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Original Research Paper

Farmers' Perceptions of Integrated Farming Systems for Sustainable Agrotourism in Das Batu Lanteh Sumbawa, Indonesia

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Abstract

Integrated farming systems (IFS) offer a sustainable approach to optimize agricultural resources and support agro-tourism development in dryland regions. This study aims to analyze farmers' perceptions of IFS and its potential implementation for sustainable agro-tourism in the Batu Lanteh watershed, Sumbawa. Using a descriptive-analytical mixed-methods approach, data were collected through surveys of 30 purposively selected farmers across three villages, complemented by in-depth interviews and field observations. Results indicate that farmers partially adopt IFS practices such as using crop residues as feed, cultivating legumes, and recycling manure but face constraints due to limited agricultural literacy, small land holdings, aging farmers, and inadequate market access. Although economic benefits like increased income and reduced production costs are positively perceived, consistent implementation of long-term ecological practices remains low. The study concludes that enhancing IFS adoption and agro-tourism integration requires targeted technical assistance, farmer education, and improved infrastructure. These efforts can optimize resource use, strengthen environmental conservation, and promote sustainable agro-tourism in dryland contexts.

Keywords: **A**gricultural literacy; **A**gro-tourism; **I**ntegrated farming system; Sustainability.

INTRODUCTION

Integrated Farming Systems (IFS) are widely recognized as a sustainable agricultural approach that enhances the efficiency of natural resource use, strengthens ecological balance, and improves the socio-economic resilience of rural communities. As a holistic production strategy, IFS integrates crops, livestock, and other agricultural components to optimize nutrient cycling, reduce external inputs, and minimize environmental degradation. These characteristics make IFS highly relevant in dryland regions, where climate variability, water scarcity, and land degradation continue to threaten food security and the stability of rural livelihoods (Bhagat, 2024; Sultan et al., 2024).

In the context of rural development, the expansion of agrotourism serves as an important strategy for diversifying local economies and increasing community welfare. The success of agrotourism initiatives largely depends on strengthening farmers' agricultural literacy so that they are able to recognize, manage, and optimize local agricultural potential in an integrated and sustainable manner. Agricultural literacy in this regard includes knowledge of crop cultivation, livestock management, organic waste utilization, and ecological interactions underlying integrated farming practices, as well as an understanding of the aesthetic and educational values that enhance the attractiveness of agriculture-based tourism. Strengthening this comprehensive literacy enables farmers to design integrated farming models that simultaneously support production, conservation, and recreational functions within an agrotourism setting.

However, despite strong theoretical evidence demonstrating the benefits of integrated farming including increased productivity, improved soil fertility, and reduced carbon emissions and fertilizer dependency (Bhagat, 2024; Sultan et al., 2024) its application in many dryland rural areas remains partial and suboptimal. Farmers often manage crops and livestock separately, organic waste is underutilized, and ecological interactions that should underpin integration are not effectively implemented. These conditions are closely associated with limited agricultural literacy, inadequate access to technical assistance, and the lack of context-specific models that translate agroecological principles into practical, tourism-supportive designs. As a result, existing agrotourism practices tend to remain conventional and subsistence-oriented, offering limited educational and environmental value and thus weakening destination competitiveness. Addressing this challenge requires alternative solutions in the form of

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integrated farming models explicitly based on farmers' literacy levels and local resource conditions, representing a gap that remains underexplored in current research.

Most previous studies predominantly focus on the technical performance and production outcomes of integrated farming systems, while socio-cultural aspects such as farmers' perceptions, motivations, and readiness to adopt integration within an agrotourism framework remain limited (Indrawati, 2022; Sultan et al., 2024). This gap highlights an urgent need for empirical research that examines the socio-economic and perceptual dimensions influencing farmers' adoption of integrated farming and its alignment with sustainable agrotourism development. Therefore, this study aims to: (1) analyze farmers' agricultural literacy, perceptions, and motivations related to integrated farming systems in dryland areas with agrotourism potential; (2) assess farmers' readiness and key constraints in implementing integrated farming practices as part of agrotourism development; and (3) formulate strategic recommendations for integrating IFS into sustainable agrotourism models that improve environmental performance, educational value, and rural livelihoods.

RESEARCH METHOD

Time and Place

This research was conducted from August 2024 to February 2025 and carried out in an academic setting using secondary data analysis supported by document studies. Data collection was conducted through various credible information sources, including official publications from the Central Statistics Agency (BPS), reports from the Department of Agriculture and the Tourism Office of East Lombok Regency, scientific publications indexed nationally and internationally, and regional planning documents such as RPJMD and RIPPDA (Regional Tourism Development Master Plan). This method enabled a comprehensive understanding of the potential utilization of pineapple waste, functional food processing strategies, and integrated agro-tourism development in East Lombok.

Research Design

This study employed a descriptive–analytical design with a concurrent mixed-methods approach, in which quantitative and qualitative data were collected simultaneously to provide complementary insights (Curry et al., 2019). The quantitative component was designed to map the distribution of farmers' perceptions, levels of agricultural literacy, and readiness. Implement integrated farming systems, as well as to identify factors associated with these variables. The qualitative component aimed to explore in greater depth the reasons, experiences, motivations, and constraints that shape farmers' attitudes toward integrated farming and its linkage with agrotourism development (Xiao, et al., 2025). This mixed-methods design was chosen to ensure that the findings not only describe patterns and trends numerically but also capture the contextual and socio-cultural nuances that are crucial for formulating practical recommendations for sustainable agrotourism in dryland areas (Rosalina, 2023).

Research Population and Sample

The population of this study consisted of all farmers residing and working in the Batu Lanteh watershed area who are engaged in livestock production, food crop cultivation, and/or horticulture. From this population, a sample of 30 farmers was selected, with proportional representation from the three study villages (10 respondents each from Batu Dulang, Kelungkung, and Pelat) to capture intra-village diversity. A purposive sampling technique was applied using inclusion criteria (Campbell et al., 2020): (a) farmers of productive age and actively involved in agricultural activities, (b) residing permanently in one of the three focus villages, and (c) having experience with or potential for integrating livestock and crops and/or participating in local agrotourism activities. Simple stratification was used to ensure variation in type of enterprise (mainly livestock, mainly crops, or a combination) and involvement in agrotourism (involved/not involved) (Agnoletti, 2012) ; when the number of eligible farmers exceeded the quota in a given stratum, simple random selection was conducted to reach the target of 10 respondents per village. The main research variables included socio-demographic characteristics (age, education, family size, land area, and farming experience), agricultural literacy. Perceptions of integrated farming systems (measured using a 5-point Likert scale), and attitudes and readiness to adopt integrated farming as a basis for agrotourism development (Badri 2025). Data were collected using structured questionnaires, a semi-structured in-depth interview guide, and field observation checklists, which together functioned as the primary tools and materials for capturing both quantitative and qualitative information relevant to the research objectives (Ramadhan, 2025).

Research Procedure

The research procedure consisted of three main stages: preparation, field implementation, and data processing. In the preparation stage, the instruments (questionnaire, interview guide, and observation checklist) were developed based on the research objectives and relevant literature on integrated farming systems, agricultural literacy, and agrotourism. The draft instruments were then reviewed by experts in sustainable agriculture and rural development to assess content validity, clarity, and relevance. Based on expert feedback, the instruments were revised and subsequently pilot-tested with 5–8 farmers outside the study villages to evaluate their practicality and comprehensibility; minor adjustments were made following the pilot test. During this stage, the research team also obtained formal permission from relevant local authorities and coordinated with village leaders, agricultural extension officers, and farmer group representatives to facilitate access and ensure smooth implementation in the field.

In the field implementation stage, respondents were identified according to the inclusion criteria and stratification scheme. The structured questionnaire was administered face-to-face by trained researchers/enumerators to minimize misunderstanding and ensure completeness of responses. In-depth interviews were conducted with a subset of respondents selected to represent different types of enterprises and levels of involvement in agrotourism, with the aim of obtaining richer narratives on perceptions, motivations, and constraints related to integrated farming and agrotourism development. Field observations were carried out in parallel to document actual farming practices, land use patterns, and existing or potential agrotourism activities. Ethical considerations were

integrated into the procedure: respondents were informed about the purpose and scope of the research, assured of the confidentiality of their personal data, and asked to provide informed consent prior to participation; audio recordings of interviews were made only with explicit permission and stored securely for research use only. In the data processing stage, completed questionnaires were checked for consistency, coded, and entered into a spreadsheet, while interview recordings were transcribed verbatim and field notes organized for subsequent analysis.

Research Data Analysis

Quantitative data from the questionnaires were analyzed using descriptive statistics to summarize farmers' characteristics and to map perceptions (Oktarino, 2025), literacy levels, and readiness to implement integrated farming systems (e.g., frequencies, percentages, means) (Ramdhan, 2025). For Likert-scale items, the mean score for each item and construct was calculated using the formula (Arikunto, 2014).

$$\bar{X} = \frac{\sum x_i}{n} \quad (1)$$

where x_i represents the individual response score and n, n is the number of respondents, thereby providing an overall indication of agreement or disagreement with each statement. Where relevant, simple association or comparison tests (non-parametric tests when the data did not meet normality assumptions) were used to explore relationships between socio-demographic factors and key perception or readiness variables.

RESULTS AND DISCUSSION

Socio-demographic Characteristics and Resource Base of Farmers

This sub-section describes the socio-demographic characteristics and resource base of farmers in the Batu Lanteh watershed, which form the context for understanding their perceptions and readiness to implement integrated farming systems for sustainable agrotourism. The analysis focuses on age, education, household size, landholding, and business duration, as these factors strongly influence labor availability, decision-making capacity, and the adoption of new agricultural practices. The results provide an initial overview of the human and physical capital that can support or constrain the development of integrated farming-based agrotourism in the study area.

These results show that farming in the Batu Lanteh watershed is dominated by older farmers with relatively low levels of formal education, small landholdings, and family-based labor arrangements. Most respondents have moderate to long experience in agricultural business, although many have not yet been exposed intensively to integrated farming and agrotourism innovations.

The age distribution indicates that 73.33% of respondents are over 40 years old, with the largest group being farmers above 51 years (40%). This pattern reflects the broader trend of an aging farming population in rural Indonesia, which has been associated with slower adoption of new technologies and a tendency to maintain traditional practices (Sari et al., 2022; BPS, 2021). In the context of integrated farming and agrotourism, this age structure may constrain experimentation with new enterprises or service-oriented activities (such as hosting visitors or managing educational tours), and suggests that generational regeneration and youth involvement will be critical for long-term sustainability.

Educational attainment is also relatively low, with 63.33% (Table 1), of respondents having only completed elementary school and fewer than one-third having reached senior high school or university level. Low formal education can limit farmers' ability to access, interpret, and apply technical information on integrated farming, environmental management, and agrotourism business development (Smith & Lee, 2021). This condition implies that more intensive, tailored extension and training approaches such as participatory demonstrations, farmer field schools, and peer-to-peer learning are needed to build agricultural literacy and tourism-related skills, rather than relying solely on written materials or formal classroom-based methods.

Household size and family composition also play an important role in shaping labor capacity. Most respondents live in nuclear families with four members 43.33% (Table 1), which is consistent with family-based farm management commonly found in rural Indonesia (Putra, 2020). This structure can be advantageous for integrated farming and agrotourism because family members can be involved flexibly in various activities, such as livestock care, crop management, hosting visitors, preparing local products, and guiding educational tours. However, limited family labor may also become a bottleneck if agrotourism activities expand without adequate labor planning or external support.

Landholding data show that nearly half of respondents (46.67%) own only 0.1–1 ha of land, and only 3.33% control more than 4 ha. Such small and fragmented holdings are typical in many dryland areas and often constrain economies of scale, but they also make integrated farming particularly relevant as a strategy to intensify land use and increase output per unit area (Rahman et al., 2020; Nurhadi et al., 2021). In the context of agrotourism, small plots can still be highly attractive when designed as compact demonstration sites that combine crops, livestock, and simple educational facilities, thereby producing both food and experiential value for visitors (Djuwendah et al., 2023; Baby & Kim, 2024).

Regarding business duration, 43.33% of farmers have been in farming for 1–10 years, while 36.66% have more than 20 years of experience (Table 1). This combination of relatively new and very experienced farmers creates opportunities for horizontal learning and mentoring, where senior farmers share practical knowledge of local conditions and junior farmers contribute openness to innovation and agrotourism ideas. Previous studies have shown that business experience can positively influence the adoption of sustainable practices when combined with adequate institutional support and market incentives (Smith et al., 2022; Baby & Kim, 2024).

Overall, the socio-demographic and resource profile suggests that while farmers in the Batu Lanteh watershed face structural constraints particularly in terms of age, education, and land size they also possess key assets in the form of family labor and accumulated farming experience. These characteristics underscore the need for integrated interventions that combine technical training, business capacity building, and youth engagement to translate the potential of integrated farming into viable, community-based agrotourism initiatives.

Table 1. Socio-demographic characteristics and resource base of respondents (n = 30)

Variable	Category	Frequency	Percentage (%)
Age	21–30	2	6,67
	31–40	6	20,00
	41–50	10	33,33
	>51	12	40,00
Education	Elementary School	19	63,33
	junior high school	3	10,00
	Senior high school	6	20,00
	University student	2	6,67
Family members	1	1	3,33
	2	5	16,67
	3	5	16,67
	4	13	43,33
	5	5	16,67
	>6	1	3,33
Land area (ha)	0,1–1	14	46,67
	1,1–2	9	30,00
	2,1–3	3	10,00
	3,1–4	3	10,00
	>4,1	1	3,33
Business duration (year)	1–10	13	43,33
	11–20	6	20,00
	21–30	7	23,33
	31–40	4	13,33
Feed straw	STS	1	3,33
	TS	3	10,00
	N	10	33,33
	S	3	10,00
	SS	13	43,33
Plant legumes	STS	2	6,67
	TS	3	10,00
	N	11	36,67
	S	10	33,33
	SS	4	13,33
Feces as fertilizer	STS	1	3,33
	TS	9	30,00
	N	10	33,33
	S	4	13,33
	SS	6	20,00
Increasing income	STS	1	3,33
	TS	1	3,33
	N	8	26,67
	S	13	43,33
	SS	7	23,33
Reducing costs	STS	2	6,67
	TS	1	3,33
	N	9	30,00
	S	13	43,33
	SS	5	16,67

*Description: STS = Strongly disagree, TS = Disagree, N = Netral, S = Agree, SS = Strongly agree

Adoption of Integrated Farming Practices and Perceived Economic Benefits

This sub-section presents farmers' adoption of key integrated farming practices and their perceptions of the economic benefits associated with these practices. The focus is on the use of rice straw as livestock feed, the cultivation of legumes, and the use of livestock manure as organic fertilizer, as well as farmers' perceptions of whether integrated farming can increase income and reduce production costs. These practices are central components of integrated farming systems that link crops and livestock through internal nutrient and biomass flows. Understanding adoption levels and perceived benefits is essential for assessing the readiness of farmers to implement integrated farming systems more fully and to package them as attractive agrotourism experiences.

The results indicate that 53.33% of farmers (S + SS) have a positive perception of using straw as animal feed, while only 13.33% express disagreement (STS + TS) (Table 1). This suggests that crop–livestock integration through straw utilization is relatively well accepted and, in many cases, already practiced. Such use of straw is consistent with findings from Rahman et al. (2020), who report that recycling crop residues as feed can reduce dependence on purchased concentrate feeds and contribute to more sustainable feed systems. In the context of agrotourism, straw-based feeding practices can be showcased to visitors through demonstrations of low-cost feed production, thereby conveying principles of resource efficiency and circular economy in farming systems.

Perceptions regarding legume cultivation are more varied: 46.66% agree or strongly agree with legume planting, 36.67% are neutral, and 16.67% disagree (Table 1). This distribution suggests that while many farmers recognize the benefits of legumes for soil fertility and livestock feed, others are hesitant, possibly due to limited knowledge of management techniques, seed availability, or perceived market demand. Legumes are well known for their role in biological nitrogen fixation and soil quality enhancement, which are critical in dryland systems (Sultan et al., 2024). However, without adequate technical assistance and demonstration plots, farmers may prioritize staple crops that provide more immediate and familiar economic returns. Integrating legume demonstration areas into agrotourism circuits could help bridge this gap by visually illustrating their agronomic and ecological benefits to both farmers and visitors.

The use of livestock manure as organic fertilizer shows an even more fragmented pattern: although 33.33% of respondents agree or strongly agree with its use, 30.00% disagree and 33.33% remain neutral (Table 1). This indicates that a significant proportion of farmers either underutilize manure or continue to rely primarily on chemical fertilizers. Similar constraints have been noted in other smallholder contexts, where concerns about labor requirements, odor, disease risk, or limited knowledge of composting techniques reduce the adoption of organic fertilizer practices (Nurhadi et al., 2021). From an agrotourism perspective, manure management offers strong educational potential for example, by organizing "farm-to-soil" learning activities where visitors can observe or participate in composting processes and understand how organic matter supports soil health and crop productivity. Such activities can transform what is often perceived as waste into a visible asset in the eyes of both farmers and tourists.

Despite partial adoption of ecological practices, farmers' perceptions of the economic benefits of integrated farming are relatively positive. A total of 66.66% of respondents (S + SS) agree (Table), that integrated practices can increase income, and a similar proportion perceive that these practices can reduce production costs. These findings align with previous studies which show that integrated farming can improve profitability through input savings, diversified outputs, and more efficient resource use (Smith et al., 2022; Sultan et al., 2024). In the Batu Lanteh context, the combination of reduced feed and fertilizer costs with additional income from value-added activities such as direct sales to visitors, educational tours, or on-farm processing

could significantly strengthen farm household resilience (Baby & Kim, 2024).

However, the coexistence of positive economic perceptions and partial ecological practice adoption reveals an important implementation gap. While many farmers recognize the potential financial benefits of integration, they may lack the technical skills, time, labor, or initial capital to fully implement practices such as systematic manure management or diversified legume-based cropping. Moreover, existing agrotourism activities in the area remain limited and tend to showcase conventional farming rather than fully integrated systems, thereby underutilizing the educational and experiential value of integrated practices (Indrawati, 2022; Muksin, 2021). This gap suggests that targeted interventions such as on-farm demonstration units, farmer-to-farmer learning, and integrated training modules linking technical, business, and tourism aspects are needed to translate positive perceptions into concrete behavior change.

The synthesis of these findings underlines that integrated farming practices in the Batu Lanteh watershed are currently adopted in a partial and selective manner, with stronger uptake of practices that generate immediate and easily perceived benefits (such as straw utilization) and weaker adoption of practices that require more knowledge or labor (such as legume management and manure-based fertilization). At the same time, farmers generally perceive integrated farming as economically advantageous, which represents an important motivational lever. For sustainable agrotourism development, these patterns imply that policy and program interventions should: (1) prioritize strengthening agricultural literacy and practical skills related to key integration points (crop residues, legumes, manure); (2) design agrotourism products that explicitly highlight and reward integrated practices (e.g., thematic tours on nutrient cycling, waste utilization, and soil health); and (3) address structural constraints such as small land size, aging farmers, and limited market access through collective action, institutional support, and infrastructure development.

By aligning technical assistance, agrotourism product design, and local resource conditions, integrated farming systems in the Batu Lanteh watershed can move from partial and mainly subsistence-oriented implementation toward more systematic, educational, and market-responsive models. This transformation is essential to realize the dual goals of environmental sustainability and rural livelihood enhancement that underpin the concept of integrated farming-based agrotourism in dryland regions.

CONCLUSION

This study shows that farmers in the Batu Lanteh watershed only partially adopt key components of integrated farming systems such as the use of crop residues as feed, legume cultivation, and manure recycling because their implementation is constrained by limited agricultural literacy, small landholdings, aging farmers, and weak market and infrastructure support. Farmers' perceptions of integrated farming are generally positive, particularly regarding its potential to increase income and reduce production costs, but these perceptions have not yet led to consistent application of long-term ecological practices. Therefore, strengthening farmers' knowledge and skills, improving supporting infrastructure and market access, and developing agrotourism products that explicitly showcase integrated farming are essential strategies to enhance IFS adoption and promote sustainable agrotourism development in dryland areas like the Batu Lanteh watershed.

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