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Farmers' Perceptions of Livestock Manure Processing Technology for Organic Fertilizer in Rice Farming in Tlanakan Subdistrict, Pamekasan Regency

Ruhmani Lovitasari [1*], Apri Arisandi [2], Slamet Subari [3]
[1-3] Master of Natural Resource Management, University Trunojoyo Madura, East Java, Indonesia

* Corresponding Author: **Ruhmani Lovitasari**

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Abstract
This study aims to analyze farmers' perceptions and adoption levels toward livestock manure processing technology for organic fertilizer in rice farming in Tlanakan Subdistrict, Pamekasan Regency. The research is motivated by the low utilization of cattle manure as organic fertilizer, despite its large potential and the support of local government programs through extension activities and provision of processing equipment. The results show that farmers' perceptions of manure-processing technology fall into a moderate-to-positive category, particularly in terms of relative advantage and observability. However, aspects such as complexity and the availability of production facilities remain major constraints. Factors influencing farmers' perceptions include age, education level, farming experience, income, extension workers' roles, and social interaction. These findings indicate that continuous extension services and improved access to production facilities are key to enhancing the adoption of organic fertilizer processing technology.

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Keywords: Farmers' Perception, Manure Processing Technology, Organic Fertilizer, Innovation Adoption, Rice Farming

Introduction

Pamekasan Regency, with an area of 792.3 km², has substantial potential for food crop agriculture due to its relatively fertile soils. According to BPS Pamekasan data, land productivity declined from 2015 to 2018. Various governmental efforts eventually contributed to a 5% productivity increase from 2019 to 2022. However, Pamekasan remains the district with the lowest productivity compared to the other three districts on Madura Island.

The Food Security and Agriculture Office of Pamekasan supports extension programs and training on organic fertilizer processing technologies, such as transforming livestock manure into Bokashi to improve soil fertility. The training introduces farmers to manure fermentation techniques, decomposer microbes, and effective application methods.

In Tlanakan Subdistrict, the livestock sector—especially cattle farming—plays a significant role. With a cattle population of 850, producing around 15 kg of manure per head per day, the total daily manure availability reaches approximately 12.75 tons. Despite this abundant resource, the use of cattle manure as organic fertilizer remains low. Several reasons for this include: farmers' perception that organic fertilizers are less effective than chemical fertilizers; limited access to supplementary materials for Bokashi production such as rice husks, bran, or EM4; the relatively long fermentation process (±2 weeks); and a preference for chemical fertilizers due to their immediate effects.

The limited use of cattle manure is strongly influenced by farmers' perceptions shaped by psychological, economic, and technical factors. Perceptions regarding the effectiveness of organic versus chemical fertilizers, the complexity of manure processing, and cost–benefit considerations all play influential roles.

Based on the above context, it is necessary to examine farmers' perceptions of manure-processing technology and the use of organic fertilizers. This understanding is expected to assist in formulating more effective strategies to promote organic fertilizer adoption and support productivity improvement and sustainable agriculture in Pamekasan Regency

2. Research Methodology

The study was conducted in Tlanakan Subdistrict, Pamekasan Regency, from March to June 2025. The research population consisted of 410 farmer-livestock raisers from three villages. A sample of 32 respondents was selected using the Slovin formula (17% margin of error) and simple random sampling. Primary data were obtained through interviews using a Likert-scale questionnaire (1–5), field observations, and documentation. Validity and reliability were tested using SPSS, with Cronbach's Alpha values > 0.6.

Research variables included:

1. **X (Farmers' Characteristics):** age, education, farming experience, land size, income, role of extension workers, social interaction.
2. **Y (Perception of Technology):** complexity, availability of production facilities, relative advantage, observability.

Data were analyzed using descriptive quantitative methods to describe perception tendencies and relationships between variables.

3. Results and Discussion

3.1. Farmers' Characteristics

Farmers' characteristics play an important role in understanding how they assess and respond to agricultural innovations. Based on data from 32 respondents in Tlanakan Subdistrict, most rice farmers exhibit relatively homogeneous socio-economic profiles. The characteristics examined included age, education, farming experience, land size, and income.

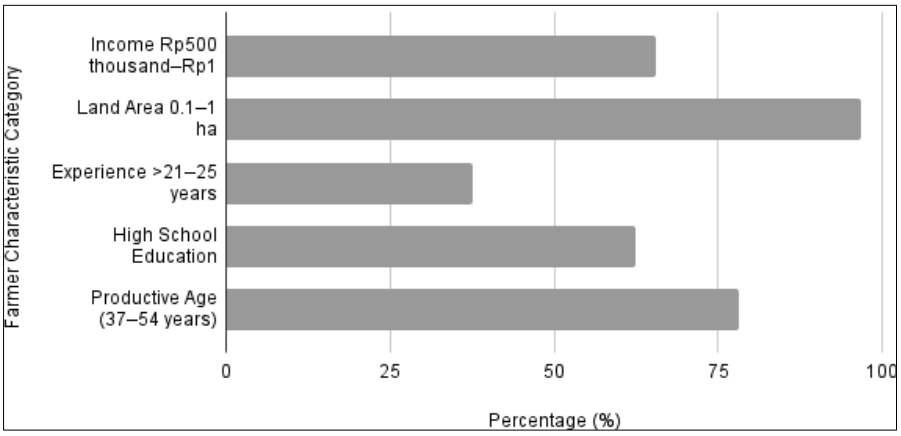

Fig 1: Farmers' Characteristics in Tlanakan Subdistrict

Most respondents were in the productive age group (37–54 years), accounting for 78.125%. This indicates adequate physical and mental capacity to adopt innovations such as manure-processing technology. According to Nurmanaf (2007) [5], older farmers tend to rely more on traditional farming experience and adopt new technologies more slowly.

In terms of formal education, most farmers completed senior high school (62.5%). This reflects a moderate level of functional literacy but limited ability to understand technical and scientific information related to manure fermentation. Soekartawi (2005) [7] suggests that higher formal education broadens farmers' perspectives and increases openness to new technologies.

Farming experience also plays an important role. Approximately 37.5% have been farming for 21–25 years, indicating strong empirical knowledge regarding agroecosystems. Experienced farmers tend to be more selective and rational in evaluating new technologies. As noted by Mardikanto (2009) [2], longer farming experience enhances practical knowledge of seasonal patterns, pest control, and cultivation strategies, influencing the way farmers assess risks and benefits of organic fertilizer technologies.

Land ownership is relatively small, with 96.87% of respondents cultivating 0.1– 1 ha, classifying them as small-scale farmers.

Limited land reduces their ability to experiment with innovations at larger scales. Soekartawi (2002) [8] notes that larger land size increases opportunities to invest in new technologies due to higher potential economic returns, while smallholders tend to be more risk-averse.

Economically, most farmers earn between IDR 500,000–1,000,000 per month (65.625%), mainly from crop farming and cattle raising. With such limited land, productivity and income remain modest. According to Soekartawi (2002) [8], restricted land area typically correlates with low farmer income due to limited production capacity and restricted diversification opportunities.

Overall, farmers in Tlanakan are smallholders with extensive experience, low– moderate education, and moderate income. However, they possess significant potential to accept manure-processing innovations. Strengthening participatory extension services, ensuring access to production inputs, and empowering farmer groups are essential strategies to build farmers' capacity for sustainable organic agriculture.

3.2. Farmers' Perceptions of Cattle Manure Processing Technology

Perception levels were measured using questionnaires distributed to 32 respondents. Farmers' perceptions include assessments of technological complexity, production facilities, relative advantage, and observability.

Table 1: Distribution of Respondents by Perception Level

No	Perception Aspect	Ideal Score	Actual Score	Percentage (%)	Category
1	Complexity	640	458	71.5	High
2	Production Facilities	640	368	57.5	Moderate
3	Relative Advantage	800	602	75.25	High
4	Observability	800	600	75	High
	Perception (Overall)			69.81	High

The overall perception score of 69.81% indicates that farmers hold a generally positive view of manure-processing technology, although perceptions vary by aspect.

Many farmers still perceive manure processing as complex, especially during the fermentation and mixing stages. Those familiar with chemical fertilizers view manure processing as labor-intensive. Limited post-training technical support also reinforces this perception. According to Soekartawi (2005) [7], the simpler an innovation, the faster its adoption. Practical training and field demonstrations are therefore crucial.

While cattle manure is abundant, supplementary materials such as EM4, rice husks, and cutting tools remain limited, making the technology less practical. This aligns with Nurmanaf (2007) [5], who emphasizes that farmers' economic conditions strongly influence their ability to access production inputs.

Conversely, farmers expressed highly positive perceptions of relative advantage. They recognize long-term benefits such as improved soil fertility, reduced dependence on chemical fertilizers, and lower production costs. Following Soekartawi's (2005) [7] view, innovations offering greater relative advantage encourage faster adoption.

Some farmers reported observing better crop performance and improved soil structure after applying organic fertilizers. This supports the principle of observability in innovation diffusion theory. A 52-year-old respondent with 25 years of farming experience stated:

> *"In the past, the crop was often attacked by brown planthopper, but now the plants are stronger and less damaged."*

This aligns with Wahyudi *et al*. (2019), who found that organic fertilizers enhance soil microbial biodiversity, increasing plant resistance to pests.

Overall, farmers' perceptions are positive, particularly regarding relative advantage and observability. Education, farming experience, and extension services contribute positively to perception, while age and limited facilities remain constraints. Strengthening participatory extension, improving access to production inputs, and empowering village-level organic fertilizer groups are essential strategies.

3.3. Level of Farmers' Adoption of Livestock Manure Processing Technology

The results revealed that 96.87% of farmers fall into the high adoption category, 3.13% into the moderate category, and none into the low or very low categories.

Table 2: Distribution of Respondents by Adoption Level

Category	Score Range	Respondent	Percentage (%)
Very Low	20 – 36	0	0
Low	37 – 52	0	0
Moderate	53 - 68	1	3,13
High	69 - 84	31	96,87
Very High	85 - 100	0	0

High adoption levels are driven by positive perceptions of relative advantage and observability, such as improved soil fertility, reduced chemical fertilizer use, and enhanced yields. These findings align with Rogers' (2003) [6] Diffusion of Innovations theory, which highlights the importance of relative advantage, compatibility, complexity, trialability, and observability.

Extension support and farmer group activities have played key roles in strengthening adoption through technical assistance and field training. This is consistent with Dewi Marwanti *et al*. (2021) [3], who found that extension frequency and farmer understanding significantly improve organic fertilizer adoption.

Although adoption is generally high, none of the farmers reached the very high category, indicating remaining challenges such as limited time, labor, and capital. Mardikanto (2006) [1] notes that socio-economic constraints often hinder full innovation adoption. Therefore, sustained support— such as simple processing tools, subsidized decomposers, and stronger farmer institutions—is necessary for optimal and sustainable adoption.

4. Conclusion

The findings indicate that farming experience significantly influences farmers' perceptions across all aspects of manure-processing technology, including complexity, production facilities, relative advantage, and observability. Experienced farmers tend to be more critical and realistic in evaluating the benefits and constraints of the technology, whereas inexperienced farmers rely on simpler, short-term judgments. Thus, experience should form the basis for designing strategies to strengthen farmers' perceptions of organic manure technologies.

Recommendations:

1. Extension services should adopt experiential learning approaches through field schools and demonstrations, involving experienced farmers as mentors to facilitate practical knowledge sharing and build farmer-to-farmer trust.
2. Farmer groups should function as collective organic fertilizer production centers**,** addressing facility limitations while promoting experience exchange among members.

3. Local governments should provide policy support**,** including simple equipment, subsidies for microbial activators, and incentives for farmers consistently using organic fertilizers, to strengthen perceptions of economic and ecological benefits.
4. Academics and researchers should develop simpler, cheaper, and smallholder-friendly organic fertilizer processing technologies.

Collaboration among extension workers, farmer groups, local government, and academia will enable farmers' experience to serve as a key social asset in strengthening perceptions and expanding the adoption of manure-processing technology in Tlanakan Subdistrict.

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