

Assessing the Sustainability Index of the Environmental, Economic, and Social Aspects in Community-Based Tourism

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ABSTRAK

Pariwisata berbasis komunitas mendorong pembangunan berkelanjutan melalui partisipasi local, namun pencapaian keberlanjutan jangka panjang menghadapi tantangan, terkait keseimbangan dampak lingkungan, ekonomi, dan sosial. Penelitian ini mengevaluasi keberlanjutan pariwisata berbasis komunitas di Agro Eduwisata Organik Mulyaharja, Indonesia menggunakan metode gabungan (*mix method*). Data diperoleh menggunakan kuesioner dan panduan wawancara dan observasi. Analisis Menggunakan *Multiaspect Sustainability Analysis (MSA)* pada tiga dimensi, yaitu lingkungan, ekonomi, dan sosial, mengacu pada protokol MSA, 21 pemangku kepentingan dipilih secara purposive berdasarkan keterlibatan langsung pada pengelolaan pariwisata. Hasil menunjukan aspek lingkungan masuk kategori berkelanjutan dengan indeks 57,14, sedangkan ekonomi (35,71) dan sosial (50,00) masuk dalam kategori kurang berkelanjutan, dengan indeks gabungan 47,62 yang juga menunjukan status kurang berkelanjutan. Analisis *leverage* mengidentifikasi pengelolaan sampah atau air, kunjungan wisatawan, aksesibilitas dan kepuasan pengunjung sebagai titik intervensi kritis. Penelitian ini berkontribusi pada kerangka MSA terintegrasi untuk penilaian pariwisata berbasis komunitas pedesaan dan panduan praktis perbaikan berkelanjutan.

Kata kunci: Pariwisata Berbasis Komunitas, Keberlanjutan, *Multiaspect Sustainability Analysis*, Kelurahan Mulyaharja

ABSTRACT

Community-based tourism promotes sustainable development through local participation, yet achieving long-term sustainability remains challenging due to interconnected environmental, economic, and social factors. This study evaluates community-based tourism sustainability at Agro Eduwisata Organik Mulyaharja, a mixed-methods approach was employed. Data were collected using questionnaires, interview guides, and observations. Data analysis using Multi-Aspect Sustainability Analysis (MSA) across three dimensions. Following MSA protocols, 21 stakeholders were purposively selected based on their direct involvement in destination management. Results show environmental sustainability (57.14), while economic (35.71) and social (50.00) aspects fall into low sustainability categories, yielding an overall index of 47.62. Leverage analysis identifies waste/water management, tourist visitation, accessibility, and visitor satisfaction as critical intervention points. This study contributes an integrated MSA framework for rural community-based tourism assessment and provides practical guidance for targeted sustainability improvements.

Keywords: Community-based Tourism, Sustainability, *Multiaspect Sustainability Analysis*, Mulyaharja District

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1. INTRODUCTION

Community-based tourism has emerged as a key approach to sustainable tourism by promoting local participation, improving livelihoods, and conserving natural resources (Burgos & Mertens, 2017; Dangi & Jamal, 2016). However, many community-based tourism destinations face challenges including uneven economic benefits, limited community participation, and environmental degradation (Holland et al., 2022; Powell et al., 2018). These issues are particularly

acute in developing countries, where institutional capacity is often weak.

The distinctions between community-based tourism in developed and developing countries stem from their differing operational contexts, with more positive characteristics and outcomes in developed countries compared to developing ones (Zielinski et al., 2020; Kunjuraman et al., 2022). Previous research on community-based tourism has played a crucial role in the development of conceptual models and typologies (Okazaki, 2008; Park et al., 2018); or

identifying the barriers and challenges (Marzuki & Hay, 2013; Park et al., 2018; Tosun, 2000). Although this community-based approach has proven effective in improving the economic status of communities (Dodds et al., 2018) it also leads to both positive and negative changes to the tourism destination (Su et al., 2019); or poor management often results in limited local involvement in both the planning and decision-making processes (Powell et al., 2018; Sabuhoro et al., 2021); this issue is further compounded when tourism development fails to align with local cultural norms and traditions (Bancin et al., 2024; West et al., 2006).

In Indonesia, community-based tourism initiatives have grown substantially, with 7,275 village tourism sites implementing community-based approaches, with highest concentration of community-based village tourism initiatives is found in East Java with 1,155 village tourism sites. (Ministry of Maritime Affairs, 2021). Yet Indonesia ranked 135th out of 140 countries in sustainable tourism performance (World Economic Forum, 2019), indicating significant room for improvement.

One example is Agro Eduwisata Organik Mulyaharja in Bogor, West Java. The destination has developed community-based tourism by integrating agricultural activities, environmental education, cultural attraction, culinary tourism, and community participation. Since its establishment, the destination has received recognition from local government. However, previous studies have identified several sustainability issues, including agricultural land conversion, inadequate waste management, increasing water demand, unequal distribution of tourism benefits, and emerging competition among local residents (Rana et al., 2023). These challenges may reduce the long-term sustainability of the destination if appropriate management interventions are not implemented.

Previous studies conducted in Mulyaharja have primarily focused on specific issues such tourism strategies, agricultural development, community income, or social impacts (Qotrunnada & Ansori, 2023). Likewise, broader community-based tourism literature has generally examined environmental, economic, or social dimension separately or emphasized community participation without quantitatively integrating multiple sustainability dimensions into a single assessment framework.

1.1. Research Gap

Three critical gaps remain in the literature. First, most studies assess sustainability dimensions separately, failing to capture interconnections among environmental, economic, and social aspects (Dangi & Jamal, 2016). While Multiaspect Sustainability Analysis (MSA) has been applied in various contexts, its application to rural community based-tourism in Indonesia remains underexplored. Second, empirical evidence from rural Indonesian tourism destinations

is limited, particularly regarding practical strategies for enhancing sustainability through targeted interventions (Zielinski et al., 2020). Third, existing studies have not systematically identified leverage factors—attributes with the greatest potential to improve sustainability—that could guide evidence-based decision-making.

1.2. Research Context

Agro Eduwisata Organik Mulyaharja, Bogor City, West Java, combines agricultural activities, environmental education, and community-managed tourism within a 23-hectare area. However, it faces significant challenges: 5 hectares (28%) of agricultural land converted for tourism (IPB Press, 2021), inadequate waste management (Parantika et al., 2020), increased community competition (Rana et al., 2023), and 76% of the population remaining low-income despite tourism development (Qotrunnada & Ansori, 2023). These challenges make it an appropriate case for evaluating sustainability and identifying priority interventions.

1.3. Research Questions and Objectives

This study addresses three questions: (1) What is the sustainability status of community-based tourism across environmental, economic, and social dimensions? (2) Which leverage factors have the greatest potential to improve sustainability? (3) What interventions can be prioritized for long-term sustainability. Accordingly, this study aims to: (1) analyze sustainability status using MSA, (2) identify priority leverage factors, and (3) formulate evidence-based recommendations for sustainable community based-management.

2. METHODOLOGY

2.1. Research Design and Study Site

This study employed a mixed-methods approach (Creswell, 2014; Stronza et al., 2019). Research was conducted at Agro Eduwisata Organik Mulyaharja, Kampung Ciharashas, Mulyaharja Village, South Bogor District, Bogor City, West Java, from July to September 2024 (Figure 1).

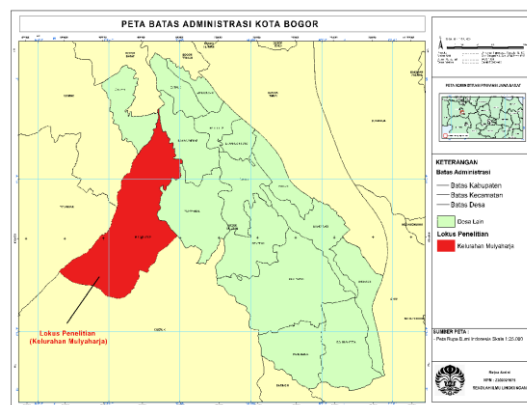


Figure 1. Map of Research Location

Source: Field survey, 2024

The study spanned three months, from July to September 2024, allowing for a comprehensive exploration of seasonal and operational dynamics within the tourism site. The research was conducted over a three-month period, from July to September 2024. The research process involved several stages, 1. The development of a questionnaire based on literature and field observations then the questionnaire was evaluated by experts to minimize errors and ensure its validity; 2. The completion of the questionnaire was conducted by the researcher through interviews with selected respondents based on the established criteria and characteristics of the respondents; 3. The data collected from the questionnaire, once completed by the respondents, was processed using Multiaspect Sustainability Analysis software.

The total stakeholder respondents are 21 people regarding purposive sampling was considered appropriate because respondents represented all major stakeholder groups directly involved in tourism. The objective of this study is the expert-based sustainability assessment. The sample size is consistent with established MSA protocols, which typically employ 15-30 respondents as the method relies on informed expert judgment rather than statistical representativeness (Fauzi & Anna, 2013; Kavanagh & Pitcher, 2004). MSA studies in Indonesia have utilized similar sample sizes: tourism development in Berau Regency (30 respondents), salt edu-tourism (30 respondents), and Kalong Cave ecotourism. In MSA, the quality and relevance of informants is more critical than quantity.

The 21 stakeholder respondents with the composition are, two tourism managers; two tourism employees; five small business owners (food stall; two adult farmers group; five women's farmers group; one village administration; one agriculture office; one tourism office; two environmental office.

2.2. Questionnaire Development and Validation

The questionnaire was developed from literature and field observations, reviewed by three experts for content validity, and pilot-tested with 5 respondents. Reliability was confirmed through Monte Carlo analysis, with uncertainty values below 5 indicating acceptable reliability (Kavanagh & Pitcher, 2004).

2.3. Sustainability Attributes

Sustainability was evaluated across three dimensions, each with seven attributes: Environmental are, environmental management or biodiversity, waste management, water management, environmental awareness, pesticide reduction, renewable energy utilization, and land-use management. Economic dimensions are, local business development, tourism products, access to

capital, accessibility, local employment, tourist visits, and regional income. Social dimensions are, community participation, quality of life, cultural preservation, tourist satisfaction, social capital, and women's participation.

2.4. Data Analysis

Data was analyzed using MSA software (Exsimpro). Each attribute was scored on a 1-5 ordinal scale and transformed into sustainability index values (0-100) through Multidimensional Scaling. All attributes were assigned equal weights. Leverage analysis identified attributes with the greatest influence on sustainability. Monte Carlo analysis assessed stability and robustness. Sustainability status was classified: Unsustainable (0-25), Low Sustainable (>25-50), Sustainable (>50-75), and Highly Sustainable (>75-100). Uncertainty values below 5 indicate acceptable validity.

Regarding to Firmansyah, I (2022), the naming of status can be adjusted to the criteria of the status, the grouping of status value criteria divided into two, three, four, and five ranging from unsustainable to very sustainable. The adjustment of the status naming criteria is by existing standard, both on regulation, SOPs, and minimum service standard, which would be better if based on the existing literature. The author using the widely accepted four interval classification to provide a more detailed interpretation of sustainability status (Table 1).

Table 1. Sustainability Index Values and Status Categories

Index value	Sustainability Categories	Performance
0-25	Unsustainable	Bad
>25-50	Low sustainable	Low
>50-75	Sustainable	Moderate
>76-100	Very Sustainable	Very good

Source: Firmansyah, I. (2022)

This analysis generated the following results 1. The sustainability index value for each aspect, along with the average sustainability score and its corresponding status category 2. *Leverage factors*, or the key drivers influencing sustainability 3. The validation score from the *random iteration*. The assessment categories are displayed in Table 1.

3. RESULTS AND DISCUSSION

3.1. Analysis of Environmental, Economic, and Social Conditions and Their Sustainability Status

The environmental dimension achieved the highest index (57.14), indicating moderately sustainable status. The economic (35.71) and social (50.00) dimensions fell into low sustainability, resulting in an overall index of 47.62 fell into low sustainable category (Figure 2).

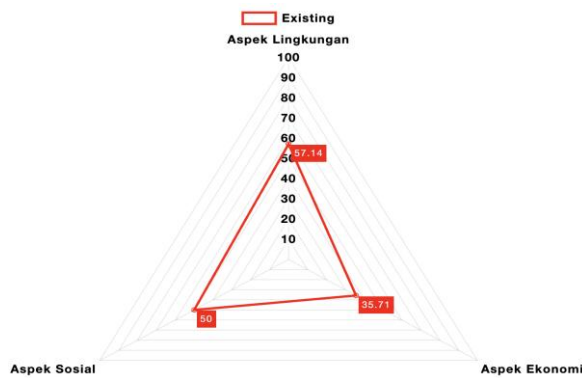


Figure 2. The Sustainability Index of Community-Based Tourism in Kampung Wisata Mulyaharja

The results of the analysis indicate that the sustainability index for the environmental aspect scored 57.4, categorizing it as moderately sustainable. The economic aspect scored 34.71, placing it in the low sustainable category, while the social aspect with a score of 50.00 falls under the low sustainable category. The results indicate that the environmental aspect holds the highest sustainability index compared to the other aspects, namely the economic and social aspects. The economic aspect is the least sustainable, with the lowest index score. Although the social aspect is categorized as low sustainable, its index score of 50 is close to the threshold for being classified as sufficiently sustainable, as the lower limit for this category is a score > 50.

The economic aspect is the least sustainable, with a score slightly above the lower threshold for the low sustainable category (>25). The sustainability index values for each aspect are further detailed in the following subsections. The sustainability status for environmental, economic, and social aspects is summarized in Table 2.

Table 2. Sustainability Status for Environmental, Economic dan Social

No	Aspect	Current condition (Existing)
1	Environmental Aspect	57,14 (Sustainable)
2	Economic Aspect	35,71 (Low Sustainable)
3	Social Aspect	50,00 (Low Sustainable)
	Total Average	47,62 (Low Sustainable)
	Sustainability Status	Low Sustainable

Source: Firmansyah, I. (2022)

Table 2 shows that the average sustainability status across the three aspects—environmental, economic, and social—is 47.62. This indicates that, on average, the sustainability status of tourism at Agro Eduwisata Organik Mulyaharja falls into the low sustainable category. This analysis generated the following results 1. The sustainability index value for each aspect, along with the average sustainability score and its corresponding status category 2. *Leverage factors*, or the key drivers influencing sustainability 3. The validation score from the *random iteration*.

3.2. Environmental Condition and the Sustainability Status

The environmental dimension (57.14) indicates moderate sustainability (Figure 3).

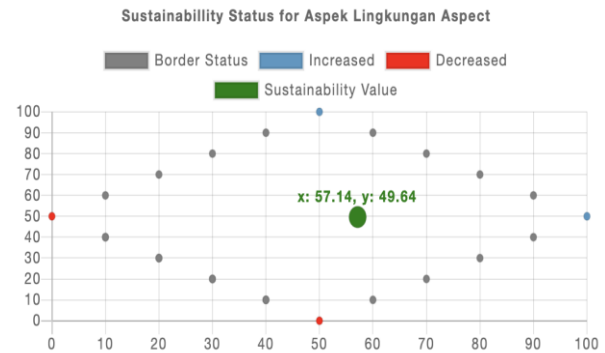


Figure 3. The Sustainability Index of Environmental Aspect

Ordination diagram showing environmental sustainability index of 57.14 with y-axis value of 49.64. The y-axis value of 49.64 indicates potential for future improvement or decline. Leverage analysis identified waste management and water management as the most influential factors (sensitivity value = 1.0), suggesting improvements in these areas would yield the greatest sustainability gains (Figure 4).

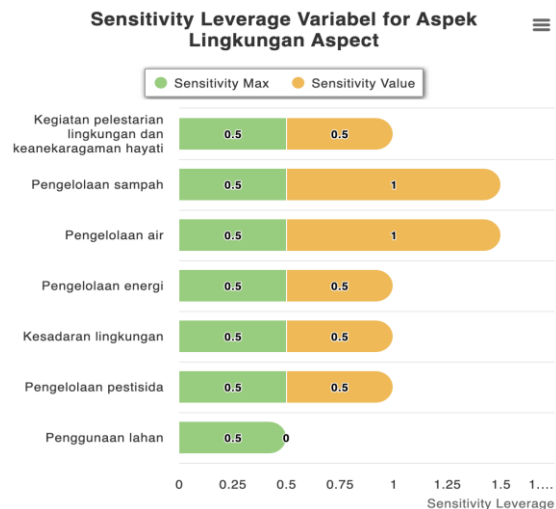


Figure 4. Leverage Factors in Environmental Aspects

Bar chart showing sensitivity values for environmental attributes: Waste Management (1.0), Water Management (1.0), Environmental Management/Biodiversity (0.5), Pesticide Reduction (0.5), Renewable Energy (0.5), Environmental Awareness (0.5), Land-Use Management (0).

Field observations revealed irregular waste collection, no systematic segregation or recycling, and plastic waste around visitor areas. Water quality was poor (cloudy, yellowish), with no routine monitoring. Only 15% of agricultural land uses organic farming; conventional farming continues, risking soil and water contamination. These findings align with Goodwin (2009), Rocca and Zielinski (2022), and

Snyman (2017), who identified waste and water management as fundamental to environmental sustainability. Unlike previous studies focusing primarily on tourism impacts, this study demonstrates how tourism and agricultural activities simultaneously influence environmental outcomes in agro-tourism contexts.

The results of the analysis suggest that if two top priorities are to be selected to improve environmental sustainability, waste management and water management should be the focus. This condition suggests that waste and water management have not been effectively implemented in Kampung Wisata Mulyaharja. Observations and interviews indicate that waste management is limited to sporadic collection, without a regular schedule. There have been no routine activities for sorting or processing waste, indicating that waste management in Kampung Wisata Mulyaharja requires significant improvement. Waste is one of the negative impacts of tourism. This is supported by field observations, which revealed a large amount of plastic waste, such as beverage bottles, discarded at the edges of rice fields. Many visitors also fail to dispose of waste in the designated bins, leading to litter scattered around the seating areas and huts. The second leverage factor is water management; if water is managed more effectively, it could significantly enhance environmental sustainability. The water demand has increased with the present of tourism. While previously water usage was primarily for agriculture, it now also caters to visitor's needs, such as for toilets, ablution, handwashing, dishwashing, cooking, and other activities. The increased water demand also extends to food stalls, where water is needed for cooking, drinking, washing vegetables, and cleaning utensils. Furthermore, the water quality at the site is poor, with observations indicating murky, yellowish water. In the toilet facilities, water flow is inadequate

The main attraction of Mulyaharja Tourism is its nature-based tourism, particularly the lush green landscapes of rice paddies. As such, visitors have high expectations that the tourism experience is closely tied to the environment. In addition to the lush green rice paddy views, visitors expect a clean environment, adequate sanitation, and a sufficient supply of clean water. Land use is one factor that has reached its optimal capacity. Although there has been a conversion of 5 hectares (28%) of agricultural land, land use is still in accordance with its designated purpose. Environmental awareness is also present among some members of the community and visitors.

3.3. Economic Condition and Sustainability Status

The economic dimension recorded the lowest index (35.71) (Figure 5).

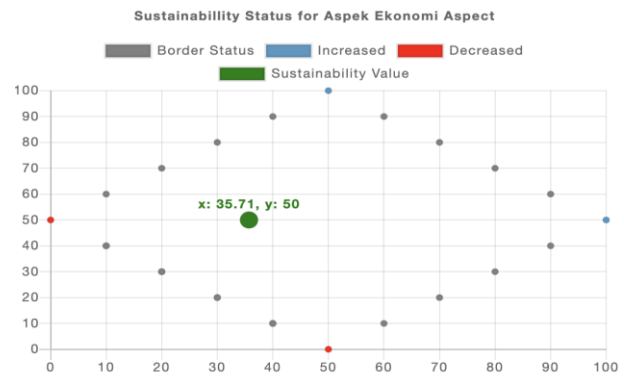


Figure 5. Sustainability Index of Economic Aspect

Ordination diagram showing economic sustainability index of 35.71 with y-axis value of 50. The y-axis value of 50 indicates potential for improvement or decline. This condition indicates the evaluation of the economic status within the sustainability boundaries, reflecting the dynamics between improvements and declines in the overall economic aspect. The sustainability index value suggests that tourism activities in the Kampung Wisata Mulyaharja area have not yet optimally contributed to improving the local community's economy.

Leverage analysis identified tourist visitation and accessibility as the most influential factors (Figure 6).

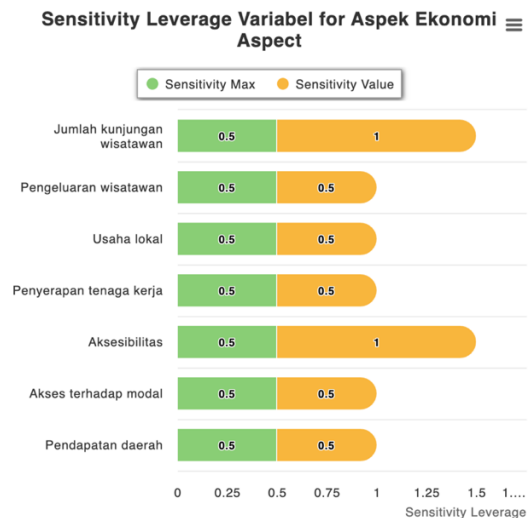


Figure 6. Leverage Factors in Economic Aspect

Bar chart showing sensitivity values for economic attributes: Tourist Visits (1.0), Tourist Expenditure (1.0), Accessibility (1.0), Local Businesses (0.5), Labor Absorption (0.5), Access to Capital (0.5), Regional Income (0.5).

With an average of 117 daily visitors, ticket income amounts to only Rp. 1,170,000/day (Rp. 10,800,000/month). Additional income from 10% commission on food/beverage sales ranges from Rp. 100,000-200,000 per stall daily. Revenue is insufficient to support long-term management and infrastructure. As a community-based tourism model, financial resources depend entirely on tourism

revenue; external capital is not permitted to maintain sustainability (Tolkach & King, 2015).

These findings are consistent with previous studies, which indicate that one of the main challenges faced by community-based tourism is the limited income and the difficulty in increasing tourist attractions (Stone, M.T., & Nyaupane, G.P. 2018; Mitchell & Ashley, C. 2010); who found limited income as a principal challenge facing community-based tourism destinations. Choi, H.C., & Sirakaya, E. 2006, emphasized that innovation in tourism products and destination management is necessary to increase visitor demand and strengthen local economic resilience.

3.4. Social Condition and Sustainability Status

The social dimension achieved 50.00, at the upper limit of low sustainability and close to moderate (Figure 7).

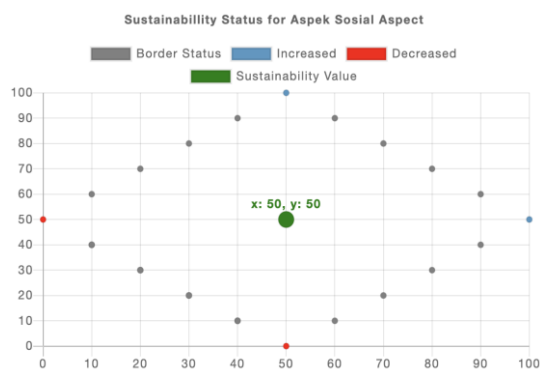


Figure 7. Sustainability Index of Social Aspect

Ordination diagram showing social sustainability index of 50.00 with y-axis value of 50). The y-axis value of 50 indicates that social aspect has the potential for improvement or decline. Leverage analysis identified tourism products or attractions and visitor satisfaction as the most influential factors, both have a sensitivity value of 1. The leverage factors for the social aspect are shown in Figure 8.

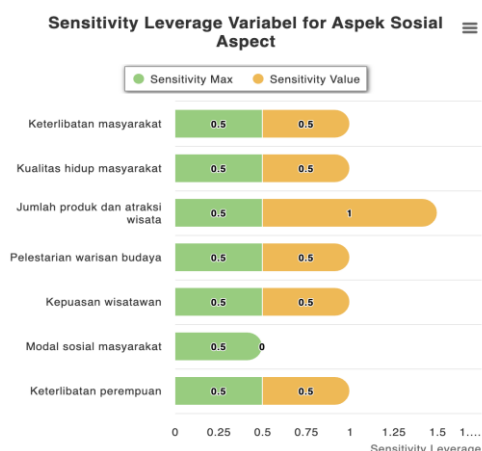


Figure 8. Leverage Factors of the Social Aspect

Bar chart showing sensitivity values for social attributes: Tourism Products/Attractions (1.0),

Visitor Satisfaction (1.0), Community Involvement (0.5), Quality of Life (0.5), Cultural Preservation (0.5), Social Capital (0.5), Women's Participation (0.5)] Current attractions are limited to rice field views, local culinary experiences, trekking, and photo spots. Stakeholders emphasized the need for additional educational, cultural, and recreational activities.

These findings support Zielinski et al. (2022), Meng et al. (2023), and Su et al. (2021), who demonstrated that diversified tourism products contribute to visitor satisfaction, community engagement, and social well-being. Pang et al. (2021) emphasized that tourism product innovation strengthens social sustainability by creating opportunities for local participation and cultural preservation.

3.5. Validation Value and Status

In the final section, the validation status of the multispect sustainability analysis for the environmental, economic, and social aspects is presented. Monte Carlo validation produced an average uncertainty of 3.32 (below the 5 threshold), confirming reliability (Table 3). Values below 5 indicate acceptable validity (Kavanagh & Pitcher, 2004).

Table 3. Validation Status

Aspect	Uncertainty Error	Validation Status
Environment	0,14	2,86
Economic	0	3,71
Social	0	3,39
Validation Status		3,32

Source: Author's analysis using MSA

The validity of the analysis is determined based on the average value of random iterations, for value is below 5, the analysis is considered valid. In this case, the average validation value from random iterations is 3.32, confirming that the analysis is valid. The individual aspect values are also valid, with the environmental aspect scoring 2.86, the economic aspect 3.71, and the social aspect 3.39. This indicates that the analysis is acceptable, and the error margin is small.

4. CONCLUSION

4.1. Summary of Findings

This study assessed community-based tourism sustainability at Agro Eduwisata Organik Mulyaharja using MSA. The environmental dimension (57.14) shows moderate sustainability, while economic (35.71) and social (50.00) dimensions remain low, with an overall index of 47.62. Leverage factors identified include waste and water management (environmental), tourist visitation and accessibility (economic), and tourism products and visitor satisfaction (social).

4.2. Theoretical Contributions

This study contributes to sustainability assessment literature in three ways. First, it demonstrates Multiaspect Sustainability Analysis (MSA), applicability in rural Indonesian agro-tourism, confirming the method is feasible with 21 purposively selected stakeholders. Second, it reveals interconnected sustainability dimensions, showing environmental management alone cannot ensure overall sustainability without corresponding economic and social improvements, empirically validating integrated approach propositions (Dangi & Jamal, 2016; Burgos & Mertens, 2017). Third, it provides empirical evidence on leverage factors in agro-tourism, extending previous research by identifying specific, actionable intervention points rather than broad recommendations.

4.3. Practical Implications

Practical implication for environmental aspect is to implement integrated waste management with regular collection and segregation; establish routine water quality monitoring; expand organic farming beyond 15%; strengthen environmental awareness programs. Economic implications are to diversify tourism products; develop a business plan to stabilize revenue; improve accessibility through enhanced infrastructure; implement innovative marketing. Social implications are to introduce off-season activities; collaborate with third parties for events; strengthen community participation in planning; develop educational/cultural activities.

4.4. Limitations and Future Research

Several limitations must be acknowledged. The sample size of 21 stakeholders, while consistent with li protocols, limits statistical generalizability. The assessment reflects stakeholder perceptions rather than objective measurements. The cross-sectional design captures sustainability at a single point in time. Equal weighting of attributes may not reflect differential policy priorities. The single case study limits generalizability.

Future research should: (1) validate findings with larger samples incorporating objective indicators, (2) conduct longitudinal assessments to track sustainability trajectories, (3) compare multiple community-based tourism destinations across regions, (4) incorporate stakeholder-derived weights, and (5) develop and test intervention strategies based on leverage factors.

Despite these limitations, this study provides an evidence-based framework for evaluating and improving sustainability in rural Indonesia, contributing to broader discourse on sustainable tourism development in developing countries.

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