

DEVELOPMENT OF AN ENVIRONMENTALLY FRIENDLY SANITATION SYSTEM IN TANJUNG PURA DISTRICT, LANGKAT REGENCY

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Abstract

This study aims to explore the development of an environmentally friendly sanitation system that is in accordance with the social, economic, and environmental characteristics in Tanjung Pura District, Langkat Regency. Based on existing conditions that indicate low quality of sanitation management, this study identifies various models of sanitation systems that can be applied in the area, including community-based decentralized sanitation systems, communal wastewater treatment systems, and green technology. The results of the study indicate that community-based sanitation models and communal wastewater treatment are the most appropriate solutions to improve sanitation and environmental quality in Tanjung Pura District. The importance of community roles and collaboration between various stakeholders, such as government, private sector, and non-governmental organizations, are also emphasized as success factors in developing a sustainable sanitation system.

Keywords: *Sanitation Development, Environmentally Friendly, Community Participatory Sanitation System, Stakeholder Collaboration.*

INTRODUCTION

Good sanitation is one of the fundamental aspects in improving the quality of life of the community. In various regions, including Tanjung Pura District, Langkat Regency, the challenge of providing adequate sanitation systems is still an important issue that requires serious attention. Inadequate sanitation conditions not only impact public health, but also cause environmental problems such as groundwater pollution, unpleasant odors, and the spread of environmentally-based diseases. This is further exacerbated by the increasing population and urbanization that is not balanced by the development of environmentally friendly sanitation infrastructure. Based on initial observations, most sanitation systems in Tanjung Pura District still rely on conventional systems that do not meet sustainability standards. Many sanitation facilities do not pay attention to the principles of proper waste management, such as the use of septic tanks that are not watertight or direct discharge into water bodies without prior treatment. This condition increases the risk of environmental pollution, especially to clean water sources that are vital to community life.

On the other hand, the growing awareness of the importance of sustainable development opens up opportunities to develop more environmentally friendly sanitation systems. The concept of environmentally friendly sanitation does not only focus on waste disposal, but also includes efforts to process, reuse, and reduce negative impacts on the environment. The implementation of innovative sanitation technology, community-based management, and ecological approaches are strategies that can be applied to address sanitation issues in Tanjung Pura District. The development of this environmentally friendly sanitation system is very important to encourage the creation of a healthy residential environment, improve the quality of life of the community, and support the achievement of sustainable development goals (SDGs), especially in point 6, namely "Clean Water and Adequate Sanitation for All". The concept of environmentally friendly sanitation does not only focus on waste disposal, but also includes efforts to process, reuse, and reduce negative impacts on the environment (Akus Harmoko et al., 2024). Therefore, it is necessary to conduct an integrated study and planning to formulate a sanitation system development model that is effective, efficient, and in accordance with social, economic, and environmental conditions in Tanjung Pura District.

Tanjung Pura District, Langkat Regency, is currently facing various serious problems related to the sanitation system. Although the need for proper sanitation is increasingly urgent along with population growth, in reality, most people still use a domestic waste disposal system that does not meet health and environmental sustainability standards. Many households dispose of waste directly into open drainage channels or into rivers without processing, causing water and soil pollution around the settlement. This phenomenon is exacerbated by the lack of adequate public sanitation facilities, as well as low public awareness of the importance of clean and healthy living behavior. In several villages, the septic tank installations used do not meet technical standards, such as not being watertight, not being pumped out regularly, and some even leak, polluting the groundwater sources that residents use daily for consumption needs. This condition increases the risk of transmission of various environmental-based diseases, such as diarrhea, digestive tract infections, and skin diseases. In addition, the limited budget of local governments for sanitation development, the lack of strict domestic waste management regulations, and weak coordination between related agencies, have worsened the situation. Efforts to educate the public about environmentally friendly sanitation management are also still not optimal. As a result, this sanitation problem not only has an impact on health aspects, but also reduces the quality of the environment and has the potential to hinder sustainable regional development. This phenomenon illustrates the need for planned and integrated interventions to develop a sanitation system that is not only effective from a technical perspective, but also oriented towards environmental conservation. A community-based approach, the application of environmentally friendly technology, and increased collective awareness are needed to create a clean, healthy, and sustainable environment in Tanjung Pura District.

Research on the development of an environmentally friendly sanitation system in Tanjung Pura District, Langkat Regency is very important to be carried out immediately, considering that the sanitation conditions in the area are still far from adequate standards and have the potential to cause serious impacts on public health and environmental sustainability. Poorly managed sanitation systems have caused water and soil pollution, which ultimately increases the risk of spreading environmentally-based diseases. If not addressed immediately, this condition can worsen the quality of life of the community and increase the burden of health costs in the future. In addition, in the context of sustainable development, sanitation management is one of the important indicators in achieving the Sustainable Development Goals (SDGs), especially goal number 6 on access to clean water and proper sanitation. Therefore, efforts to develop a sanitation system that is not only effective in processing waste, but also environmentally friendly, are an urgent need. This research is expected to be able to provide concrete solutions that are in accordance with the social, cultural, and economic characteristics of the community in Tanjung Pura District, so that the interventions designed can be accepted and implemented sustainably. Another urgency lies in the need to develop a community-based sanitation model that encourages active participation of residents in sanitation management, while introducing simple, affordable, and environmentally friendly waste processing technologies. Thus, this study not only contributes in the form of technical recommendations, but also builds collective awareness of the community to protect their environment. Through this study, it is hoped that a more comprehensive understanding can be obtained regarding the challenges and opportunities in developing an environmentally friendly sanitation system in Tanjung Pura District, which will ultimately become the basis for policy making and planning more effective, efficient, and sustainable sanitation programs in the future.

Various previous studies have discussed sanitation management, both from technical, social, and environmental aspects. For example, research by Sutrisno (2018) on "Application of Biofilter Technology for Domestic Wastewater Treatment in Urban Areas" shows that the use of environmentally friendly technology can improve the quality of wastewater, thereby reducing environmental pollution. This study emphasizes more on the technological aspect of wastewater treatment with an engineering approach, but pays less attention to social factors and community empowerment in sustainable management. Furthermore, Lestari and Pratama (2020) in their study "Community-Based Sanitation Management Model in Peri-Urban Areas" highlight the importance of community involvement in sanitation management to create sustainable behavioral change. This study provides an overview that the social aspect is very important in the sanitation system, but has not specifically examined the application of simple technology that is appropriate to local conditions in rural or semi-urban areas such as Tanjung Pura District. Another study by Ramdhan (2021) on "Evaluation of Sanitation Infrastructure and its Implications for Environmental Health in Coastal Areas" found that inadequate infrastructure increases the risk of disease spread, but focuses more on evaluating existing conditions without developing concrete models or solutions that are environmentally friendly and participatory.

Identification of problems

Based on the background, phenomena, urgency, and research gaps that have been described previously, several problems can be identified as follows:

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1. Sanitation conditions in Tanjung Pura District still do not meet the standards of proper and environmentally friendly sanitation.
2. There is still a lot of domestic waste being dumped into the environment without adequate processing, thus polluting water and soil.
3. Minimal use of simple, effective and environmentally friendly waste processing technology.
4. Lack of community awareness and participation in sustainable sanitation management.
5. There is no sanitation development model based on local conditions, which integrates technical, social and environmental aspects.
6. Limited regulatory, program, and infrastructure support from local governments in supporting environmentally friendly sanitation.

Formulation of the problem

Based on the identification of the problem, the formulation of the problem in this study can be arranged as follows:

1. What is the existing condition of the sanitation system in Tanjung Pura District, Langkat Regency?
2. What are the factors that hinder the development of an environmentally friendly sanitation system in Tanjung Pura District?
3. What is the role of the community and stakeholders in supporting the development of environment-based sanitation?
4. What kind of environmentally friendly sanitation system development model is appropriate to the social, economic, and environmental characteristics of Tanjung Pura District?

LITERATURE REVIEW

2.1 Concept of Sanitation

Sanitation is an effort made to maintain and improve the quality of the environment, especially in preventing human contact with hazardous waste that can cause disease. According to the World Health Organization (WHO) in a study cited by Pratiwi (2018), sanitation includes the provision of facilities and services for the disposal of human waste, both in the form of feces and urine, as well as the safe management of liquid waste. Poor sanitation is known to be closely related to various infectious diseases, so its development is an important factor in public health.

2.2 Understanding Environmentally Friendly Sanitation

Eco-friendly sanitation refers to a sanitation system approach that prioritizes waste management that is safe for humans and the environment, while minimizing ecological impacts. According to Rahmawati (2019), an eco-friendly sanitation system is a system that applies the principle of recycling resources, such as water and nutrients, and reduces pollution to soil, water, and air. The goal is not only to meet basic human needs for sanitation, but also to maintain the sustainability of the surrounding ecosystem.

2.3 Principles of Environmentally Friendly Sanitation

Based on Susanto's opinion (2020), there are several basic principles in developing an environmentally friendly sanitation system, namely:

1. Resource Efficiency: Using water and energy as efficiently as possible.
2. On-site Waste Processing: Waste is processed on-site to reduce the burden on public waste systems.
3. Waste Recycling: Reusing waste for agricultural purposes (such as compost or biogas).
4. Environmental Impact Reduction: The system must reduce carbon emissions and pollution.

Susanto (2020) also added that this approach needs to be adapted to local conditions, both in terms of culture, economy, and geographical characteristics.

2.4 Strategy for Developing an Environmentally Friendly Sanitation System

According to Handayani (2019), the strategy for developing an environmentally friendly sanitation system at the regional level includes several steps, including:

1. Mapping of existing sanitation needs and conditions.
2. Education and outreach to the community about the importance of environmental sanitation.
3. Selection of appropriate sanitation technologies, such as dry composting toilets, bio-septic tanks, and constructed wetlands.

4. Strengthening local regulations that support the development of green sanitation infrastructure.
5. Involvement of local communities in planning and management of sanitation systems.

This strategy is considered effective in increasing public awareness while maintaining the sustainability of the system in the long term. (Sugiarto & Kustiah Ramadania, 2024).

2.5 Environmentally Friendly Sanitation Technology

Based on a study by Yusuf (2020), several environmentally friendly sanitation technologies include:

1. Bio-septic tank: A biological septic tank that uses anaerobic bacteria to break down waste.
2. Dry Toilet: A sanitation system that does not use water to dispose of human waste, making it suitable for areas experiencing water crises.
3. Constructed Wetlands: Artificial wetlands that function as a liquid waste treatment system by utilizing aquatic plants.

This technology is not only effective in processing waste, but also has additional benefits such as the production of organic fertilizer or renewable energy.

2.6 Relevance to Tanjung Pura District, Langkat Regency

Tanjung Pura District in Langkat Regency has the characteristics of a lowland area with several areas prone to flooding and groundwater pollution. Based on the principles and technologies that have been put forward, the development of an environmentally friendly sanitation system in this area must take into account local geographic and socio-cultural conditions. Approaches that can be used include the development of community-based bio-septic tanks, the use of dry toilet technology in flood-prone areas, and massive environmental health education campaigns.

2.7 Framework of Thought

Poor sanitation has a direct impact on public health and environmental pollution. Therefore, it is necessary to develop an environmentally friendly sanitation system that does not only focus on waste disposal, but also maintains the sustainability of the ecosystem.

Problem:

Poor Sanitation → Infectious Diseases + Environmental Pollution



Objective:

Development of Environmentally Friendly Sanitation Systems



Principles:

- Resource Efficiency
- On-site Waste Management



Alternative Technology



Implementation Strategy:

- Mapping of Sanitation Needs
- Education and Counseling
- Selection of Appropriate Technology



Expected results:

- Clean Environment
- Improved Health
- Ecosystem is maintained
- Sustainability of Sanitation

The development of an environmentally friendly sanitation system is based on the principles of resource efficiency, on-site waste management, recycling, and reducing environmental impact. Technologies such as bio-septic tanks, dry toilets, and constructed wetlands are alternative solutions that can be applied according to regional characteristics. In the context of Tanjung Pura District which has low-lying areas and is vulnerable to flooding,

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sanitation development must consider geographic, social, and economic factors of the community. A strategy is needed in the form of mapping sanitation needs, educating the community, selecting the right technology, and actively involving the community in managing the sanitation system. With this approach, it is hoped that an environmentally friendly, sustainable sanitation system will be realized and can improve the quality of life of the Tanjung Pura District community.

RESEARCH METHODS

3.1 Research Approaches and Types

This study uses a qualitative approach with a descriptive research type. According to Sugiyono (2018), a qualitative approach aims to understand the phenomena experienced by research subjects holistically through descriptions in the form of words and language, in a specific natural context. (Sugiarto et al., 2024). Descriptive research aims to describe systematically and factually the facts and characteristics of a particular population or phenomenon (Notoatmodjo, 2019). In this context, a descriptive qualitative approach is used to explore and describe the existing conditions, challenges, and strategies for developing an environmentally friendly sanitation system in Tanjung Pura District, Langkat Regency.

3.2 Location and Time of Research

This research was conducted in Tanjung Pura District, Langkat Regency. This location was chosen because it has environmental characteristics that are vulnerable to pollution and suboptimal sanitation. The research period is planned to take place from May to July 2025.

3.3 Research Informants

The informants in this study were selected by purposive sampling. According to Creswell (2018), purposive sampling is a sampling technique with certain considerations to obtain in-depth data. The informants selected include:

1. Sub-district and village government apparatus related to sanitation.
2. Community users of sanitation systems.
3. Community leader and environmental activist.
4. Sanitation service provider.

The number of informants was adjusted until the data obtained reached saturation (Redjeki, 2020).

3.4 Data Collection Techniques

Data collection techniques are carried out using the following methods:

1. In-depth interviews: to explore experiences, perceptions, and expectations regarding sanitation development.
2. Direct observation: observing the existing condition of the sanitation system and community behavior.
3. Documentation study: reviewing documents related to sanitation programs and regional policies.

According to Moleong (2019), a combination of these techniques is needed to increase the validity and depth of the data.

3.5 Data Analysis Techniques

Data analysis in this study uses thematic analysis method. Data from interviews, observations, and documentation are analyzed through the following stages:

1. Data Reduction: filtering relevant data.
2. Data Presentation: organizing data into categories or themes.
3. Drawing Conclusions: formulating findings based on emerging patterns.

In line with the opinion of Miles, Huberman, and Saldaña (2018), thematic analysis allows researchers to find important themes from qualitative data to understand the phenomenon being studied.

3.6 Data Validity Test

Data validity testing is carried out by:

1. Source Triangulation: comparing information from various informants and data sources.
2. Triangulation Technique: using more than one data collection technique.
3. Member Checking: asking the informant for confirmation regarding the interpretation of the data obtained.



Figure 4.2 Overview of the Existing Condition of the Sanitation System in Tanjung Pura District, Langkat Regency

Although there are several programs from the local government that try to address sanitation issues, such as counseling on the importance of clean and healthy sanitation, as well as assistance for the construction of sanitation facilities in households, these programs have not been able to fully reach all levels of society in Tanjung Pura District. The obstacles faced include limited funds, low public awareness, and lack of active participation from residents in managing the existing sanitation system. Overall, the existing condition of the sanitation system in Tanjung Pura District, Langkat Regency shows the need for more comprehensive improvement efforts. A more comprehensive approach is needed in planning and building sanitation infrastructure that is in accordance with local characteristics, which integrates technical aspects of waste management, community empowerment, and policy support from the local government.

What are the factors that are obstacles in the development of an environmentally friendly sanitation system in Tanjung Pura District?

The development of an environmentally friendly sanitation system in Tanjung Pura District, Langkat Regency faces a number of quite complex obstacles. Several factors that are the main obstacles in efforts to develop better and environmentally friendly sanitation in this area include technical, social, economic, and institutional aspects. The following is a discussion of these factors:

1. **Infrastructure and Technology Limitations**

One of the main factors that hinders the development of environmentally friendly sanitation systems in Tanjung Pura District is the limited infrastructure available. Most sanitation facilities in this area still rely on simple conventional waste disposal systems, such as septic tanks or direct discharge into open drainage channels. Many septic tanks do not meet technical standards, such as being unsealed or poorly maintained, causing groundwater pollution. Environmentally friendly waste treatment technologies, such as biofilter systems or communal-based liquid waste treatment, have not been widely implemented, although these technologies can be more efficient and sustainable solutions.

2. **Resource and Financing Limitations**

Budget constraints from the local government are one of the main obstacles in developing an environmentally friendly sanitation system in Tanjung Pura District. Although sanitation is an important aspect of regional development, the available budget is often insufficient to finance the development of adequate sanitation infrastructure. In addition, the cost of maintaining and managing an environmentally friendly sanitation system tends to be higher than that of a conventional system. These resource limitations mean that many sanitation programs cannot be implemented optimally.

3. **Low Public Awareness**

Another significant obstacle in the development of environmentally friendly sanitation is the low level of public awareness of the importance of healthy sanitation and a clean environment. Many residents still think that disposing of waste directly into rivers or open channels is not a big problem. The lack of understanding of the impact of poor sanitation on health and the environment, as well as the lack of education about clean living behavior, makes it difficult for sanitation improvement efforts to be widely accepted. For this reason, a community empowerment approach is needed so that residents can be more concerned and active in sanitation management. (Harahap *et al.*, 2024)

4. **Limitations of Government Regulation and Policy**

Although local governments have issued several policies related to sanitation management, existing regulations are often not sufficient to support the development of environmentally friendly sanitation systems

effectively. Some existing policies do not specifically cover regulations that support environmentally friendly sanitation technology, or do not even pay attention to the potential of the community in sanitation management. The lack of supervision of policy implementation also causes many sanitation programs to not run optimally. This shows that more integrated and systematic policies need to be made to support the development of sustainable sanitation systems.

5. Geographical and Topographic Characteristics

Geographical and topographical factors in Tanjung Pura District also affect the development of environmentally friendly sanitation systems. Some areas located in lowland areas or close to water bodies, such as rivers or swamps, have their own challenges in waste management. Existing drainage systems are often inadequate, and environmentally friendly waste management requires technology that can adapt to local environmental conditions. In addition, the development of sanitation infrastructure in areas with uneven topography also requires more mature planning in order to reduce the risk of pollution and increase the effectiveness of sanitation management.

6. Lack of Coordination Between Stakeholders

The development of an environmentally friendly sanitation system requires cooperation between various parties, including the government, the community, and the private sector. However, coordination between stakeholders in Tanjung Pura District is still weak. Sometimes, the sanitation programs that are implemented are not well integrated, both in terms of technical, social, and policy. This disharmony between related parties hinders efforts to create an effective and sustainable sanitation system.

Overall, the development of an environmentally friendly sanitation system in Tanjung Pura District faces various challenges that need to be addressed in an integrated manner. Therefore, a holistic approach is needed, starting from increasing public awareness, building adequate infrastructure, strengthening regulations, to better collaboration between the government, the community, and related parties.

What is the role of the community and stakeholders in supporting the development of environmentally based sanitation?

The development of an environmentally friendly sanitation system in Tanjung Pura District, Langkat Regency cannot be separated from the active role of the community and the involvement of various stakeholders. The role of these two elements is very important to ensure that the sanitation system developed is not only technically effective, but also sustainable and in accordance with local needs and socio-economic conditions. Therefore, collaboration between the community, government, and the private sector is a determining factor in the success of an environmentally friendly sanitation program.

1. Role of Society

The community has a very important role in supporting the development of an environmentally based sanitation system. Some of the main roles that can be taken by the community are as follows:

a) Participation in Planning and Development

Communities must be involved from the planning stage in the development of sanitation systems. Community participation in planning and selecting sanitation technologies that are appropriate to local conditions is very important. For example, choosing environmentally friendly waste management that suits the needs and habits of the community, such as biofilter technology, communal-based wastewater treatment, or decentralized waste management systems.

b) Empowerment in Sanitation Management

One of the best ways to ensure the sustainability of sanitation management is to empower communities to manage sanitation facilities independently.(Hidayat et al., 2023). This empowerment can be done through training and education on how to care for and maintain sanitation facilities, the importance of wastewater management, and the negative impacts of poor sanitation on health and the environment. Communities that have sufficient knowledge will be more motivated to maintain the cleanliness of the environment and existing sanitation facilities.

c) Behavior Change

Changing community behavior in terms of sanitation management is an important step. Continuous education about the importance of clean and healthy sanitation will increase public awareness not to litter or dispose of liquid waste into open channels. Health and hygiene campaigns can be a means to change ingrained bad habits, such as dumping waste into rivers or drainage channels.

2. Role of Stakeholders

In addition to the community, other stakeholders also play an equally important role in supporting the development of an environmentally based sanitation system. These stakeholders include local governments, the private sector, and non-governmental organizations (NGOs). The following are the roles of each stakeholder:

a) Local government

Local governments play a major role in formulating policies and providing regulations that support the development of environmentally friendly sanitation systems. The government is also responsible for allocating budgets, both for the development of sanitation infrastructure and for education and outreach programs to the community. In addition, the government must also play a role in providing public sanitation facilities in areas that have not been reached, as well as providing incentives or support for the implementation of environmentally friendly sanitation technologies. Not only that, local governments must also ensure that there is supervision and enforcement of regulations on sanitation management. Without effective supervision, environmentally-based sanitation programs will be difficult to run well. Therefore, government involvement in ensuring the quality and sustainability of sanitation management is crucial.

b) Private Sector

The role of the private sector, especially companies engaged in technology and waste management, is very important in providing innovative and environmentally friendly technological solutions for waste management. Private companies can help introduce new technologies that are more efficient, affordable, and suited to local needs. In addition, the private sector can also play a role in implementing environmentally-based sanitation projects, both in terms of providing infrastructure, training, and maintaining sanitation facilities. On the other hand, the private sector can also work with local governments to develop innovative funding models, such as public-private partnerships (PPPs), to fund larger and more sustainable sanitation projects.

c) Non-Governmental Organizations (NGOs)

Non-governmental organizations (NGOs) often play a critical role in providing direct assistance to communities in sanitation management. NGOs can act as facilitators in building community capacity through training, awareness campaigns, and educational programs on clean and environmentally friendly sanitation. NGOs can also help design and implement small community-based projects, such as building public toilets or communal wastewater treatment systems. In addition, NGOs often serve as a bridge between communities and government, voicing community needs and problems related to sanitation and providing recommendations for improvement.

3. Collaboration between stakeholders

To achieve the goal of developing an environmentally friendly sanitation system in Tanjung Pura District, good collaboration between the community, government, private sector, and non-governmental institutions is essential. Each party has a complementary role, so effective and efficient coordination is needed to create sustainable sanitation solutions. Through this collaboration, it is hoped that a sanitation system can be created that is not only environmentally friendly, but can also be accepted and maintained by the community in the long term.

What kind of environmentally friendly sanitation system development model is appropriate to the social, economic and environmental characteristics of Tanjung Pura District?

The development of an environmentally friendly sanitation system in Tanjung Pura District, Langkat Regency requires an approach that integrates various aspects, ranging from social, economic, to local environmental characteristics. Therefore, the sanitation development model applied must be able to adapt to community conditions, economic potential, and the existing natural environment. Here are some models that can be considered in this context:

1. Community-Based Decentralized Sanitation Model

Given the social characteristics of the community in Tanjung Pura District which still relies on a household system and is based on dense settlements, a decentralized community-based sanitation model can be an effective solution. This model prioritizes the development of a sanitation system managed by the community itself, with support from the government and other related parties. In this model, each household or community group can manage domestic waste independently through the use of environmentally friendly technologies, such as biogas, communal-based liquid waste processing, or solid waste processing with environmentally friendly technologies such

as composters. Decentralized management provides advantages because it can be adapted to local conditions, accelerates the development process, and facilitates maintenance and supervision by the community itself. With this approach, the community is directly involved in the development and maintenance of the sanitation system, so that they can better understand the importance of good and sustainable waste management. In addition, this model allows for increased awareness and active involvement of the community in maintaining environmental cleanliness and health.

2. Communal Wastewater Treatment System Model

The geographical characteristics of Tanjung Pura District, which consists of densely populated settlements and most of its areas are located close to water bodies, such as rivers and swamps, require a more effective approach to liquid waste management. The decentralized wastewater treatment system model is the right choice for this area. In this model, liquid waste from several households will be collected and processed together using environmentally friendly communal-based wastewater treatment technology. Some technologies that can be applied include those that utilize plants to process waste. This technology can be adjusted to soil conditions and water availability in the area, and is more efficient in terms of cost and maintenance compared to a centralized treatment system. The communal system model can also reduce the risk of groundwater and water body pollution, and can improve the quality of water around residential areas. In addition, this collective waste management also facilitates the community in sharing resources and strengthening a sense of togetherness in maintaining environmental cleanliness.

3. Solid Waste Processing Model with Environmentally Friendly Technology

In Tanjung Pura District, household solid waste, especially organic waste, is often not managed properly. One suitable development model is solid waste management through composting or community-based waste processing. This technology is very suitable for application in areas that still depend on agricultural and fisheries activities, because organic waste can be processed into compost which is useful as fertilizer to improve soil quality. In addition, communal-based waste processing technology, such as integrated waste processing sites (TPST), can be applied to manage waste more efficiently. In the TPST model, waste will be sorted first between organic and inorganic, then organic waste will be processed into fertilizer, while inorganic waste will be processed for recycling or further management. The application of this community-based waste processing model requires socialization and training to the community to increase their awareness and involvement in sorting waste. In addition, this approach provides dual benefits for the community, namely reducing the volume of waste that pollutes the environment and providing useful results, such as compost that can be used for agriculture or household gardens.

4. Green Technology and Renewable Energy Implementation Model

With the potential of existing natural resources, such as organic waste from agriculture and fisheries, Tanjung Pura District has the opportunity to apply green technology in sanitation management. One technology that can be applied is a liquid waste processing system with biogas, which converts waste into a renewable energy source. The biogas produced can be used for household needs or forwarded to a small energy processing unit. In addition, the use of environmentally friendly technologies such as constructed wetlands that utilize natural processes to clean wastewater can also be applied in this area. This technology can reduce operational and maintenance costs, as well as minimize environmental impacts. The application of this green technology is in accordance with the socio-economic conditions of the community, most of whom depend on the agricultural sector, because this technology can also increase community income through the use of waste as a source of energy or organic fertilizer. In addition, the development of this technology will also strengthen public awareness of the importance of environmental sustainability.

5. Collaboration Model between Government, Community, and Private Sector

To optimize the implementation of environmentally friendly sanitation development models, collaboration between the government, community, and private sector is essential. Local governments play a role in providing supportive regulations, budget allocation, and facilitation in the implementation of environmentally-based sanitation projects. Communities, as previously discussed, must be involved in the sanitation planning and management process, while the private sector can play a role in providing innovative technology and financing sanitation projects. This collaborative model will strengthen the implementation of environmentally-based sanitation programs and ensure that the systems built can be accepted, maintained, and run well in the long term. Considering the social, economic, and environmental characteristics in Tanjung Pura District, the development model of an environmentally friendly sanitation system must be based on technology that is easy to implement, efficient, and can be managed by the

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community. The implementation of a communal and decentralized sanitation model, as well as the use of green technology that utilizes waste for energy or fertilizer, is expected to be a sustainable and beneficial solution for the local community.

CLOSING

Conclusion

Based on the results of research conducted on the development of environmentally friendly sanitation systems in Tanjung Pura District, it can be concluded that sanitation management in this area faces various challenges, both in terms of infrastructure, funding, and community participation. However, there is a great opportunity to implement an environmentally-based sanitation system that is in accordance with local social, economic, and environmental characteristics. The most suitable model for this area is a decentralized community-based sanitation system, which allows each household or community group to manage waste independently with environmentally friendly technology. In addition, the implementation of communal wastewater treatment systems, community-based waste processing, and green technologies such as biogas can provide dual benefits, namely more efficient waste management and increased community welfare through the utilization of local resources. The success of developing this environmentally friendly sanitation system is highly dependent on the active role of the community, support from stakeholders, and good collaboration between the government, private sector, and non-governmental organizations.

Suggestion

Based on these conclusions, several suggestions that can be given for the development of an environmentally friendly sanitation system in Tanjung Pura District are:

1. Increasing Community Socialization and Education

It is important to raise public awareness about the importance of environmentally friendly sanitation through structured education programs. The public needs to be given an understanding of how to manage domestic waste, the benefits of environmentally friendly waste processing, and the impact of poor sanitation on health and the environment.

2. Strengthening Collaboration between Stakeholders

The development of sanitation systems must involve various parties, including local governments, communities, the private sector, and non-governmental organizations. This collaboration is important to ensure that all technical, social, and economic aspects of sanitation development can be managed well and sustainably.

3. Infrastructure Provision and Financing

Local governments should play an active role in providing the necessary infrastructure, as well as allocating adequate funds for the construction and maintenance of sanitation systems. In addition, a public-private partnership (PPP)-based funding model can be considered to optimize sanitation project financing.

4. Implementation of Environmentally Friendly Technology

Environmentally friendly technologies such as biogas, composters, and constructed wetlands need to be implemented in waste management, considering the sustainability and cost efficiency offered by these technologies.

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