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(Research/ Review) Article

Evaluation of the Sustainability of the Slum Settlement Management Program in Tegal Sari Mandala Village II: Ecological and Social Perspective

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Abstract: Slums are one of the biggest challenges in sustainable urban development. In the midst of the government's efforts to run a program to handle slum organizations, the issue of miscarriage after physical intervention often goes unnoticed. This study aims to stop the slum management program in Tegal Sari Mandala II Village, with a Mixed Methods approach that combines linear multiple quantitative regression analysis and a qualitative descriptive approach.The results show that community participation has a significant effect on poverty programs, while infra-structure quality has not shown a statistically strong relationship. Qualitative findings support these results, where residents feel more attached to the programs they have followed in the past. Meanwhile, a number of infrastructures that are not in accordance with needs are considered less effective in supporting sustainability. This study concludes that the desire of the program is not only determined by technical aspects, but also by social, institutional, and cultural factors that are intertwined. Strategic recommendations include strengthening participation, improving design based on local needs, and integration with spatial policies.

Keywords: Evaluation; Handling Programs; Infrastructure; Programs

1. Introduction

The problem of slums is one of the main challenges in urban development in Indonesia. Various major cities, including the city of Medan, face the complexity of arranging densely populated areas with low infrastructure quality and poor environmental conditions. Slum areas are synonymous with high density, lack of sanitation, lack of green open space, and low access to basic residential facilities (Nuraini, 2021; Aini et al., 2023). One of the government's approaches to dealing with this problem is through the City Without Slums Program (Kotaku), which aims to reduce the area of slums in an integrated manner.

However, the sustainability of slum management programs after physical intervention is often not optimal. This can be seen in the weak maintenance of infrastructure, declining community participation, and limited long-term impacts on the quality of the social and ecological environment (Nuraini et al., 2023; Sugiarto & Kustiah Ramadania, 2024). In this context, it is important to conduct a program sustainability evaluation taking into account the interaction between social and ecological aspects simultaneously.

Tegal Sari Mandala II Village, Medan Denai District, is one of the areas that has experienced slum management program interventions. This area reflects the urban typology of dense settlements in the city of Medan which are vulnerable to environmental degradation and spatial irregularities. As revealed by Hartini et al. (2023), drainage and sanitation infrastructure in the Medan Denai area still often experiences functional constraints due to the lack of a sustainable management system.

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Another problem that arises is the low involvement of the community in the management of program results. Hidayat et al. (2023) stated that the success of residential infrastructure management is highly dependent on the level of citizen participation, from planning to maintenance. When the community does not feel that they have a say in the results of the program, the potential for damage and neglect will increase.

Ecologically, densely populated areas such as Tegal Sari Mandala II also face significant environmental risks, especially in terms of water pollution, closed channels, and reduced open space (Linda et al., 2024; Nuraini, 2024). Therefore, it is necessary to conduct an evaluative study that not only assesses physical output, but also considers social and ecological sustainability as a systemic unit.

Sebagaimana dikemukakan oleh Haloho & Sugiarto (2024), pembangunan wilayah tanpa pendekatan integratif antara aspek spasial dan sosial cenderung menghasilkan hasil yang tidak bertahan lama. Kajian lintas dimensi diperlukan untuk memahami dinamika perubahan pasca program, termasuk respons warga, fungsi infrastruktur, serta tantangan kelembagaan lokal.

Beberapa penelitian terdahulu juga telah menyoroti pentingnya pelestarian ruang hidup dan peran kearifan lokal dalam menjaga keberlanjutan permukiman (Nuraini, 2019; Purba et al., 2024). Namun, belum banyak penelitian yang secara spesifik mengevaluasi keberlanjutan program penanganan kumuh di tingkat lokal dengan menggunakan pendekatan integratif dan berbasis komunitas.

In this context, this study focuses on evaluating the sustainability of the slum management program in Tegal Sari Mandala II Village, with a mixed approach that combines quantitative and qualitative dimensions. This approach is expected to be able to fully describe the socio-ecological conditions of the region, as well as provide evidence-based recommendations for strengthening policies at the local level.

Departing from these conditions, the main problem in this study is how the form of community participation in the slum management program, how the quality of the environmental infrastructure is produced, and the extent of the influence of these two variables on the overall sustainability of the program. Based on the formulation of the problem, the purpose of this study is to identify forms of community participation, analyze the quality of environmental infrastructure built through slum management programs, and evaluate the influence of both on the sustainability of the program in Tegal Sari Mandala II Village. With the achievement of these goals, this research is expected to make theoretical, practical, and academic contributions.

Theoretically, this research can add to the treasure of the scientific literature on the approach to evaluating the sustainability of social-and ecological-based residential areas, especially in the urban context in Indonesia. Practically, this research can provide policy recommendations that are applicable to local governments, Kotaku program implementers, and local communities in improving the sustainability of physical and social intervention results in slum areas. Meanwhile, academically, the results of this research can be a reference for future researchers who want to develop a similar study with a mixed methods approach in the context of sustainable settlement governance.

2. Preliminaries or Related Work or Literature Review

Theoretical Foundations

The sustainability of slum management programs is an increasingly important issue in regional and urban planning, especially in the context of dense urban areas such as Tegal Sari Mandala II Village. Slums are not only characterized by poor environmental physical conditions, but also by weak social systems and low community participation in environmental management. Therefore, the approach to this problem cannot be done sectorally, but it is necessary to integrate social and ecological perspectives in one complete framework. In the framework of sustainable development, the concept of "sustainable settlement" emphasizes the importance of maintaining a balanced environmental, social, and economic function in the long term. As explained by Nuraini (2024), the sustainability of settlements is not only about maintaining the physical of buildings and infrastructure, but also about how the environment still supports a decent, healthy, and productive life for its citizens.

In the urban planning literature, sustainability is typically associated with three main pillars: social, economic, and environmental. However, in the context of slums, social and environmental aspects become more prominent because they are directly related to the quality of life of the population and the carrying capacity of the area. One of the key elements in main-

taining the sustainability of the slum management program is community participation. Community participation is not only an indicator of involvement in the development process, but also a form of social ownership of the results of the program. Aini et al. (2023) emphasized that the involvement of residents in residential spatial planning, especially those with distinctive cultural backgrounds such as the Mandailing ethnicity, is very important to preserve the environment and local wisdom.

As Sugiarto et al. (2023) show, the active participation of the community in every stage of development—from planning, implementation, to maintenance—affects the long-term effectiveness of the infrastructure built. Without citizen involvement, public facilities such as drainage, sanitation, or green open spaces tend to be poorly maintained and suffer a decline in function in just a short period of time. This phenomenon is supported by the findings of Hartini et al. (2023) who examined the characteristics of drainage management in Medan Sunggal District. The study revealed that the sustainability of infrastructure is highly dependent on participatory management and technical understanding of its functions by citizens.

Furthermore, the quality of environmental infrastructure is a crucial factor in supporting the sustainability of settlements. Good infrastructure will create a healthy environment and prevent environmental risks such as flooding, pollution, and the spread of diseases. However, the technical quality of the infrastructure alone is not enough; It needs to be supported by user behavior that is aware of the importance of responsible care and utilization. Linda et al. (2024) emphasize that environmental sustainability can only be achieved if the community has a sufficient understanding of the functions and benefits of the infrastructure, especially in terms of sanitation, drainage, and domestic waste management.

In the context of slums, a socio-ecological approach is important because these areas are often under pressure from both sides. Socially, there is inequality in access to basic services and weak social institutions. Ecologically, the residential environment is often located in disaster-prone areas, riverbanks, or degraded areas. Sugiarto & Kustiah Ramadania (2024) show that riverbank land management in the Medan Maimun area requires a regulatory and technical approach at the same time, which pays attention to spatial regulations and the adaptive capacity of the community. This parallels the conditions in Tegal Sari Mandala II which is also a dense area and is close to the city's main water flow.

The study of Hidayat et al. (2023) adds that the success of environmental infrastructure systems, such as wastewater management and sanitation, is largely determined by social factors—in particular citizen participation in planning and maintenance. They researched the management of waste infrastructure in Medan Deli and found that sustainability cannot be guaranteed by physical development alone, but requires intensive social interaction and citizen empowerment. Therefore, in this study, community participation is raised as one of the main variables in analyzing the sustainability of the program.

On the other hand, a study from Purba et al. (2024) shows that the success of urban spatial planning is largely determined by the ability of local governments and communities to build basic transportation and utility systems that are adaptive to growth. If not managed properly, urban spaces can develop sporadically and worsen environmental conditions. In the case of slums, the lack of integration between macro planning and local socio-ecological conditions often leads to long-term program failure.

The integration between community participation and infrastructure quality is what has become the focus of many settlement sustainability research. Nuraini et al. (2023) offer the concept of "three-world structures" in settlement planning that combines physical, social, and spiritual structures as the basis for building a sustainable region. This approach provides the perspective that sustainability can be seen not only from a purely technical aspect, but also from the alignment of local values and social dynamics of society.

3. Proposed Method

This study uses a mixed method approach that combines qualitative and quantitative methods in an integrated manner to answer the complexity of sustainability issues in slum management programs. This selection approach is based on the need to explore socio-ecological dynamics in depth and simultaneously quantitatively measure the relationship between participation, the quality of community infrastructure, and program desires. According to Creswell and Plano Clark (2021), a blended approach is particularly relevant when researchers encounter problems that require integration between data objectives and meaning-rich social contexts.

The location of this research is in Tegal Sari Mandala II Village, Medan Denai District, Medan City, North Sumatra. This area was chosen because it is one of the areas with a high level of population density, limited access to basic infrastructure, and has been the target of intervention in slum management programs by the government. The research was carried out during the period from January to April 2025, which included the process of observation, data collection, analysis, and interpretation of results.

The study population was the entire head of a household in the intervention program area, which is estimated to amount to about 500 households. Of these, as many as 150 respondents were used as research samples. For quantitative needs, a proportional random sampling technique is used, while for a qualitative approach, a purposive sampling technique is used, by selecting community leaders, environmental officials, RT/RW administrators, and program managers.

The data collected in this study consisted of primary data and secondary data. Primary data were obtained through questionnaires, in-depth interviews, focus group discussions (FGDs), and field observations. Secondary data includes program documents, village reports, and academic studies relevant to the research theme.

The data collection process is carried out in a triangulated manner, which is by combining various techniques and data sources to increase the validity of the results. The qualitative approach was used to explore in depth the meaning, perception, and dynamics of community participation, while the quantitative approach was used to statistically test the influence of participation and infrastructure on program poverty using multiple linear regression analysis. The entire quantitative analysis process was carried out with the help of SPSS software version 20, and was preceded by testing classical assumptions such as normality, multicollinearity, and heteroscedasticity tests.

As for qualitative data, the analysis method from Miles and Huberman is used, namely through the stages of data reduction, data presentation, and conclusion drawn. This analysis allowed researchers to identify key themes, relationships between concepts, and social dynamics that influence the desires of the program at the local level.

With the preparation of this integrative method, the research is expected to be able to provide a complete and comprehensive understanding of the factors that affect the continuity of slum organization management programs, as well as include the development of evidence-based policies in densely populated urban areas such as Tegal Sari Mandala II Village.

Conceptual Framework

This study examines one dependency variable, namely the Sustainability of the Slum Handling Program, and two independent variables, namely community participation and the quality of environmental infrastructure. The conceptual framework in this study is described as follows:

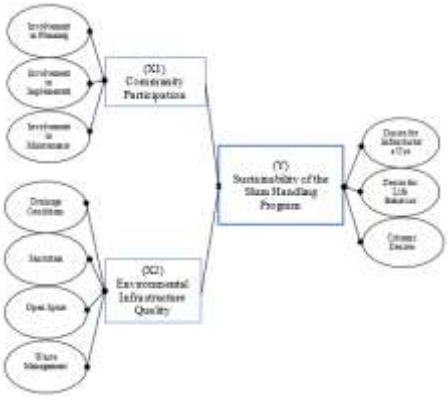

Figure 1. Research Conceptual Framework
Source : Framed in 2025

The sustainability of the program is measured based on indicators of the sustainability of the use of public facilities, infrastructure maintenance, and sustainable citizen participation in environmental activities. Meanwhile, community participation is understood through the involvement of residents in each stage of program implementation, and the quality of infrastructure is seen from the function of drainage, sanitation conditions, wastewater management system, and the existence of green open spaces.

Conceptually, the relationship between participation and sustainability is also reviewed by Haloho & Sugiarto (2024) in their study on the impact of the construction of the Trans

Sumatra Toll Road on regional development. They concluded that large-scale infrastructure interventions can be successful if local communities are actively involved in the spatial planning and adjustment process. Without strong social support, infrastructure risks becoming a failed project or even a space conflict.

By looking at the results of the study, it can be concluded that the two main independent variables that play a role in the sustainability of slum management programs are community participation and the quality of environmental infrastructure. These two variables complement each other: participation strengthens the legitimacy and acceptability of the program, while the quality of infrastructure becomes the technical foundation for the physical sustainability of the region. The sustainability of the program itself, as a bound variable, can be seen from the sustainability of the use of facilities, the sustainability of clean and healthy living behaviors, and the sustainability of community awareness and participation in maintaining the residential environment.

In this study, a mixed methods approach was used to dig deeper into the two independent variables. Through a qualitative approach, it will be explored in depth how participation occurs, the underlying values, and the social barriers that exist in the field. Meanwhile, a quantitative approach is used to measure public perception of infrastructure quality and its impact on program sustainability. This allows researchers not only to see the relationship between variables statistically, but also to understand the social context behind them.

By referring to various previous literature and research that has been mentioned, this research occupies an important space in the discourse on the sustainability of slum programs in Indonesia. This research not only fills the void in the local context of Tegal Sari Mandala II, but also strengthens an interdisciplinary approach that emphasizes the importance of integration between social and ecological dimensions in inclusive and sustainable urban development.

4. Results and Discussion

General Description of Respondents

This study involved as many as 150 respondents who were heads of families in Tegal Sari Mandala II Village. The demographic characteristics of the respondents are an important basis for understanding the social context in the implementation and entire slum management programs. One of the main aspects described is age group, as age range can affect the level of understanding, engagement, and motivation in environmental activities.

Respondent Age

The age distribution of respondents is shown in the graph below:

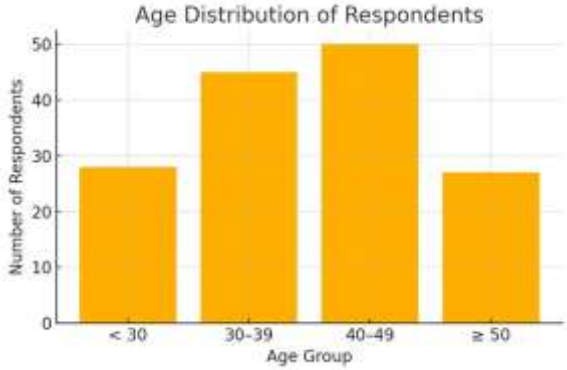

Figure 2. Age Distribution of Study Respondents
Source : Author, 2025

Based on the graph, it can be seen that most of the respondents are between 40-49 years old (33.3%) and 30-39 years old (30%). This shows that most of them are of productive age who generally have higher energy and responsibility for the sustainability of the environment in which they live.

The age groups of <30 years (18.7%) and ≥50 years (18%) were also quite significant. The presence of a younger age group indicates the involvement of a new generation in organizational issues, while the older age group has the potential to provide experience and local wisdom in regional management.

This balance between age groups is a potential in an effort to build cross-generational collaboration in maintaining the longing for the programs that have been implemented.

Respondent Gender

Gender distribution provides an overview of the representation of men and women in this study. It is important to assess the extent of slum organization management programs that involve both gender groups in a participatory process. The following is a graph of the respondents' gender distribution:

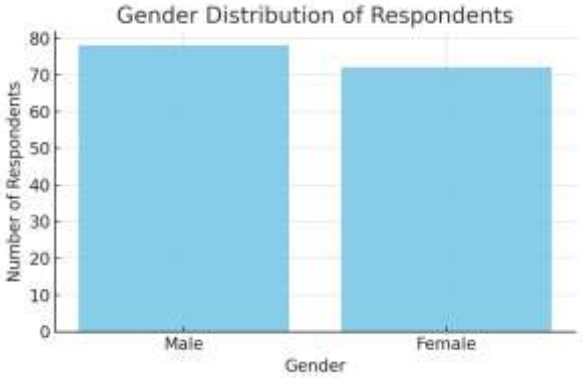

Figure 3. Gender Distribution of Research Respondents
Source : Author, 2025

The results of data collection showed that male respondents were slightly more than women, namely 78 people (52%) compared to 72 people (48%). This relatively balanced comparison reflects that engagement in the program is not dominated by either gender, which is a positive indicator in the context of social displacement.

The active participation of these two groups is an important social capital in encouraging the creation of collective awareness of the management of the organizational environment. In addition, the balance of the number of male and female respondents also strengthens the social validity of the research results.

Latest Education Respondents

The level of education of the respondents is an important aspect in assessing the extent of their capacity to understand the slum organization handling program. Education also influences attitudes, behaviors, and participation in maintaining infrastructure. The following is a graph of the respondents' last education:

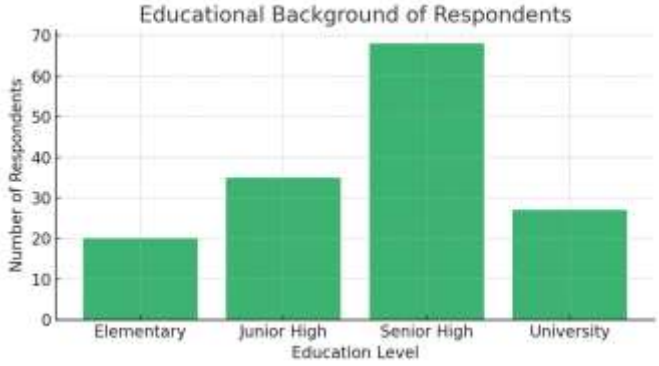

Figure 4. Distribution of the Research Respondents' Last Education
Source : Author, 2025

Most of the respondents had a high school education background (45.3%), followed by junior high school (23.3%) and college (18%). Meanwhile, only 13.3% of respondents completed their education at the elementary level.

This distribution shows that most of the respondents are at the secondary education level, which is sufficient to understand the urgency of environmental cleanliness, infrastructure utilization, and social participation. Respondents with higher education are generally more responsive to collaborative programs, while those with lower education retain contributions through informal or cultural approaches.

Respondent's Main Occupation

The type of work is one of the socio-economic indicators that affects the pattern of community participation in environmental programs. By knowing the job profile of the respondents, we can map leisure time, economic carrying capacity, and possible involvement in the care infrastructure. The following graph of the respondents' main occupations:

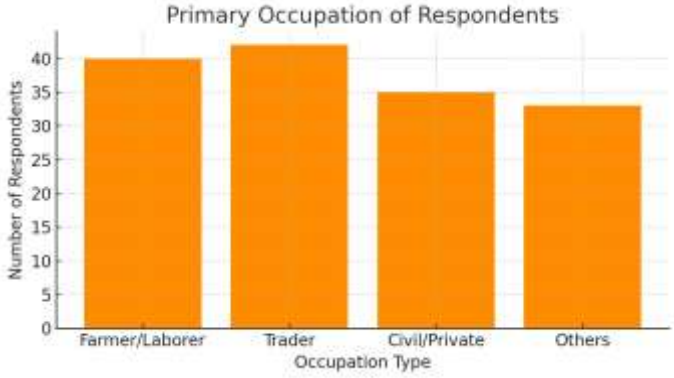

Figure 5. Distribution of the main occupations of the study respondents
Source : Author, 2025

Most of the respondents worked as traders (28%) and farmers or laborers (26.7%). In addition, as many as 23.3% of respondents are public or private employees, while another 22% have diverse jobs such as informal services, housewives, or self-employed.

This condition shows that most residents have jobs with short periods of time and relatively high mobility. Informal worker groups such as traders and laborers tend to be easily accessible for community-based programs, but also face economic stability challenges that can affect sustainability engagement.

Qualitative Research Results

The qualitative approach in this study was used to explore the meaning and deep perception of the people of Tegal Sari Mandala II Village related to the occurrence of slum organization handling programs. The techniques used include in-depth interviews, field observations, and focus group discussions (FGD) with various parties, among other community leaders, RT/RW administrators, Kotaku program managers, and residents who use infrastructure.

The analysis was carried out using the Miles and Huberman approach, which included three main stages: data reduction, data presentation, and conclusion. Here are the findings based on the main categories described:

Community Participation

Interviews with the Chairman of RT and two community leaders revealed that the level of citizen participation was quite high in the early stages of implementation, especially during socialization and physical development. However, the enthusiasm of the residents began to decline in the maintenance phase, mainly due to the lack of follow-up assistance and the unclear structure of post-program management.

"At first, I was enthusiastic, everyone helped build water channels and clean the land. But now it's a bit difficult to get a job done. No one is in charge of coordination," – (Chairman of RT 01).

The following table includes the intensity of citizen engagement:

Table 1. Intensity of Citizen Involvement

Form of Participation	Engagement Rate	Brief Description
Planning Deliberation	Tall	Almost all residents attended
Infrastructure Development	Keep	Restricted by working time
Routine Maintenance	Low	Many residents are inactive again

Source : Interview by the author to the research source, 2025

Perception of Infrastructure

Most residents expressed satisfaction with the existence of infrastructure such as drainage, paving roads, and communal garbage cans. However, there are still complaints about drainage that quickly clogs up and limited access to public toilet facilities.

"The drainage was good when it was built, but now it has started to get clogged. No one cleaned it," – (Resident of RW 03).

Some residents also said that they felt that they were not sufficiently involved in technical planning, such as the placement of channels and the height of paving blocks, causing build-up during heavy rain.

Social and Institutional Barriers

The results of the FGD indicate that the cessation of the program was hampered by the lack of coordination between local institutions. The absence of a permanent forum for monitoring and the absence of a post-intervention management structure make maintenance responsibilities unclear.

"After the project is completed, it is not clear who will take care of it. Sometimes residents take the initiative, but often they also wait for each other," – (Local Kotaku program manager).

Social and Environmental Values

Although structurally still weak, it was found that there were social values that greed, such as the culture of mutual cooperation that still persisted in certain groups of citizens. In some cases, youth groups and dasawisma women still carry out regular environmental clean-up activities.

"We have cleaning activities every week. Even though it is small, it is still maintained," – (Chairman of the Dasawisma RT 04 Group).

Based on the results of interviews, observations, and focus group discussions, it is known that the level of community participation tends to be high in the early stages of the program, but it weakens over time due to limited assistance and lack of post-intervention management. Respondents showed appreciation for the existence of infrastructure, but there were challenges in terms of maintenance and functional continuity. Institutional barriers and unclear roles between local actors also affect the effectiveness of the program. Despite this, social values such as mutual cooperation and community initiatives still persist in some groups of citizens, which shows the potential for further development. These findings provide an early picture that the desire for the program is strongly influenced by social dynamics and institutional capacity, and shows that there are differences in the level of citizen involvement and perception of infrastructure quality. Therefore, in the next section, it will be explained quantitatively how the variables of community participation and infrastructure quality affect the desire of the program statistically.

Quantitative Research Results

Descriptive Statistics of Research Variables

Descriptive statistical analysis was carried out to understand the general tendency of each variable in this study, namely community participation (X1), quality of environmental infrastructure (X2), and desirability of slum organization management programs (Y). The following table presents the mean, standard deviation, and number of respondents for each variable:

Table 2. Descriptive Statistics of Research Variables

Variabel	Mean	Standard Deviation	Number of Respondents
Program Sustainability (Y)	3.95	892	150
Community Participation (X1)	3.99	871	150
Quality Infrastructure (X2)	3.44	966	150

Source : SPSS 20 Author's Process, 2025

From these results, it can be seen that the community participation variable has the highest average value, which is 3.99, with a standard deviation of 0.871. This indicates that in general the community responds positively to their involvement in the program, although there is still little variation in perceptions or levels of participation between individuals.

Meanwhile, the program desire variable (Y) had an average of 3.95, indicating that the public's perception of infrastructure desires was quite high, even though the initial participation did not exceed. The standard deviation of 0.892 indicates that this perception tends to be stable among respondents.

In contrast, infrastructure quality (X2) obtained the lowest average value, namely 3.44, with a comparatively larger standard deviation (0.966). This reflects a considerable variation in public assessment of the quality of the facilities built, which can come from different physical conditions between locations, or from a mismatch between expectations and program results in the field.

Overall, these descriptive results provide an early picture that community participation and the perception of desire are relatively high, but the physical quality of the infrastructure is still a challenge in ensuring truly sustainable program outcomes.

Furthermore, multiple linear regression analysis was carried out to find out how much influence community participation (X1) and environmental infrastructure quality (X2) had on the death of slum management programs (Y). This model was tested using the enter method and tested for feasibility through a series of classical assumption tests. The results are outlined in the following table:

Table 3. Results of the Classical Assumption Test of Research

Test Type	Test Results	Conclusion
Normality (Kolmogorov-Smirnov)	Sig. = 0.713	Usual
Multicollinearity (VIF)	VIF X1 = 1.001; X2 = 1.001	Multicollinearity does not occur
Multicollinearity (Tolerance)	Toll X1 = 0.999; X2 = 0.999	Multicollinearity does not occur
Autocorrelation (Durbin-Watson)	DW = 1.019	No autocorrelation
Heteroskedasticity (Visual)	No special patterns	Heteroscedasticity does not occur

Source : SPSS 20 Author's Process, 2025

This table summarizes five important tests used to ensure that the regression model meets basic statistical requirements:

1. Normality
   The Kolmogorov-Smirnov test yielded a significance value of 0.713, which > 0.05. This shows that the residual model is functioning normally and that the assumption of normality is met.
2. Multicollinearity
   The values of VIF = 1.001 and Tolerance = 0.999 for X1 and X2 indicate the absence of linear relationships between extreme free variables. In other words, each variable stands statistically independent.
3. Autocorrelation
   The Durbin-Watson autocorrelation of 1.019, close to the number 2, indicates that the residue does not undergo significant autocorrelation.
4. Heteroscedasticity
   The results of the residual visualization (in the form of scatterplots and histograms in SPSS) do not show a specific pattern, so it can be concluded that the variance of the error is constant (homoscedasticity).

Multiple Linear Regression Results

Based on the results of multiple linear regression analysis, information was obtained that the variables of community participation (X1) and environmental infrastructure quality (X2) were jointly included in the model to test their influence on the desirability of the slum management program (Y). The results of the multiple linear regression test are summarized in the following table:

Table 4. Multiple Linear Regression Test Results

Variabel	Coeficin B	Std. Error	t-count	Sig. (p-value)
(Constanta)	4.084	426	9.588	0.000
Community Participation (X1)	0.010	84	123	0.044

Quality Infrastructure (X2)	-0.05	76	-658	0.051
Model Summary : $R^2 = 0.081 \rightarrow 8.1\%$ variation Y is explained by X1 and X2 Adjusted $R^2 = -0.011$ Sig. F Perubahan = 0.031 Durbin Watson Value = 1.019				

Source : SPSS 20 Author's Process, 2025

Based on the table above, the regression equation is obtained as follows:

Y = 4.084 + 0.010 (X1) - 0.050 (X2)

The regression results show that community participation has a real contribution to the desire of the slum management program. This is indicated by a significance value of 0.044, which is below the threshold of 0.05. A positive coefficient of 0.010 indicates that any increase in participation—whether in the form of citizen involvement in deliberation, development implementation, or post-project maintenance—tends to drive the program's desire in a better direction. Although the value of this coefficient seems small, its significance shows a consistent relationship between citizen social involvement and the sustainability of infrastructure functions.

In contrast, the infrastructure quality variable displayed was negatively related to program termination, with a coefficient value of –0.050 and significance of 0.051. This value is technically close to the limit of significance, but it is not strong enough to be statistically influential. This phenomenon can be caused by diverse perceptions of the physical quality of buildings, or because the construction maintenance system is still weak. The community may feel that the existence of facilities alone is not enough if it is not followed by a good utilization and management system. Therefore, even if the infrastructure has been built well physically, its desires are not necessarily guaranteed without adequate social support.

Further, an R^2 value of 0.081 indicates that only about 8.1% of the variation in program desires can be explained by these two variables. In other words, there is more than 90% variation caused by other factors that have not yet been included in the model. This reflects that desirable issues in the organizational context do not only depend on the aspects of participation and physical quality alone, but also on broader institutional elements, policies, culture, and social incentives.

This model can still be considered suitable for simultaneous use, given that the results of the F test show a significance value of 0.031. However, the overall effectiveness of the model is still low, so a more holistic approach is needed in assessing the success of similar programs.

Discussion

The results of this study show that community participation has a significant influence on the sustainability of slum management programs. These findings are in line with research by Arifin et al. (2024), which emphasizes the importance of community participation in waste management in slums around the banks of the Tallo River. They found that factors such as the condition of the waste bank, employment, and knowledge of waste affected the level of community participation.

However, the results of this study differ from the findings of Hartini et al. (2023), who highlight that sustainable infrastructure development in slum areas requires careful planning and active community participation to achieve sustainability.

Quantitative & Qualitative Data Synthesis

Quantitative analysis shows that community participation has a significant effect on the sustainability of the program, while the quality of infrastructure does not. These results were reinforced by qualitative findings, where residents stated that their involvement in the planning and implementation of the program increased their sense of ownership and responsibility for the sustainability of the program.

However, some residents also revealed that the infrastructure built is not always in accordance with their needs, such as quickly clogged drains or inadequate toilet facilities. This

shows that the quality of infrastructure that is not in accordance with the needs of the community can hinder the sustainability of the program.

Several studies support the finding that community participation plays an important role in the sustainability of slum programs. Katresna and Adharina (2024) emphasized that community participation in environmental management can improve the quality of life and sustainability of settlements. Research by Hartini et al. (2023) also found that the high level of community participation in the planning, implementation, and maintenance of the Kotaku program in Tamansari Village contributed to the success of the program.

Furthermore, this is in line with the findings of Linda et al. (2024) which highlight the role of social involvement in shaping the interaction patterns of rural communities and residential areas. This social involvement is closely correlated with the success of the management of the residential environment of the Mandailing community in Sibanggor Julu Village.

Support also comes from the Katresna & Adharina study (2024), which states that the success of residential environmental programs depends on the consistency of citizen participation in the maintenance and maintenance activities of the infrastructure built.

However, there are also studies that show that the quality of infrastructure plays an important role in the sustainability of the program. Research by Dyah and Yuliastuti (2014) highlights that the decline in environmental quality in urban settlements can affect the sustainability of settlements.

Meanwhile, in contrast to these findings, some studies emphasize that it is precisely the quality of physical infrastructure that is the main key to sustainability. For example, research by Dyah & Yuliastuti (2022) in Built Environment Studies shows that development that does not consider aspects of material quality and technical design causes degradation of environmental function even though people are socially active.

Similarly, the findings of Zakaria et al. (2023) concluded that positive perceptions of the quality of public infrastructure are directly correlated with the sustainability of urban people's healthy lifestyles – this was not found in this study, which suggests X2 has no significant effect. Research by Hartini et al. (2023) also found that beneficiaries are satisfied with the quality of urban infrastructure and services in slums, suggesting that good infrastructure quality can support the sustainability of the program.

5. Conclusions

Based on the results of the study that combines quantitative and qualitative approaches, it can be concluded that the implementation of the slum organization handling program in Tegal Sari Mandala II Village in general still faces complex challenges. Active community participation has proven to be the most influential factor in the sustainability of the program. The higher the level of citizen involvement—both in the planning, implementation, and maintenance processes—the more likely it is that the program can continue to run and provide long-term benefits.

In contrast, the quality of physical infrastructure, while important, has not shown significant influence in quantitative models. The results of the interviews show that some people feel that the infrastructure built has not been fully in accordance with needs, or has not been accompanied by adequate utilization education. Thus, the desired program is not solely determined by the physical quality of the facilities, but rather by the synergy between the social and technical aspects that are built in the process.

The regression model also shows that there are many other factors beyond participation and infrastructure that influence desire, such as institutional roles, policy support, and local cultural values. Therefore, the desired strategy must be multi-sector and not only focus on the physical aspect. Based on these findings, some of the strategy recommendations that can be implemented immediately include:

1. Improve formal and informal community participation mechanisms, such as periodic citizen deliberation forums, environmental management training, and program incentives for joint infrastructure maintenance. Participation should be seen as an ongoing process, not just engagement at the beginning of the program.
2. Evaluate and adjust infrastructure design based on the real needs of the community, by involving residents in determining technical specifications and development locations. This is important to prevent the appearance of facilities that are not used or have less than optimal function.

3. Strengthening the role of local institutions, especially in the aspects of surveillance and poverty. Village governments and non-governmental groups need to be provided with managerial training to be able to manage and develop environment-based programs independently.
4. Encourage the organization of integration programs with spatial policies and community-based regional development, so that interventions are not fragmented. This effort is important to ensure the integration between technical planning and the socio-economic dynamics of citizens.
5. Establish a sustainability monitoring and evaluation system involving citizen representatives, local academics, and the government. This system can be used to assess the effectiveness of the program periodically and be the basis for future improvements.

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