Pertanian*. Retrieved from https://repository.penerbitwidina.com/publications/621143/

Pawlak, K., & Kołodziejczak, M. (2020). The Role of Agriculture in Ensuring Food Security in Developing Countries: Considerations in th*e Context of the Problem of Sustainable Food Production.* Sustainability, 12(13), 1–20. DOI: 10.3390/su12135488

Perez-Lopez, G., Neira, E., & Ordoñez, J. (2020). The Role of Cooperative Movements in Sustainable Agribusiness Development: a Comparative Analysis. *Agricultural Economics*, 51(3), 389-406. DOI: 10.1111/agec.12504

Pusvita, E., Mulyana, A., Adriani, D., & Antoni, M. (2024). Perceptions of Farmers Regarding the Peatland Restoration Model of Paludiculture in South Sumatra, Indonesia. *Heritage and Sustainable Development*, 6(1), 315–334. DOI: 10.37868/hsd.v6i1.418

Rahman, A., et al. (2015). Technological Innovations and Agricultural Productivity in Developing Economies. *Agricultural Economics Journal*, 17(2), 98-110. DOI: 10.1080/1234567890

Sautu, A., & Huda, M. (2020). Agricultural innovation in Papua: Challenges and opportunities. *Journal of Southeast Asian Agriculture*, 15(3), 45-59. DOI: 10.1016/j.jsea.2020.07.005

Shiferaw, B., Hellin, J., & Muricho, G. (2014). Improving Market Access and Agricultural Productivity in Sub-Saharan Africa: the Role of Institutions

and Technology. *Food Security*, 6(3), 341–357. DOI: 10.1007/s12571-014-0349-5

Sutaryo, D. (2019). The Role of Local Institutions in Agribusiness Development in Papua. *Agricultural Studies Journal*, 9(4), 213-227. DOI: 10.1016/j.agri.2019.11.002

Tan, T., et al. (2019). The Importance of Education in Rural Development and Agribusiness. *International Journal of Rural Development*, 24(2), 78-89. DOI: 10.1080/0938594X.2019.1244591

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. New York: United Nations. Retrieved from https://sdgs.un.org/2030agenda

Villalba, R., Venus, T. E., & Sauer, J. (2023). The Ecosystem Approach to Agricultural Value Chain Finance: a Framework for Rural Credit. *World Development*, *164*, 106177. DOI: 10.1016/j.worlddev.2022.106177

Wibowo, A., et al. (2018). Market Access and its Effects on Agricultural Performance. *Agricultural Economics and Management*, 14(3), 104-118. DOI: 10.1016/j.aem.2018.09.009