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EFFECTIVE AND SUSTAINABLE SANITATION SYSTEM DEVELOPMENT PLAN FOR SLUM SETTLEMENTS IN TANJUNGBALAI CITY

Nella Febrina Silalahi[1], Cut Nuraini[2*], Abdi Sugiarto[3]
[1,2,3] Universitas pembangunan Panca Budi
Email: silalahinella@gmail.com
Corresponding Author: Cut Nuraini cutnuraini@dosen.pancabudi.ac.id

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Abstract

Sanitation issues in slum areas in Tanjungbalai City are a major concern in efforts to improve the quality of life and public health. This study aims to explore the factors that influence sanitation management in slum areas and provide policy recommendations to improve sanitation management. The research method used is a qualitative approach with data collection through interviews and field observations. The results of the study indicate that the main factors that hinder effective and sustainable sanitation management in slum areas are limited infrastructure, low community participation, and limited budget. In addition, the impact of poor sanitation on health and the environment is very significant, including increasing rates of water-based diseases and environmental pollution. The suggested policy recommendations include improving sanitation infrastructure, implementing environmentally friendly waste processing technology, empowering communities, and stricter law enforcement. Collaboration between the government, private sector, and communities is also needed to ensure the sustainability of sanitation programs in the future.

Keywords: ***Slum Sanitation, Sanitation Management, Public Health, Sanitation Policy and Sanitation Infrastructure.***

INTRODUCTION

The background of the problem in the development plan for an effective and sustainable sanitation system for slums in Tanjungbalai City is closely related to environmental conditions that are increasingly under pressure due to rapid population growth and limited supporting infrastructure. Along with the increasing population, especially in slum areas, poor sanitation quality is one of the main challenges in maintaining public health.(Rangkuti et al., 2023). Slums in Tanjungbalai City are often not equipped with adequate sanitation management systems, such as proper waste disposal channels and wastewater treatment plants (WWTP). This causes a decrease in the quality of life, increases the risk of disease spread, and adds to the burden on the city's health system. In addition, this condition also affects the surrounding environment, with pollution of groundwater, rivers, and waterways that can impact ecosystems and natural resources. The importance of developing an effective and sustainable sanitation system in slums is crucial to support the creation of a healthy and livable environment. Without an integrated sanitation system, efforts to improve the quality of life of the community will be hampered.(Akus Harmoko et al., 2024). Therefore, planning a sanitation system that is not only effective but also sustainable is needed to overcome sanitation problems in the area. This system is expected to be able to meet long-term sanitation needs by considering technical, social, and environmental aspects that are friendly to natural resources. The development of a good and sustainable sanitation system not only supports the fulfillment of the basic rights of the community to proper sanitation, but can also improve the quality of life, reduce the potential for sanitation-related diseases, and maintain environmental sustainability for future generations. In this context, the role of government, society, and the private sector is very important to create effective and responsible solutions to overcome sanitation problems in Tanjungbalai City. The phenomenon of problems that occur in Tanjungbalai City related to sanitation in slums is very striking and concerning. This city, like many other big cities, is experiencing rapid urbanization, where many residents move from rural areas to urban areas in the hope of finding work and a better life. However, this phenomenon is also accompanied by the development of increasingly widespread slums, especially in densely populated areas that are not supported by adequate

infrastructure, especially in terms of sanitation management. Slums in Tanjungbalai City often do not have a proper and functioning wastewater disposal system. Liquid waste that is not managed properly is often dumped directly into open water channels, rivers, or even into the ground, causing environmental pollution. Polluted groundwater is one of the consequences of poor sanitation management, which poses a high risk to public health. In addition, this condition also worsens the quality of drinking water from rivers or wells around the settlement. Another observable phenomenon is the high number of diseases associated with poor sanitation, such as diarrhea, cholera, and skin diseases, which are increasingly found among residents living in slums. The spread of these diseases is faster due to the lack of public awareness of the importance of good sanitation, as well as limited health facilities in these areas. The existence of these irregular and poorly managed slums also has a negative impact on the environment. Waste that is not managed properly often piles up on the side of the road or in water channels, blocking water flow, and increasing the risk of flooding during the rainy season. Air, soil, and water pollution caused by the lack of an adequate waste management system worsens the quality of the environment in the area. With these phenomena, it is clear that sanitation problems in Tanjungbalai City greatly affect the quality of life of the community, create unhealthy conditions, and worsen environmental degradation. Therefore, a comprehensive and sustainable solution is needed to address this sanitation problem in order to create a healthy, safe, and comfortable residential environment for all residents of Tanjungbalai City.

The urgency of this research is very important, considering the poor sanitation conditions in slums in Tanjungbalai City which have become a long-term problem with serious impacts on public health and environmental sustainability. This research is very urgent because of the need to find effective and sustainable solutions to overcome the growing sanitation problems. The increasingly widespread slums, with minimal sanitation management systems, have negative impacts that not only create discomfort, but also pose a real health threat to its residents. One of the main urgencies of this research is to provide a deeper understanding of the sanitation conditions in slum areas, which often receive less attention from the government and other related parties. With this research, it is hoped that the main causal factors can be identified as to why the sanitation system in slums is not yet effective, as well as the most appropriate and sustainable solutions to overcome this problem. This research is also important to provide an overview of how good sanitation management can improve the quality of life of the community and reduce the potential for the spread of disease. In addition, this research is also urgent because of the need to design a sanitation system model that can be applied effectively in slums, taking into account the limitations of infrastructure, budget, and technical capacity in the field. With the development of knowledge about the needs and characteristics of the area, the solutions developed can be more targeted and can be easily implemented by the government and the community. Another urgency is in the context of increasing community awareness and participation. Communities in slums often lack information about the importance of good sanitation, as well as how to manage waste properly. This research will provide a strong basis for developing education and training programs for the community so that they are more concerned and proactive in maintaining the sanitation of their environment. Finally, this study also has an urgency to support government efforts in achieving sustainable development goals (SDGs), especially those related to proper sanitation and access to clean water. This study is not only relevant to Tanjungbalai City, but also contributes to the development of sanitation policies at the regional or national level. With this great urgency, this study is expected to be the basis for more effective policy planning and interventions to improve sanitation conditions in slums and improve the quality of life of the community in Tanjungbalai City.

Identification of problems

Slums in Tanjungbalai City are areas with high population density and very poor sanitation quality. Many residential areas do not have proper waste management systems, well-organized drainage channels, or adequate wastewater treatment plants (WWTP). As a result, poor sanitation results in environmental pollution, groundwater pollution, and increased cases of sanitation-related diseases such as diarrhea, cholera, and skin diseases. In addition, irregular waste management and limited sanitation facilities worsen environmental quality and public health. This phenomenon is exacerbated by the lack of public awareness of the importance of good sanitation and the limitations of local governments in providing adequate infrastructure in slums. People living in slums are often forced to live with very limited sanitation facilities, which affects their overall quality of life. Therefore, the problem of poor sanitation in slums is a very urgent issue to be addressed.

Formulation of the problem

Based on the problem identification above, the problem formulation in this study is as follows:

1. What is the condition of the sanitation system in slums in Tanjungbalai City?

2. What are the main causal factors that hinder effective and sustainable sanitation management in slums in Tanjungbalai City?
3. What are the impacts of poor sanitation on public health and environmental quality in the slums of Tanjungbalai City?
4. What is the role of the community and government in overcoming sanitation problems in the slums of Tanjungbalai City?
5. What sanitation system model can be applied effectively and sustainably to slums in Tanjungbalai City?
6. What are the policy recommendations that need to be taken to improve sanitation management in slums in Tanjungbalai City?

LITERATURE REVIEW

Developing effective and sustainable sanitation systems in slums is one of the major challenges in sustainable urban planning. Slums often lack access to adequate sanitation facilities, which can lead to a variety of health and environmental problems.(Muhammad Aris et al., 2024). For this reason, various theories and approaches have been developed by experts in order to design and implement sanitation systems that can overcome these problems.

2.1 Community Based Sanitation

One approach that is widely used in developing sanitation systems in slums is community-based sanitation. According to Fauzi (2019), community-based sanitation is an approach that involves the community in every stage, from planning to maintaining the sanitation system. Fauzi argues that communities who are directly involved in sanitation management tend to be more responsible for the sustainability of the existing system. In addition, this approach is also more adaptive to varying local conditions. This approach can be implemented through the provision of shared sanitation facilities, such as communal toilets, which are managed by the local community. In this regard, Sutrisno and Asri (2020) emphasized the importance of collaboration between the government and the community in creating an effective and sustainable sanitation system. They suggested that community-based sanitation systems could be expanded with the use of simple technologies that could facilitate sanitation management by communities with limited funds.

2.2 Sustainability in Sanitation Management

Sustainability is an important factor that must be considered in designing a sanitation system for slums. According to Hartanto (2020), to create a sustainable sanitation system, three main aspects must be considered: social, economic, and environmental aspects. Social sustainability refers to the active participation of the community in managing the sanitation system. Economic sustainability relates to the community's ability to fund and maintain sanitation facilities in the long term. Meanwhile, environmental sustainability includes efforts to maintain environmental quality by reducing pollution and using natural resources wisely.(Rahmadani et al., 2023). Rizal (2020) added that sanitation sustainability must also involve policies that support the development of efficient and environmentally friendly sanitation infrastructure. In this case, the government plays an important role in creating policies that support the development of sustainable sanitation systems, as well as providing incentives for environmentally friendly technologies that can be used by communities in slums.

2.3 The Role of Technology in Sanitation Management

Technological developments have provided many opportunities to improve sanitation systems in slums. Efficient and accessible technology is key to creating better and more sustainable sanitation. Fauzi (2019) suggests the use of simple technologies such as biotechnology-based communal toilets that can process human waste into compost or other organic materials. This type of technology allows for easy maintenance and affordable costs, suitable for slums with limited resources. In addition, environmentally friendly wastewater treatment technologies, such as decentralized wastewater treatment systems, can also be applied in slums. Hartanto (2020) noted that wastewater treatment using a system integrated with clean water management is a solution that can help improve the quality of sanitation in slum areas, by reducing environmental pollution.

2.4 The Importance of Community Participation in Sanitation Management

Community participation in sanitation system management is the main key to the success of effective and sustainable sanitation development. Sutrisno and Asri (2020) emphasized that sanitation management that involves active community participation can increase the sense of ownership of sanitation facilities and reduce the risk of damage or neglect. Communities involved in decision-making will feel more responsible for caring for and maintaining the cleanliness of their environment.(Saputra & Sugiarto, 2024). Furthermore, Rizal (2020) argues that the success of the sanitation system also depends heavily on community empowerment. This empowerment can be done through education and training related to good sanitation, as well as counseling on the importance of cleanliness and environmental health.

2.5 Framework of Thought

This framework aims to provide a clear picture of how the development of an effective and sustainable sanitation system can be implemented in slums, especially in Tanjungbalai City. This framework covers technical, social, and policy aspects that are interrelated in forming a sanitation system that is not only effective but also sustainable in the long term.

Figure 2.1 Framework of Thought
Source: Author's Thoughts, 2025

1. Sanitation problems in slums are the starting point that shows the poor conditions that need to be addressed.
2. The Community-Based Sanitation Approach helps in empowering communities to play an active role in sanitation planning and maintenance.
3. Sustainability of Sanitation Management is an important factor in ensuring that the sanitation system can be maintained in the long term by considering social, economic and environmental aspects.
4. The role of technology is to provide practical and efficient solutions in sanitation management with easy-to-implement technology.
5. Government policies are very important in providing support and regulations that facilitate the implementation of sanitation systems in slums.
6. Community participation in sanitation management plays a role in ensuring the sustainability and success of the implemented system.

RESEARCH METHODS

3.1 Types of Research

The type of research used is qualitative descriptive research. This study aims to describe in detail the phenomena that occur in sanitation management in slums, as well as to identify factors that influence the effectiveness and sustainability of the sanitation system.

Research Approach

This study uses a case study approach that focuses on slums in Tanjungbalai City. Case studies are chosen because they allow researchers to study phenomena in depth in specific existing contexts, so that they can understand the social and technical dynamics in managing sanitation systems in these slums.(Sugiarto et al., 2024). This approach also helps to explore information on the challenges and solutions found in the development of sanitation systems.

3.2 Research Location

This research will be conducted in slums in Tanjungbalai City. The selection of this location is based on the still concerning sanitation conditions, as well as the need to develop a better and more sustainable sanitation system.

3.3 Population and Sample

The population in this study were all people living in slums in Tanjungbalai City, as well as stakeholders involved in sanitation management in the area. The research sample consisted of:

1. Slum communities (especially RT heads, residents involved in sanitation management, and families who have limited access to sanitation facilities).

2. Stakeholders (city government, NGOs, and other parties involved in sanitation development).

Sample selection was carried out using purposive sampling techniques, where respondents were selected based on certain criteria relevant to the research objectives, such as direct involvement in sanitation management.

3.4 Data Collection Techniques

Some data collection techniques used in this study are:

1. In-depth interviews: Interviews were conducted with communities and stakeholders to explore their understanding of sanitation management, challenges faced, and solutions implemented.
2. Focus Group Discussion (FGD): FGDs are conducted with community groups to discuss issues related to sanitation, community participation, and sustainability of sanitation systems.
3. Participatory observation: Researchers will conduct direct observations in the field to see the sanitation conditions in slums and community interactions in sanitation management.

3.5 Data Analysis Techniques

Data collected from interviews, FGDs, and observations will be analyzed using thematic analysis techniques. The steps in thematic analysis include:

1. Transcription of data from interviews and FGDs.
2. Coding: Identifying themes that emerged in interview and FGD transcripts.
3. Theme grouping: Grouping data based on themes relevant to the research objectives, such as community participation, sustainability of sanitation systems, and challenges faced.
4. Narrative development: Developing the results of the analysis into a narrative that describes the main findings of this research.

3.6 Data Validity and Reliability

To ensure the validity and reliability of the data, this study will use data triangulation techniques, namely by comparing the results of interviews, FGDs, and observations. In addition, researchers will also conduct member checking, namely asking for feedback from respondents on the findings obtained to ensure the conformity of the data with the respondents' views.

RESULTS AND DISCUSSION

What is the condition of the sanitation system in slums in Tanjungbalai City?

Tanjungbalai City is an area located in the East Coastal Area of North Sumatra, Tanjungbalai City is one of the cities that has a large area of slums. The presence of slums in the area has basically been going on for a long time and its existence is caused by several factors that are related to each other such as rapid migration from villages to cities, unemployment, poverty, poor planning, low quality buildings, and limited facilities and infrastructure, including poor quality sanitation as one of its components.

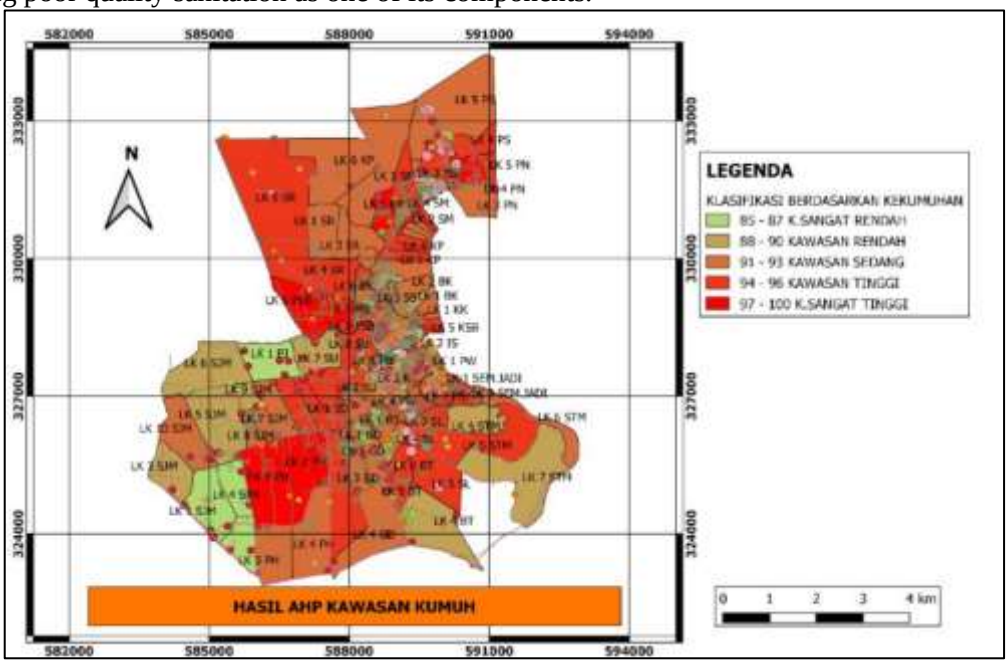

Figure 1.1. Slum Area of Tanjung Balai City
Source: Adinda, 2021

The current condition of the sanitation system in slums in Tanjungbalai City is very concerning. These slums, which are usually located in densely populated areas and do not have good governance, face various problems related to sanitation management. Most of these areas are not equipped with proper sanitation infrastructure, such as wastewater drainage, waste disposal facilities, or wastewater treatment plants (IPAL). This causes liquid and solid waste to often be disposed of carelessly, which then pollutes the surrounding soil, water, and air.(Rahmadhani et al., 2023).

1. Inadequate Sewerage Channels In many slums, existing sewerage channels (SPAL) are very limited and not well organized. Many households dispose of liquid waste directly into open water channels, rivers, or even into the ground. This causes groundwater and river pollution, which impacts the quality of drinking water in the surrounding area. Unorganized water channels that are blocked by garbage also increase the risk of flooding, further worsening environmental conditions.
2. Poor Waste Management Household waste in slums is often not managed properly. Much of the waste is dumped carelessly on the streets, along drains, or even burned openly. In addition to polluting the environment, these piles of waste are also a source of health problems, as they attract rodents and disease-carrying insects. Poorly managed waste also blocks the flow of water in drains, which can cause waterlogging and flooding, especially during the rainy season.
3. Lack of Wastewater Treatment Plants (WWTP) Most slums in Tanjungbalai City do not have proper Wastewater Treatment Plants (WWTP). Without adequate WWTP, liquid waste produced by households and small businesses in the area cannot be properly treated before being discharged into the environment. Liquid waste that is discharged without proper treatment contains hazardous materials, such as pathogenic microorganisms, which can contaminate water and cause the spread of diseases, such as diarrhea and cholera.
4. Limited Access to Clean Water. In addition to waste management issues, slums also often lack access to safe, clean water. Many households rely on well water or other open water sources that are vulnerable to contamination. This worsens sanitation problems, as residents are forced to use contaminated water for their daily needs, including drinking and bathing.
5. Lack of Community Awareness and Participation People in slums often lack adequate awareness of the importance of good sanitation management. Most of them do not have sufficient knowledge on how to dispose of waste properly or process household waste safely. In addition, due to economic constraints, they are unable to access proper sanitation facilities, so they prefer to continue using environmentally unfriendly methods.
6. Infrastructure and Government Resource Constraints The Tanjungbalai City Government, despite its efforts to improve the quality of life of its citizens, still faces major challenges in building adequate sanitation infrastructure in slum areas. Limited budgets and limited technical capacity and human resources at the local government level are often major barriers to building an integrated and sustainable sanitation system.

Overall, the condition of the sanitation system in the slums in Tanjungbalai City is very poor and requires serious attention. The main problems faced are the lack of adequate wastewater drainage, poor waste management, the absence of IPAL, and limited access to clean water. To overcome this problem, careful planning and collaboration between the government, community, and private sector are needed to build an effective, environmentally friendly, and sustainable sanitation system.

What are the main causal factors that hinder effective and sustainable sanitation management in the slums of Tanjungbalai City?

There are various factors that hinder effective and sustainable sanitation management in slums in Tanjungbalai City. These factors include technical, social, economic, and institutional issues that affect the sustainability of the sanitation system in the area. The following are some of the main causal factors that hinder effective sanitation management:

1. Infrastructure and Facilities Limitations One of the main factors that hinder sanitation management in slums is the limited infrastructure and adequate sanitation facilities. In many slums, there are no properly arranged wastewater drainage systems (SPAL), and some areas do not even have a wastewater disposal system at all. In addition, most households do not have access to proper wastewater treatment plants (IPAL). The lack of sanitation facilities results in liquid and solid waste being disposed of carelessly, which causes water and soil pollution, and increases the risk of disease.
2. Budget and Government Resource Constraints One of the main obstacles to effective sanitation management is the limited budget of local governments to build and maintain sanitation infrastructure. Tanjungbalai City, like many other cities, faces challenges in allocating sufficient funds for the development of sanitation

infrastructure in slum areas. These budget constraints often make it difficult for governments to build and maintain the sewerage systems, wastewater treatment facilities, and waste management systems needed to keep the environment clean and healthy.(Ramadhani & Nuraini, 2024).

3. High Population Density Slums in Tanjungbalai City generally have a very high population density. This makes sanitation management more complicated and expensive. In densely populated conditions, it is difficult to build adequate sanitation infrastructure, due to the limited space and costs required to install a large and integrated waste disposal system. This density also increases the volume of waste that must be managed, adding to the burden on the existing sanitation system.
4. Lack of Community Awareness and Participation One of the major obstacles to sustainable sanitation management is the lack of awareness and active participation from the community. Many residents in slums do not fully understand the importance of good sanitation for health and the environment. People often do not have the habit of disposing of garbage in the right place or managing household waste properly. The lack of education about healthy sanitation and the low level of community participation in maintaining environmental cleanliness worsen the sanitation situation in slums.
5. Irregular Settlement Patterns Slums in Tanjungbalai City are usually built without clear and regular planning. This causes difficulties in building sanitation infrastructure that is in accordance with the geographical conditions and spatial planning of the city. Many houses are built in flood-prone areas or have limited access to drainage, which makes it difficult to improve the sanitation system. This irregular settlement pattern also hampers the distribution of clean water and waste management, and increases the potential for pollution.
6. Lack of Expertise and Technology The lack of expertise in planning and managing effective sanitation systems is also a limiting factor. In slums, the lack of technical knowledge regarding proper sanitation system design and implementation often makes sanitation infrastructure planning and construction less efficient. In addition, the lack of environmentally friendly technology also slows down the implementation of sustainable wastewater treatment systems, such as community-based waste treatment systems or recyclable waste management technologies.
7. Policy and Regulatory Limitations Although local governments have created various policies and programs to improve sanitation, the implementation of these policies is often hampered by regulations that are not strong enough or effective enough. Unclearness regarding the division of responsibilities between the government, communities, and the private sector in terms of sanitation management can lead to overlapping tasks and inefficiencies in the implementation of sanitation programs. In addition, the lack of supervision and law enforcement related to environmental cleanliness makes people feel that there are no consequences for those who violate sanitation regulations.
8. Social and Economic Issues of the Community The high level of poverty in slums also affects the community's ability to access proper sanitation facilities. Many families do not have the financial ability to build private sanitation facilities such as proper toilets or to pay for the maintenance costs of public sanitation systems. As a result, they tend to use unsafe waste disposal methods that pose high health risks.

What is the impact of poor sanitation on public health and environmental quality in the slums of Tanjungbalai City?

Poor sanitation in the slums of Tanjungbalai City has serious impacts on both public health and environmental quality. The inability to properly manage liquid and solid waste, as well as limited access to proper sanitation facilities, has created very dangerous conditions for residents living in the area. Here are some of the main impacts caused by poor sanitation in slums:

1. Impact on Public Health

a. Waterborne Diseases One of the most significant impacts of poor sanitation is the spread of waterborne diseases. In slums, liquid waste is often dumped carelessly into open drains, rivers, or even into the ground, which contaminates the water sources used by the community. This water pollution carries a high risk of causing diseases such as diarrhea, cholera, typhoid, and dysentery. Residents who consume contaminated water, whether for drinking, bathing, or cooking, are highly susceptible to infections that can endanger their health.

b. Skin Diseases and Respiratory Tract Infections Poor sanitation can also cause skin diseases, such as eczema, dermatitis, and other skin infections. This occurs due to direct contact with an environment polluted by waste or garbage. In addition, piles of garbage that are not managed properly also create a breeding ground for flies, rats, and other disease-carrying animals. The germs carried by these animals can cause infections and respiratory diseases, especially in children and the elderly who are more vulnerable.

c. Mental and Social Health Risks The impact of poor sanitation is not only limited to physical problems, but can also affect people's mental health. Dirty and polluted housing conditions can cause stress and anxiety for residents, who are forced to live in unsuitable conditions. Uncertainty about their own and their families' health also adds to the psychological burden for residents living in slums, who often feel there is no long-term solution to their problems.

d. Vector-Borne Diseases Scattered waste in slum areas creates an ideal breeding ground for disease vectors, such as mosquitoes, flies, and rats. These vectors carry a variety of infectious diseases, such as dengue fever (from Aedes mosquitoes), leptospirosis (from rats), and gastrointestinal diseases caused by flies. With poor sanitation management, these disease vectors reproduce more rapidly, increasing the risk of disease spread.

2. Impact on Environmental Quality

a. Water and Soil Pollution One of the most obvious impacts of poor sanitation is water and soil pollution. Liquid waste that is dumped carelessly into drains or rivers causes pollution that disrupts the water ecosystem. Water that is contaminated with organic or chemical waste becomes unfit for consumption or use in daily activities, such as bathing or washing. Soil pollution also occurs when solid waste, such as garbage, is dumped carelessly, causing degradation of soil quality and reducing its fertility.

b. Air Quality Degradation Poor waste management in slums, such as open burning of waste, can pollute the air with smoke and hazardous particles. Uncontrolled waste burning releases toxic substances, including carbon monoxide, dioxins, and other hazardous compounds, which can pollute the air and have adverse effects on respiratory health, especially for children and the elderly who have weaker immune systems. In addition, the unpleasant odor caused by rotting waste also pollutes the air and reduces the quality of life of residents.

c. Ecosystem and Wildlife Damage Water and soil pollution due to poor sanitation also have negative impacts on local ecosystems. Polluted rivers, for example, can reduce the abundance and diversity of their biodiversity, including fish and other aquatic organisms that depend on clean water. Soil pollution also limits the soil's ability to support plant growth, leading to reduced food security and the destruction of natural habitats for local fauna.

d. Increased Risk of Flooding and Water Pollution Poorly managed waste often clogs drainage channels, causing water flow to be obstructed, especially during the rainy season. Piles of waste and garbage that clog water channels can increase the risk of flooding, which worsens environmental conditions and causes further damage. Flooding caused by blocked drainage channels also contributes to increased water and soil pollution, as well as worsening sanitation in the area.

3. Social and Economic Impacts

a. Economic Burden on the Community Poor sanitation increases the economic burden on the community, both in terms of medical costs for waterborne diseases and the cost of cleaning up an environment that is not well managed. In addition, poor sanitation can also affect the productivity of the community, because they are more often sick and have to spend time on treatment or caring for sick family members. This causes a decrease in their quality of life and income.

b. Limited Access to Health Facilities Poor sanitation also hinders people's access to adequate health facilities. Diseases caused by poor sanitation can increase the demand for health services, which are often inadequate to handle the increasing number of patients. This puts additional pressure on the local health system and leads to a decline in the quality of health services in the area.

The impact of poor sanitation on public health and environmental quality in the slums of Tanjungbalai City is very serious. The spread of disease, environmental pollution, air quality degradation, and ecosystem damage are some of the main impacts that can be observed. Therefore, efforts to improve sanitation conditions in slum areas are urgently needed to prevent further losses to public health, the environment, and the economy. The government, communities, and related sectors need to work together to create effective, environmentally friendly, and sustainable sanitation solutions.

What is the role of the community and government in overcoming sanitation problems in the slums of Tanjungbalai City?

The problem of poor sanitation in the slums of Tanjungbalai City requires close collaboration between the community and the government. Both parties have a very important role in creating effective and sustainable solutions to improve sanitation conditions in this area. Each party has different responsibilities and contributions, but they support each other to achieve the same goal: creating a cleaner, healthier, and more livable environment.

1. The Role of Society in Overcoming Sanitation Problems

a. Increasing Awareness and Education on Sanitation The community has a very important role in changing behavior related to sanitation. One of the first steps that must be taken is to increase awareness about the importance of good sanitation for health and quality of life. The community needs to be educated about how to manage waste, the importance of using proper sanitation facilities, and the health risks that arise from poor sanitation. Educational programs through environmental campaigns or training on safe sanitation can help the community understand the benefits of good sanitation and how to apply it in everyday life.

b. Participation in Waste Management and Waste Disposal The community needs to actively participate in waste management and waste disposal. One way that can be done is by forming community groups that are tasked with managing waste at the environmental level. The community must be encouraged to get used to throwing away waste in its place, sorting organic and inorganic waste, and avoiding indiscriminate disposal of liquid and solid waste. In addition, efforts to reduce plastic waste by reducing the use of disposable materials or recycling can reduce the volume of waste produced.

c. Maintenance of Community Sanitation Facilities In some slums, the government often builds shared sanitation facilities for the benefit of residents, such as public toilets or wastewater treatment facilities. The community needs to be involved in the maintenance of these facilities to ensure that they continue to function properly. Mutual cooperation and cooperation between residents in maintaining the cleanliness and maintenance of sanitation facilities will extend the life of the facilities and ensure that sanitation continues to function properly.

d. Environmental Monitoring and Supervision Communities also have a role in monitoring and reporting sanitation problems in their environment. For example, if there is unauthorized waste disposal or clogged drainage channels, the community can work together with the government to carry out maintenance or repairs. Through a community-based monitoring system, the community can contribute to maintaining the cleanliness of their environment.

2. The Role of Government in Addressing Sanitation Problems

a. Planning and Provision of Sanitation Infrastructure The government has a major role in planning and providing adequate sanitation infrastructure. This includes building and maintaining wastewater drainage channels (SPAL), wastewater treatment plants (IPAL), and efficient waste management facilities. Provision of appropriate infrastructure is essential to ensure that liquid and solid waste can be managed properly and do not pollute the environment. The government must also ensure that the development of sanitation infrastructure is carried out by taking into account urban spatial planning and the needs of the community in each region.

b. Provision of Resources and Budget One of the major challenges in managing sanitation in slums is the limited budget and resources. The government needs to allocate sufficient funds for the development and maintenance of sanitation infrastructure. In addition, the government must also work with donor agencies, the private sector, or other related parties to obtain additional funds to support sanitation projects. The involvement of the private sector in the provision of sanitation services, such as waste management or wastewater treatment, can help reduce the burden on the government budget.

c. Providing Incentives and Supportive Regulations The government can also play a role in providing incentives to communities that actively participate in sanitation management, such as through subsidy programs for families who build sanitation facilities in their homes. In addition, the government must strengthen regulations related to sanitation, such as requiring waste management that meets standards, building environmentally friendly waste disposal systems, and enforcing the law against those who litter or pollute the environment. Strict law enforcement will encourage public awareness and prevent behavior that is detrimental to the environment.

d. Sanitation Counseling and Education The government must play a role in providing ongoing counseling and education to the community regarding the importance of good sanitation for health. These counseling programs can be carried out through various channels, such as mass media, environmental campaigns, training at the community level, or schools. By providing clear and precise information on how to maintain good sanitation, the community will be more motivated to participate in efforts to improve their environmental sanitation.

e. Collaboration between Stakeholders The government needs to collaborate with various stakeholders, including the private sector, non-governmental organizations (NGOs), and international institutions, to design and implement more effective sanitation programs. This collaboration can produce more sustainable solutions and utilize various existing resources, both in terms of technology, finance, and knowledge. By building strong partnerships between the public and private sectors, the challenges of sanitation management in slums can be better addressed.

3. Synergy between the Community and the Government

The importance of synergy between the community and the government in sanitation management cannot be underestimated. The government can provide facilities and policies, while the community can ensure that the policies are implemented properly. In addition, the community also needs to have a sense of responsibility towards their

environment, and the government must ensure that they have access to the information and resources needed to actively participate. The involvement of both parties will create a more effective, environmentally friendly and sustainable sanitation system. Overall, the role of the community and government in addressing sanitation problems in the slums of Tanjungbalai City is very important and complementary. The community must actively participate in sanitation management and maintain the cleanliness of their environment, while the government must provide the infrastructure, regulations, and education needed to support these efforts. Close collaboration between the two will produce more effective solutions in improving sanitation conditions and improving the quality of life of people in slums.

What sanitation system model can be applied effectively and sustainably to slum settlements in Tanjungbalai City?

Slums in Tanjungbalai City face major challenges in terms of good and sustainable sanitation management. To overcome this problem, it is important to design and implement a sanitation system model that is appropriate to local characteristics and needs, and can run effectively and sustainably in the long term. Here are some sanitation system models that can be applied to slums in Tanjungbalai City:

1. Centralized Sanitation Model (Centralized System)

Description: This model involves the construction of centralized sanitation infrastructure, such as a wastewater system (SPAL) that flows to a large wastewater treatment plant (WWTP) managed by the government or regional water management agency. Wastewater produced by households will be channeled through closed channels to a treatment facility before being discharged into the environment.

Superiority:

a) Effective for densely populated areas: This model is suitable for areas with high population density, as it is able to handle waste from many households.
b) Centralized and controlled waste treatment: Centralized wastewater treatment plants allow for more efficient waste management and stricter supervision.
c) Improving environmental quality: After being treated in the wastewater treatment plant, wastewater can be discharged or reused with better quality standards.

Limitations:

a) High investment costs: Construction of sewerage and waste treatment facilities requires a large budget, which may be a challenge for areas with limited funds.
b) Technical challenges: The construction and maintenance of centralized sanitation infrastructure requires careful planning and adequate technical capabilities.

Recommendation: This model can be applied to larger slum areas in Tanjungbalai City, especially in areas close to the city center or areas that already have access to better drainage systems.

2. Decentralized Sanitation Model (Decentralized System)

Description: In this model, sanitation is managed locally or separately, where each household or group of households has its own sanitation facilities, such as septic tanks, biogas toilets, or communal-based waste management systems. Liquid and solid waste management systems are carried out independently or with the help of the community.

Superiority:

a) Lower costs: Because it does not require the construction of large sewer lines or centralized waste treatment facilities, construction and maintenance costs are lower.
b) Increasing community participation: Communities have direct responsibility for sanitation management, which can increase awareness and concern for environmental cleanliness.
c) Flexibility and scalability: This model can be implemented in stages, according to the capacity and needs of each slum.

Limitations:

a) Solid waste management challenges: Solid waste management may remain a problem as many people still litter.
b) Limitations in wastewater treatment: Although decentralized systems can treat wastewater locally, individual or family wastewater treatment may not be effective enough in addressing environmental pollution if not managed properly.

Recommendation: This model is suitable for smaller or scattered slum areas, where large sewage channels are difficult to build. This system can be implemented using simple technologies such as biogas toilets or household solid waste treatment systems.

3. Integrated Waste and Solid Waste Management Model (Integrated Waste Management System)

Description: This model integrates solid waste management and liquid waste treatment in one comprehensive system. Household waste is separated by type, with organic waste processed into compost or biogas, while inorganic waste is recycled. In addition, wastewater is treated through a community-based filtration or treatment system before being discharged into the environment.

Superiority:

a) Reducing the volume of waste sent to landfill: Waste sorting reduces the burden of waste that must be disposed of and increases opportunities for recycling.
b) Increasing community awareness and participation: Communities are involved in waste sorting and waste processing, which can increase the sense of responsibility for environmental cleanliness.
c) Potential for energy production: Processed organic waste can be used to produce biogas, which can be used for household or community needs.

Limitations:

a) Limited facilities and technology: Not all settlements have the facilities or technology necessary to process waste and garbage in an efficient manner.
b) High understanding and commitment from the community is required: Effective waste management requires high understanding and commitment from all members of the community.

Recommendation: This model can be applied to slums with a community-based approach. The government can provide training to the community on waste management, as well as provide simple and easily accessible technologies, such as household composters and biogas-based waste processing systems.

4. Nature-Based Sanitation System Model (Ecological Sanitation System)

Description: This model uses ecological principles for waste management. Examples include solid and liquid waste treatment systems that use natural technologies, such as biological filtration systems or toilets that convert waste into compost or biogas without requiring much energy or water.

Superiority:

a) Eco-friendly: This model reduces environmental pollution as it uses natural processes to treat waste.
b) Resource efficiency: Reducing water use in waste treatment and producing useful by-products such as compost and biogas.
c) Sustainable: These systems can last a long time with relatively low operating costs and minimal environmental impact.

Limitations:

a) Requires sufficient technical understanding: Nature-based technologies such as biological waste treatment require good technical understanding and careful maintenance.
b) Large-scale limitations: This model is more suitable for small communities or individuals, rather than entire large settlements.

Recommendation: This model is very suitable for slums that have limited access to conventional sanitation infrastructure. Simple technologies such as composters or biogas-based toilets can be applied to improve sanitation conditions by utilizing local resources.

5. Combination Model (Hybrid System)

Description: This model combines elements of centralized and decentralized sanitation systems, with the aim of providing flexible and adaptive solutions to local conditions. For example, a centralized sewerage system can be implemented in certain areas, while other areas use community-based waste management systems.

Superiority:

a) High flexibility: This model can be implemented in stages, according to the capacity and needs of each region.
b) Maximizing existing resources: Combining multiple technologies enables more efficient and sustainable sanitation management.

c) Inter-stakeholder collaboration: Encourage collaboration between government, communities and the private sector to create better sanitation solutions.

Limitations:

a) Complexity in planning and implementation: Combining different sanitation models requires good coordination between the parties involved and careful planning.

Recommendation: This combination model is suitable for slums that have various conditions, both in terms of population density, access to infrastructure, and level of community awareness of sanitation.

The selection of the right sanitation system model for slums in Tanjungbalai City must consider various factors, including local conditions, budget, technical capacity, and community participation. The most effective model is one that combines centralized and decentralized solutions, accompanied by a community-based approach that involves residents in sanitation management. With a flexible, innovative, and sustainable approach, sanitation problems in slums can be better resolved and have a positive impact on the quality of life of the community.

What are the policy recommendations that need to be taken to improve sanitation management in the slums of Tanjungbalai City?

Improving sanitation management in slums in Tanjungbalai City requires comprehensive policies, based on understanding local conditions, and can be implemented sustainably. With slum conditions that often lack adequate sanitation infrastructure, policies are needed that not only target physical development, but also increase community capacity and effective waste management. Here are some policy recommendations that need to be considered to improve sanitation management in slums in Tanjungbalai City:

1. Improvement of Equitable Sanitation Infrastructure

Description: One of the main policies that needs to be taken is the development and improvement of comprehensive and even sanitation infrastructure, including wastewater disposal systems (SPAL), wastewater treatment plants (IPAL), and waste management facilities that can be accessed by all levels of society. The development of more efficient drainage channels and IPAL in slums will reduce water pollution and improve environmental quality.

Recommendation:

- City governments need to set priorities for the development of sanitation infrastructure in slum areas using population density and pollution levels data.
- Allocating sufficient budget for the development and maintenance of sanitation infrastructure, taking into account the use of appropriate and environmentally friendly technology.
- Ensuring that sanitation facilities, such as public toilets, are available in strategic locations to reduce open defecation behavior.

Benefit:

- Improving the quality of public health by preventing sanitation-based diseases.
- Reducing environmental pollution and negative impacts on ecosystems.
- Encourage the creation of a more livable and healthy residential environment.

2. Effective and Integrated Waste Management Policy

Description: Waste management is one of the major challenges in sanitation management in slums. The policy that needs to be implemented is an integrated waste management system, starting from waste sorting at the household level, providing waste bins, to an efficient waste recycling system. The government also needs to provide modern and environmentally-based waste processing facilities, such as integrated waste processing facilities (TPST) and composting facilities.

Recommendation:

- Implementing educational programs on waste sorting and reducing plastic waste in the community.
- Encourage community participation in waste management by providing incentives for those who are active in recycling or waste processing programs.
- Build or repair waste processing facilities that can process organic waste into compost and inorganic waste into recycled materials.
- Providing adequate waste management facilities and infrastructure at the residential level, such as separate waste bins and an efficient waste transportation system.

Benefit:

- Reducing the volume of waste sent to landfills and increasing recycling rates.

- Prevent environmental pollution and improve the cleanliness of residential environments.
- Increasing public awareness of the importance of responsible waste management.

3. Increasing Community Capacity and Participation in Sanitation Management

Description: Policies that support active community participation in sanitation management in slums are essential to ensure the sustainability of sanitation programs. Communities must be involved in every stage of planning, construction, and maintenance of sanitation facilities. In addition, increasing community capacity through education and training related to sanitation will strengthen the sense of responsibility for environmental cleanliness.

Recommendation:

- Conducting training and outreach on good sanitation, maintenance of sanitation facilities, and waste management for local communities.
- Forming working groups or community organizations to manage environmental cleanliness, such as sanitation management groups or waste banks.
- Providing incentives to residents who actively participate in sanitation programs, such as providing facilities or awards for a clean environment.

Benefit:

- Increasing public awareness of the importance of good sanitation for health and the environment.
- Increase the community's sense of ownership and responsibility for environmental cleanliness.
- Ensuring the sustainability of sanitation programs at the settlement level.

4. Application of Appropriate Technology for Waste Management and Sanitation

Description: The use of environmentally friendly and appropriate technology in waste management is essential to improve the efficiency of sanitation systems. Technologies such as biological wastewater treatment, the use of composting toilets, or local wastewater treatment systems (septic tanks or biogas toilets) can be effective and sustainable solutions in slums.

Recommendation:

- Encourage the use of technologies that are appropriate to local conditions and that can be easily implemented by communities, such as biogas toilets or simple, nature-based waste treatment systems.
- Providing training and technical assistance to the community in operating and maintaining this waste processing system.
- The government can provide subsidies or support for communities who want to install sanitation facilities based on more environmentally friendly technology.

Benefit:

- Reducing the burden of environmental pollution by utilizing a more efficient and environmentally friendly waste processing system.
- Providing more sustainable sanitation solutions with low operational costs.
- Reducing dependence on large infrastructure that requires high investment.

5. Implementation of Strict Regulations and Law Enforcement

Description: Poor sanitation management is often caused by a lack of law enforcement against violations related to hygiene and sanitation. Therefore, policies that emphasize strict enforcement of sanitation regulations are essential to create a clean and healthy environment. Clear regulations regarding waste disposal, liquid waste, and construction of sanitation facilities must be strictly enforced.

Recommendation:

- Establish and enforce regulations governing sanitation and waste management in slums.
- Provide appropriate sanctions for individuals or groups who violate sanitation regulations, such as littering or dumping waste into open water channels.
- Conduct routine inspections and supervision of sanitation facilities and environmental cleanliness in slum areas.

Benefit:

- Increasing public awareness of the importance of complying with environmental sanitation and cleanliness rules.
- Ensure that sanitation-related violations receive serious attention and appropriate action.
- Creating a more orderly and clean environment.

6. Collaboration between stakeholders

Description: Collaboration between governments, the private sector, non-governmental organizations (NGOs), and communities is essential to creating effective sanitation solutions. This collaboration will help provide the resources, technology, and support needed to address sanitation issues holistically.

Recommendation:

- Forming partnerships between government and the private sector in the development and maintenance of sanitation infrastructure.
- Involve NGOs that have experience in sanitation programs to provide training and outreach to the community.
- Collaborate with international donor agencies that can help fund sustainable sanitation projects.

Benefit:

- Increasing the availability of resources and technology needed to improve sanitation management.
- Increasing participation and involvement of various parties in creating effective sanitation solutions.
- Ensuring the sustainability of sanitation programs through solid collaboration.

CLOSING

Conclusion

Sanitation management in slum areas of Tanjungbalai City currently still faces many challenges, both in terms of infrastructure, public awareness, and management capacity. Inadequate sanitation infrastructure and lack of effective waste management worsen public health conditions and environmental quality. Factors such as budget constraints, lack of coordination between the government and the community, and minimal active community participation are the main causes of obstacles to effective sanitation management.

However, with more integrated policies, such as the development of equitable sanitation infrastructure, increasing community participation, and implementing environmentally friendly waste processing technology, it is hoped that sanitation in slums can be improved sustainably. Strengthening policies and regulations that support sanitation management, as well as more intensive collaboration between the government, community, and private sector, are very important steps to create a healthier environment.

Suggestion

1. Infrastructure Development: The government must increase investment in the development and maintenance of equitable sanitation infrastructure, including wastewater drainage, wastewater treatment plants (WWTP), and waste management facilities.
2. Community Empowerment: Conducting more intensive education and outreach programs on good sanitation at the community level, and increasing community participation in sanitation management.
3. Technology Utilization: Encourage the use of locally appropriate technologies for waste treatment, such as the use of biogas toilets or nature-based wastewater treatment systems.
4. Law Enforcement: The government must strictly enforce sanitation regulations, including imposing sanctions on violators who litter or ignore environmental cleanliness.
5. Multi-Stakeholder Collaboration: Increasing collaboration between government, private sector, NGOs and communities to provide more sustainable sanitation solutions.

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