JAPSI (Journal of Agriprecision and Social Impact)
Volume 2 Issue 2 July 2025
e-ISSN: 3032-7849; p-ISSN: 3046-5397, Page 266-290
DOI: https://doi.org/10.62793/japsi.v2i2.60
Available online at: https://journal.kdp.co.id/index.php/japsi

Factors Influencing Community Participation in Sustainable Beef Cattle Waste Management in Kediri City, Indonesia

Alven Muarof
Department of Animal Science, Faculty of Animal Science, Brawijaya University

Siti Azizah
Department af Animal Science, Faculty of Animal Science, Brawijaya University

Ita Wahju Nursita
Department of Animal Science, Faculty of Animal Science, Brawijaya University

Address: Veteran Street, Malang 65145, East Java, Indonesia
Corresponding author: siti.azizah@ub.ac.id

Abstract. *Farmers in Kediri City still have low awareness of proper livestock waste management. It has also been reported that many local residents have complained about the pollution caused by livestock waste. Furthermore, the waste is often disposed of in makeshift dumping sites created by the farmers themselves, and some farmers even discharge livestock waste into the Brantas River. The purpose of this study was to analyze livestock farmers' participation and the factors influencing their involvement in the livestock waste processing program. The sampling technique in this study used the purposive sampling method, for sampling the population of farmers, it was obtained by the purposive sampling method, namely selecting respondents who participated in the beef cattle waste processing program in Kediri City. The main variables observed in this study were: motivation (X2), perception (X3), role of stakeholders (X4), participation (Y1), and sustainability (Y2). This research study employed a descriptive survey method. The questionnaires are the main tool in gathering data. The data analysis method involved statistical model testing using SEM SmartPLS. The results showed that livestock farmers' participation in the beef cattle waste processing program was influenced by motivation and perception variables. This is attributed to the minimal role played by stakeholders in livestock waste processing in Kediri City. Furthermore, higher levels of motivation and more positive perceptions are associated with greater participation, which in turn has a positive impact on sustainability.*

Keywords: *Livestock waste, Motivation, Participation, Perception, SEM PLS, Stakeholder, Sustainability*

Received: March 28, 2025; Accepted: June 22, 2025; Published: July 5 2025
*Corresponding author, siti.azizah@ub.ac.id

INTRODUCTION

Based on direct observations, livestock farmers in Kediri City still show low awareness of proper livestock waste management. The results of observations also show that many local residents complain about pollution caused by this waste. In addition, livestock waste is often disposed of in temporary landfills made by the farmers themselves, some even dispose of waste directly into the Brantas River. This is in line with research by Prambudi et al. (2020) which states that although waste cannot be completely eliminated, waste can be managed properly. If not processed optimally, waste can damage the environment and pollute water, soil, and air. This problem continues because many farmers dump waste directly into the environment without adequate processing or management. Some farmers have begun to realize the hidden potential of livestock waste, but this awareness is not yet evenly distributed throughout the livestock community. Research conducted at the Kediri Regency People's Animal Husbandry School (SPR) shows that livestock waste is an urgent concern, because it contributes significantly to global warming (Prambudi et al., 2020). One of the main reasons why livestock farmers have not processed their livestock waste is the lack of funds and support from the local government. Increased support is needed in the form of training, financial assistance, and economic empowerment programs to encourage waste processing an initiative that can ultimately improve livestock farmers' livelihoods.

In 2023, the Food Security and Agriculture Office of Kediri City, through its livestock division, implemented a program to process beef cattle waste into compost that can later be used as fertilizer to increase crop yields. This waste processing program aims to encourage farmers to manage the waste generated by their livestock more effectively. In addition, the program is expected to raise farmers' awareness of the importance of appropriate and environmentally friendly waste management. The program was implemented in Tempurejo and Blabak Villages, located in Pesantren Sub-district, and in Pojok Village, located in Mojoroto Sub-district, Kediri City. Furthermore, government support must be complemented by active participation from farmers. Their involvement is essential to improving livestock productivity in Kediri City and ensuring the sustainability of the livestock waste management program. The purpose of this study is to examine the level of participation of livestock farmers in the waste processing program organized by the Food Security and Agriculture Office of Kediri City, as well as to

identify the factors that influence their participation. The findings of this study are expected to support the sustainability of the livestock waste processing program in Kediri City. The novelty of this research lies in the use of a different data analysis method, namely Structural Equation Modeling (SEM-PLS), to analyze the level of community participation in livestock waste processing. In addition, this study adopts different variables from those used in previous research to identify the factors influencing livestock farmers' participation in waste processing programs in Kediri City. This research is expected to enhance farmers' participation, thereby supporting the sustainability of livestock waste processing programs in the region.

LITERATURE REVIEW

Livestock waste includes all waste generated from livestock activities, whether in the form of solid, liquid, gas, or feed residue. Solid waste consists of materials in solid form, such as livestock manure, carcasses, or entrails from livestock slaughter. Liquid waste includes substances in liquid form, such as urine or water used for cleaning equipment. Gaseous waste refers to any material in the gas phase. If livestock waste is disposed of without prior treatment, it can cause significant environmental pollution. Waste from cattle farms often triggers complaints from local residents due to its negative impacts, such as skin irritation from using contaminated river water and strong, unpleasant odors. The general public has become increasingly aware of the harmful effects of livestock manure waste. Many parties have successfully processed livestock manure into useful products that contribute to improving farmers' welfare. These products include biogas, fertilizer, alternative fuel, and even bricks (Adetia et al., 2020). Compost, for example, is decomposed organic matter such as grass, leaves, kitchen waste, straw, and other debris that enriches the soil (Ekawandani & Alvianingsih, 2018). Therefore, farmer participation is crucial in livestock waste processing efforts to reduce the resulting environmental pollution. This participation can be influenced by both internal and external factors. According to Makatita (2021), internal factors influencing community participation include individual characteristics. Meanwhile, Faharudin et al. (2020) identify perception and motivation as key internal factors. Sardjo et al. (2017) emphasize that sustainability programs also constitute an internal factor. On the other hand, Setiawan et al. (2018) argue that external factors are shaped by the role of stakeholders.

Motivation is an internal drive that influences a person's participation in an activity. In this context, farmers' motivation to participate in livestock waste treatment programs plays a significant role, whether it stems from economic motives (e.g., generating additional income through products such as biogas or fertilizer) or environmental motives (e.g., reducing pollution). Motivation serves as the primary driving force behind farmers' decisions to engage in waste treatment initiatives. This motivation may arise from financial incentives such as increased income from waste utilization or from a sense of environmental responsibility. This view is supported by Fahruddin et al. (2020), who found that highly motivated farmers, whether driven by economic benefits or environmental concerns, tend to participate more actively. Therefore, motivation is a critical factor in fostering farmers' awareness and commitment to processing livestock waste in a sustainable manner.

Furthermore, farmers' perception of the livestock waste management program significantly influences their level of participation. When farmers have a positive perception of the program's benefits such as improved welfare or a cleaner environment they are more likely to engage actively. Conversely, negative perceptions, such as the belief that the program is difficult to implement or lacks direct benefits, tend to hinder participation. This is supported by research conducted by Faharuddin et al. (2020), which found that positive perceptions can shape the belief that the program offers tangible advantages. Farmers who recognize the environmental and economic benefits of the program are more likely to support and actively participate in its implementation. In addition, stakeholders play a crucial role in the success of livestock waste management programs. The government, as a key stakeholder, is responsible for providing support in the form of facilities, training, and incentives. Moreover, community leaders, farmer organizations, and agricultural extension workers also play important roles in motivating and guiding farmers to participate. Stakeholder involvement fosters a collaborative environment that supports more effective program implementation. In this study, stakeholder involvement was found to have a significant impact on the level of farmer participation.

Participation refers to the active involvement of individuals or groups in an activity, process, or decision-making. It can be either voluntary or structured, and generally aims to provide those involved with the opportunity to contribute toward achieving a shared

goal. In democratic processes, participation is often driven by individual initiative. However, as noted by Mikkelsen (2011), not many communities are willing to rely solely on voluntary approaches to encourage their members to take part in motivational development activities. A key characteristic of the participation process is the formation of new and stronger social networks, which serve as platforms for collaboration in achieving specific objectives. According to Mardikanto (2022), participation as a process leads to the development of these networks, where various parties work together at different stages to realize goals that are meaningful to the community or related social structures. Livestock farming in Kediri City represents an important economic sector for the local population, particularly for those living in the city's outskirts. While Kediri is more widely known for its trade and tobacco industries, many residents still rely on livestock farming—raising cattle, goats, chickens, and ducksas a primary source of income. Therefore, proper processing of livestock waste is essential, not only to reduce environmental impacts but also to enhance the economic well-being of farmers.

RESEARCH METHODS

Research methods refer to a series of structured steps or procedures used in the research process to collect, analyze, and interpret data. The choice of method depends on the research objectives, the type of data required, and the research questions to be addressed. According to Yusuf (2016), research methods are generally divided into two main categories:

a. Quantitative Research

This method focuses on collecting data that can be measured and analyzed statistically. Quantitative research typically uses instruments such as surveys, questionnaires, or experiments to gather data from a sample population. The primary goal is to test hypotheses, understand the relationships between variables, or measure the effects of one variable on another, ultimately providing objective conclusions about the research topic.

b. Qualitative Research

Qualitative research aims to gain an in-depth understanding of phenomena by collecting descriptive data through interviews, observations, or document analysis. This method is used to explore perspectives, experiences, and meanings from the viewpoint of individuals. It is particularly suitable when researchers seek to

understand the social context or an individual's perception of a particular event or issue. Data in qualitative research is analyzed interpretively to identify emerging themes or patterns.

This study employs an exploratory qualitative research design aimed at explaining the influence of the independent variable motivation, perception, and the role of stakeholders on the dependent variables, namely the level of farmer participation and the sustainability of the livestock waste treatment program in Kediri City. Primary data were collected through observation, interviews, and documentation, while secondary data were obtained from supporting sources such as journal articles and previous studies relevant to the research topic. The sampling technique in this study used the purposive sampling method. According to Fatihudin (2015) purposive sampling is a method in which researchers determine specific characteristics of prospective respondents that are in accordance with the objectives of the study so that they are expected to be able to answer the research problems. For sampling the population of farmers, it was obtained by the purposive sampling method, namely selecting respondents who participated in the beef cattle waste processing program in Kediri City.

Data Analysis

This research was conducted from February to April 2024 in Kediri City. The research site was selected at the Food Security and Agriculture Office (Department of Food Security and Agriculture, DKPP) of Kediri City, which serves as the implementing agency for government affairs in the fields of food, agriculture, and fisheries under the authority of the Kediri City Government. DKPP focuses on supporting and advancing the agricultural sector and food security within the Kediri City area. Kediri City consists of three sub-districts: Kota, Mojoroto, and Pesantren. The selection of research locations was based on field surveys and community complaints regarding unprocessed livestock waste that contributes to environmental pollution. The study was specifically conducted in Pesantren and Mojoroto sub-districts, namely in Bawang, Blabak, and Pojok villages. Data collection was carried out using semi-structured questionnaires, which were distributed to respondents who had provided written consent prior to participation, as well as through structured interviews. A total of 80 farmers were selected as the research sample. The main variables observed in this study were: motivation (X2), perception (X3), role of stakeholders (X4), participation (Y1), and sustainability (Y2). This study applied the

SEM-PLS method for data processing using WarpPLS 7.0 software. The SEM-PLS approach was chosen because it is efficient for handling smaller sample sizes and complex models without requiring strict assumptions about the underlying data (Sholihin and Ratmono, 2021). SEM-PLS is also considered effective as it can confirm existing theories, develop new relationships that lack a theoretical foundation, and analyze latent variables with formative, reflective, or mixed indicators (Solimun et al., 2017). In this study, all latent variables were measured using reflective indicators.

Outer Model

In PLS-SEM analysis using WarpPLS, there are two structural models: the outer model and the inner model. According to Sholihin and Ratmono (2021), the outer model explains how each indicator used in the study relates to its corresponding latent variable. This model functions to test the validity and reliability of the research instruments. The outer model assessment includes several tests: convergent validity, discriminant validity, and reliability testing.

The first test performed on the outer model is convergent validity, which assesses the degree to which two measures of the same concept are correlated (Sholihin and Ratmono, 2021). Convergent validity is measured by analyzing the factor loading values, which should be greater than or equal to 0.70. Values below 0.40 should be eliminated (Sholihin and Ratmono, 2021). In addition, convergent validity can also be evaluated through the Average Variance Extracted (AVE) value, which should be at least 0.50 or higher. An AVE value greater than 0.50 indicates that the construct explains more than half of the variance in its indicators. Conversely, an AVE value less than 0.50 suggests that more error remains in the items than the variance that can be explained.

Next, discriminant validity is tested to assess the extent to which a construct is truly distinct from other constructs (Sholihin and Ratmono, 2021). This is done by comparing the loading values with cross-loading factors. If the loading value of an indicator is greater than its cross-loadings on other constructs, then the indicator is considered to meet discriminant validity.

Finally, reliability testing is evaluated using two indicators: composite reliability and Cronbach's Alpha. Composite reliability is considered acceptable if it is greater than or equal to 0.70, although this is not a strict threshold (Solimun et al., 2017). Meanwhile, a

questionnaire is considered reliable if its Cronbach's Alpha value exceeds 0.60 (Sholihin and Ratmono, 2021).

Inner Model

After completing the assessment of the outer model, the next step is to test the inner model or the structural model used in the study. Solimun et al. (2017) explain that the inner model describes the relationships between latent variables based on the theoretical framework of the research. The inner model evaluation involves several tests by analyzing the path coefficient, R-squared (R^2) values, and Goodness of Fit.

The first evaluation in the inner model is by observing the path coefficients, which indicate the direction and strength of relationships between the variables used. Path coefficients range from -1 to +1; values closer to +1 indicate a strong and significant positive relationship, while values closer to 0 suggest weaker or insignificant relationships (Sholihin and Ratmono, 2021).

The next evaluation is based on R-squared (R^2) values or the coefficient of determination. R^2 values range from 0 to 1, where higher values indicate greater predictive accuracy (Sholihin and Ratmono, 2021). However, determining a fixed threshold for R^2 values is complex, as it depends on the complexity of the model and the discipline in which the research is conducted.

RESULTS AND DISCUSSION

Descriptive Test

The descriptive test is used to provide a general overview of the research data. This analysis was conducted using frequency distribution and mean (average) value calculations, with the results summarized below.

Table 1. Description of Motivation Variables

Indicator	1		2		3		4		Mean
	F	%	f	%	F	%	f	%	
X2.1	0	0.0%	11	13.8%	30	37.5%	39	48.8%	3.350
X2.2	0	0.0%	1	1.3%	34	42.5%	45	56.3%	3.550
X2.3	0	0.0%	17	21.3%	38	47.5%	25	31.3%	3.100
X2.4	9	11.3%	38	47.5%	33	41.3%	0	0.0%	2.300
X2.5	0	0.0%	5	6.3%	37	46.3%	38	47.5%	3.413
Motivation (X2)									3.143

Source: Processed primary data, 2025.

The overall description of the motivation variable shows an average score of 3.143, indicating that respondents' perceptions are at a high level. The indicator with the highest average score is X2.2, with a value of 3,550, while the indicator with the lowest average score is X2.4, with a value of 2,300. The research findings indicate that motivation, specifically under the indicator of the need for personal security, has a very high average score in relation to livestock waste management. The personal security needs indicator recorded a variable value of 3.550, showing that respondents have a very high level of motivation regarding the extent to which they seek personal security in the management of beef cattle waste.

Table 2. Description of Perception Variables

Indicator	1		2		3		4		Mean
	F	%	f	%	F	%	f	%	
X3.1	0	0.0%	0	0.0%	39	48.8%	41	51.3%	3.513
X3.2	0	0.0%	0	0.0%	27	33.8%	53	66.3%	3.663
X3.3	0	0.0%	0	0.0%	22	27.5%	58	72.5%	3.725
Perception (X3)									3.633

Source: Processed primary data, 2025.

The overall description of the perception variable shows an average score of 3.633, indicating that respondents' perceptions are at a very high level. The indicator with the highest average score is X3.3, with a value of 3.725, while the indicator with the lowest average score is X3.1, with a value of 3.513. The research results indicate that farmers have a very high level of perception regarding their behavior and actions. The conative perception indicator shows a variable value of 3.725 which reflects a very high perception of the extent to which farmers demonstrate behavior and take action in response to the waste produced by beef cattle.

Table 3. Description of Stakeholder Variables

Indicator	1		2		3		4		Mean
	F	%	f	%	F	%	f	%	
X4.1	12	15.0%	56	70.0%	12	15.0%	0	0.0%	2.000
X4.2	0	0.0%	0	0.0%	34	42.5%	46	57.5%	3.575
X4.3	13	16.3%	48	60.0%	19	23.8%	0	0.0%	2.075
Stakeholders (X4)									2.550

Source: Processed primary data, 2025.

The overall description of the stakeholder variable shows an average score of 2.550, indicating that respondents' perceptions are at a moderate level. The indicator with the

highest average score is X4.2, with a value of 3,575, while the indicator with the lowest average score is X4.1, with a value of 2,000. The research findings indicate that extension agents have a very high average score regarding livestock waste management. In the stakeholder indicator, extension agents recorded a variable value of 3.575, indicating a very high level of contribution by Department of Food Security and Agriculture (DKPP) to the management of beef cattle waste.

Table 4. Description of Participation Variables

Indicator	1		2		3		4		Mean
	F	%	f	%	F	%	f	%	
Y1.1	0	0.0%	0	0.0%	21	26.3%	59	73.8%	3.738
Y1.2	0	0.0%	0	0.0%	34	42.5%	46	57.5%	3.575
Y1.3	0	0.0%	10	12.5%	30	37.5%	40	50.0%	3.375
Y1.4	0	0.0%	19	23.8%	28	35.0%	33	41.3%	3.175
Y1.5	0	0.0%	15	18.8%	35	43.8%	30	37.5%	3.188
Participation (Y1)									3.410

Source: Processed primary data, 2025.

The overall description of the participation variable shows an average score of 3.410, indicating that respondents' perceptions are at a very high level. The indicator with the highest average score is Y1.1, with a value of 3.738, while the indicator with the lowest average score is Y1.4, with a value of 3.175. The research findings show that participation, particularly in the indicator of planning and decision-making regarding the time and location of implementation, has a very high average score in relation to livestock waste management. This indicator recorded a variable value of 3.738, indicating that respondents demonstrate a very high level of participation in terms of their involvement in planning and decision-making regarding the timing and location of beef cattle waste management activities.

Table 5. Description of Sustainability Variables

Indicator	1		2		3		4		Mean
	F	%	f	%	F	%	f	%	
Y2.1.1	0	0.0%	12	15.0%	29	36.3%	39	48.8%	3.338
Y2.1.2	0	0.0%	22	27.5%	34	42.5%	24	30.0%	3.025
Y2.1.3	0	0.0%	19	23.8%	29	36.3%	32	40.0%	3.163
Y2.2	0	0.0%	1	1.3%	34	42.5%	45	56.3%	3.550
Y2.3	0	0.0%	1	1.3%	27	33.8%	52	65.0%	3.638
Y2.4	0	0.0%	1	1.3%	36	45.0%	43	53.8%	3.525
Y2.5	0	0.0%	0	0.0%	55	68.8%	25	31.3%	3.313
Sustainability									3.364

Source: Processed primary data, 2025.

The overall description of the sustainability variable obtained an average of 3.364, which means that the respondents' perceptions are at a very high level. The indicator that has the highest average is indicator Y2.3 of 3.638, while the indicator that has the lowest average is indicator Y2.1.2 of 3.025. The research findings indicate that sustainability has a very high average score in relation to the economic impact indicator in livestock waste management. The economic impact indicator recorded a variable value of 3.638, showing that the sustainability of beef cattle waste management is strongly influenced by the extent to which respondents experience the economic benefits resulting from the waste management process.

Partial Least Square Test

Structural Equation Modeling (SEM) is a method used to address the limitations of regression analysis. According to experts, SEM research methods are divided into two approaches: Covariance-Based SEM (CB-SEM) and Variance-Based SEM, also known as Partial Least Squares (PLS). Partial Least Squares is a robust analytical method that does not rely on many assumptions. The PLS approach is distribution-free, meaning it does not require data to follow a specific distribution and can handle nominal, categorical, ordinal, interval, and ratio data types. PLS employs bootstrapping or random resampling techniques, so the assumption of normality is not an issue. Additionally, PLS does not require a minimum sample size, allowing research with small samples to still utilize this method. As a non-parametric technique, PLS modeling does not require data to be normally distributed. Data analysis in this study was conducted using SmartPLS version 7.0 software. The Partial Least Squares (PLS) test was used to analyze the effects of

motivation (X2), perception (X3), stakeholder role (X4), participation (Y1), and sustainability (Y2).

Outer Model Test Results

Outer model analysis is conducted to ensure that the measurements used are appropriate, meaning they are valid and reliable. This analysis specifies the relationship between latent variables and their indicators. The results of the outer model test include convergent validity, discriminant validity, and construct reliability tests.

a. Convergent Validity Test

Convergent validity is assessed based on the correlation between the item score/component score and the construct score, which is reflected in the standardized loading factor. This factor indicates the strength of the correlation between each measurement item (indicator) and its corresponding construct. An individual reflective measure is considered strong if it has a correlation greater than 0.7 with the construct being measured. According to Chin, as cited by Imam Ghozali, outer loading values between 0.5 and 0.6 are considered acceptable.

Table 6. Convergent Validity Results on the Reflective Model

Variable	Indicator	Loading	Condition	Description
Motivation (X2)	X2.1	0.796	>0.70	Achieved
	X2.2	0.730	>0.70	Achieved
	X2.3	0.804	>0.70	Achieved
	X2.4	0.824	>0.70	Achieved
	X2.5	0.759	>0.70	Achieved
Perception(X3)	X3.1	0.735	>0.70	Achieved
	X3.2	0.836	>0.70	Achieved
	X3.3	0.835	>0.70	Achieved
Sustainability (Y2)	Y2.1.1	0.853	>0.70	Achieved
	Y2.1.2	0.899	>0.70	Achieved
	Y2.1.3	0.851	>0.70	Achieved
	Y2.2	0.813	>0.70	Achieved
	Y2.3	0.888	>0.70	Achieved
	Y2.4	0.850	>0.70	Achieved
	Y2.5	0.738	>0.70	Achieved

Source: Processed primary data, 2025.

The convergent validity test aims to ensure that each item or question designed reflectively accurately represents the concept or phenomenon being measured. This test

assesses the extent to which the items have an adequate level of correlation with their intended constructs, thereby demonstrating their suitability in measuring the specified construct. The results of the convergent validity test for motivation (X2), perception (X3), and sustainability (Y2), using a reflective measurement model, showed that all indicators had loading factor values greater than 0.700, indicating that the variables' indicators have met the criteria for convergent validity. Specifically, the motivation variable (X2), measured through the item regarding whether the cattle waste processing program fulfills self-esteem needs such as the desire to be respected, the desire to receive awards, and the desire to be appreciated (X2.4) has a very high loading factor value of 0.824. This indicates that this item is highly relevant and significant in measuring motivation (X2).

Table 7. Convergent Validity Results on the Formative Model

Variable	Indicator	P-value	Condition	Description
Stakeholders (X4)	X4.1	0.049	<0.05	Achieved
	X4.2	0.001	<0.05	Achieved
	X4.3	0.026	<0.05	Achieved
Participation (Y1)	Y1.1	0.006	<0.05	Achieved
	Y1.2	0.037	<0.05	Achieved
	Y1.3	0.003	<0.05	Achieved
	Y1.4	0.000	<0.05	Achieved
	Y1.5	0.002	<0.05	Achieved

Source: Processed primary data, 2025.

The results of the convergent validity test for stakeholders (X4) and participation (Y1), using a formative measurement model, showed that the significance values (p-values) of the indicators were less than 0.05, indicating that the indicators of these variables have met the criteria for convergent validity.

b. Discriminant Validity Test

Discriminant validity is a measurement model with reflective indicators, assessed based on the cross-loading between the measurement items and the constructs. If the correlation between a construct and its measurement items is greater than the correlation with other constructs, it indicates that the indicators better represent their respective construct compared to others. Another method for assessing discriminant validity is by comparing the square root of the Average Variance Extracted (AVE) with the correlations among constructs.

Table 8. Results of Discriminant Validity in the Reflective Model

Variable	X2	X3	Y2	Description
Motivation (X2)	0.783			Achieved
Perception (X3)	0.606	0.803		Achieved
Sustainability (Y2)	0.774	0.684	0.843	Achieved

Source: Processed primary data, 2025.

The results of the discriminant validity test using the square root of the AVE showed that the AVE root values (in bold) are greater than the correlation values between latent variables. Therefore, motivation (X2), perception (X3), and sustainability (Y2) have met the criteria for discriminant validity.

c. Construct Reliability Test

Composite reliability is an indicator used to measure a construct, which can be observed through the latent variable coefficients. To evaluate composite reliability, two measures are commonly used: internal consistency and Cronbach's Alpha. In this assessment, a value greater than 0.70 indicates that the construct has high reliability. Cronbach's Alpha is a reliability test used to reinforce the results of composite reliability. A variable is considered reliable if it has a composite reliability value greater than 0.70.

Table 9. Results of Validity and Reliability of Constructs in the Reflective Model

Variable	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Motivation (X2)	0.843	0.888	0.613
Perception (X3)	0.723	0.845	0.645
Sustainability (Y2)	0.932	0.945	0.711

Source: Processed primary data, 2025.

The results of the construct validity test for motivation (X2), perception (X3), and sustainability (Y2), using the Average Variance Extracted (AVE) values, showed that all results met the criteria with values above 0.500, indicating acceptable construct validity. The construct reliability test results, based on Composite Reliability and Cronbach's Alpha values, also met the criteria with values above 0.70, indicating satisfactory construct reliability.

Inner Model Test Results

Inner model analysis, also known as inner relation, structural model, or substantive theory, describes the relationships between latent variables based on substantive theory. The inner model analysis can be evaluated using the R-squared value for the dependent constructs. In evaluating the inner model with PLS (Partial Least Squares), the process begins by examining the R-squared values for each dependent latent variable. The interpretation of these values is similar to that in regression analysis. Changes in the R-squared values can be used to assess whether certain independent latent variables have a substantive effect on the dependent latent variable. The results of the inner model testing include the coefficient of determination (R-squared).

a. R-Square (R^2)

The predictive power of the structural model can be measured using the R-square (R^2) value. This value can explain the magnitude of the influence on endogenous variables.

Table 10. Results of the Determination Coefficient Test

Variable	R Square	R Square Adjusted
Participation (Y1)	0.805	0.797
Sustainability (Y2)	0.691	0.687

Source: Processed primary data, 2025.

The coefficient of determination for participation (Y1) obtained an R-squared value of 0.805, which means that 80.5 percent of the variation in participation (Y1) can be explained by motivation (X2), perception (X3), and stakeholders (X4), while the remaining 19.5 percent is explained by other variables. The coefficient of determination for sustainability (Y2) obtained an R-squared value of 0.691, which means that 69.1 percent of the variation in sustainability (Y2) can be explained by participation (Y1), while the remaining 30.9 percent is explained by other variables.

b. Q-Square (Q^2)

In measuring the predictive relevance of the structural model as a whole, the calculation of the Q-square value (Q^2) is used. The Q-square value obtained is 0.940, which is greater than 0.35, so it is stated that the structural model as a whole has strong predictive relevance.

c. Effect Size (f^2) Test

Table 11. Effect Size Test Results (f^2)

Variable	Y1	Y2
Motivation (X2)	1.316	
Perception (X3)	0.338	
Stakeholders (X4)	0.050	
Participation (Y1)		2.241

Source: Processed primary data, 2025.

The results of the effect size test show that the influence between variables obtained f^2 is more than zero, which indicates a moderate influence at the structural level.

Research Model Development

Based on the model testing, the latent variables in this study are grouped into two categories: exogenous variables and endogenous variables. The exogenous variables in

this research are motivation (X2), perception (X3), and stakeholders (X4), while the endogenous variables are participation (Y1) and sustainability (Y2). The model is considered good if the hypothesized model development is theoretically supported by empirical data. The results of the analysis using Partial Least Squares (PLS) to determine the influence among variables in full are illustrated in the following figure:

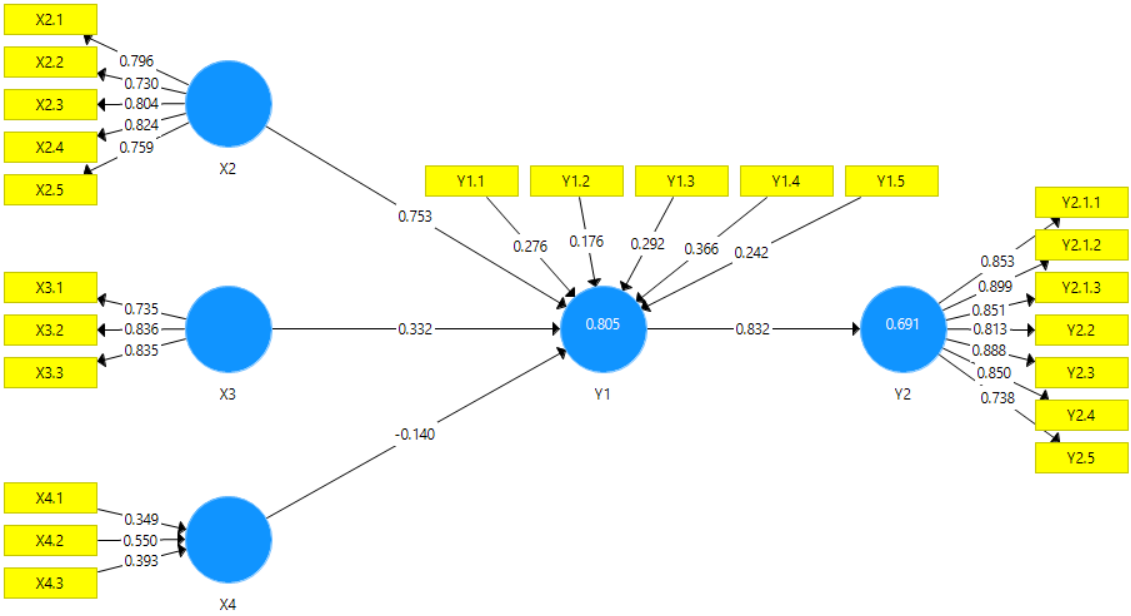

Figure 1. Research Model Path Diagram

Source: Processed primary data, 2025.

Testing the outer model of the motivation variable (X2) shows that the X2.4 indicator, with a loading of 0.824, has the highest loading and is therefore the dominant indicator forming the motivation variable (X2). The perception variable (X3) shows that the X3.2 indicator, with a loading of 0.836, has the highest loading and is thus the dominant indicator forming the perception variable (X3). Furthermore, the stakeholder variable (X4) shows that the X4.2 indicator, with a weight of 0.550, is the dominant indicator forming the stakeholder variable (X4).

Testing the outer model of the participation variable (Y1) reveals that the Y1.4 indicator, with a weight of 0.366, is the dominant indicator forming the participation variable (Y1). The sustainability variable (Y2) shows that the Y2.1.2 indicator, with a loading of 0.899, has the highest loading and is the dominant indicator forming the sustainability variable (Y2).

Inner model testing shows that the direct effects of motivation (X2), perception (X3), and stakeholders (X4) on participation (Y1) are positive, and that participation (Y1) has a positive effect on sustainability (Y2).

In hypothesis testing, the results are based on the t-statistic value and probability value. For hypothesis testing at a 5% significance level, the critical t-statistic value is 1.645. Thus, the hypothesis is accepted (Ha) and the null hypothesis (H0) is rejected when t-statistic > 1.645. Using probability, Ha is accepted if the p-value is < 0.05. Based on the empirical data used in this study, the proposed hypotheses were tested. The following presents the results of hypothesis testing based on the path coefficient values and T-statistic / p-values.

Table 12. Hypothesis Test Results

No	Affect	Koef.	t	p	Description
1	X2 -> Y1	0.753	7.147	0.000	Significant
2	X3 -> Y1	0.332	2.807	0.003	Significant
3	X4 -> Y1	-0.140	1.701	0.045	Significant
4	Y1 -> Y2	0.832	22.069	0.000	Significant
5	X2 -> Y1 -> Y2	0.627	6.694	0.000	Significant
6	X3 -> Y1 -> Y2	0.276	2.767	0.003	Significant
7	X4 -> Y1 -> Y2	-0.116	1.693	0.046	Significant

Source: Processed primary data, 2025.

The results of hypothesis testing are presented as follows:

1. **The effect of motivation (X2) on participation (Y1)**

   The hypothesis regarding the influence of motivation (X2) on participation (Y1) obtained a path coefficient of 0.753, a t-statistic value of 7.147, and a significance value of 0.000. These results show that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 (p < 0.05), indicating that motivation (X2) has a positive and significant effect on participation (Y1). This means that higher or better motivation (X2) will lead to higher or better participation (Y1). Thus, this hypothesis is supported.

2. **The effect of perception (X3) on participation (Y1)**

   The hypothesis regarding the effect of perception (X3) on participation (Y1) obtained a path coefficient of 0.332, a t-statistic value of 2.807, and a significance value of 0.003. These results indicate that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 (p < 0.05), showing that

perception (X3) has a positive and significant effect on participation (Y1). This means that higher or better perception (X3) will lead to higher or better participation (Y1). Therefore, this hypothesis is supported.

3. The effect of stakeholders (X4) on participation (Y1)

The hypothesis regarding the effect of stakeholders (X4) on participation (Y1) obtained a path coefficient of -0.140, a t-statistic value of 1.701, and a significance value of 0.045. These results show that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 ($p < 0.05$), indicating that stakeholders (X4) have a negative and significant effect on participation (Y1). This means that the lower the influence of stakeholders (X4), the higher or better the participation (Y1). Thus, this hypothesis is supported.

4. The effect of participation (Y1) on sustainability (Y2)

The hypothesis regarding the effect of participation (Y1) on sustainability (Y2) obtained a path coefficient of 0.832, a t-statistic value of 22.069, and a significance value of 0.000. These results indicate that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 ($p < 0.05$), showing that participation (Y1) has a positive and significant effect on sustainability (Y2). This means that higher or better participation (Y1) leads to higher or better sustainability (Y2). Therefore, this hypothesis is supported.

5. The effect of motivation (X2) on sustainability (Y2) with participation (Y1) as a mediator

The hypothesis regarding the effect of motivation (X2) on sustainability (Y2) with participation (Y1) as a mediator obtained a path coefficient of 0.627, a t-statistic value of 6.694, and a significance value of 0.000. These results indicate that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 ($p < 0.05$), showing that motivation (X2) has a positive and significant effect on sustainability (Y2) mediated by participation (Y1). This means that higher or better motivation (X2) positively influences higher or better participation (Y1), which in turn indirectly affects higher or better sustainability (Y2). Thus, this hypothesis is supported.

6. **The effect of perception (X3) on sustainability (Y2) with participation (Y1) as a mediator**

The hypothesis regarding the effect of perception (X3) on sustainability (Y2) with participation (Y1) as a mediator obtained a path coefficient of 0.276, a t-statistic value of 2.767, and a significance value of 0.003. These results indicate that the t-statistic value is greater than the critical value (t stat > 1.645) and the significance value is less than 0.05 ($p < 0.05$), showing that perception (X3) has a positive and significant effect on sustainability (Y2) mediated by participation (Y1). This means that higher or better perception (X3) positively influences higher or better participation (Y1), which in turn indirectly affects higher or better sustainability (Y2). Thus, this hypothesis is supported.

7. **The effect of stakeholders (X4) on sustainability (Y2) with participation (Y1) as a mediator**

The hypothesis regarding the effect of stakeholders (X4) on sustainability (Y2) with participation (Y1) as a mediator obtained a path coefficient of -0.116, a t-statistic value of 1.693, and a significance value of 0.046. These results indicate that the t-statistic value is slightly above the critical value (t stat > 1.645) and the significance value is less than 0.05 ($p < 0.05$), showing that stakeholders (X4) have a negative and significant effect on sustainability (Y2) mediated by participation (Y1). This means that the lower the influence of stakeholders (X4), the higher or better the participation (Y1), which in turn indirectly affects higher or better sustainability (Y2). Therefore, this hypothesis is supported.

The study results indicate that motivation and perception both have a significant positive effect on participation and the sustainability of beef cattle waste management in Kediri City. In contrast, the involvement of stakeholders was found to have a significant negative effect on both participation and sustainability in this context. This outcome appears to stem from the insufficient support provided by the local government for beef cattle waste processing. As a result, stakeholders should be empowered to assist and support the community especially the cattle farmers in processing the waste generated by their livestock. Stakeholders must collaborate closely with community members to increase participation and to foster momentum toward the sustainable management of beef cattle waste.

Motivation is considered one of the most important elements in efforts to improve agricultural productivity. Motivation refers to the factors that provide direction and drive to behavior or the desire to perform a task, whether with great effort or minimal exertion (Harianjana, 2002). It can be defined as a pressure or encouragement that prompts an individual to engage in a particular activity (Nurmastiti et al., 2018). According to Darwis, (2017), a motivated person is characterized by enthusiasm, future-oriented thinking, and having a clear plan. In the context of farmers, motivation can be described as the internal driving force that compels them to act. The research findings by Nurmasiti et al. (2023) indicates that farmers hope to independently manage livestock waste in order to meet their own livelihood needs. By using waste autonomously, farmers become more self-reliant in running their farming operations, thereby enabling them to fulfill their daily living necessities. Furthermore, the presence of clear goals to be achieved also contributes to increased motivation.

Community perceptions of livestock farming vary considerably. This is supported by a study conducted by Fakihuddin et al. (2020), which aimed to analysis the environmental pollution impacts and public perceptions regarding the presence of poultry farms. Based on data collection and analysis, the study found that the most pressing environmental impacts included soil infertility, accumulation of chicken manure, and unpleasant odors. These issues hindered residents from engaging in their daily activities effectively and caused economic losses among farmers due to decreased productivity. The findings indicate that the community is particularly disturbed by air pollution in the form of foul odors. Therefore, proper management of livestock waste is essential to prevent disturbances to the surrounding community and to enhance the economic well-being of the farmers.

According to Marganingsih and Hartono (2021), the role of the local government is crucial in livestock waste management. The government can act as a facilitator by providing the necessary infrastructure and facilities to address problems, including involving relevant stakeholders. Additionally, the village government serves as a mediator, positioning itself as a neutral third party that prioritizes consensus-based solutions. Furthermore, the village government functions as a motivator by offering encouragement, raising awareness, and providing guidance on the importance of environmental preservation. Moreover, Marganingsih and Hartono (2021) state that the government, in

its role as a mediator in resolving issues related to cattle waste pollution, positions itself as a neutral third party that prioritizes the achievement of collaborative solutions. This is accomplished through deliberative meetings involving all relevant stakeholders. In its role as a motivator, the local government is responsible for providing motivation, raising awareness, and offering guidance to both cattle-owning farmers and non-farming villagers about the importance of protecting and preserving the environment.

Farmers' motivation and perception play an important role in determining the level of participation and sustainability of beef cattle waste management. Farmers with high motivation tend to be more actively involved in waste management activities because they have an internal drive to improve environmental conditions and increase the economic value of the waste produced. Likewise, positive perceptions of the benefits and importance of waste management strengthen farmers' long-term intentions and involvement. These two factors work together to encourage participation that goes beyond physical involvement, including awareness and long-term commitment. However, the role of stakeholders especially the government and related institutions is also a determining factor. When stakeholders are not actively involved as facilitators, mediators, or motivators the sustainability of the program can be disrupted. Weak support from stakeholders can reduce the effectiveness of the program, even when farmers' motivation and perception are high. Therefore, the synergy between farmers' motivation and perception and active support from stakeholders is essential to increase participation and ensure sustainable and environmentally friendly livestock waste management.

CONCLUSION

This research shows that community participation in the management of beef cattle waste in Kediri City is relatively high. The factors influencing this participation are motivation and perception, both of which have a positive and significant effect on participation and the sustainability of livestock waste management. In contrast, stakeholders exhibit a significant negative influence. Low stakeholder involvement has been associated with increased community participation. This is attributed to the limited role stakeholders currently play in livestock waste management in Kediri City. Furthermore, higher levels of motivation and more positive perceptions are directly associated with greater participation, which in turn positively affects sustainability. The high level of community participation serves as a strong foundation for effective livestock

waste management. Participation encompasses not only physical involvement but also awareness, knowledge, and long-term commitment from farmers. Without active participation, such programs are likely to be short-lived. However, with full engagement from farmers, livestock waste management can become an integral component of a sustainable and environmentally friendly agricultural system.

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