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SUSTAINABLE DEVELOPMENT STRATEGY OF DOMESTIC WASTEWATER TREATMENT INSTALLATION (IPAL) IN BANDUNG REGENCY

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Abstract
This study discusses the sustainable development of Domestic Wastewater Treatment Plants (IPAL) in the Working Area of UPTD Domestic IPAL Soreang, Bandung Regency. Sanitation services in this area are still not optimal, especially in the processing of domestic wastewater in residential areas. This study aims to obtain data and formulate effective strategies in the management of domestic wastewater treatment plants. Using a qualitative method with a case study approach, this study identified five main factors that influence the sustainability of domestic wastewater treatment plant development, namely institutional, service, social, economic, and environmental aspects. From the results of the study, six alternative strategies were formulated to increase the effectiveness of domestic wastewater treatment plant development, namely: (1) Meeting the needs of domestic wastewater treatment facilities; (2) Strengthening management institutions, such as the establishment of BUMD or BLU; (3) Encouraging alternative financing through corporate social and environmental responsibility (TJSLP); (4) Preparing supporting regulations in the form of Regent Regulations (Perbup); (5) Applying legal sanctions for direct wastewater discharge into the environment; and (6) Optimizing the Community-Based Total Sanitation (STBM) program to reduce the practice of open defecation (BABS). These strategies are expected to increase the effectiveness and sustainability of domestic wastewater treatment plant management, so that they have a positive impact on the environment and public health of Bandung Regency.

Keywords: Alternative Strategy, Sustainable Development, Domestic Wastewater Treatment, Residential Area, Bandung Regency,

A. INTRODUCTION

Water and sanitation have an essential role in supporting human survival and maintaining health (Alfin et al., 2022). Thus, water and sanitation must be recognized as key components in efforts to fulfill human rights to a decent standard of living and the right to optimal health (Salata, 2015). This principle is in line with the mandate contained in the 1945 Constitution. In relation to this, the complexity of the sanitation development program in the Bandung Regency area is an interesting issue and is currently receiving attention. One aspect that is of primary concern is the Target of achieving Universal Access 100-0-100 including the provision of 100% access to proper sanitation, in accordance with the 2020-2024 Regional Medium-Term Development Plan (RPJMD).

Bandung Regency as one of the regencies in West Java Province has the second highest population after Bogor Regency. Based on the 2023-2024 Population Aggregate Data for Bandung Regency, the population of Bandung Regency reached 3,749,172 people (Didukcapil, 2024). The large population creates its own challenges for the commitment of the Bandung Regency Government in providing access to residential sanitation services. In the existing conditions, sanitation services in Bandung Regency until now tend to be less than optimal, seen from the coverage of wastewater sector services in 2018 to 2021 which only reached

71.13%,2 and has not reached the Millennium Development Goals (MDGs) target (Pracastino et al. (nd). It appears that the sanitation conditions in Bandung Regency were previously still below the established MDGs standards, so that they are currently being continued in achieving the Sustainable Developments Goals (SDGs) until 2030.

Through its participation in the Settlement Sanitation Development Acceleration Program (PPSP), the Bandung Regency Government remains determined to improve the quality of settlement sanitation in Bandung Regency (Pratiwi, 2023). In this case, there are four sanitation sectors that are the main focus of handling, namely the domestic wastewater sector, the waste sector, the residential drainage sector and the PHBS (Clean and Healthy Living Behavior) sector. It is realized that to achieve the sanitation achievement target, follow-up is needed. The strategic issues of the sanitation sector that have been identified need to be followed up with efforts to formulate a clear strategy towards optimal sanitation services in the future (Zulkifli et al., 2024). In response to this, updating the strategy for improving sanitation conditions in settlements in Bandung Regency is absolutely necessary, especially in achieving sustainable development goals.

Conceptually, Budimanta (2004) provides a view that sustainable development is a strategic approach that is carried out systematically and in a planned manner to improve welfare, quality of life, and environmental sustainability, without reducing the rights and opportunities for future generations to enjoy them. Thus, the concept of sustainable development emphasizes meeting current needs without sacrificing the needs of future generations as a whole. Therefore, one of the main challenges in realizing sustainable development is creating solutions that can prevent and overcome environmental damage, while supporting economic development and social justice in a balanced manner (Wibawa, 2019).

Manifestation of these conditions, the Bandung Regency Government utilizes the Domestic Wastewater Treatment Plant (IPAL) infrastructure which is a mandatory regional government affair as a form of basic service for the community, which aims to increase access to environmentally friendly domestic wastewater services in order to achieve an increase in the quality of community life, and the realization of a healthy environment. Associated with the main problems raised in this study, the benchmark that is put forward is the concept of sustainable development that focuses on the pro-environmental role of the government, especially in the Work Area of the Regional Technical Implementation Unit (UPTD) of the Soreang Domestic Wastewater Treatment Plant (IPAL) for domestic wastewater management in protecting and preserving water resources, including environmental quality management by controlling the discharge of domestic wastewater directly to the surface of the water and land through optimization of the Domestic Wastewater Treatment Plant (IPAL) infrastructure in Bandung Regency.

Bandung Regency Regional Regulation Number 11 of 2020 concerning Domestic Wastewater Management emphasizes that domestic wastewater management must be based on the principles of government responsibility, sustainability, integration, justice, openness, participation, awareness, application of the polluter pays principle, benefit, and good governance. However, considering that sanitation services are currently not optimal, an effective strategy is needed to realize a clean and healthy Bandung Regency as an effort to protect public health. As a complement, the Regulation of the Minister of Environment and Forestry (Permen LHK) Number 68 of 2016 concerning Domestic Wastewater Quality Standards states that domestic waste generated from household activities, businesses, or activities has the potential to pollute the environment, so it must go through a processing process before being discharged into the environment

This research is based on problems related to the sustainable development of Domestic Wastewater Treatment Plants (IPAL) in the UPTD Domestic IPAL Soreang Work Area, Bandung Regency. Although domestic wastewater treatment in this area has been carried out, its effectiveness and sustainability are still not optimal. Therefore, this study aims to understand how sustainable development of domestic wastewater treatment plants takes place in the region and to identify factors that cause suboptimal management, both from institutional, service, social, economic, and environmental aspects. In addition, this study also attempts to

formulate appropriate alternative strategies to increase the effectiveness of domestic wastewater treatment plant development so that it can run better and more sustainably. Thus, the results of this study are expected to provide concrete recommendations for local governments and related parties in managing domestic wastewater treatment systems more efficiently and effectively.

B. LITERATURE REVIEW

Strategy Concept

In general, strategy is the process of formulating and determining plans by the highest executive officials in public institutions, which are oriented towards achieving the organization's long-term goals, which are complemented by determining the steps or efforts that must be taken to realize these goals. Conceptually, Sedarmayanti (2014) states that: "Strategy is a long plan, followed by actions aimed at achieving certain goals, which are generally victory". In strategy there is an analysis of factors that are very useful in formulating alternatives that will facilitate the highest decision makers (in each organization) in choosing the best alternative. The choice of the best alternative is made after considering the consequences that will arise if an alternative is chosen and implemented.

Complementing this, Salusu (2015) raised Chandler's view that: "Strategy can be defined as the determination of long-term goals and objectives of an organization and the use of a series of actions and allocation of resources needed to achieve these goals". There are three important components in Chandler's definition, namely the existence of goals and objectives, the existence of a way of acting, and the allocation of resources to achieve goals". Thus, in making decisions as part of strategic planning, it must be linked to the environment (internal and external) considering that the function of strategy is to create patterns in missions, goals, policies, programs, actions, and important decisions, and to be a bridge between organizational resources and their environment.

Development Concept

Conceptually, Kartasasmita (1996) stated that: "Development is essentially from and for all the people". Thus, in an effort to achieve the intended development targets, it must involve and in turn be enjoyed by all levels of society. This demand is actually in accordance with the concept of sustainable development. Furthermore, Nurman (2019) raised Siagian's view that "Development as an effort or series of growth and change efforts that are planned and carried out consciously by a nation, state, and government, towards modernity in the context of nation building". Complementing this, Iskandar (2020) raised McMichael's view that: "The essence of development inevitably contains changes".

The development of further thinking on development is not only related to increasing real income, but more broadly the concept of development concerns the most fundamental thing, namely the quality of human beings themselves. Thus, the concept of developing the quality of human resources means a planned effort to improve the personal and social conditions of a nation, in order to play a role in determining a better future .

Concept of Sustainable Development

Nurman (2019:121) raised the concept of sustainable development popularized through the WCED report, entitled "Our Common Future". This report defines "Sustainable development as development that meets the needs of the current generation without reducing the ability of future generations to meet their own needs. Furthermore, Nurman (2019:122) raised Budimanta's view that: "Sustainable development is a perspective on activities carried out systematically and in a planned manner within the framework of improving the welfare, quality of life and environment of humanity without reducing access and opportunities for future generations to enjoy and utilize it. " The sustainable development process includes a planned change process, consisting of 3 (three) pillars of sustainable development, namely: economic development policies, social development and environmental protection. The three pillars are interrelated and are the driving pillars for sustainable development. At each stage, the goal of development is economic growth, but with the basis of

consideration of increasingly comprehensive aspects in each stage. The first stage, the basis of consideration is only on ecological balance. The second stage, the basis is consideration by including aspects of social justice. The third stage, basic considerations in development also include aspects of the political and socio-cultural aspirations of the local community, such as customs.

Related to the focus and limitations of the research raised in this study is the concept of sustainable development, with the benchmark using Syahputra's view raised by Nurman (2019:124), regarding environmental management guidelines, because it has a very close relationship with sanitation services, especially domestic wastewater management, including:

1) Placing a development project activity in the correct location according to ecological principles. This refers to efforts to minimize negative impacts on the surrounding natural environment. This is related to the governance of Domestic IPAL, environmental impacts, government commitments to community participation.
2) Utilization of renewable resources (renewable resources) must not exceed their sustainable potential, as well as efforts to find replacements for non-renewable resources. This is related to the principle of sustainability or sustainability in the management of natural resources (water and land). This is related to the implementation of regulations, public awareness, cooperation between stakeholders, to government efforts to maintain water quality so that it continues to meet quality standards.
3) Disposal of industrial and household waste must not exceed the pollution assimilation capacity. This reflects an important principle in environmental and wastewater management. This principle emphasizes that the volume and type of pollution discharged into the environment must not exceed the ability of the ecosystem or natural system to assimilate or overcome the impact of the pollution. This relates to the determination of standards and assimilation capacity to the availability of supporting facilities for domestic wastewater management.
4) Changes in ecological function must not exceed the carrying capacity of the environment. This refers to the principle that human activities, including the construction or operation of Domestic Wastewater Treatment Plants, must not cause ecological changes that exceed nature's ability to overcome or repair the impact. Conceptually, the meaning of point 4 is closely related to the meaning of point 3. However, what is emphasized in this case is the relationship between the influence of domestic wastewater on water quality and aquatic ecosystems, the influence of domestic wastewater on soil quality, the influence of domestic wastewater on biodiversity, and the application of strict laws and sanctions.

Domestic wastewater management is a crucial aspect in supporting sustainable development, especially in the Working Area of the Regional Technical Implementation Unit (UPTD) of the Soreang Domestic Wastewater Treatment Plant (IPAL), Bandung Regency. Therefore, in achieving the goals of Bandung Regency, it is necessary to design strategies that not only focus on economic growth (pro-economic) and social (pro-social) but also pay attention to environmental aspects (pro-environment), by optimizing the involvement of stakeholders. This strategy needs to be designed by considering the strategic issues faced by Bandung Regency.

C. METHOD

This study emphasizes more on qualitative methods. Qualitative data is used to explain quantitative data. One interesting combination is the case study approach with SWOT analysis (Rahardjo, 2020. The data collection techniques used in this study are observation, in-depth interviews and documentation and determination of informants. In qualitative research, theory functions as an analytical tool that helps researchers interpret data and understand the problems/social symptoms being studied, more broadly and deeply (Pasolong, 2020). For data mining (research) researchers adopt in this study is the pro-environmental role of the government regarding the sustainable development process, with the benchmark using Syahputra's

views raised by Nurman (2019), regarding several things that are signs of environmental management. The selection of theory is based on the consideration that the theory/concept can help researchers when explaining variables, predicting propositions, to providing recommendations as problem solvers. Research data sources include primary and secondary data sources. Primary data is a source of research data obtained directly from the original source (not through intermediary media). Primary data can be in the form of opinions of subjects (people) individually or in groups, results of observations of an object (physical), events or activities, and test results. The advantage of using primary data is that researchers can collect data according to what is desired because irrelevant data can be eliminated or at least reduced, so that the data obtained is more accurate. Primary data includes: Transcripts of interview results, field observations, and data on informants. Secondary data is a source of research data obtained by researchers indirectly through intermediary media. This data is used to support the primary data that has been obtained, namely library materials, literature, previous research, books, and so on such as evidence of historical records or reports that have been compiled in archives (documentary data). (Sangadji & Sopiah, 2010)

D. RESULT AND DISCUSSION

Sustainable Development of Domestic Wastewater Treatment Plant (IPAL) in Soreang, Bandung Regency

The development of settlements in Bandung Regency cannot be separated from the development of the sanitation sector, and conceptually the quality of sanitation in a settlement that is good along with its development will have a significant influence on improving the level of public health, or vice versa.

One of the things that is in the spotlight is the commitment to Achieving Universal Access 100 0 100 or 100% access to proper sanitation in accordance with the 2020-2024 Regional Medium-Term Development Plan (RPJMD). Based on the West Java Province Open Data, it is known that the Existing Condition of Sanitation Services in Bandung Regency currently tends to be less than optimal. This can be seen from the coverage of wastewater sector services (starting from) 2018 to 2021 which has only reached 71.13%, with the number of residents who have proper sanitation coverage of 2644130 coverage/residents, and has not reached the Millennium Development Goals (MDGs) target. Furthermore, in 2023/2024 the Existing Condition of Sanitation Quality in several areas/coverages of Bandung Regency also tends to be less than optimal. This can be seen based on data from the Central Statistics Agency (BPS) of West Java Province, the number of households in Bandung Regency that have access to proper sanitation (calculated) has only reached 66.67%. [3] As can be seen in Table 1 :

Table 1
Percentage of Households Having Access to Adequate Sanitation

Regency/City	Percentage of Households Having Access to Child Sanitation		
	2021	2022	2023
Bogor	63.91	73.47	71.49
Sukabumi	64.35	63.32	53.21
Cianjur	58.52	61.76	63.83
Bandung	64.51	70.85	66.67
Garut	43.73	51.90	54.68
Tasikmalaya	49.35	54.39	51.33
Ciamis	66.59	75.50	71.38

Source: Central Statistics Agency (BPS) of West Java Province

This shows that the sanitation conditions of Bandung Regency were previously still below the established MDGs standards, and currently the optimization of the development of access to sanitation services is being continued in achieving the Sustainable Development Goals (SDGs) targets until 2030.

The current suboptimal sanitation services have spurred the need for sanitation management in Bandung Regency. Through its participation in the Settlement Sanitation Development Acceleration (PPSP) program, the Bandung Regency Government is determined to improve the quality of settlement sanitation in Bandung Regency. What is emphasized in this study is one of the main sanitation sectors, namely the domestic wastewater sector in the Soreang IPALD work area of Bandung Regency.

The following is a description of the object / locus in this study, namely the party responsible for the domestic wastewater sector. IPALD Soreang, which is one of the work units under the Public Works and Spatial Planning Agency of Bandung Regency, was established in 1996 and is located in Pamekaran Village, Soreang District. IPALD Soreang was built as one of the Government's efforts to provide supporting facilities to realize a clean and safe Soreang area by paying attention to environmental sustainability. Currently, the capacity of IPALD Soreang is 10 liters per second and occupies an area of 1600 m2 with final waste disposal into the Citarum River. IPALD Soreang is estimated to only be able to accommodate household wastewater from ± 400 house connections in the Soreang area, but in the future this Wastewater Treatment Plant (according to plan) will be developed, so that it is projected to be able to serve the western part of Soreang City with a capacity of 2500 connections or approximately for 10,000 people.

As an initial step in realizing the plan, (based on information) the Bandung Regency sanitation group has compiled a white paper on Bandung Regency sanitation. The white paper on sanitation broadly contains a description of the profile of the existing sanitation conditions of Bandung Regency. In compiling the white paper on sanitation (in addition to the sanitation aspect), the clean water aspect was also taken into consideration considering the important role of clean water in determining the implementation of quality sanitation.

The preparation of the sanitation white paper is the basis of a series of steps to improve the quality of sanitation in Bandung Regency. It is recognized that to achieve the target of improving sanitation, follow-up is needed. Strategic issues in the sanitation sector that have been identified need to be followed up with efforts to formulate a clear strategy towards optimal sanitation service conditions in the future. It is hoped that with the preparation of this document, there will be acceleration in the development of adequate and sustainable sanitation in Bandung Regency.

Returning to the focus on environmental conditions, one of the first strategic issues highlighted in this case is the environmental carrying capacity or the capacity to accommodate the burden of water pollution in the Citarum River which is considered to have been exceeded due to significant domestic wastewater pollution. This is also influenced by the catchment areas or watersheds of the Citarum River which have experienced a decline in function in maintaining water availability and environmental health. This is due to the increase in population and the number of industries that produce domestic waste and are discharged directly into the river, so that the domestic waste produced causes poor water quality.

In relation to this, in the scope of settlements, the selection of domestic wastewater management systems has a significant impact on the sustainability of the management system. In general, there are two types of domestic wastewater management systems, namely: On-site sanitation systems (decentralized), where wastewater treatment facilities are located within the plot or land boundaries owned. These facilities are separate waste disposal units such as septic tanks or cubluks, and centralized or off-site sanitation systems (centralized), where the Domestic Wastewater Treatment Plant (IPAL) located outside the plot or at a distance and land boundaries, uses pipes to simultaneously dispose of wastewater from inside the house and then flows to the Soreang IPALD/IPLT.

Based on information, one form of domestic waste pollution control has been carried out by building and improving the management of Domestic Wastewater Treatment Plants (IPAL) and Fecal Sludge Treatment Plants (IPLT). However, based on findings, the number of Domestic IPALs is currently still far from expectations. From the proposal side, (for example) the IPALD that still needs to be built is in Kopo Sayati, Cilampeni-Soreang, Rancaekek, while in Majalaya. IPAL can already be used to support the function of existing domestic IPALs, such as IPAL Bojongsoang, which is located in Bojongsari Village, Bojongsoang District, Bandung Regency.

Looking at the development side, especially in Soreang IPALD/IPLT, based on the Soreang IPALD development plan, in the future it is important to manifest the Soreang IPALD development plan , by paying attention to the stages of the development plan that have been previously determined/planned, including: Stage 1 Fecal Sludge Management, Stage 2 Intercept Effulent Septic Tank, Stage 3 Development of Interceptor Replacement Network , Stage 4 Domestic Wastewater Management.

Factors causing the less than optimal sustainable development of domestic wastewater treatment plants (IPAL) in Bandung Regency

Sustainable Development of Domestic Wastewater Treatment Plants (WWTP) has an important role in maintaining environmental quality, especially in areas experiencing increasing population and urbanization, such as Bandung Regency. The realization of the construction of IPALD aims to process domestic waste so as not to pollute water sources and the surrounding environment. However, in the context of Sustainable Development of Domestic Wastewater Treatment Plants (IPAL) in Bandung Regency, based on the discussion (description) and findings of the analysis/case study results, it is known that there are several main factors that cause the realization of the sustainable development program to be less than optimal, including:

a. Domestic wastewater management installation management

There is a significant gap between the availability and needs of domestic wastewater treatment facilities in Bandung Regency in the period 2020 to 2024. One of the main problems is the low coverage of Domestic Wastewater Treatment Plant (IPALD) services, especially in areas far from the city center or densely populated residential areas. The percentage of the population who have access to IPALD services is still low, causing most people to discharge domestic wastewater (grey water/black water) directly into the environment without going through a standard processing process.

In addition, the limited reach of IPALD services is an obstacle to effective domestic waste management efforts. Inadequate infrastructure in various regions means that wastewater treatment services are not yet widely accessible. Limited local government funding is also an obstacle, considering that large investments are needed to build and expand IPALD services to be able to reach all areas of Bandung Regency. Another challenge faced is the uneven distribution of the population, where differences in population density make it difficult to plan and implement a comprehensive IPALD system.

In densely populated residential areas, there are specific constraints that further worsen the effectiveness of domestic waste management services. Limited space makes the installation of individual or communal wastewater treatment systems difficult, especially for the installation of septic tanks and other treatment facilities. Inadequate sanitation systems also remain a problem, as many homes in the area use systems that do not meet standards. In addition, low public awareness and compliance with environmentally friendly waste management results in the practice of disposing of waste directly into rivers or gutters still often occurring. Another factor that worsens this condition is the limited financial and technical resources of the community in building a better waste management system.

The problem of IPALD governance in Bandung Regency is also a major factor causing this service to not operate optimally. Lack of maintenance and care of IPALD facilities results in a decrease in the effectiveness of wastewater treatment. In addition, the technology used is still not optimally developed, so it

is unable to process waste efficiently. Limited human resources and funds are also obstacles in improving IPALD operations. Coupled with the low public awareness in using IPALD properly, these various problems further complicate sustainable development efforts in domestic wastewater management in Bandung Regency.

b. Availability of domestic wastewater management resources

The availability of resources in domestic wastewater management in Bandung Regency still faces various challenges, one of which is the lack of trained workers. This is especially the case at UPTD IPALD Soreang, where the number of experts in the field of waste management is still limited. In fact, providing competent workers is the main requirement for improving the quality and efficiency of waste management services. Without sufficient manpower and adequate skills, IPALD operations cannot run optimally, thus impacting the effectiveness of the waste processing system in the area.

Apart from the labor shortage, the welfare and motivation of workers in this sector is also a problem that needs attention. Many waste management workers face less than ideal working conditions, from low wages to inadequate work facilities. This situation can reduce the enthusiasm and productivity of workers in carrying out their duties. The lack of incentives and support from the local government also contributes to low worker motivation, potentially worsening the problems in domestic wastewater management in Bandung Regency.

c. Availability of funding support from local governments

The main problem in funding domestic wastewater management in Bandung Regency is the limited regional budget. The available budget must be divided into three main sectors, namely waste management, liquid waste, and drainage. With these limitations, the allocation of funds for wastewater treatment is often insufficient, thus hampering the development and improvement of Domestic IPAL infrastructure. These budget limitations also have an impact on the operations of the Soreang IPALD UPTD, including in terms of facility maintenance, increasing workforce capacity, and expanding service coverage.

In addition to regional budget constraints, dependence on central government funds is an additional obstacle in wastewater management. Many programs rely on the Additional Assistance Budget (ABT) or better known as the Revised Budget. This dependence can cause obstacles in policy implementation because funds allocated from the center do not always match the specific needs of the region. In addition, delays in disbursement of funds often hamper the continuity of projects, thus delaying improvements or the construction of more efficient wastewater treatment systems.

On the other hand, the potential of funds from the private sector through the Corporate Social Responsibility (CSR) program has not been optimally utilized. Companies are required to set aside part of their profits in one year as a form of social responsibility. However, the contribution of CSR funds to wastewater management is still minimal, both due to the lack of regulations that direct the use of these funds and the low awareness of companies regarding the importance of sustainable waste management. If managed properly, CSR funds can be a solution in supporting the construction and development of Domestic IPAL infrastructure, thereby reducing dependence on the government budget and increasing the effectiveness of waste management services in Bandung Regency.

d. Strengthening the regulatory framework

The absence of a Regent Regulation (Perbup) that specifically regulates the implementation instructions for controlling and processing domestic waste (B3). The weakness is that the researcher has not found the latest Regent Regulation, as a guideline explaining the implementation of the administrative sanctions, or it can be said that there is none. In this case, what the researcher can find is Regent Regulation No. 57 of 2011 concerning Implementation Guidelines for Bandung Regency Regional Regulation Number 6 of 2010 concerning Control of Hazardous and Toxic Waste Management. Meanwhile, the Implementation Guidelines for Bandung Regency Regional Regulation No. 2 of 2018 concerning Hazardous and Toxic Waste Management do not yet exist. Weak strengthening in the regulatory framework will have an impact on the weak implementation of existing regulations.

e. The implementation of laws and sanctions related to domestic wastewater management is not yet optimal.

Although there are regulations governing domestic waste management, their implementation still faces various obstacles. One of the main problems is the weak supervision and law enforcement against individuals and companies that violate the rules regarding waste disposal. Many people still dump domestic waste directly into the environment without processing, while sanctions for violators are often not strictly enforced. In addition, legal awareness among the public and business actors is still low, so that environmentally unfriendly waste disposal practices continue to occur. Lack of coordination between local governments, law enforcement officers, and related agencies is also a factor that slows down the effectiveness of law enforcement. To increase the effectiveness of regulations, efforts are needed to increase public awareness through socialization, strengthening regulations with stricter sanctions, and increasing the capacity for monitoring and taking action against violations in domestic wastewater management.

f. **The problem of open defecation (BABS), which concerns several factors that influence the high rate of BABS in Bandung Regency.**

Access to proper sanitation remains a major challenge in many regions, especially in rural areas and densely populated residential areas. The lack of availability of healthy toilets and adequate sanitation facilities has forced many people to practice open defecation (BABS). This is exacerbated by the low public awareness of the importance of good sanitation. Many residents do not fully understand the negative impacts of BABS on health and the environment, so this practice continues to occur. Socialization regarding the dangers of poor sanitation and the importance of using healthy toilets still needs to be improved to change people's behavior patterns.

Apart from the awareness factor, limited infrastructure is also a major obstacle in providing adequate sanitation. Inadequate pipe networks and waste processing systems make it increasingly difficult for communities to access quality sanitation services. In addition, economic factors also play a role in hampering efforts to improve sanitation. Many families, especially in low-income areas, do not have sufficient funds to build healthy latrines or access better sanitation facilities. Therefore, government intervention and support from various parties, including the private sector, are needed to provide affordable sanitation facilities and encourage changes in community behavior towards healthier lifestyles.

Alternative strategies in the sustainable development of domestic wastewater treatment plants (IPAL) in Bandung Regency

Regarding the context of Sustainable Development of Domestic Wastewater Treatment Plants (IPAL) in the Working Area of UPTD Domestic Wastewater Treatment Plants (IPAL) Soreang, Bandung Regency, SWOT analysis is an important tool to measure and/or evaluate strengths, weaknesses, opportunities, and threats in order to develop appropriate sustainability strategies, based on logic that can maximize strengths and opportunities to achieve sustainable development goals, but can minimize weaknesses and threats.

Based on the analysis of internal and external factors of Sustainable Development of Domestic Wastewater Treatment Plants (IPAL) in the Working Area of UPTD Domestic Wastewater Treatment Plants (IPAL) Soreang, Bandung Regency, the focus is on the position of Quadrant 2, namely the ST (Strengths-Threats) strategy which emphasizes the use of existing strengths to overcome threats that can hinder the sustainability of organizational activities, in domestic wastewater management. The position of the SWOT analysis can be seen in Figure 1

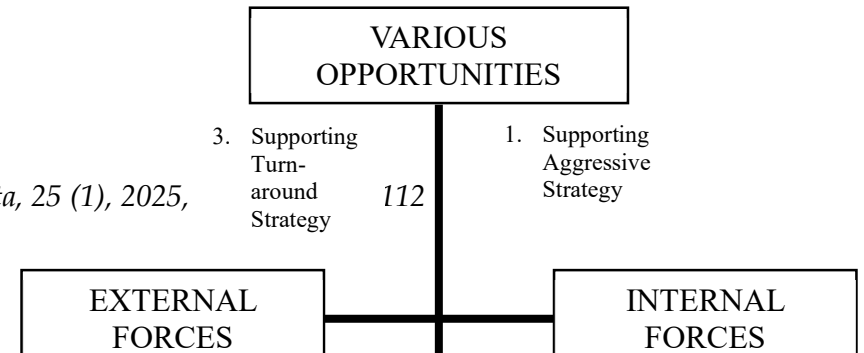

Figure 1. SWOT Analysis Position Matrix

Conceptually, this position shows a strong organization but facing major challenges. The recommended strategy is the Concentric Diversification Strategy, meaning that the organization is in a stable condition but facing a number of major challenges so that it is estimated that the wheels of the organization will have difficulty continuing to turn if they only rely on the previous strategy. Therefore, it is necessary to expand activities or services within a scope that is closely related to domestic wastewater management in the Working Area of the Domestic Wastewater Treatment Installation (IPAL) UPTD Soreang, Bandung Regency, by utilizing existing strengths/potentials and overcoming the threats faced.

Complementing this, based on the SWOT analysis, the researcher systematically identified factors based on 4 (four) components/assessment factors, namely strengths, weaknesses, opportunities, and threats. After that, the researcher compiled the components or assessment factors into a SWOT Matrix, as an effort to describe as a whole how external opportunities and threats faced by the organization can be adjusted to existing strengths and weaknesses, with four sets of alternative strategic possibilities, which can be seen in Table 2:

Table 2 SWOT Matrix

EXTERNAL FACTORS / INTERNAL FACTORS	**Opportunity (O)**	**Threats (T)**
	O1. There are government policies that support biodiversity conservation O2. Availability of funding support from the central government O3. Cooperation between stakeholders O4. The increasing need for clean water O5. Recycling of domestic wastewater O6. Development of domestic wastewater management facilities through a community-based approach O7. Strict enforcement of law and sanctions O8. Guidance in domestic wastewater management	T1. Environmental impact T2. Areas suitable for development with off-site systems T3. Public awareness to follow domestic wastewater management standards produced by their households T4. Relativity of Domestic Waste Pollution T5. Areas suitable for development with on-site systems T6. The Problem of Open Defecation (BABS) T7. The effect of waste on water quality and aquatic ecosystems T8. The impact of waste on biodiversity

Strength (S)	**SO**	**ST**
S1. The existence of a master plan for the wastewater management system (domestic) as a comprehensive planning document S2. The government is committed to maintaining environmental quality S3. The government continues to strive to develop strategies to maintain water quality to meet quality standards. S4. There is socialization, education and evaluation of domestic wastewater management S5. There are government efforts to maintain the pollution load so that it does not exceed assimilation capacity. S6. The government continues to strive to develop and implement various strategies for developing domestic wastewater management systems. S7. The government has a mandate (based on applicable regulations) to carry out supervision and evaluation of domestic wastewater management. S8. There are provisions regarding domestic wastewater quality standards	1. Utilization of fecal sludge and bacterial media to create products with economic value 2. Consistent application of the laws and regulations that have been prepared 3. Increasing the role of the private sector and business world in the development and management of domestic wastewater infrastructure. 4. Adding House Connections (SR) for centralized domestic wastewater treatment plants and revitalizing domestic wastewater management infrastructure with existing off-site systems.	1. Expanding the scope of access to wastewater facilities based on local systems (on-site) and centralized systems (off-site). 2. Improving the quality of communal on-site wastewater services for Low-Income Communities (MBR). 3. Improving the effectiveness of regional regulations in regulating domestic wastewater management 4. Changing behavior and increasing public understanding of the urgency/importance of domestic wastewater management in residential areas. 5. Wide dissemination of information regarding regulations on domestic wastewater management, so that the community and related parties can understand and implement the regulations properly.
Weakness (W)	**WO**	**WT**
W1. Domestic Wastewater Treatment Plant Management Problems W2. Availability of domestic wastewater management resources W3. Availability of funding support from local governments W4. Laws and sanctions for violations of regulations (domestic wastewater management) W5. Strengthening the regulatory framework in Bandung Regency W6. Reuse of domestic wastewater W7. Domestic wastewater management infrastructure connectivity W8. Condition of Soreang IPALD/IPLT	1. Strengthening the appropriate regulatory framework to support the implementation of wastewater management in settlements 2. Optimizing institutions and apparatus in domestic wastewater management 3. Revitalization/renewal of domestic wastewater management infrastructure with existing off-site systems. 4. Increasing the use of safe septic tanks (biofilter septic tanks) by households 5. Optimization of the capacity of Domestic Wastewater Treatment Plants (IPAL) and fecal sludge management plants (IPLT).	1. Encourage the strengthening and establishment of wastewater management institutions at the regional level. 2. Facilitate the establishment and institutionalization of wastewater management at the community level. 3. Encourage increased political commitment from stakeholders to give greater priority to residential wastewater management. 4. Increasing the quantity of domestic wastewater management infrastructure with off-site systems 5. Increasing community access to domestic wastewater management services with off-site systems

To facilitate understanding, the researcher summarizes these explanations in the form of a table and identifies three important aspects that need to be considered, namely: policy, strategy, and action plan aspects, as can be seen in Table 3:

Table 3 Policies, Strategies and Action Plans

NO	POLICY	STRATEGY	ACTION PLAN
11	Increasing access to domestic wastewater management infrastructure and facilities, both in the form of on-site and off-site systems , in urban and rural areas, to improve public health conditions.	1. Expanding the scope of access to wastewater facilities based on local systems (on-site) and centralized systems (off-site). 2. Improving the quality of communal on-site wastewater services for Low-Income Communities (MBR). 3. Improving the effectiveness of regional regulations in regulating domestic wastewater management.	1. Fulfilling the availability and/or needs of domestic wastewater facilities in Bandung Regency. 2. Optimizing the strategy and implementation of the Community-Based Total Sanitation (STBM) or Community Led Total Sanitation (CLTS) program to reduce open defecation practices. 3. Increasing socialization and outreach activities regarding the rules and mechanisms for managing domestic wastewater in a sustainable manner.
22	Increasing community and private sector participation in the implementation and development of domestic wastewater management systems in residential areas.	1. Changing behavior and increasing public understanding of the urgency/importance of domestic wastewater management in residential areas.	1. Implementing socialization programs or educational campaigns aimed at emphasizing the importance of domestic wastewater management among the community. 2. Providing training and assistance to communities regarding the provision of infrastructure and facilities for domestic wastewater management in residential areas. 3. Conducting outreach to the private sector and business world regarding investment opportunities in the field of domestic/residential wastewater management. 4. Providing consulting services to the community / industry, regarding good wastewater management. 5. Strengthening the role of the community and private sector/business world in implementing the development of residential wastewater management systems.
33 3	Developing regulations that support the implementation of wastewater management in residential areas is an important step in strengthening environmental governance and public health.	1. Wide dissemination of information regarding regulations on domestic wastewater management, so that the community and related parties can understand and implement the regulations properly.	1. Conducting reviews and improvements to Norms, Standards, Procedures, and Criteria (NSPM) in national policies and strategies related to residential wastewater system management. 2. Reviewing minimum service standards in residential wastewater management to ensure compliance with community needs. 3. Carrying out comprehensive socialization regarding regulations related to the implementation of domestic

NO	POLICY	STRATEGY	ACTION PLAN
			wastewater management in residential areas. 4. Developing an adequate information system to support the implementation of domestic wastewater management, thereby facilitating data access and transparency.

The results of the study indicate that the role of the government must be more than just the development of domestic wastewater treatment infrastructure/installations, strengthening is needed in terms of regulation, supervision, participation and public education so that the wastewater treatment system really runs, in accordance with the environmental guidelines outlined by Syahputra. Especially the government's active steps in involving the community and the private sector and the business world in domestic wastewater management are considered as efforts that are in accordance (significant) with the guidelines outlined by Syahputra, to emphasize the importance of various parties in maintaining the sustainability of biodiversity, maintaining the quality of river water, groundwater resources, and overall environmental health, which are very important for human survival (in general) and the community in the UPTD IPALD Soreang work area, Bandung Regency (in particular).

In addition, the researcher assessed that efforts to maintain the use of renewable resources such as water and energy used in the waste processing process do not exceed their sustainable potential show a commitment to the principle of sustainable development. The technology used in wastewater processing at UPTD IPALD Soreang is considered to be quite efficient in utilizing energy and water sustainably, in maintaining the balance of the local ecosystem.

Finally, Researchers who support this theory appreciate the government's efforts: DPUTR in maintaining environmental carrying capacity through continuous monitoring / supervision, and together with UPTD IPALD Soreang which periodically evaluates the ecological impacts of waste treatment facilities, including changes in water quality and biodiversity in the surrounding area. These steps are considered in accordance with the principle of maintaining changes in ecological functions that do not exceed environmental carrying capacity, which is a key element in Syahputra's theory.

Negative Attitudes towards Syahputra's Theory: On the other hand , Researchers who are more critical of the application of Syahputra's theory in the context of UPTD IPALD Soreang highlighted a number of problems in implementation in the field. One of the main criticisms is that although in theory the placement of waste treatment facilities in locations that comply with ecological principles is a good thing, in practice it still faces pressure from continuously growing residential activities. Wastewater treatment facilities at UPTD IPALD Soreang, as well as communal IPAL in residential areas are still insufficient to handle the increasing volume of domestic waste due to population growth and urbanization. This means that the use of renewable resources (water) in domestic wastewater treatment has the potential to exceed its sustainable potential in the future , especially if there is no significant increase in infrastructure capacity. Researchers consider that the concept of sustainable potential proposed in Syahputra's theory is still difficult to implement realistically amidst the pressures of economic and social growth in society.

In addition, criticism is also directed at waste management which is considered not yet fully effective in maintaining the assimilation capacity of pollution. Although a waste processing system has been built, research shows that waste produced by households in the UPTD IPALD Soreang work area, Bandung Regency still exceeds the existing processing capacity, even BABS practices still occur. This can cause more serious water pollution in the long term if there is no increase in capacity and more sophisticated waste processing technology. The researcher argues that Syahputra's guidelines regarding pollution assimilation capacity are not fully complied with in this context.

Finally, in terms of changes in ecological function and environmental carrying capacity, critical researchers assess that despite monitoring efforts, the environmental carrying capacity in the working area of the UPTD IPALD Soreang, Bandung Regency is still at risk. Population growth and increasing economic and social activities continue to put pressure on the environment, which may exceed natural carrying capacity in the coming years. They highlight that Syahputra's theory, although conceptually strong, still requires a more flexible and dynamic approach to deal with rapid changes in the field.

The researcher's attitude towards the application of Syahputra's theory in domestic wastewater management in the UPTD IPALD Soreang work area, Bandung Regency, shows significant differences in views. On the one hand, Researchers who support this theory see serious efforts to implement environmental signs in a sustainable manner (pro-environment), including in terms of project placement, resource utilization, waste management, and maintaining environmental carrying capacity. However, on the other hand, critics of the application of this theory highlight various challenges (that still exist) in terms of: Governance of domestic wastewater management installations, availability of domestic wastewater management resources, availability of funding support, strengthening the regulatory framework, implementation of laws and sanctions, BABS problems.

Although the environmental management guidelines proposed in Syahputra's theory provide strong guidance, in the context of Sustainable Development of Domestic Wastewater Treatment Plants (WWTP), its implementation still needs further improvement. In response to this, as a form of contribution to Syahputra's theory, the researcher recommends the addition of "Criteria that Implications for Sustainable Development of Domestic Wastewater Treatment Plants (WWTP)" and the Realization Model of Sustainable Development of Domestic Wastewater Treatment Plants (WWTP), which emphasizes 5 important aspects, including: Institutional, Service, Social, Economic, Environmental. The implications of these criteria and models can help create the right strategy in ensuring Sustainable Development of Domestic Wastewater Treatment Plants (WWTP) in the Working Area of UPTD Domestic Wastewater Treatment Plants (WWTP) Soreang, Bandung Regency.

Regarding the novelty of this research, the researcher created a Sustainable Development Strategy Model for Domestic Wastewater Treatment Plants (IPAL), as follows:

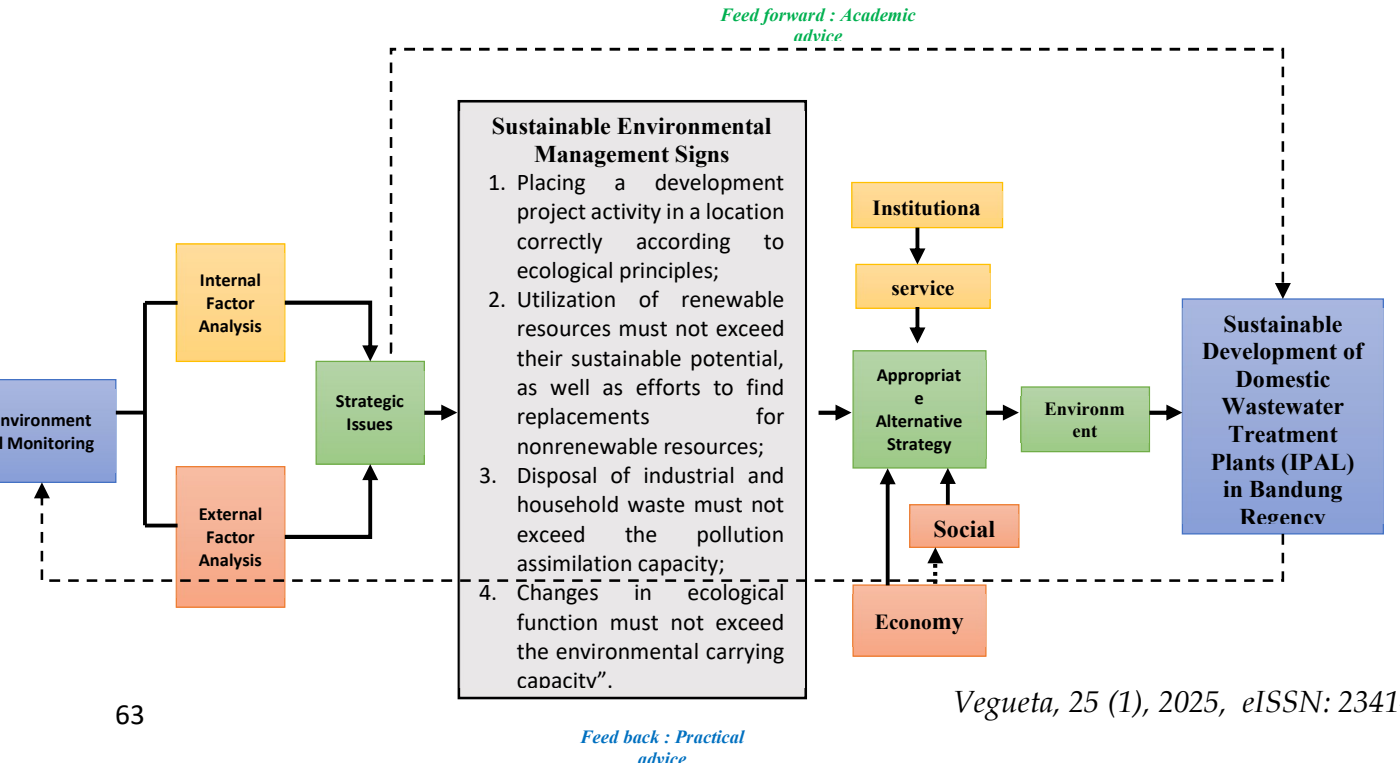

Figure 2 Sustainable Development Strategy Model for Domestic Wastewater Treatment Plants (WWTP)

E. CONCLUSION

Based on the research results, domestic wastewater sanitation and processing services in the Domestic Wastewater Treatment Plant (IPAL) Work Area of Soreang, Bandung Regency are still not optimal. One of the main obstacles is the wastewater management infrastructure that has not reached the 100% target, so it requires more attention from the local government. The main challenge in the sustainable development of Domestic IPAL is the low public awareness of the importance of domestic wastewater processing. To overcome this problem, the Public Works and Spatial Planning Agency (DPUTR) can take advantage of opportunities by establishing partnerships with consultants or specialists in socialization and education of the public regarding the importance of good wastewater management. This partnership not only increases public awareness but also helps DPUTR in presenting more effective and sustainable waste management solutions. However, weak law enforcement and sanctions for violations in the disposal of domestic waste are still obstacles, although the government's commitment to maintaining environmental quality remains the main force in dealing with this problem.

To overcome various inhibiting factors in the sustainable development of Domestic Wastewater Treatment Plants, a comprehensive alternative strategy is needed. Several main strategies that can be implemented include expanding the scope of community access to wastewater treatment facilities based on local systems (on-site) and centralized systems (off-site), as well as improving the quality of communal wastewater services for low-income communities. In addition, increasing the effectiveness of regional regulations is a key factor in ensuring that domestic wastewater management runs well. Education and changes in community behavior regarding the importance of wastewater treatment also need to be strengthened through a strategy of wider information dissemination regarding applicable regulations. Strengthening the regulatory framework and establishing wastewater management institutions at the regional level are important steps to support the implementation of a more efficient waste management system. In addition, encouraging private sector participation in the development and management of domestic wastewater infrastructure can be a sustainable solution to overcome limited local government funding.

REFERENCES

1. Alfin, E., Rahmatulloh, R., & Suendarti, M. (2022). Infrastruktur air dan tantangan di Indonesia. *SENTRI: Jurnal Riset Ilmiah, 1*(2), 382-391.
2. Bandung Regency Regional Regulation Number 11 of 2020 concerning Domestic Wastewater Management
3. Budimanta, Arif. Dkk. (2004). Corporate Social Responsibility. Indonesia Center for Sustainable Development (ICSD). Jakarta.
4. Csete, M. S., & Poyraz, A. Y. (2022). Sustainability Framework For Revealing And Analysing The Co-Benefits Of Nature-Based Solutions To Urban Water Challenges. European *Journal Of Sustainable Development, 11*(4), 1. Https://Doi.Org/10.14207/Ejsd.2022.V11n4p1
5. Disdulcapil. (2024). Data Agregat Kependudukan Kabupaten Bandung.
6. Iskandar, A. H. (2020). *SDGS Desa (Percepatan Pencapaian Tujuan Pembangunan Nasional Berkelanjutan).* Jakarta: Yayasan Pustaka Obor Indonesia

7. Kartasasmita, G. (1996). *Pembangunan Untuk Rakyat (Memadukan Pertumbuhan dan Pemerataan)*, Jakarta: Pustaka Cidesindo.
8. Kipāne, A., & Vilks, A. (2022). Legal Framework For Environmental Protection In The Context Of Sustainable Development. *European Journal Of Sustainable Development, 11*(4), 169. Https://Doi.Org/10.14207/Ejsd.2022.V11n4p169
9. Lingkungan, P. T., Pengkajian, B., & Teknologi, P. (2017). Kebijakan Dan Strategi Pengelolaan Air Limbah Domestik Di Indonesia Satmoko Yudo Dan Nusa Idaman Said.
10. Nurman. (2019). Strategi Pembangunan Daerah. Depok: Rajawali Pers.
11. Pasolong, H. (2020). Metode penelitian administrasi publik. Bandung: Alfabeta.
12. Pracastino, Y., Balai, H., Dan, P., Penerapan, P., & Permukiman, T. (N.D.). Identifikasi Masalah Tata Kelola Instalasi Pengolahan Air Limbah (Ipal) Terpusat Di Kabupaten Bandung Governance Problem Identification Of Waste Water Treatment Instalation (Ipal) In Bandung District
13. Pratiwi, V. F. (2023). Kebijakan Penyelenggaraan Percepatan Pembangunan Sanitasi Permukiman Di Daerah. Jurnal Kajian Pemerintah: Journal of Government, Social and Politics, 9(2), 81-89.
14. Rahardjo, M. (2020). Metode Penelitian Kualitatif, Untuk Ilmu Sosial dan Humaniora (Teori dan Praktik). Malang: Republik Media
15. Regent Regulation No. 57 of 2011 concerning Implementation Guidelines for Bandung Regency Regional Regulation Number 6 of 2010 concerning Control of Hazardous and Toxic Waste Management
16. Regional Regulation Number 12 of 2016 concerning the Formation and Composition of Regional Apparatus and Bandung Regent Regulation Number 60 of 2016 concerning the Position and Organizational Structure of Regional Services (Bandung Regency Regional News 2016, Number 62).
17. Regulation of the Minister of Environment and Forestry Number 68 of 2016 concerning Domestic Wastewater Quality Standards.
18. Sallata, M. K. (2015). Konservasi dan pengelolaan sumber daya air berdasarkan keberadaannya sebagai sumber daya alam. Jurnal Penelitian Sosial dan Ekonomi Kehutanan, 12(1), 75-86.
19. Salusu. (2015). *Pengambilan Keputusan Stratejik, untuk Organisasi Publik dan Nonprofit.* Jakarta: Grasindo.
20. Sangadji, E. M., & Sopiah, S. (2010). Metodologi Penelitian Pendekatan Praktis dalam Penelitian. Yogyakarta: CV Andi Offset.
21. Sedarmayanti. (2014), Manajemen Strategi, Bandung, PT Refika Aditama.
22. Suryani, A. S., Penelitian, P., Keahlian, B., Ri, D., Jenderal, J., & Subroto, G. (2020). Pembangunan Air Bersih Dan Sanitasi Saat Pandemi Covid-19 Clean Water And Sanitation Development During The Covid-19 Pandemic. Jurnal Masalah-Masalah Sosial |, 11(2), 2614–5863. Https://Doi.Org/10.22212/Aspirasi.V11i2.1757
23. Syabil, S., Putri, S., Pertiwi, R., & Setiyawati, M. E. (N.D.). Pembangunan Air Bersih Dan Sanitasi Dalam Mewujudkan Ekonomi Hijau.
24. Ujungberung, K., Cileunyi, D., Arina, F., Isya, A. ', Mohammad, D., & Sururi, R. (2021). Strategi Sistem Pengelolaan Air Limbah Domestik Di. Jukung Jurnal Teknik Lingkungan, 7(1), 1–17.
25. Vari Afandi, Y., & Rya Sunoko, H. (2013). Status Keberlanjutan Sistem Pengelolaan Air Limbah Domestik Komunal Berbasis Masyarakat Di Kota Probolinggo. 11, 100–109
26. Wibawa, K. C. S. (2019). Mengembangkan partisipasi masyarakat dalam perlindungan dan pengelolaan lingkungan hidup untuk pembangunan berkelanjutan. *Administrative Law and Governance Journal, 2*(1), 79-92.
27. Zulkifli, Z. F., Hendriyulianti, D. A., Rahma, F., Ayu, R. M., Wicaksana, B. P., Pratama, D. A., ... & Angelita, H. B. (2024). Sanitasi untuk Semua dalam Pendampingan Pengelolaan Sanitasi dan

Penyediaan Air Bersih untuk Masyarakat Desa Tebing Tinggi. *Studium: Jurnal Pengabdian Kepada Masyarakat, 3*(3), 117-124.