

Model for Determining Follow-up Actions in Slum Areas in North Sumatra: Case Study in Tebing Tinggi City

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Abstract

Even in various cities, inadequately habitable residential areas tend to become slums and no longer meet the standards of a healthy residential environment. This study utilizes descriptive analysis and multiple linear regression analysis with a total of 100 respondents. The Slum Environment Follow-up Determination Model shows the results of the settlement conditions in Tebing Tinggi City, where many people live in unsuitable places, with damaged or inadequate building structures, high housing density, and wooden buildings. As a result, they are vulnerable to fire hazards. Additionally, there is a lack of clean water services, drainage facilities, household waste disposal, waste management, and poor environmental road quality (many roads lack upper pavement or are dirt roads), as well as inadequate street lighting. The low levels of education and income indicate a low socioeconomic status in the slum areas of Tebing Tinggi City. Factors such as Building Density Level (BDL), Environmental Drainage, income, and education collectively significantly influence people's decisions to live in slum environments. However, factors such as Building Density Level (BDL), Environmental Drainage, income, and education partially influence people's decisions to live in slum environments. The pattern of community participation in tackling slum areas remains the same, with an average of 57% not participating in decision-making, implementation, achievement, and program result evaluation.

Keywords: Determination, Slum Environment, Tebing Tinggi City

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Introduction

The increasing population, especially in urban areas, has led to various problems, including difficulties in meeting housing needs. Population growth and urbanization increase the demand for settlement land, leading to the emergence of slums in various locations such as riverbanks and vacant land (Adisasmita & Rahardjo, 1994), (Mulyo, 2000), (Sabari H., 2005) & (Tebing Tinggi City Regulation, 2013). Slum environments often lack basic infrastructure, causing health, aesthetic, and comfort issues. Slum environments can become health problem hotspots due to unhygienic conditions (Bintoro, 1984) & (Jois, 2006). Also, from an infrastructure perspective, slum environments are densely packed, making it challenging for vehicles like ambulances and fire trucks to navigate. The condition of slum environments can be one of the causes of environmental ecosystem degradation due to the reduction of infiltration areas due to the density of wild settlements (Milanie F., Aryza, Sitepu, & Syahfitri, 2022).

Tebing Tinggi City in North Sumatra faces similar problems, including the growth of slum housing. According to Mayor's Decree No. 050/2128 Year 2014, which determines the locations of slum housing in Tebing Tinggi City, there are five slum neighborhoods with a total of 10.05 hectares of land (Mayor's Decree No.050/2128, 2014) & (Tebing Tinggi City Regulation, 2013). Building Density Level (BDL), commuting distance, income, and education level are some of the factors influencing the population living in the slum environment of Tebing Tinggi City. Factors such as Building Density Level (BDL), commuting distance, income, and education level affect settlement conditions (Hariyanto, 2007). Improving the quality of settlements in the city is necessary, focusing on sustainable management, improvement or revitalization, and rejuvenation to enhance the quality of life for residents, especially those with low incomes (Hurlock, 1972) & (Lubis L., 2004).

The design of houses as dwellings must consider architectural, psychological, economic structure of the community, and lifestyle aspects of socialization. The design should also take into account economic, thermal, spatial, and environmental conditioning factors. By constructing houses in densely populated settlement areas, it is hoped to meet the housing needs for the low-income population currently residing in the slums of Tebing Tinggi City (Bangun D., 2005; Djalal, 2008; Damayanti, 2012; Nuraini et al, 2023).

Methods

The study was conducted in Tebing Tinggi, North Sumatra, in five slum neighborhoods. The Mayor's Decree (No.050/2128, 2014) designates the locations of slum housing. The population sample for the study includes all households in the five slum settlement areas. The sample size consists of 100 respondents (households) determined using the Slovin formula.

Data collection was carried out through field surveys and questionnaire distribution. Both primary and secondary data will be used to test the research hypotheses (Erlina, 2011). Descriptive analysis is employed to explain the conditions of the slum environment, including land use, clean water availability, drainage systems, sanitation, waste management, and roads in Tebing Tinggi City, using a multiple linear regression research model (Djalal, 2008) & (Umar & Husein, 2003).

Furthermore, descriptive analysis is also used to elucidate the socio-economic conditions of the community in the slum environment of Tebing Tinggi City. This research will also evaluate the level of community participation in addressing the slum environment in Tebing Tinggi City.

Theoretical Study

Planning, according to Handayani in (Bintoro, 1984), (Blaag, 1986), and (Sabari H., 2005), involves determining what, when, and with whom. This process systematically prepares by understanding the use of limited resources to achieve goals effectively and efficiently, requiring the formulation of appropriate policies. According to Etzioni in (Sabari H., 2005; Sugiarto & Ramadania, 2023), there are three categories in planning theory: the comprehensive (logical) approach, the incremental approach, and the mixed search approach (strategic planning model). The comprehensive approach involves fact analysis, problem diagnosis, goal formulation, and the design of alternative methods. Regional planning approaches can be divided into three methods: addressing urban social issues, focusing on stagnant industrial areas, and paying attention to rural areas. Regionalization and decentralization are needed to level development, dividing the country into geographical units with good coordination, involving decisions by regional and local governments (Hurlock, 1972; Lois, 2006; Nuraini & Suprayitno, 2019).

Slums are a depiction of bad attitudes and behaviors, defined by middle-class living standards and income by Clinard in (Mulyo, 2000). Factors of squalor involve environmental deterioration from both physical and social perspectives. The impacts include poor housing conditions, high population density, inadequate environmental facilities, deviant behavior, slum culture, and apathy (Bangun D., 2005). Slum housing does not meet standards and is legally classified as uninhabitable. Slum settlement characteristics involve inadequate public facilities, dwelling conditions indicating economic incapacity, space utilization levels indicating disorder, and social and economic diversity of residents (Amiruddin, 1970) & (Damayanti, 2012). Improvement efforts include urban rejuvenation programs, village improvements, apartment buildings, relocation, land consolidation, land distribution, and directed land development (Budihardjo E., 1984; Hariyanto, 2007; Millanie et al, 2023; H.R, 2008).

There are three ways to improve the quality of the environment in slum settlements: 1) Participatory approaches, focusing on community input and behavioral change; 2) Sustainable development, integrating environmental, social, and economic goals; 3) Spatial approaches, involving the redefinition and restructuring of settlements (Kusnopranoto, 1985), (Jois, 2006) & (Milanie F., Aryza, Sitepu, & Syahfitri, 2022). Internal factors such as gender, age, education level, income, and occupation influence community participation. Men are more likely to participate, age and skills affect the level of participation, education level enhances knowledge, income level influences the type of participation, and occupation affects leisure time (McAndrew, 1983) & (Miraza B., 2005). Community participation can be measured through various types, such as thoughts, energy, social participation, skills, goods, money, decision-making, and representative participation. Regional development aims to increase benefits for the community by mobilizing components such as natural resources, human resources, infrastructure, technology, and culture. The concept of regional development in Indonesia is integrated with spatial planning and the utilization of regional resources. The growth and development of regions are influenced by locational decision aspects, urban systems, and agglomeration mechanisms. The basic principles of UUPR emphasize improving the welfare of the community and sustainable environments through a regional development approach (Mulyo, 2000), (Nugroho & R, 2004), (Sabari H., 2005), (Perda Kota Tebing Tinggi, 2013) & (Milanie F., Aryza, Sitepu, & Syahfitri, 2022).

Results and Discussion

Tebing Tinggi City plays a role as the gateway to the capital of North Sumatra Province. Development needs to be accelerated to enhance the city's role and function. The city center is divided into several City Region Parts (BWK), such as the City Center, North BWK, East BWK, West BWK, and South BWK. Spatial planning and city development plans focus on improving services in trade, social culture, and education. Considering population distribution, density, and regional functions, the plan sets the development towards the north, east, and west, while the southern and southwest regions are designated as reserve areas for agriculture. This plan also illustrates the concept of the city's activity service structure by dividing the city into cultivation and protection environments, as well as setting the intensity of high, medium, and low activities. All of this is done to ensure efficient and sustainable city development until 2045.

In terms of the city center, the concentric pattern of Tebing Tinggi City is expected to continue to grow along with the existing strategic sectors, supported by well-designed road networks. The main center is located in the City Center BWK, focusing on activities with high intensity

and aiming to reduce the current city center's burden while improving the efficiency of the city's facility service system.

In terms of the city's regional center, Tebing Tinggi City is strengthened by four planned BWKs, requiring facilities and infrastructure in accordance with spatial utilization policies and population support. The BWK center provides services such as secondary artery road access, trade, secondary education, places of worship, offices, recreation, sports, and outdoor parks. With one city center and four BWK centers, the city's service system is expected to be more efficient and widespread, facilitating the fulfillment of community needs for urban facilities. The service system plan includes education, worship, welfare, exchange, government buildings, entertainment, and sports. This service structure also accommodates the diverse needs of the community, such as relocating the central market to North BWK and developing office facilities in North BWK. Environmental parks and green corridors are designed according to housing needs, and the distribution of facilities is arranged to support the formation of neighborhood units. Although the majority of Tebing Tinggi City residents are considered well-off families, 0.86% of families still faced difficulties in meeting basic needs such as food, clothing, and toilets in 2011. The Model for Determining Follow-up Actions in Slum Areas in North Sumatra is explained through several aspects below:

Condition of Slum Settlements

The Tebing Tinggi slum environment consists mostly of permanent residences with high density, but there are also non-permanent settlements or inadequately habitable houses. Many houses in this environment do not meet safety, health, and security standards, as evidenced by inadequate foundations, walls, roofs, and floors. This indicates that the residential environment in slum areas is becoming increasingly uninhabitable. Housing challenges include a shortage of homes for some communities, living in inadequate housing, high population density, wood-based construction increasing the risk of fires, and numerous communities residing in flood-prone areas along riverbanks.

In terms of clean water, the Regional Water Company (PDAM) provides clean water from various sources, including groundwater and rainwater, with a pumping distribution system. Although providing water within less than 24 hours, most people still do not have access to clean water from PDAM. Therefore, many people use water from PDAM and wells, although its quality does not meet standards for bathing, laundry, and washing kitchen utensils, they continue these practices. Regarding drainage channels, the drainage system in the Tebing Tinggi City slum faces problems with water flow, with channels categorized as smooth, clogged, flooded, or non-existent. Many channels are damaged, clogged with garbage, and narrowed by mud, soil, and trash, making them unable to function properly. Some areas even lack drainage channels, causing waterlogging during rain and relying only on percolation. Community awareness of the importance of drainage management remains low, evidenced by a lack of maintenance, sedimentation, and garbage disposal in them. The Tebing Tinggi slum areas face serious problems related to the damage of the drainage system.

In terms of sanitation, the low use of septic tanks in the Tebing Tinggi City residential areas indicates poor sanitation conditions. Waste in the slum environment consists of household waste, both solid and liquid waste (sewage). Most waste, especially liquid waste, is managed by local disposal systems with latrines and septic tanks, while some are directly dumped into rivers. The choice of waste management by the community itself, especially direct disposal into rivers, and the construction of inadequate family latrines on riverbanks, indicate serious challenges in waste management. The lack of the use of family latrines equipped with percolation also increases the potential for environmental pollution in the area.

In terms of waste disposal, the Tebing Tinggi slum environment uses local waste disposal systems, such as landfilling, burning, stacking in open areas, or direct dumping into rivers. Awareness of cleanliness, especially in waste management, is not well-recognized by most slum residents, as seen from scattered household waste piles throughout the residential environment. The area, including settlements and open land, often becomes a dumping ground for garbage. The communal waste management system in the Tebing Tinggi slum area is also ineffective.

In terms of roads, they not only connect regions but also help direct economic flows between regions, influencing the growth and development of an area. The road conditions in Tebing Tinggi City vary, categorized as good, moderate, lightly damaged, and heavily damaged. The main roads connecting slum areas have a well-constructed asphalt of 5-6 meters in good condition. Although the city system and accessibility in the slum environment are easy, the roads there, generally constructed of concrete paving, are often damaged and flooded.

Socio-Economic of the Community

This research describes the characteristics of respondents from the Tebing Tinggi City slum area, including age, gender, length of residence, number of family dependents, education level, income, and their livelihoods, as outlined more clearly in the following table:

Table 1. Characteristics of Respondents in the Socio-Economic Category of the Community

No	Age	Education	Gender	Family Dependents	Length of Residency	Income	Occupation
1	The diversity in the age of respondents reflects participation from various age groups. The majority are aged 36-45 years (31.99%), followed by the age group 46-55 years (23.00%), and those above 55 years (8.00%). The potential for business development and family income is evident among the productive age group.	The majority of respondents have a high school education level (48.00%), followed by junior high school (36.00%), diploma (D1/D3 - 12.00%), and elementary school (SD - 4.00%).	The majority of respondents are male (79.9%), while females account for only 21.0%. The distribution of respondents indicates a majority of males.	The distribution of respondents shows that the most common number of dependents is 3 individuals (44%), followed by 4 individuals (28%), 2 individuals (13%), and 5 individuals (13%). The majority live in the slum area with family dependents ranging from two to five individuals.	The majority of respondents are native residents of the area, with the highest age group between 21 and 30 years old (37%), followed by those over 30 years old (32%), and a small percentage below 10 years old (5.00%).	The majority have income between Rp. 501,000 and Rp. 1,000,000 (54%), although some have income below Rp. 500,000.	The majority work as traders (43%), followed by entrepreneurs (25%), pedicab drivers (12%), tailors (8%), parking attendants (5%), and retirees (7%). The main livelihood reported by the community is as traders.

Source: Primary Data Processed by the Author, 2022

Results of Classical Assumption Tests

This section explains the results of testing the Multiple Linear Regression model by presenting the outcomes of three tests: the Normality Test, the Multicollinearity Test, and the Heteroscedasticity Test, as follows:

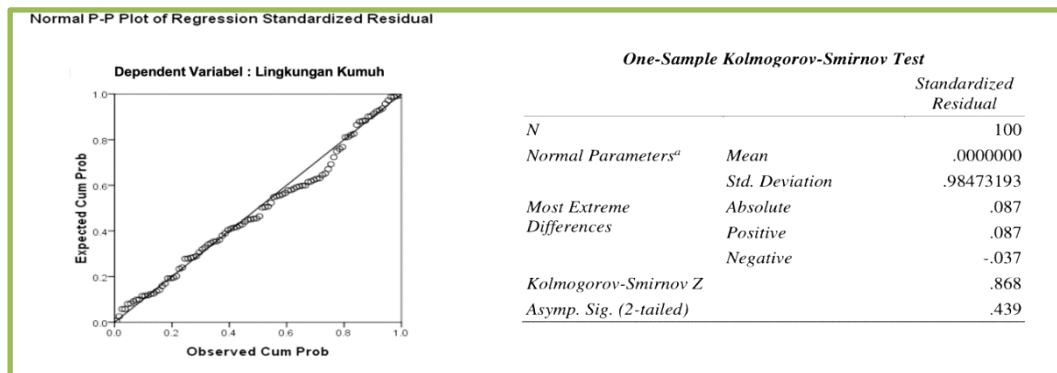


Figure 1. Normality Test Through Normal Probability Plot and Kolmogorov-Smirnov

Source: SPSS 23 Data Analysis, 2022

Normality test in this study was conducted using the Normal Probability Plot, further supported by the Kolmogorov-Smirnov test. The illustration above indicates that the points mostly follow a straight line. Additionally, the results of the Kolmogorov-Smirnov test show a significance value greater than 0.05 ($\alpha=5\%$), specifically at 0.439. Therefore, it can be concluded that the residual distribution in the regression model exhibits characteristics of a normal distribution.

Table 2. Multicollinearity Test

Model	Collinearity Tolerance	Statistics VIF
(Constant)		
Building Density Level (BDL)	.609	1.821
Environmental Drainage	.370	2.515
Income	.451	2.001
Education	.915	1.051
^a Dependent Variable : Slum Environment		

Source: Data Processed using SPSS 23, 2022

Table 2 above illustrates that the Variance Inflation Factor (VIF) values for the variables Building Density Level (TKB), Environmental Drainage, Income, and Education are below 10, and the tolerance values are above 0.1. Therefore, it can be concluded that there is no indication of multicollinearity among the variables.

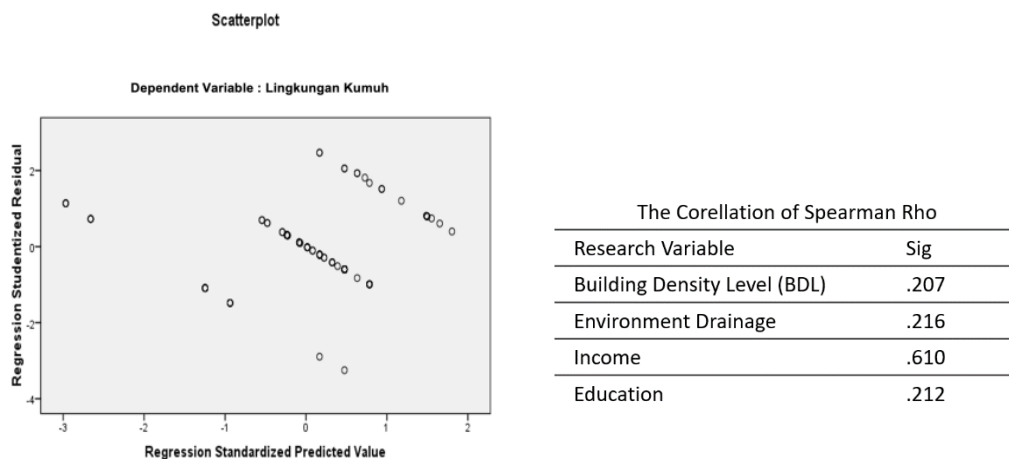


Image 2. Heteroscedasticity Test Through Scatterplot and Spearman Rho Correlation
 (Source: Data Processing with SPSS 23, 2022)

The analysis indicates that the points are scattered randomly around zero, both above and below the Y-axis, without a specific pattern or trend on the plot diagram. No heteroscedasticity occurs, and the regression model is suitable for predicting factors in the slum environment as it meets the classical assumption test requirements. This validity is reinforced by the results of the Spearman Rho correlation test between the independent variables and the residual values, showing that all Spearman Rho correlation significance values are >0.05, indicating the absence of heteroscedasticity.

Results of Multiple Linear Regression Test

By applying the multiple regression equation, a function reflecting the factors influencing living conditions in the slum environment has been formulated. Variables considered to have a significant impact on the population residing in the slum environment include Building Density Level (X1), Environmental Drainage (X2), income (X3), and education (X4). All these variables are then collectively included in the multiple regression equation, and the results are expressed as follows: By applying the multiple regression equation, a function reflecting the factors influencing living conditions in the slum environment has been formulated. Variables considered to have a significant impact on the population residing in the slum environment include Building Density Level (X1), Environmental Drainage (X2), income (X3), and education (X4). All these variables are then collectively included in the multiple regression equation, and the results are expressed as follows:

$$Y = 6,299 - 0,333 (X1) - 0,266 (X2) - 0,218 (X3) - 0,146 (X4)$$

Table 3. Multiple Linear Regression Hypothesis Test

Variable	Coefficient	T-Account	Sig
Constanta	7,499		
Building Density Level (BDL) (TKB) (X1)	-0,213	-3,122	0.000
Environmental Drainage (X2)	-0,275	-2,891	0.006
Income (X3)	-0,232	-2,665	0.008
Education (X4)	-0,150	-3,256	0.002
R ²	0,787		

T Table	2,000		
T Account	36,891		
F Table	2,38		
<i>^aDependent Variable : Slum Environment</i>			
Source: Data Processed with SPSS 23, 2022			

The test results above show that the regression constant (a) of 7.449 indicates that if all independent variables (TKB, Environmental Drainage, income, and education) are equal to 0, the Slum Environment score will be 7.449. The Building Density Level (TKB) with a coefficient of -0.213 has a negative and significant impact on the Slum Environment, where an increase in TKB reduces the likelihood of living in the Slum Environment. Environmental Drainage (X2) with a coefficient of -0.275 also has a negative and significant impact on the Slum Environment, indicating that the location of work affects the choice of residence. Income (X3) and Education (X4) with coefficients of -0.232 and -0.150 respectively have a negative and significant impact on the Slum Environment, indicating that income and education levels affect the decision to live in the Slum Environment. Overall, the variables TKB, Environmental Drainage, income, and education significantly influence the Slum Environment score. The coefficient of determination R-squared (R²) of 0.787 indicates that 78.7% of the variation in the independent variable can explain the variation in the Slum Environment. The remaining 21.3%, is explained by other factors not included in the model equation.

Community Participation as Follow-up to the Slum Environment

Community participation here refers to the conscious and spontaneous involvement of residents, accompanied by responsibility, as one of the models for determining follow-up actions in the slum environment. This goal involves efforts to accelerate the fulfillment of community needs and enhance the institutional capacity of the community and authorities, through initiatives to increase participation in the development of infrastructure and facilities that support government policies. Therefore, it is expected that the community will participate in government programs. The analysis results are as follows:

Table 4. Community Participation as a Model for Determining Follow-up Actions in the Slum Environment

Criteria	Results							
	I		II		III		IV	
	F	%	F	%	F	%	F	%
Always Participate	15	15,00	13	13,00	18	18,00	12	12,00
Often Participate	25	25,00	30	30,00	29	29,00	30	30,00
Do Not Participate	60	60,00	57	57,00	53	53,00	58	58,00
Total	100	100	100	100	100	100	100	100

Source: Processed Primary Data, 2022

Description:

- I = Involvement in decision-making for follow-up actions in the Slum Environment program
- II = Involvement in implementing follow-up actions in the Slum Environment program
- III = Involvement in receiving results from follow-up actions in the Slum Environment program
- IV = Involvement in evaluating follow-up actions in the Slum Environment program

Table 4 above shows that the determination model in the follow-up actions for handling the Slum Environment tends to have a similar pattern. Community participation in decision-making for the Slum Environment follow-up program is 15.00% Always Participating, 25.00% Often Participating, and 60.00% Not Participating. Meanwhile, community participation in the program's implementation indicates 13.00% Always Participating, 30.00% Often Participating, and 57.00% Not Participating. Similarly, community participation in receiving program results reaches 18.00% Always Participating, 29.00% Often Participating, and 53.00% Not Participating. Finally, community participation in evaluating the Slum Environment follow-up program reaches 13.00% Always Participating, 30.00% Often Participating, and 58.00% Not Participating.

Discussion

The housing and settlement conditions in the Slum Environment of Tebing Tinggi City mostly consist of permanent buildings with high population density. Additionally, there are also non-permanent settlements or uninhabitable houses, where the quality of building structures does not meet requirements, both in terms of safety and inhabitant health. This includes an evaluation of the foundation, walls, roof, and floor of houses to ensure healthy living conditions. If many houses in an area do not meet safety, health, and security standards, it indicates that the environment is moving towards uninhabitable housing conditions. The condition of clean water in the Slum Environment of Tebing Tinggi City indicates a lack of clean water services, with many houses lacking direct connections to obtain clean water. Drainage also faces problems, especially the lack of drainage infrastructure that causes frequent flooding. Community awareness in maintaining drainage channels is also low, resulting in the lack of functionality of these channels. Sanitation conditions and household waste disposal indicate a lack of infrastructure and facilities, including a lack of land for household waste development and community awareness in disposing of household waste. Waste management also faces similar problems, with a lack of infrastructure and community awareness in disposing of waste. The condition of roads also indicates low quality, with many dirt roads and damage due to non-functional drainage channels. The findings of this study are consistent with previous findings stating that the lack of accessibility to enter or leave an area, along with facilities and utilities that do not meet acceptable standards, can lead to slums. Therefore, efforts from the Tebing Tinggi City Government are needed to build apartment buildings, conduct outreach on the impact of living in slums, and improve slum settlement facilities and infrastructure (Cahya & Juanda, 2012) & (Hariyanto, 2007).

In terms of the socio-economic conditions of the community, there are several factors that influence the decision to stay in slum settlements. Respondents' productive age, long duration of residence, a large number of family dependents, low educational levels, and inadequate income and livelihoods are factors influencing this decision. Additionally, the environmental conditions are also influenced by economic, social, and cultural factors, as well as the community's level of education (Mulia, 2008), (Surtiani, 2006), and (Zulkarnaen, 2004).

Regression analysis shows that building density, environmental drainage, income, and education negatively influence factors affecting people living in the Slum Environment. These results confirm that an environment with low building density, good environmental drainage, and high income and education will motivate people to avoid living in slum areas (Malau, 2006) and (Hariyanto, 2007).

Community participation in the follow-up of the Slum Environment indicates a low level, with only about 14% average participation in decision-making, implementation, receiving program results, and evaluating program results. This finding is consistent with previous research

indicating that the level of slum conditions in an area can be reflected in the level of community participation in various activities, such as providing information or willingness to engage (Advianty and Handayani, 2013) & (Hariyanto, 2007).

Several alternatives and strategies have been proposed for handling the Slum Environment, including land acquisition by the government, increasing community access, the role of the private sector in developing affordable housing, and urban infrastructure rehabilitation programs. Additionally, environmental health education, fostering environmentally aware communities, and developing public infrastructure are considered effective strategies in addressing slum problems (Hariyanto, 2007) and (Daulay, 2012).

Conclusion

The settlement conditions in Tebing Tinggi City reflect many uninhabitable and damaged houses, with inadequate building structures, increasing the risk of fire due to the use of wooden construction and high housing density. Additionally, the lack of clean water services, insufficient drainage facilities, inadequate household waste management, waste disposal issues, and poor environmental road quality (many dirt roads) indicate a lack of community awareness. The socio-economic status of the community in the slum settlements of Tebing Tinggi City remains low, as seen from the minimal levels of education and income. Factors such as Building Density Level (BDL), Environmental Drainage, income, and education collectively influence the community's decision to live in slum environments. Individually, BDL, Environmental Drainage, education, and income negatively affect the Slum Environment. Community participation in the follow-up of the Slum Environment is low, with only about 14% averaging participation in decision-making, implementation, acceptance of program results, and evaluation of program results. Therefore, it is recommended that the Tebing Tinggi City Government conduct a survey of land status and ownership and undertake settlement infrastructure planning by rehabilitating clean water, drainage, sanitation, waste management, and roads. There is also a need to increase community income through funding programs to enable them to start businesses and earn enough income to live in suitable settlement locations. Evaluation of housing and settlement development policies is essential, especially considering that low Building Density Levels, inadequate Environmental Drainage, and minimal income can influence the community's decision to stay in a particular location. The Tebing Tinggi City Government needs to take follow-up actions in line with the local budget conditions and spatial planning, and can collaborate with private developers in the construction of apartment buildings.

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