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Sustainable Livelihood Level of the Community in Kalampadu Village, Ogan Ilir Regency: An Analysis Using SEM-PLS

Yulasteriyani [1,*], Cynthia Azhara Putri [1], Istiqoma [1], Muhammad Yusuf Abror [2], and Diana Dewi Sartika [1]

[1] Department of Sociology, Faculty of Social and Political Sciences, Sriwijaya University, Ogan Ilir Regency, South Sumatra Province, 30662, Indonesia
[2] Çanakkale Onsekiz Mart University, Terzioğlu Campus, 17100 Çanakkale, Türkiye
* Corresponding Author: yulasteriyani@fisip.unsri.ac.id

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ABSTRACT

This study examines the relationship between Pentagon Assets (PA), Livelihood Strategies (LS), and Sustainable Livelihood (SL) in the community of Kalampadu Village, Ogan Ilir Regency, using Structural Equation Modeling-Partial Least Squares (SEM-PLS). The research framework is based on the Sustainable Livelihood (SL) theory proposed by Scoones (1998) and further developed by DFID (1999). This study adopts an associative research design with a quantitative approach to assess the community's level of sustainable livelihood through statistical analysis. Data were collected through observations, questionnaires, and literature reviews. The sampling method used was probability sampling, with a sample of 188 households selected from a total population of 354, determined using Slovin's formula. The collected data were analyzed using SEM-PLS. The findings reveal that PA has a significant influence on LS, with a path coefficient of 11.976, while LS makes a substantial contribution to SL, with a path coefficient of 5.136. These results indicate that asset ownership strongly affects livelihood strategies, which in turn supports the achievement of sustainable livelihoods. This study provides valuable insights for policymakers to develop asset-based strategies aimed at enhancing well-being through sustainable livelihood approaches. Policies should emphasize community empowerment, the adoption of green technologies, environmentally friendly skills training, and collaboration among the government, private sector, and local communities to achieve efficient and well-monitored sustainable development.

Keywords: *Community Empowerment; Livelihood Strategies; Rural Communities; Sustainable Livelihood; Vulnerability*

1. Introduction

The economic vulnerability of farmers and rural communities is driven by climate change, characterized by rising temperatures and unpredictable rainfall, which reduce agricultural yields and threaten food security (Bates et al., 2008; Kandji et al., 2006). Soil degradation caused by erosion, deforestation, and excessive land use further diminishes soil quality and productivity. Meanwhile, drought and pollution exacerbate the scarcity of clean water, which is essential for agriculture and daily life. Collectively, these factors threaten rural economic sustainability and worsen social inequality (Smit et al., 2000).

The economic vulnerability of farming households, particularly among non-irrigated farmers, remains a significant issue. Despite various agricultural development initiatives aimed at increasing farmers' incomes, poverty continues to persist in agricultural communities (Datau et al., 2017; Nurmanaf, 2003; Prayitna et al., 2020; Sari et al., 2014; Wanimbo, 2019). Climate change, soil degradation, and water availability are key factors influencing rural livelihoods. According to Mosher, household welfare is significantly affected by income levels (Mosher, 1991), while Sajogyo argued that welfare levels can be measured by the proportion of household expenditure equivalent to per capita rice consumption per year (Sajogyo, 1982). Household expenditure levels vary based on income groups, family size, social status, food prices, distribution processes, and consumption patterns.

In Kalampadu Village, the majority of the population relies on rain-fed rice farming as their primary livelihood. Based on preliminary observations, 90% of the 354 households in the village are engaged in farming. The agricultural ecology in this community faces significant economic vulnerability, with 41 households living below the poverty line, while the rest employ various livelihood strategies to sustain themselves, including on-farm, off-farm, and non-farm activities (Yulasteriyani, 2018; Yulasteriyani et al., 2022; Yulasteriyani, Randi, et al., 2023; Yulasteriyani et al., 2021). Additionally, rural communities are gradually transitioning their livelihood structures from on-farm to non-farm activities, particularly in e-commerce. However, the sustainability of this transition has not yet been assessed (Yulasteriyani, Malinda, et al., 2023).

Sustainable livelihoods are achieved when communities possess the capacity to adapt and recover from various vulnerabilities, including shocks, long-term changes, and seasonal fluctuations. To sustain and improve their livelihoods, communities rely on various assets, such as natural and environmental resources, social capital, financial capital, and human resources, which include access to education and physical infrastructure (DFID, 2005; Saragih et al., 2007).

Extensive research has been conducted on rural livelihood strategies, but few studies have applied the Sustainable Livelihood (SL) framework. Previous research has examined the livelihoods of poor communities and their resilience (Dharmawan, 2023; Subair et al., 2015), sustainable household farming (rice fields, plantations, and livestock), fisheries, and communities around tourist areas (Fachlevi et al., 2022; Ibrahim et al., 2020; Roy, 2020; Wuryantoro & Ayu, 2019); as well as the strengthening of social capital and livelihood development (Aprianty Azis & Muh Amir, 2022; Widodo, 2012). Some studies on SL have been conducted, but they primarily focus on vulnerable communities (Martopo et al., 2012; Saputra et al., 2019; Tenrisau Adam et al., 2023; Wijayanti et al., 2016).

Building upon the literature review and field data, this study aims to analyze the Sustainable Livelihood Level of the Community in Kalampadu Village, Ogan Ilir Regency: An

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Analysis Using SEM-PLS. This research extends previous studies (Yulasteriyani et al., 2022; Yulasteriyani, Randi, et al., 2023), which explored livelihood systems and the transformation of non-farm livelihood structures. The key distinction of this study lies in its application of the sustainable livelihood framework across all livelihood structures (on-farm, off-farm, and non-farm).

2. Literature Review

2.1. Sustainable Livelihood

Sustainable livelihood, as explained by Chambers & Conway, refers to a condition that involves the capabilities, assets, and activities required to sustain a living (Chambers & Conway, 1992). A livelihood is considered sustainable if it can withstand and recover from shocks and stresses, maintain or enhance its capabilities and assets, and provide a viable means of living for future generations. The primary goal of sustainable livelihood is to improve access to quality education, information technology, training, healthcare, and adequate nutrition; to create a supportive and cohesive social environment; to ensure safer access and better management of natural resources and basic infrastructure; and to enhance financial resource accessibility (DFID, 2005; Saragih et al., 2007; Scoones, 1998).

The fundamental principles of sustainability emphasize the importance of livelihood resilience in the face of various changes, including shocks and trends, as well as the ability to renew livelihoods over the long term (Saragih et al., 2007; Scoones, 1998). The basic framework of sustainable livelihood consists of several key elements. First, development should be people-centered, placing communities at the core of development efforts. Second, a holistic approach is needed to understand livelihoods comprehensively. Third, livelihood dynamics must be considered, allowing responses to changes in community livelihoods. Fourth, optimizing community potential is crucial by utilizing existing strengths to improve living conditions. Fifth, there must be a strong linkage between macro and micro policies to ensure alignment at different levels. Lastly, livelihood sustainability should be ensured for long-term economic and social stability.

Sustainable livelihood consists of four interrelated dimensions: environmental, economic, social, and institutional sustainability. Environmental sustainability is achieved when natural resources are managed efficiently to meet the needs of future generations without degrading ecosystems. Economic sustainability is attained when economic units, such as households, can maintain stable expenditures, which often serve as a better indicator of well-being than income, particularly among low-income communities. Social sustainability is realized through reducing inequality and enhancing equity by strengthening social capital and community empowerment. Institutional sustainability is achieved when institutions can continuously support community welfare in the long run (Saragih et al., 2007; Scoones, 1998).

Sustainable livelihood activities involve a range of strategies based on available priorities and opportunities, utilizing existing resources and capabilities to maintain or enhance the quality of life. Each individual or group may develop different livelihood strategies depending on their assets and vulnerability to environmental changes (Martopo et al., 2012; Saragih et al., 2007). Scholars have classified livelihood strategies in various ways. Scoones categorizes them based on efforts to increase income, including intensification, extensification, diversification, and migration (Scoones, 1998). Livelihood strategies are classified based on household socioeconomic status, distinguishing between survival, consolidation, and accumulation. Meanwhile, Ellis differentiates livelihood strategies based on the types of activities undertaken,

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distinguishing between those based on natural resources and those that do not rely on natural resources (Ellis, 2000).

2.2. Sustainable Livelihood Framework

The Sustainable Livelihood (SL) framework is used to understand the sustainable livelihoods of communities, such as those in Kalampadu Village. This framework focuses on examining the livelihoods of marginalized or impoverished communities and how they cope with challenges such as disasters, conflicts, and crises. In this context, communities rely on various livelihood assets, including natural resources, social capital, financial capital, human resources, and available infrastructure. To ensure livelihood sustainability, communities often diversify their economic activities by transforming the assets they possess (DFID, 2005; Saragih et al., 2007; Scoones, 1998).

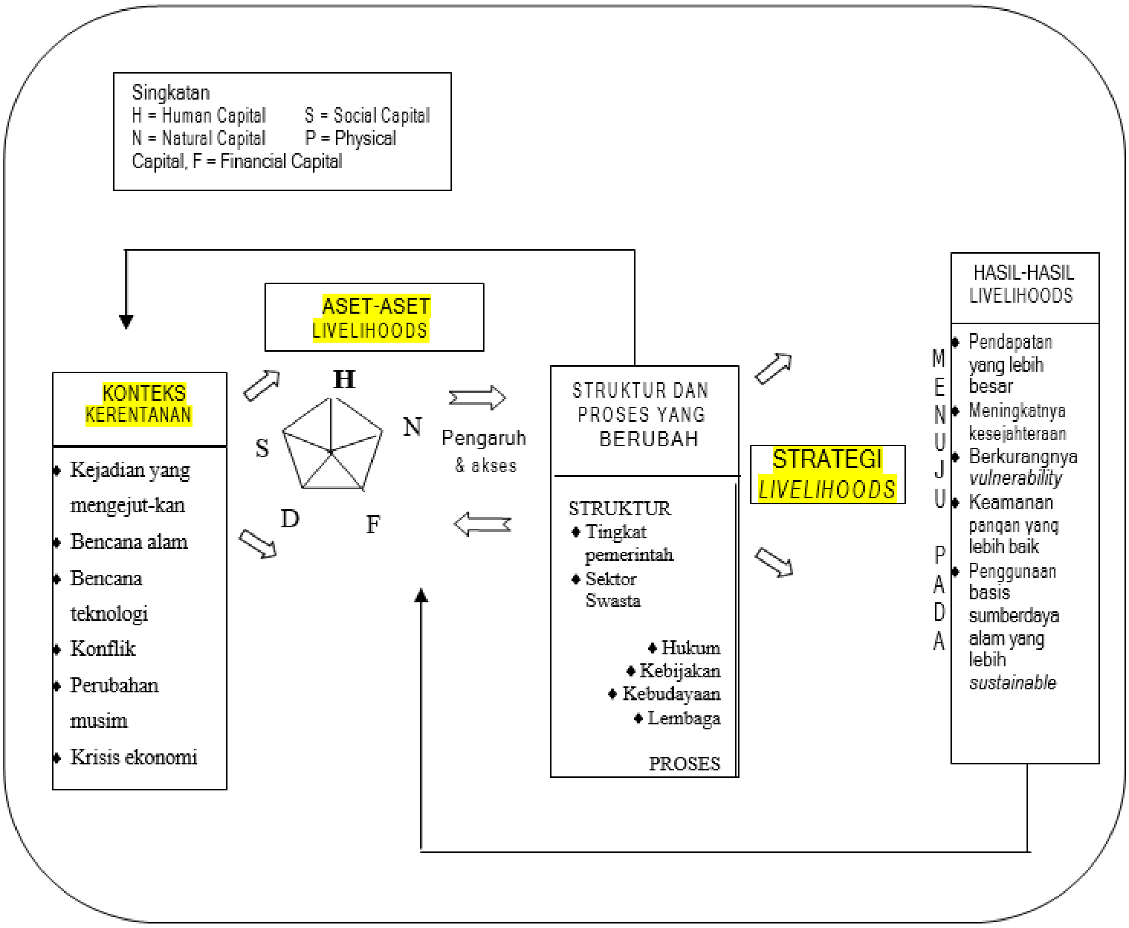

Figure 1. Sustainable Livelihood Framework (Translated from DFID 1999, Sustainable Livelihoods Guidance Sheets)

2.3. Pentagon Asset (Capital Asset)

The Sustainable Livelihood framework develops the concept of capital assets based on the belief that communities require various types of assets to achieve sustainable livelihood outcomes. A single type of asset is insufficient to meet diverse livelihood needs, especially for poor or marginalized groups with limited access to these resources. Communities in such conditions must find innovative ways to acquire and combine different assets to sustain their livelihoods (Saragih et al., 2007; Scoones, 1998).

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The strength of a household or community depends on the quantity, diversity, and balance of the assets they possess. Individuals or communities with only financial wealth but lacking social support, such as strong kinship ties, will experience insecurity. Without support from relatives or the community, they become vulnerable to threats in times of crisis or disaster (Saragih et al., 2007). The following diagram illustrates the pentagon asset in the sustainable livelihood framework:

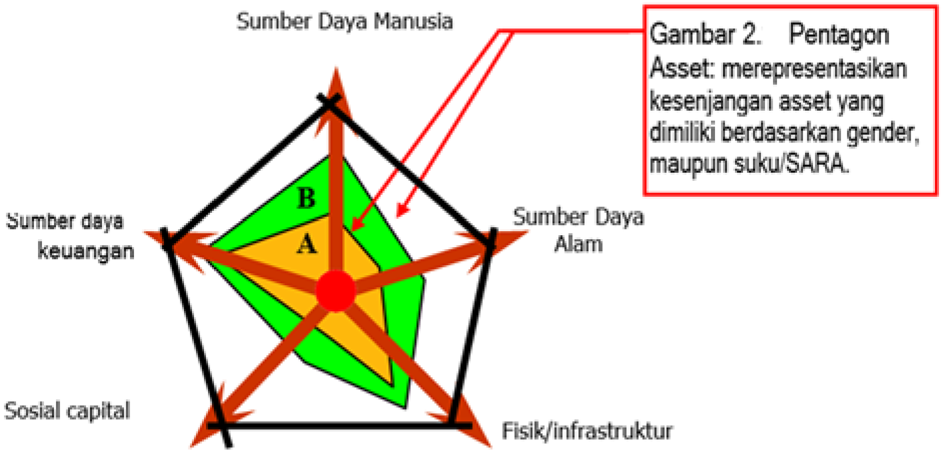

Figure 2. Pentagon Asset

This approach aims to depict the strengths of a community, including the assets and resources they possess, as well as how these assets can be transformed into activities that generate positive and sustainable livelihoods. People need various assets that can be converted through activities to achieve better livelihood outcomes. The assets owned by families or individuals within a community are not homogeneous, leading to diverse activities and varied results (Saragih et al., 2007).

To ensure their survival, the people of Kalampadu Village must optimize and modify all available resources. The pentagon asset of farming households is a key determinant in constructing a sustainable livelihood model in the village. Households with a diverse and substantial asset base are better equipped to adapt to vulnerabilities, both in the agricultural and non-agricultural sectors that continue to evolve. Conversely, households with limited resources are more susceptible to poverty, putting their livelihoods at risk of becoming unsustainable.

3. Research Methodology

This study is categorized as associative research with a quantitative approach, aiming to measure relationships between variables numerically (Sugiyono, 2014). Quantitative data is used to analyze the level of sustainable livelihood in the community and assess it using Structural Equation Modeling – Partial Least Squares (SEM-PLS), a method effective for evaluating complex relationships and measuring both direct and indirect effects of various livelihood assets and strategies (Sarstedt et al., 2021; Sholihin & Ratmono, 2021). The research was conducted in Kalampadu Village, Muara Kuang Subdistrict, Ogan Ilir Regency.

A probability sampling method was applied, allowing each member of the population an equal chance of selection (Sugiyono, 2014). With a total population of 354 families, the sample size was determined using Slovin's formula, resulting in 188 respondent families. Data collection involved observation, questionnaire distribution, and literature review. The research

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instrument's validity was assessed using the Product Moment formula to ensure accurate variable measurement (Sugiyono, 2018).

The data analysis followed a structured SEM-PLS approach, including seven key stages (Ghozali, 2015): developing the path model, constructing the measurement model, collecting and verifying data, estimating the model using SEM-PLS algorithms, evaluating the measurement model, assessing the structural model, and interpreting the results to draw conclusions. This methodological framework provides a comprehensive assessment of the factors influencing sustainable livelihood.

4. Results and Discussion

4.1. Validity and Reliability

The measurement model assessment aims to evaluate the relationship between latent and manifest variables through convergent validity, discriminant validity, and reliability. Convergent validity is measured using Average Variance Extracted (AVE), which should be greater than 0.5. Discriminant validity is tested using the Fornell-Larcker Criterion, where the square root of AVE must be higher than the correlation between latent variables. Reliability is assessed using Cronbach's Alpha or Composite Reliability, both of which should ideally exceed 0.7.

4.1.1. Convergent Validity

Convergent validity in the measurement model with reflective indicators is evaluated by assessing the correlation between item or indicator scores and their respective constructs. An indicator is considered to have good reliability if its correlation value exceeds 0.70. However, in the early stages of research, a loading value between 0.50 and 0.60 is still acceptable (Sholihin & Ratmono, 2021). The outer loading results in this study illustrate the values for the Pentagon Asset, Livelihood Strategies, and Sustainable Livelihood variables, as shown in the following figure:

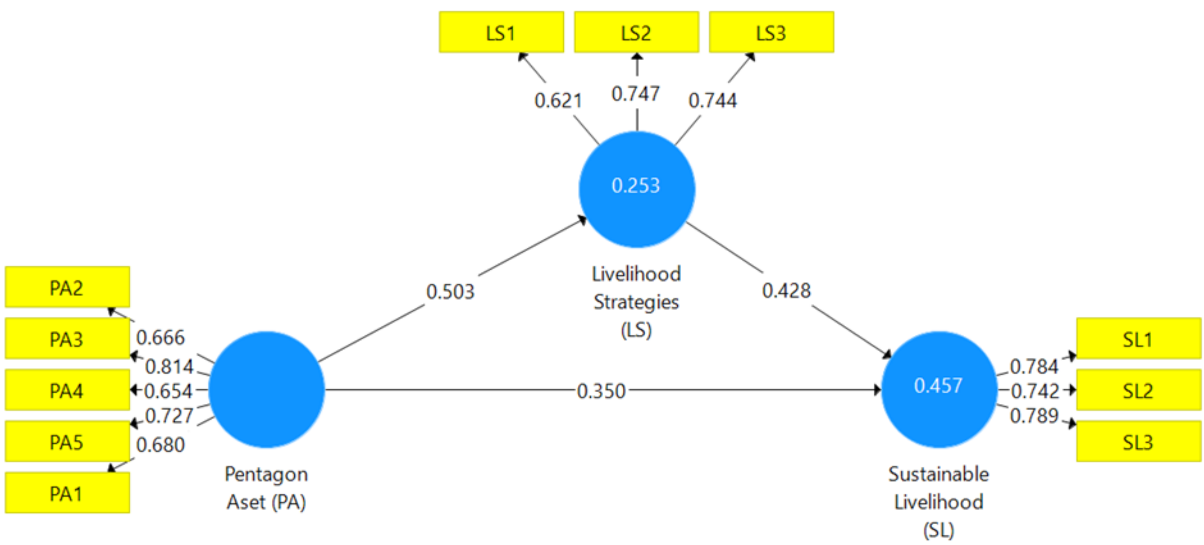

Figure 3. Outer Loading

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The outer loading results indicate that nearly all indicators have loadings above 0.70, with four indicators—LS1, PA2, PA4, and PA1—having loadings above 0.60. This confirms that all indicators are valid for measuring their respective constructs.

The outer loading diagram illustrates the relationship between three key variables: Pentagon Asset (PA), Livelihood Strategies (LS), and Sustainable Livelihood (SL), along with their corresponding indicators.

1) Pentagon Asset (PA) consists of five indicators (PA1 to PA5), with loading values ranging from 0.654 to 0.814, indicating the significant contribution of each indicator to PA.
2) Livelihood Strategies (LS) includes three indicators (LS1 to LS3), with loadings ranging from 0.621 to 0.747, showing their critical role in shaping LS.
3) Sustainable Livelihood (SL) comprises three indicators (SL1 to SL3), with loadings between 0.742 and 0.789, signifying a strong relationship with its indicators.

The relationships between variables reveal that PA has a direct influence on LS, with a loading value of 0.503, while LS is associated with SL with a loading of 0.428. Overall, the model suggests that Pentagon Asset (PA) and Livelihood Strategies (LS) play a crucial role in achieving Sustainable Livelihood (SL), where PA has a stronger impact on LS, and LS contributes to SL.

The following table presents the outer loading values:

Table 1. Outer Loading

	Livelihood Strategies (LS)	Pentagon Aset (PA)	Sustainable Livelihood (SL)
LS1	0,621		
LS2	0,747		
LS3	0,744		
PA2		0,666	
PA3		0,814	
PA4		0,654	
PA5		0,727	
SL1			0,784
SL2			0,742
SL3			0,789
PA1		0,680	

Source: Primary Data

4.1.2. Discriminant Validity

One approach to assessing discriminant validity is by examining the square root of the average variance extracted (AVE). Discriminant validity is considered adequate if the square root of AVE is greater than 0.5 (Ghozali, 2015; Sholihin & Ratmono, 2021). The discriminant validity assessment is also used to evaluate the outer model. The following table presents the discriminant validity values, demonstrating good convergent values:

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Table 2. Discriminant Validity Assessment (AVE Results)

	Livelihood Strategies (LS)	Pentagon Aset (PA)	Sustainable Livelihood (SL)
Livelihood Strategies (LS)	0,707		
Pentagon Aset (PA)	0,503	0,711	
Sustainable Livelihood (SL)	0,604	0,565	0,772

Source: Primary Data

In Table 2, the red values represent the square roots of AVE, while the black values indicate correlations between latent variables. Convergent validity is also assessed using AVE, with the criterion that an AVE value greater than 0.5 indicates good convergent validity. Based on Table 2, the square root of AVE for:

- Livelihood Strategies (LS) is 0.707, which is greater than its latent variable correlations, confirming good discriminant validity.
- Pentagon Asset (PA) has a square root of AVE of 0.711, which is also higher than its correlations with other variables.
- Sustainable Livelihood (SL) has an AVE square root of 0.772, further confirming adequate discriminant validity.

4.1.3. Composite Reliability

Composite Reliability (CR) and Cronbach's Alpha (α) are used to measure construct reliability in quantitative research, particularly in Structural Equation Modeling (SEM). CR is considered more accurate than Cronbach's Alpha, as it accounts for the factor loadings of each indicator, whereas Cronbach's Alpha assumes equal weights for all indicators, often leading to lower reliability estimates.

A construct is considered reliable if its CR or α value exceeds 0.7, although values between 0.6 and 0.7 are still acceptable in exploratory research. In SEM, CR is preferred as it provides a more precise assessment of indicator contributions compared to Cronbach's Alpha (Sholihin & Ratmono, 2021).

4.2. Goodness of Fit Testing

The Goodness of Fit (GoF) test aims to assess the quality of relationships between variables within the dataset. This evaluation involves two key indicators: the coefficient of determination and model fit testing.

- The coefficient of determination helps determine the extent to which the variables in the model explain variations in the data.
- Model fit testing evaluates whether the proposed model appropriately represents the observed data.

4.2.1. Coefficient of Determination (R-squared)

The coefficient of determination (R-squared) is an indicator used to measure how well a model explains the variation in an endogenous construct. The R-squared value ranges from 0 to 1, where a higher value indicates a greater ability of the model to explain data variability.

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In SmartPLS analysis, R^2 values of 0.75, 0.50, and 0.25 indicate that the model has strong, moderate, and weak predictive power, respectively (Sholihin & Ratmono, 2021). Additionally, the Adjusted R-squared is a refined version of R-squared, which accounts for the number of predictors and standard errors, making it a more accurate measure of the contribution of exogenous constructs to endogenous constructs.

Table 3. R Square

	R Square	R Square Adjusted
Livelihood Strategies (LS)	0,253	0,249
Sustainable Livelihood (SL)	0,457	0,451

Source: Primary Data

Based on the analysis above, both Livelihood Strategies (LS) and Sustainable Livelihood (SL) exhibit a moderate level of predictive power.

4.2.2. Model Fit Test

In Partial Least Squares (PLS) analysis, the Standardized Root Mean Square Residual (SRMR) is used as an indicator to assess model fit. A model is considered to meet the fit criteria if the SRMR value is less than 0.1. Furthermore, a model is classified as a perfect fit if the SRMR value is below 0.08 (Sholihin & Ratmono, 2021).

Table 4. Model Fit

	Saturated Model	Estimated Model
SRMR	0,165	0,165

Source: Primary Data

Based on the results above, the SRMR value exceeds the recommended threshold, indicating that the model does not meet the perfect fit criteria.

4.3. Structural Equation Modeling (SEM) Development

In developing the Structural Equation Modeling (SEM), two types of relationships are analyzed: direct effects and indirect effects. The significance of these relationships is evident from the p-values and T-Statistics in the output. The graphical output of this study is presented in the following figure:

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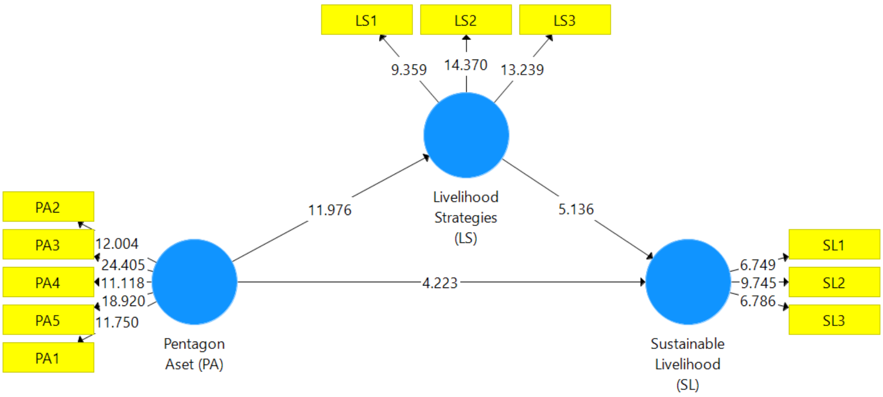

Figure 4. Graphical Output

This diagram illustrates the relationships between Pentagon Asset (PA), Livelihood Strategies (LS), and Sustainable Livelihood (SL). The PA construct shows a strong influence on LS, with path coefficients ranging from 11.750 to 24.405, indicating a significant impact of its indicators. The LS construct, with path coefficients between 9.359 and 14.370, plays a crucial role in shaping livelihood strategies. Meanwhile, SL, with path coefficients between 6.749 and 9.745, strongly affects livelihood sustainability. PA significantly influences LS (11.976), and LS positively correlates with SL (5.136), suggesting that both assets and livelihood strategies contribute to sustainability.

The graphical output in **Figure 4** further elaborates on the relationship between PA, LS, and SL. Pentagon Asset (PA) consists of five asset types that influence livelihood strategies:

1) Human Assets (education, health, and skills)
2) Natural Assets (land productivity and ownership)
3) Financial Assets (income, savings, investments, and credit access)
4) Physical Assets (housing, infrastructure, and transportation)
5) Social Assets (social relationships, side jobs, and organizational involvement)

These assets significantly impact livelihood strategies, as evidenced by the high path coefficient from PA to LS (11.976), demonstrating how asset availability determines the strategies individuals employ to enhance their livelihoods.

Furthermore, Scoones classifies livelihood strategies into four main approaches: intensification, extensification, diversification, and migration, all aimed at increasing income (Scoones, 1998). However, intensification and extensification often lead to land degradation and deforestation, threatening long-term sustainability. Extensification can harm vegetation cover, while intensification may reduce soil fertility due to excessive input usage (Lambin et al., 2003). Therefore, a more sustainable approach is needed to mitigate these negative effects.

Regarding Sustainable Livelihood (SL), four key dimensions are emphasized (DFID, 2005; Saragih et al., 2007; Scoones, 1998):

1) Environmental sustainability – Efficient natural resource management to meet future needs without damaging ecosystems.
2) Economic sustainability – Household expenditure stability, reflecting well-being, especially among low-income communities.
3) Social sustainability – Reducing inequality, strengthening social relationships, and promoting equity.

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4) Institutional sustainability – The ability of institutions to support long-term community welfare.

Overall, the relationship between PA, LS, and SL suggests that well-planned livelihood strategies can facilitate sustainable livelihoods through a balanced and inclusive approach.

4.3.1. Direct Effects

This study tests hypotheses by analyzing T-Statistics and P-Values to determine the significance of relationships between variables. A T-Statistic greater than 1.96 indicates a strong relationship between independent and dependent variables. Meanwhile, P-Values below 0.05 suggest that the relationship is statistically significant, providing sufficient evidence to support the proposed hypotheses.

This analysis evaluates the strength and direction of the direct effects among variables in the research model. The Path Coefficients results provide insights into the extent to which independent variables influence dependent variables, as well as their significance level in this study. The following table presents the Path Coefficients results, showing the direct effects between the tested variables.

Table 5. Path Coefficients for Direct Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Livelihood Strategies (LS) -> Sustainable Livelihood (SL)	0,428	0,432	0,083	5,136	**0,000**
Pentagon Aset (PA) -> Livelihood Strategies (LS)	0,503	0,511	0,042	11,976	**0,000**
Pentagon Aset (PA) -> Sustainable Livelihood (SL)	0,350	0,350	0,083	4,223	**0,000**

Source: Primary Data

Based on the Path Coefficients results in **Table 5**, all paths in the model exhibit T-Statistics greater than 1.96 and P-Values below 0.05. This indicates that all hypotheses related to direct effects in the model are supported, demonstrating significant relationships between the analyzed variables in this study.

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4.3.2. Indirect Effects

Table 6. Specific Indirect Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Livelihood Strategies (LS) -> Sustainable Livelihood (SL)					
Pentagon Aset (PA) -> Livelihood Strategies (LS)					
Pentagon Aset (PA) -> Sustainable Livelihood (SL)	0,215	0,220	0,042	5,181	0,000

Source: Primary Data

Based on Table 6, the Specific Indirect Effects results indicate that all paths in the model exhibit T-Statistics greater than 1.96 and P-Values below 0.05. These findings suggest that each indirect effect in the model is statistically significant, supporting all related hypotheses. Thus, this study confirms a significant relationship between the examined variables.

4.3.3. Model Interpretation

Based on the findings from this study and the data analysis results, as illustrated in Figure 4, the relationship between Pentagon Asset and Sustainable Livelihood is characterized by a direct and significant positive effect on both Sustainable Livelihood and Livelihood Strategies in Kalampadu Village, Ogan Ilir Regency, with an effect magnitude of 4.223.

5. Conclusion

The findings of this study indicate that Pentagon Asset (PA) has a highly significant influence on Livelihood Strategies (LS), as reflected in the path coefficient of 11.976 across both analyzed models. The management and utilization of assets, comprising various indicators, play a crucial role in determining the type of livelihood strategies adopted by individuals or communities. Greater and well-managed assets provide a strong foundation for implementing more effective and sustainable livelihood strategies. Furthermore, the results demonstrate that Livelihood Strategies (LS) positively contribute to Sustainable Livelihood (SL), with a path coefficient of 5.136. Although the effect is slightly lower than the impact of PA on LS, this relationship remains statistically significant, indicating that the livelihood strategies adopted have a direct effect on achieving sustainable livelihoods.

Overall, the analysis confirms that PA not only plays a significant role in shaping LS but also directly influences livelihood sustainability through the application of appropriate strategies. These findings provide valuable insights for developing asset-based policies that can enhance community well-being and achieve better sustainability outcomes. To balance

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economic growth with environmental sustainability, policies should focus on empowering community assets through sustainable natural resource management, adopting green technologies, and providing environmentally friendly skill training. Additionally, strengthening collaboration between the government, private sector, and communities is crucial in creating an integrative development model. Policies that promote efficient resource management, social and financial asset empowerment, and strict environmental impact monitoring will reinforce sustainable livelihood strategies and support the achievement of long-term sustainability goals.

6. Acknowledgment

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7. Declaration of Conflicting Interests

The author has declared no potential conflicts of interest regarding this article's research, authorship, and/or publication.

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About the Authors

1) **Yulasteriyani** obtained a Master's degree in Sociology from Padjadjaran University, Indonesia, in 2018. She is a lecturer in the Department of Sociology, Faculty of Social and Political Sciences, Sriwijaya University, Indonesia.
Email: yulasteriyani@fisip.unsri.ac.id

2) **Cynthia Azhara Putri** obtained a Master's degree in Notarial Law from the Faculty of Law, Sriwijaya University, Indonesia, in 2018. She is a lecturer in the Law Studies Program, Faculty of Law, Sriwijaya University, Indonesia.
Email: thiazhar@fh.unsri.ac.id

3) **Istiqoma** obtained a Master's degree in Sociology from Universitas Gadjah Mada, Indonesia, in 2019. She is a lecturer in the Department of Sociology, Faculty of Social and Political Sciences, Sriwijaya University, Indonesia.
Email: istiqoma@fisip.unsri.ac.id

4) **Muhammad Yusuf Abror** is a doctoral student in Uluslararası İlişkiler (International Relations) at Çanakkale Onsekiz Mart University, Türkiye.
Email: 24414823001@ogr.comu.edu.tr

5) **Diana Dewi Sartika** obtained a Doctorate in Sociology from Universitas Gadjah Mada, Indonesia, in 2021. She is a lecturer in the Department of Sociology, Faculty of Social and Political Sciences, Sriwijaya University, Indonesia.
Email: dianadewisartika@fisip.unsri.ac.id

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