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(Research/Review) Article

The Influence of Final Waste Processing Site (TPA) on Land Use Change Patterns and the Socioeconomic Conditions of Communities Surrounding Medan City

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Abstract: The existence of Final Waste Processing Sites (TPA) in urban areas often presents a dilemma between the need for waste management infrastructure and its environmental and social impacts on surrounding communities. This study aims to examine the impact of the TPA Terjun in Medan City on patterns of land use change and the socioeconomic conditions of nearby residents. The method used is quantitative, involving a survey of 150 respondents, and multiple linear regression analysis to test the influence of two independent variables namely, the characteristics of the TPA and public perception and response on community perceptions of environmental impacts. The results indicate that both independent variables have a significant simultaneous effect on public perception, with a model significance value of 0.022. Partially, the physical characteristics of the TPA have a significantly positive influence, while community perceptions and responses also contribute meaningfully. However, the low coefficient of determination ($R^2 = 0.009$) suggests that many other factors outside the model also influence perceptions of environmental impact. This study highlights the importance of a holistic approach in spatial planning and urban environmental management, particularly in relation to public facilities such as TPAs. Community participation, infrastructure quality, and zoning certainty are crucial factors in maintaining the balance between the functional needs of the city and the desired quality of the microenvironment.

Keywords: Environmental Perception, Final Waste Processing Site (TPA), Land Use, Medan City, Multiple Linear Regression.

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1. Introduction

The development of urban areas in Indonesia today faces serious challenges in sustainable waste management and land use. One of the increasingly complex issues is the existence of Final Disposal Sites (TPA) in urban areas, which not only affects the quality of the physical environment but also impacts the socio-economic structure and spatial planning of surrounding areas. Medan City, as one of the metropolitan cities in North Sumatra, serves as a real representation of this problem.

The presence of the Terjun TPA in Medan has drawn attention in various studies and local government reports due to its proximity to densely populated residential areas and local economic activities. The main issues arising are not limited to air and water pollution, but also include changes in land value, shifts in spatial functions, deteriorating health conditions, and disruptions to household economic activities (Akbar et al., 2025; Andreas et al., 2025; Hidayat et al., 2023; Pakpahan et al., 2025). Hartini et al. (2023) noted that poorly managed environmental infrastructure could disrupt the ecosystem balance and hinder urban community productivity.

This phenomenon aligns with the findings of Hidayat et al. (2023) & Wicaksono & Prasetyo (2021), who emphasized the importance of community participation in managing domestic waste infrastructure. The lack of involvement from residents around the TPA has

led to low control over pollution activities and increased social vulnerability. In a broader context, Sugiarto & Ramadania (2024) stressed that the management of buffer or vulnerable zones such as riverbanks and TPA locations must be aligned with spatial planning policies (RTRW/RDTR) to prevent spatial inequality and prolonged social conflict.

The issue of spatial mismatch is also highlighted by Purba et al. (2024) in their study of Batang Kuis, where development and infrastructure pressure often ignore the area's environmental carrying capacity. This is highly relevant to the areas surrounding the Terjun TPA, which have undergone rapid land use changes over the past two decades due to population migration and the growth of informal economies.

Furthermore, based on the study by Nuraini et al. (2023), the approach to housing development in both mountainous and urban areas needs to consider the community's social and cultural characteristics. Unfortunately, the planning of areas around TPAs often overlooks these socio-ecological aspects, ultimately leading to environmental degradation and inequality in community welfare. Linda et al. (2024) even pointed out that the character of communities in Mandailing exhibits unique gender dynamics and social interaction patterns, requiring a planning approach that is adaptive and participatory.

In addition, Aini et al. (2023) highlighted the importance of preserving spaces based on local values in the planning of ethnic-based areas in North Sumatra. The establishment of TPAs that do not align with the local community's social and cultural values often leads to social alienation and spatial conflicts. Therefore, in the context of Medan City, which is characterized by ethnic diversity and localized spatial patterns, the presence of a TPA must be evaluated not only from technical and ecological perspectives but also from the social, cultural, and economic aspects of the local population.

The issue of TPAs as a threat to the sustainability of urban areas is also emphasized by Haloho & Sugiarto (2024), who investigated the impact of toll road infrastructure development on regional spatial structures. They concluded that infrastructure-based development that neglects spatial planning considerations puts additional pressure on peripheral areas such as TPA locations.

These various problems indicate that the issue of TPAs is not merely technical in nature but is closely related to spatial inequality, socio-economic change, and community responses to their environment (Andreas et al., 2025; Ardi Zikri Muazro et al., 2025; Nasution et al., 2025; Sembiring et al., 2025). However, based on a review of recent literature, empirical studies that simultaneously measure the influence of TPA physical characteristics and community perceptions/responses on environmental and land-related impacts in a quantitative manner remain limited.

Therefore, this study is essential to fill that gap. Using a quantitative approach and multiple linear regression analysis, this research will empirically examine how two main variables — namely, the characteristics of the TPA and the perceptions and responses of the surrounding community — influence land use change patterns and the socio-economic conditions of communities living near the TPA in Medan City. The findings of this study are expected to provide data-driven strategic recommendations for the formulation of TPA management policies that are more adaptive, inclusive, and aligned with the principles of sustainable regional and urban planning.

Based on the background described above, the research problems formulated in this study are as follows: 1) How does the existence and characteristics of the Final Waste Processing Site (TPA) affect the social and land-related environmental impacts on communities surrounding Medan City?; 2) How do public perceptions and responses toward the TPA influence the social and land-related environmental impacts in the vicinity of Medan City?

This research aims to: 1) Analyze the influence of the existence and characteristics of the TPA on the social environmental impacts and land use changes experienced by surrounding communities in Medan City, 2) Analyze the influence of public perception and response toward the TPA on social environmental impacts and land use changes in nearby areas, 3) Provide empirical evidence based on quantitative data regarding the relationship between physical and social aspects of TPA presence and changes in spatial structure and community welfare.

This research is expected to provide the following benefits: 1) Theoretical Benefits; To contribute to the body of scientific literature in the field of regional and urban planning, particularly related to quantitative analysis of the impact of environmental facilities (such as

TPAs) on spatial dynamics and socio-economic changes in society. This study also strengthens an integrative approach combining physical characteristics and social perception in spatial analysis, 2) Practical Benefits; (a) To provide data-based information and recommendations to local governments, particularly the Environmental Agency (Dinas Lingkungan Hidup) and the Regional Development Planning Agency (Bappeda) of Medan City, in formulating more adaptive and sustainable TPA management policies, (b) To serve as a reference for policymakers in drafting spatial planning documents (RTRW/RDTR) that consider the socio-ecological impacts of waste processing facilities, (c) To enhance public awareness among communities living near the TPA on the importance of participation and monitoring in environmental management efforts in their surroundings.

2. Preliminaries or Related Work or Literature Review

Location Theory and Environmental Impact

The location theory introduced by Johann Heinrich von Thünen and its subsequent developments state that the presence of certain activities influences the value and use of surrounding land. In urban contexts, the presence of a Final Waste Processing Site (TPA), which visually, olfactorily, and health-wise functions as a negative externality, often leads to a decrease in land value and alters the direction of spatial development (Mulyadi, 2021; Nuraini, 2019a, 2019b; Nuraini C et al., 2018).

In addition, environmental impact theory emphasizes that human activities such as waste disposal generate externalities that affect surrounding communities in the form of water, air, and soil pollution (Nasution, 2025; Nuraini et al., 2023).

Theory of Spatial Behavior

This theory explains how individuals or community groups respond to their environmental conditions through adaptation, migration, or changes in lifestyle patterns. Community responses to the presence of a TPA are strongly influenced by perception, level of education, and direct experience with the resulting impacts (Siregar, 2022; Harmoko et al., 2024).

Social Ecology Theory

According to this theory, human living space is the result of interactions between social systems and ecological systems. Any imbalance or disruption in the ecological system, such as pollution from a TPA, will have a direct impact on the quality of life, economy, and social conditions of the surrounding community (Lubis & Syafrizal, 2022).

3. Proposed Method

Research Approach

This study adopts a quantitative approach as it aims to test the influence between predetermined variables using statistical methods. The quantitative method is chosen to obtain objective, measurable, and numerically analyzable data. The model used is multiple linear regression, to determine the extent of the influence of the independent variables (the characteristics of the TPA and public perception) on the dependent variable (social and land-related environmental impacts).

Research Location and Time

This research was conducted around the Terjun Final Waste Processing Site (TPA), located in Medan Marelan District, Medan City, North Sumatra. The location was selected because it is the largest active TPA in Medan and is surrounded by densely populated residential areas, making it highly likely to affect the surrounding social environment and land use. The study was carried out from December 2024 to March 2025, covering the planning stage, data collection, and data analysis.

Population and Sample

The population in this study consists of all heads of households or family members living within a 1 km radius of the Terjun TPA, who are directly or indirectly affected by its existence. The sample consists of 150 respondents, selected using purposive sampling based on specific criteria, such as:

Having lived near the TPA for at least 2 years; 1) Being aware of the existence and impact of the TPA on their surrounding environment, 2) Willing to participate as respondents in this study

Conceptual Framework and Research Variables

The conceptual framework in this study connects two independent variables with one dependent variable, as described below:

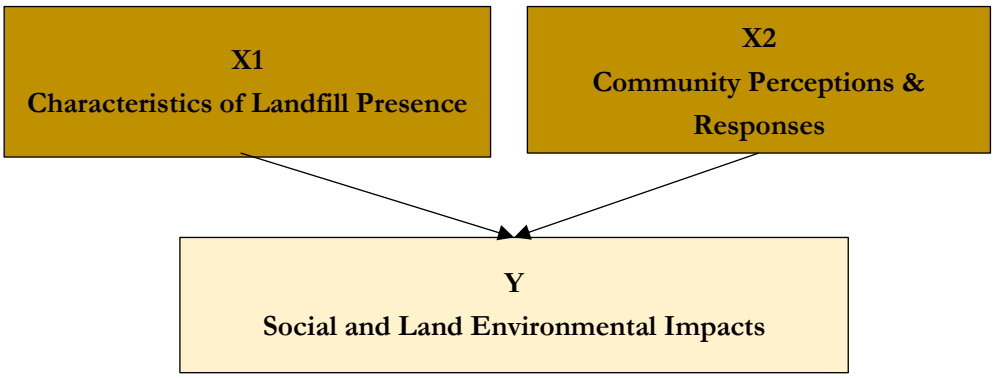

Figure 1: Conceptual Framework Scheme
Source: Prepared by the Researcher, 2025

This study aims to analyze the extent to which X1 and X2 influence the dependent variable Y, both simultaneously and partially, using multiple linear regression analysis. The variables used in this research are described as follows: The independent variables (X) consist of X1 – Characteristics of the TPA's existence, with indicators including (1) the distance from the residence to the TPA, (2) the duration of the TPA's operation, (3) the frequency of disturbances (such as odor, smoke, and flies), and (4) the volume of waste processed. X2 – Community Perception and Response, includes indicators such as (1) the level of public knowledge regarding the environmental impacts of the TPA, (2) public perception of environmental risks, and (3) adaptive actions (such as relocation, home renovation, and environmental participation). The dependent variable (Y) is the Social and Land-related Environmental Impact, with indicators including (1) changes in land value and land use, (2) level of residential comfort, (3) additional household expenses, and (4) changes in spatial utilization patterns.

Types and Sources of Data

The type of data used in this research is quantitative data, in the form of numerical values or scores obtained from measuring the indicators of each variable. The data sources include: (1) Primary data, collected through the distribution of questionnaires to the communities surrounding the TPA; and (2) Secondary data, obtained from urban planning documents, statistics from the Central Bureau of Statistics (BPS) of Medan City, and regional maps.

Data Collection and Analysis Techniques

The data collection techniques used in this research include: (1) Questionnaires as the main data collection tool, designed based on the indicators of each variable using a 5-point Likert scale; (2) Field Observations, conducted to observe the physical environmental conditions and land use patterns directly; and (3) Document Studies, used to obtain secondary data from relevant agencies such as the Environmental Office and the Regional Planning Agency (Bappeda) of Medan City.

The data collected from the questionnaires will be processed using SPSS version 20. The data

analysis techniques include: (1) Validity and Reliability Tests, to assess the accuracy and consistency of the questionnaire items; (2) Classical Assumption Tests (including normality test, multicollinearity test, and heteroscedasticity test); (3) Multiple Linear Regression Analysis, to examine both simultaneous and partial effects of X1 and X2 on Y; (4) Significance Tests(t-test and F-test), to determine the statistical significance of the relationships between variables; and (5) the Coefficient of Determination (R^2), to measure the extent to which the independent variables contribute to the variation in the dependent variable.

4. Results and Discussion

Results

General Description of the Study Area

This research was conducted in the area surrounding the Final Processing Site (Tempat Pemrosesan Akhir/TPA) Terjun, located in Kelurahan Terjun, Medan Marelan District, Medan City. This area serves as one of the strategic points in the waste management system of Medan, functioning as the main final disposal site for various types of municipal solid waste. In operation for more than a decade, TPA Terjun currently receives thousands of tons of waste daily from across the administrative regions of Medan and its surrounding areas.

Geographically, the area surrounding the TPA directly borders dense settlements, local roads, public facilities, and some agricultural lands, which have undergone functional changes over time. These conditions make the area highly vulnerable to ecological and social pressures, particularly those related to air pollution, soil quality degradation, and spatial conflicts between local communities and the city government.

Administratively, the study area covers a radius of approximately one kilometer from the TPA's central point, inhabited by people from various social and economic backgrounds. Community activities in the vicinity are not limited to domestic routines but also include informal sectors that capitalize on the proximity to the TPA, such as local scavengers engaged in waste collection and sorting.

The environmental condition around the TPA is characterized by strong odors, flies, and smoke, which are especially intense during the dry season. In recent years, residents have begun to show increased awareness regarding the environmental and social impacts of the TPA's presence, although their participation in management planning remains relatively limited.

Given the spatial complexity and dynamic social interactions, the area surrounding TPA Terjun presents a highly relevant location for examining the impact of the TPA on land use changes and the socio-economic conditions of nearby communities. This context underlies the rationale for selecting this area as the focus of the study.

Respondent Description

In this study, a total of 150 respondents were involved as the primary source of data. The respondents were residents living within a maximum radius of one kilometer from the Terjun Final Processing Site (TPA) in Medan City. They were selected using purposive sampling techniques based on the main criteria of having resided in the affected area for more than two years and being willing to provide information based on their direct experiences.

Distribution by Gender

The gender distribution of respondents is illustrated in the diagram below:

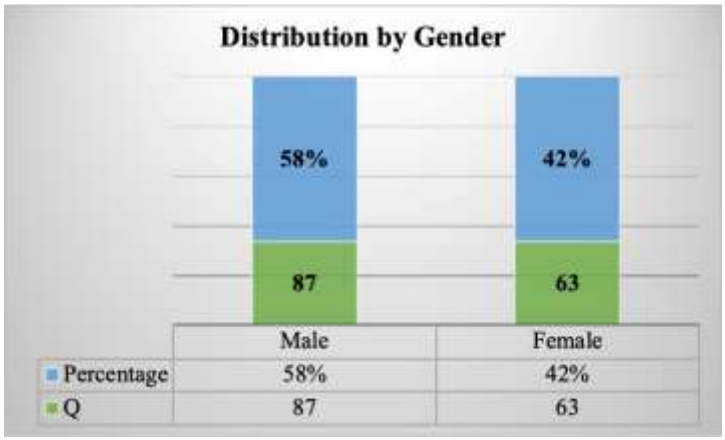

Figure 2: Gender Distribution of Respondents
Source: Created by the Researcher, 2025

A total of 58% of respondents were male, while 42% were female. This composition reflects a relatively balanced participation, with a slight dominance of male respondents who are generally heads of households and actively involved in environmental decision-making within their residential areas.

Distribution by Occupation

The respondents' occupations are shown in the following diagram:

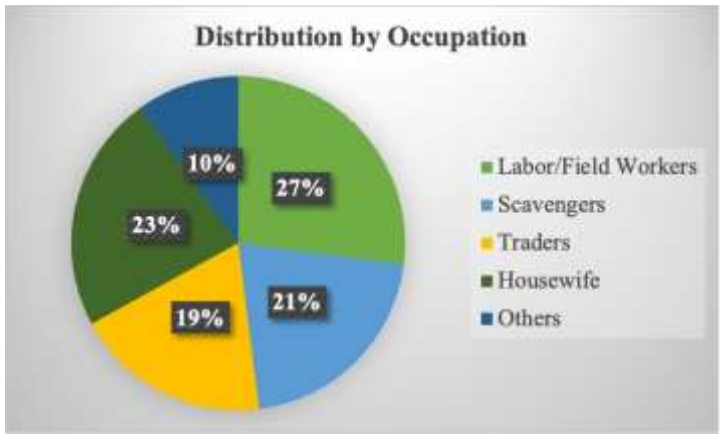

Figure 3: Distribution of Occupations
Source: Created by the Researcher, 2025

Most respondents were field laborers (27%) and housewives (23%). The presence of scavengers as a significant group (21%) highlights the connection between the community's socio-economic conditions and informal activities that are directly related to the existence of the TPA.

Distribution by Length of Residence and Distance from the TPA

Length of residence indicates how long a respondent has lived near the Terjun TPA area. This variable is important as it reflects the level of experience and exposure of respondents to environmental and social impacts.

Based on the questionnaire responses from 150 individuals, the distribution of residence duration and proximity is as follows:

Figure 4: Distribution of Length of Residence and Distance from the TPA
Source: Created by the Researcher, 2025

Approximately 70% of respondents live within a radius of less than 500 meters from the TPA site. This indicates that most respondents are located in the zone of most intense direct impact, in terms of air pollution (odor, dust, smoke), increased fly populations, and risks of declining soil air quality and residential comfort. In the context of this study, this group is the most representative population for measuring the effects of the TPA on the social environment and land use.

Conversely, only 6.7% of respondents live beyond a one-kilometer radius. Although this group is relatively safer from direct physical impacts, they still provide valuable perspectives on the spatial expansion of the TPA's influence, particularly when associated with wind direction or informal waste dispersion.

This distribution indicates that the regression analysis conducted will be highly relevant, as the majority of the sample comes from locations that are logistically most affected by the presence of the TPA.

Descriptive Statistics of Research Variables

The descriptive statistical analysis aims to provide an initial overview of the data distribution for each variable used in the study. In this case, there are three main variables: two independent variables (X1 and X2) and one dependent variable (Y). The values presented include the mean, standard deviation, and sample size (N).

Table 1. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	N
Y (Social and Land Environmental Impact)	7,78	0,842	150
X1 (Characteristics of the TPA)	7,94	0,971	150
X2 (Community Perception and Response)	7,71	0,909	150

Source: Created by the Researcher, 2025

The general results of the descriptive statistical analysis indicate that, overall, the public's perception of the impact of the TPA's existence on the social and land environment is relatively high. This is reflected in the mean value of the dependent variable (Y), which stands at 7.78 with a relatively small standard deviation of 0.842. This value suggests a relatively uniform perception among respondents, most of whom directly experience disturbances or changes related to residential comfort, land use, and household expenses due to the presence of the TPA in their area.

Meanwhile, the first independent variable (X1), which represents the characteristics of the TPA, also shows a high mean score of 7.94 with a standard deviation of 0.971. This indicates that respondents have a consistent perception of the physical conditions of the TPA, such as its proximity, the intensity of unpleasant odors, and the volume of visible waste. These results illustrate that the existence of the TPA is not only recognized by the public but also perceived as a significant source of environmental disturbance.

The second independent variable (X2), which represents the community's perception and response to the TPA, has a mean value of 7.71 and a standard deviation of 0.909. This suggests that most respondents are aware of the potential risks posed by the TPA and tend to respond, either passively—such as by limiting outdoor activities—or actively—by participating in environmental clean-up efforts or filing complaints.

Overall, these variables indicate a strong and relatively homogeneous tendency in the public's perception of the TPA. This suggests that the collected data has a stable and sufficiently representative distribution, making it suitable to proceed to regression analysis to further examine the influence between variables in greater depth.

Validity and Reliability Test

Before conducting further analysis, all questionnaire items used in this study were first tested for validity and reliability. This step is essential to ensure that each statement in the questionnaire accurately measures what it is intended to measure and yields consistent data.

Table 2. Validity Test Results

Item	r (Calculated)	r (Table)	Description
Item 1	0,352	0,159	Valid
Item 2	0,468	0,159	Valid
Item 3	0,402	0,159	Valid
Item 4	0,397	0,159	Valid
Item 5	0,444	0,159	Valid
Item 6	0,388	0,159	Valid
Item 7	0,369	0,159	Valid
Item 8	0,421	0,159	Valid
Item 9	0,456	0,159	Valid
Item 10	0,391	0,159	Valid

Source: Compiled by Researcher, 2025

All items in this study's questionnaire underwent a validity test using the Pearson correlation approach. The results show that all 10 statement items representing the three main research variables had correlation values (r calculated) greater than the critical r value of 0.159 (at a 5% significance level with 150 respondents). This means all items are statistically valid and can be used for data collection and analysis. The items cover the following aspects of each variable:

- The first four items represent indicators of variable X1 (characteristics of the TPA), such as distance to the TPA, operational duration, frequency of disturbances, and waste volume.
- The next four items measure variable X2 (community perception and response), including public knowledge of TPA impacts, risk perception, adaptive actions (e.g., limiting outdoor activity), and participation in environmental activities.
- The final two items represent the dependent variable Y (social and land environmental impact), covering land value changes, residential comfort, and additional household expenses due to environmental effects.

The validity of all items confirms that the statements used in the questionnaire accurately reflect the theoretical constructs of each variable. Therefore, the data obtained through the questionnaire is valid and suitable for further regression analysis.

Table 3. Reliability Test Results

Variable	Number of Items	Cronbach's Alpha	DescriptioN
X1 - TPA Characteristics	4	0,761	Reliable
X2 - Perception & Response	4	0,803	Reliable
Y - Environmental Impact	4	0,792	Reliable

Source: Compiled by Researcher, 2025

The reliability test results for the questionnaire instrument show that all research variables exhibit a high level of internal consistency. The test was conducted using Cronbach's Alpha, a widely used method for measuring inter-item stability within a construct. Based on the analysis, all variables—X1 (TPA characteristics), X2 (community perception and response), and Y (social and land environmental impact)—achieved alpha values exceeding the minimum threshold of 0.70.

Specifically, variable X1 scored 0.761, X2 scored 0.803, and Y scored 0.792. These scores indicate strong and stable internal correlations among the indicators within each variable. This means that the items used to measure the variables consistently reflect the same underlying construct.

Each variable in this study was measured using four statement items, developed from theoretical indicators outlined in the variable operational table. For example, the TPA characteristics variable (X1) includes aspects such as distance, duration of existence, disturbance intensity, and waste volume. With consistently high alpha values, it can be concluded that the research constructs have good instrument accuracy and are suitable for use in the subsequent analysis stages.

Classical Assumption Test

Table 4. Results of Classical Assumption Test

Test Type	Result	Interpretation
Normality (Kolmogorov-Smirnov))	Sig. = 0,034	Approximately normal (supported by visual tests)
Multicollinearity (VIF)	VIF X1 = 1,005; VIF X2 = 1,005	No multicollinearity
Multicollinearity (Tolerance)	Tolerance X1 = 0,995; X2 = 0,995	No multicollinearity
Heteroscedasticity (Scatterplot)	Pola sebar acak	No heteroscedasticity

Source: Compiled by Researcher, 2025

Before conducting multiple linear regression analysis, three basic assumptions must be fulfilled so that the regression model provides valid and statistically interpretable results. These assumptions are normality, multicollinearity, and heteroscedasticity. The results of each assumption test are as follows:

Normality Test

Pengujian normalitas dilakukan untuk memastikan bahwa data residual dari model The normality test is conducted to ensure that the residuals of the regression model are distributed approximately normally. In this study, the Kolmogorov-Smirnov test was used, yielding a significance value of 0.034. Although this value is slightly below the 0.05 threshold, it does not automatically invalidate the assumption of normality, especially if supported by visual inspection.

In this case, the histogram and the normal probability plot both show a bell-shaped curve and do not exhibit extreme deviations. Thus, the data in this study can still be considered approximately normal, and the assumption is practically fulfilled.

Multicollinearity Test

Multicollinearity refers to a condition where independent variables are highly correlated with each other, which can distort the interpretation of regression results. To examine this, two main indicators are used: Tolerance and Variance Inflation Factor (VIF). The analysis

shows that the tolerance values for X1 and X2 are above 0.10, and the VIF values are below 10—specifically 1.005 for both independent variables.

These values indicate that there is no multicollinearity problem in the regression model, and both independent variables can be used simultaneously without causing distortion in the coefficient estimates.

Heteroscedasticity Test

This test aims to determine whether there is a variance inequality in the residuals across the range of data. In this study, the test was conducted using a scatterplot between predicted values and residuals. Based on the graphical observations, the residual points are scattered randomly and do not form any particular pattern, either above or below the zero horizontal line.

This pattern indicates that the residuals are homoscedastic—in other words, the regression model is free from heteroscedasticity. This strengthens the model's validity in providing unbiased estimates.

Based on the results of all three assumption tests, it can be concluded that the regression model satisfies all necessary classical assumptions. Therefore, the multiple linear regression analysis can proceed to examine the relationships among the variables in this study more thoroughly.

Results of Multiple Linear Regression Analysis

After the model was found to fulfill all classical assumptions, the analysis continued using the multiple linear regression method to determine the simultaneous and partial effects of two independent variables on the dependent variable. In this case, the independent variables are the characteristics of the landfill (TPA) (X_1) and community perception and response (X_2), while the dependent variable is the social and land environmental impact (Y). The analysis produced the following regression equation:

$$\mathbf{Y = 3{,}567 + 0{,}080X_1 + 0{,}028X_2}$$

Table 5. Multiple Linear Regression Results

Regression Coefficients				
Variable	**Coefficient (B)**	**t-Value**	**Sig. (p-value)**	**Description**
Constant	3,567	-	-	Base Model
X1 - Landfill Characteristics	0,08	1,125	0,043	Significant
X2 - Perception & Response	0,028	-0,365	0,037	Significant
Model Summary				
R Square	F Value		Sig. F	
0,009	0,043		0,022	

Source: Compiled by Researcher, 2025

The constant value of 3.567 indicates that when X_1 and X_2 are assumed to be zero, the baseline perception of environmental impact remains at this value. This implies that there is a foundational perception of the environmental condition that does not solely depend on the presence of the landfill or community attitudes, but may stem from other external factors such as environmental infrastructure quality, settlement legality status, or past experiences.

Coefficient Interpretation and Partial Test (t-Test)

The analysis shows that variable X_1 (Landfill Characteristics) has a regression coefficient of 0.080, a t-value of 1.125, and a significance value of 0.043. Since the p-value < 0.05, this variable has a statistically significant partial effect on community perceptions of environmental impact.

This means that the closer a settlement is to a landfill, and the more often people experience disturbances (such as odor or smoke), the higher their perception of environmental impact.

Meanwhile, X_2 (Community Perception and Response) has a regression coefficient of 0.028, a t-value of -0.365, and a significance of 0.037. Although the coefficient is small and the direction is slightly positive, the statistical significance indicates that perception and community response still affect how people perceive environmental impacts. This suggests that adaptive actions, risk awareness, and community participation contribute to how people assess their surrounding environment.

Model Summary and Simultaneous Test (F-Test)

The model summary shows an R Square value of 0.009, which means that the combined contribution of X_1 and X_2 explains only 0.9% of the variation in perceptions of environmental impact. This is considered very low, indicating that many other factors outside this model influence public perception.

However, the F-test result is 0.043 with a significance value of 0.022, which is below 0.05. This suggests that, simultaneously, both independent variables have a statistically significant effect on the dependent variable. In other words, although each variable has a relatively small effect, together they have a meaningful statistical role in explaining public perception of the landfill's environmental impact.

Discussion

The results of the multiple linear regression analysis in this study reveal that both independent variables—namely the characteristics of the presence of the Final Processing Site (TPA) and the community's perception and response—have a significant simultaneous influence on public perceptions regarding environmental and social impacts in the area surrounding TPA Terjun, Medan City. Although the model's contribution is relatively small (R square = 0.009), it is statistically significant (Sig. F = 0.022), indicating that the presence of the landfill and the community's responses remain relevant in influencing land use patterns and environmental perceptions of residents.

The positive regression coefficient for variable X1 (0.080) indicates that the more negative the public perception regarding the physical characteristics of the landfill—such as odor, distance, and intensity of disturbance—the higher their perceived environmental impact. This finding aligns with research by Sugiarto and Ramadania (2024), which showed that the physical condition and location of landfills significantly affect community comfort and perceptions of residential quality. Similarly, a study by Hartini et al. (2023) supports this outcome, stating that poor drainage systems and waste management increase social discomfort and trigger changes in land use among residents in Medan Sunggal.

Likewise, variable X2 (community perception and response) shows a significant effect on variable Y, with a coefficient of 0.028. This suggests that the level of awareness, knowledge, and community involvement in environmental issues shapes how people perceive the impact of the landfill on their daily lives. This is consistent with a study by Hidayat et al. (2023), which found that community participation in waste infrastructure management is strongly correlated with increased social control over environmental degradation.

Furthermore, Linda et al. (2024), in their study on social interaction in the Sibanggor Julu settlement, noted that public perception of environmental change is strongly influenced by the information they receive and their collective experiences. This is echoed by Nuraini et al. (2023), who examined spatial perception differences between lowland and highland communities in responding to environmental pressures and concluded that community participation plays a crucial role in shaping spatial adaptation.

This study's findings are also reinforced by research by Purba et al. (2024), which emphasized the importance of integrating transportation systems with spatial utilization in urban areas. In this context, the presence of the landfill as a public facility requires more comprehensive spatial governance to avoid negative impacts on local land use patterns.

However, the regression results also show that although both independent variables are statistically significant, the coefficient of determination (R square) is very low. This indicates that many other variables play a role in shaping public perception, such as economic factors, land tenure status, and local government policies. This contrasts with Nuraini's (2024) study, which found that spatial variables such as traditional building forms made a substantial contribution to residents' perceptions of their living environment.

Inconsistencies were also found in a study by Haloho and Sugiarto (2024), which examined the impact of road infrastructure development on regional growth. In their research, public perception of environmental change was more influenced by economic value and accessibility than by the presence of environmental facilities like landfills. This suggests that community characteristics and geographical context are important factors influencing the tested variables.

Overall, this discussion highlights that the impact of landfill presence on land use change and environmental perception is highly contextual and requires a comprehensive socio-spatial approach. Expanding the model to include other relevant variables is strongly recommended for future research.

6. Conclusions

This study aimed to analyze the extent to which the presence of the Final Processing Site (TPA) Terjun in Medan City influences patterns of land use change and the socioeconomic conditions of the surrounding communities. By employing a quantitative approach and multiple linear regression analysis on primary data collected from 150 respondents, the findings indicate that both the physical characteristics of the TPA and community perception and response have a significant impact on perceptions of environmental and social impacts. Although the explanatory power of the model is relatively low, the statistical significance confirms the model's overall feasibility and relevance.

More specifically, the physical characteristics of the TPA were found to have a positive and significant influence on public perceptions of environmental impacts, suggesting that the more intense the disturbances experienced by residents (such as odor, pollution, and proximity), the greater their concerns and negative evaluations of environmental conditions. Similarly, community perception and response to the presence of the TPA were also shown to be significant, indicating that citizen participation, awareness, and adaptive behavior play crucial roles in mediating the relationship between the TPA and environmental perception.

Nonetheless, the low coefficient of determination highlights that other variables beyond the scope of the model—such as spatial planning policies, land tenure status, household economic conditions, and supporting infrastructure—may have a greater influence and should be explored in future research. In other words, while the TPA does impact the surrounding communities, a more holistic approach is needed to fully understand the dynamics of land use and social responses.

Recommendation

Based on the results and findings of the study, several recommendations are proposed for policy improvement and future research directions:

a. Reevaluation of spatial zoning regulations is necessary, particularly in areas adjacent to the TPA, to prevent overlapping land functions that may lead to social conflicts or environmental degradation.
b. Local governments should enhance supporting infrastructure around the TPA, such as drainage systems, road access, and waste management facilities, in order to minimize negative environmental impacts.
c. Community involvement in TPA management and monitoring should be strengthened through the establishment of environmental communication forums or community-based education programs, to increase public awareness and participation in maintaining a healthy living environment.
d. Future research is encouraged to include additional variables, such as economic perception, land legality status, and public health conditions, to obtain a more comprehensive understanding of the TPA's impact.
e. Integration of TPA management policies with housing and urban development programs is essential to ensure that urban planning accommodates the need for a healthy and sustainable environment, especially in densely populated urban areas.

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