



Environmental Sanitation Handling Strategy Post-Earthquake in the Working Area of Pantoloan Public Health Center, Palu City, Central Sulawesi Province

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ABSTRACT

The purpose of this study is to analyze strategies for handling environmental sanitation after an earthquake in the working area of Pantoloan Health Center, Palu City, Central Sulawesi Province. The study uses a quantitative approach with a descriptive design and two methods of analysis, namely Structural Equation Modeling (SEM) to test the relationships between variables and SWOT analysis to formulate sanitation management strategies. The variables studied include the relationship between knowledge, environmental sanitation knowledge, and attitudes toward community behavior in maintaining environmental cleanliness. The results of the study show a significant relationship between knowledge, environmental sanitation knowledge, and attitudes toward community behavior. SEM coefficient values indicate that attitude has the strongest influence on community behavior compared to other factors, with a contribution of 0.68, followed by knowledge at 0.52 and environmental sanitation knowledge at 0.47. Univariable analysis also showed that 62% of respondents have high knowledge, but only 48% consistently practice good sanitation behavior. Based on the results of the SWOT analysis, the main recommended strategies include increasing environmental health education, community empowerment, and cross-sector collaboration in the development of sustainable sanitation infrastructure. In conclusion, the success of post-disaster environmental sanitation management heavily depends on increasing public awareness and participation

INTRODUCTION

Sanitation problems in developing countries, especially Indonesia, occur frequently due to the lack of attention and concern from the government or relevant health authorities regarding sanitation efforts, including the limited availability of clean water, waste disposal facilities, inadequate public hygiene behavior, and insufficient sanitation in public places such as schools, hospitals, community health centers, mosques, recreational areas, restaurants, and others. Poor sanitation and environmental conditions can trigger an increase in environmentally-related diseases. This will undoubtedly place an even greater burden on the community, particularly those living in densely populated housing without adequate sanitation facilities (Arika et al., 2023)

This condition is also reflected in Central Sulawesi Province. According to the 2019 Profile of the Central Sulawesi Provincial Health Office, it was recorded that around 1,478 villages, or 73.3% of the total 2,017 villages, had implemented the Community-Based Total Sanitation (STBM) program. In the same year, the percentage of households with access to proper sanitation was 65.7%, or about 561,556 homes (Manton et al., 2021). Although there was a fairly encouraging development in 2022, with access to proper sanitation rising to 75.01% of households, this figure actually shows a slight decline from the previous year, which reached 76.06%, and is still lower than the national average of 80.92%. In addition, out of all villages and urban wards, only 51.1% reported having stopped the practice of open defecation (OD).

This fact indicates that the acceleration of the STBM program implementation still needs to be intensified. On the other hand, supervision of public places and facilities (TFU) in this province has reached 80.6%, including one of the highest achievements nationally. This demonstrates a commitment to maintaining public environmental health. However, only 37.0% of hospitals and health centers have managed medical waste in accordance with applicable standards, which requires special attention in improving the quality of sanitation in healthcare services in the region.

In addition to the national sanitation issues, the situation became more complex following the earthquake, tsunami, and liquefaction disaster in Palu City on September 28, 2018. The disaster not only caused casualties and physical damage but also had serious impacts on the community sanitation system. Many basic infrastructures, such as clean water networks, waste disposal channels, and public toilet facilities, were damaged. As a result, communities in the affected areas faced limited access to clean water and proper sanitation facilities. The post-earthquake situation also saw an increase in environmental-related diseases, such as diarrhea and skin infections, caused by water source contamination and poor community hygiene practices. This situation underscores the importance of environmental sanitation management that not only focuses on physical infrastructure recovery but also includes community empowerment, Improving knowledge and clean living behaviors, as well as strengthening cross-sector collaboration in building a resilient and sustainable sanitation system in disaster-prone areas (Lassa et al., 2021). To address these issues, various environmental sanitation management strategies have been developed, including approaches

that involve community empowerment, behavioral change education, and the improvement of basic infrastructure facilities. According to Rakodi (2002, in Prayoga & Mahagarmilah, 2024), settlement management approaches can be divided into three main strategies: the physical approach, which focuses on improving infrastructure and buildings; the socio-economic approach, which empowers communities by enhancing skills and economic access; and the participatory approach, which involves the community in the entire process of planning, implementation, and program evaluation..

In formulating this strategy, it is important to study the conditions through a SWOT analysis approach, consisting of internal and external analyses, to identify and explain various factors that constitute Strengths and Weaknesses. Internal analysis essentially involves analyzing and evaluating the conditions, performance, and problems encountered in the implementation of the sanitation sector strategy. Meanwhile, external analysis aims to identify various factors that constitute opportunities and challenges. Strategic analysis of internal factors includes factors that support strengths and weaknesses. Therefore, SWOT analysis not only supports the preparation of evidence-based strategies but also strengthens the relevance of interventions to the social, economic, and geographical context in the disaster-affected working area of Pantoloan Health Center (Arda et al., 2020).

Based on the description above, the researcher is interested in conducting a study with the topic "Strategies for Environmental Sanitation Management Post-Earthquake in the Work Area of Pantoloan Health Center, Palu City, Central Sulawesi Province."

Problem Formulation

Based on this background, the problem formulation in this study is whether earthquake disaster training is effective in improving the preparedness of laboratory staff at Maxima Clinical Laboratory in Palu City, Central Sulawesi.

Research Objective

To understand the condition of environmental sanitation in the work area of Pantoloan Health Center, Palu City, Central Sulawesi Province.

Specific Research Objectives

To determine the relationship between the level of environmental knowledge and community behavior in handling sanitation in the working area of Pantoloan Health Center, Palu City, Central Sulawesi Province.

- a. To determine the relationship between the level of environmental sanitation knowledge and community behavior in handling sanitation in the working area of Pantoloan Health Center, Palu City, Central Sulawesi Province.
- b. To determine the relationship between attitudes and community behavior in handling sanitation in the working area of Pantoloan Health Center, Palu City, Central Sulawesi Province.
- c. To determine community-based environmental sanitation management strategies using SWOT analysis in the working area of Pantoloan Health Center, Palu City, Central Sulawesi Province.

Theoretical Benefits

The results of this study are expected to provide useful scientific information for the development of public health knowledge and can be used as a reference to expand understanding of environmental health related to knowledge, attitudes, and behaviors towards environmental sanitation.

Practical Benefits

This study provides benefits in the form of increased knowledge and scientific understanding for researchers in the field of environmental health, particularly related to strategies for managing environmental sanitation.

LITERATURE RIVIEW

Research by Miswan Gufran D & colleagues (2019) The study results based on SEM analysis showed that the influence of environmental knowledge on attitudes towards environmental management is 0.68 with a probability value (P) of 0.00001, indicating that environmental knowledge affects attitudes in handling environmental sanitation. Meanwhile, environmental knowledge does not affect community behavior in handling environmental sanitation, with the influence of environmental knowledge on community behavior in handling environmental sanitation being 0.221 with a probability value (P) of 0.055. This study suggests that the findings can serve as an additional source of information for health practitioners as a reference for conducting further research and as a consideration for policymaking, particularly regarding matters related to environmental sanitation.

Anggi Sahara's Research (2022) Research Title: Overview of Environmental Sanitation in the Coastal Community of Pandan Sibolga. The research results showed that 52.5% or 21 respondent households met the criteria for a healthy house, while 47.5% or 19 houses did not. The criteria for a healthy house include adequate ventilation (>10% of floor area), natural lighting, ideal occupancy density (≥ 8 m²/person), and optimal temperature and humidity. Regarding family toilet facilities, 60% of respondents (24 people) have toilets that meet the requirements, such as the goose-neck type with a septic tank, whereas 40% (16 people) still use inadequate toilets or do not have one at all. Low toilet ownership is associated with economic factors and community habits that are accustomed to defecating in open areas, such as rivers or the beach. As for the provision of clean water, 85% of respondents (34 people) have access to clean water that meets health standards, baik from protected springs and dug wells. Meanwhile, 15% of respondents (6 people) still use water that is unsafe or not suitable for consumption. This study emphasizes that environmental sanitation in the coastal area of Pandan Beach is still considered suboptimal, with almost half of the households not meeting basic sanitation standards. The researchers recommend efforts to improve household health, such as improving ventilation and lighting, building healthy latrines, and adding clean water storage systems.

Environmental Sanitation Concept

Sanitation here refers to efforts made to change cultural behaviors towards a clean and healthy life by not defecating indiscriminately, managing safe drinking water and food, safely managing household waste, and safely managing household liquid waste. Therefore, environmental sanitation is an effort to achieve a healthy environment through the control of physical environmental factors, especially those that impact human survival. The World Health Organization (WHO) defines sanitation as an effort to monitor several physical environmental factors that affect humans, especially those that influence harmful effects, hinder physical health development, and threaten survival. In short, sanitation is a set of devices and systems to maintain cleanliness in order to achieve public health in a region (Hargono et al., 2022).

Clean Water

Clean water refers to water that is free from contaminants, pollutants, or harmful substances that can endanger human health or the environment. This includes water that does not contain toxic chemicals, heavy metals, bacteria, viruses, parasites, or solid particles that can pollute the water and cause health problems, and can be used by humans for consumption or daily activities, including sanitation (Tanjung et al., 2024).

Waste Management

Garbage is the residue of human efforts or activities in solid form, either in the form of organic or inorganic substances, which can be biodegradable or non-biodegradable, and is considered no longer useful, hence discarded into the environment. Waste management has been regulated under Law Number 18 of 2008 concerning Waste Management, which emphasizes the need to shift from conventional waste management to a system focused on waste reduction and handling. In 2020, the government issued further regulations related to more specific waste management, as stipulated in Government Regulation of the Republic of Indonesia Number 27 of 2020 concerning specific waste management. The specific waste referred to is waste that, due to its nature, concentration, and volume, requires special treatment, such as masks, which fall under hazardous and toxic medical waste (B3). One method of handling and reducing waste is the reuse of used items, repairing damaged goods, and designing products so that they can be refillable or can be reused, encouraging consumers to avoid the use of disposable items.

Ownership of Toilets

A toilet is one of the basic sanitation facilities needed in every home to support the health of its inhabitants as a facility for human waste disposal, consisting of a squatting or sitting area with a gooseneck or without a gooseneck, equipped with a unit for collecting waste and water for cleaning it. Toilets that are installed have several options. The best choice is a toilet that does not produce odors and has adequate water supply.

Research Conceptual Framework

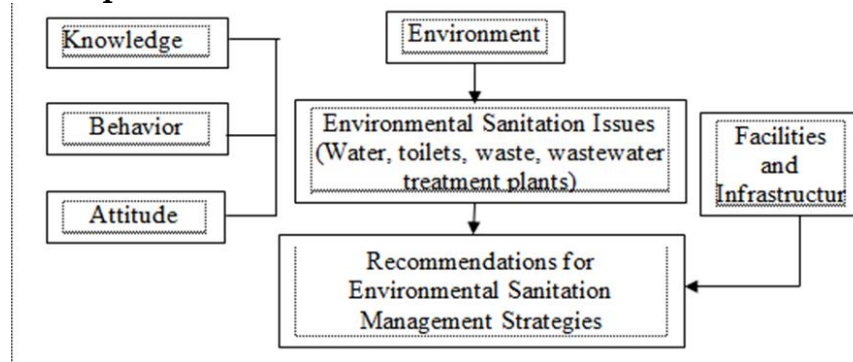


Figure 2. Conceptual Framework

METHODOLOGY

Research Design

The research design is based on the dependent variable (Y), which is environmental sanitation management, and the independent variables consisting of environmental knowledge (X1), attitude in managing the environment (X2), and environmental sanitation behavior (X3). This research design is based on the SEM model, assuming that all variables are considered to have both direct and indirect relationships. Meanwhile, to determine strategies for managing environmental sanitation, a SWOT approach is used.

Population

The population in this study is all households in Pantoloan Boya Urban Village, Palu City, totaling 827 units.

Research Sample

Sample Sampling is used to obtain information about the research object. In this study, to identify the characteristics in the study area, a sample of community respondents residing in the Pantoloan Boya Village settlement in Palu City was used using the Proportional Random Sampling technique. The sample used in this study is the number of heads of households residing in the area.

The sampling method used is Probability Sampling, which means that every element of the population has an equal chance of being selected through a systematic calculation. The sampling technique used is Proportional Stratified Sampling, because the sample is taken based on the number of households. The reason the author uses the Proportional Stratified Sampling technique is that the population is divided into several neighborhood units (RW). The determination of the sample size can be done through statistical calculation using Slovin's Formula. Slovin's Formula is used to determine the sample size from a population whose total is already known, which in this case is 827 households. Slovin's Formula is as follows:

$$n = \frac{N}{1 + N (\pi)^2}$$

Explanation: n = Sample Size N = Population Size π = Margin of error due to sampling error that can be tolerated (10%), then squared (Kriyatono, 2008).
Data Analysis Method SEM Analysis The data analysis technique used is the Structural Equation Model (SEM) technique. SEM is a multivariate statistical analysis capable of analyzing variable relationships in a complex manner. Thus, the relationships between the variables in the study can be explained comprehensively. SEM is very useful for testing and validating a model. The SEM analysis in this study is constructed with a causal relationship pattern between the dependent variable (Y), which is behavior in environmental sanitation management, and four (4) independent variables: knowledge (X1), attitude in managing the environment (X2), and behavior (X3). The concept of a causal relationship between variable Y and the X variables themselves, as well as the direct and indirect relationships among all X variables The variable Y is constructed based on the theory presented in the form of a diagram.

SWOT Analysis

The factors identified are internal environmental factors in the environmental sanitation management strategy in Pantoloan Boya Village, Palu City, which include knowledge, attitudes, and behaviors that support Environmental Sanitation, while the external environmental factors include government policies, the availability of physical facilities and infrastructure supporting environmental sanitation, and the openness of environmental sanitation management strategies in Pantoloan Boya Village, Palu City. Determining the environmental sanitation management strategy in Pantoloan Boya Village, Palu City.

RESULT

The data collected from 90 respondents across 6 research locations resulted in research findings in the form of data consisting of the following variables: community behavior in sanitation management (Y), environmental knowledge (X1), environmental sanitation knowledge (X2), and attitudes in managing the environment (X3), with values fully tabulated presented in the master table summary appendix. Referring to this data, the total scores of all variables were used to conduct a normality test, and the data description for each variable was obtained, including the range and average total scores, as well as the results of the normality test.

Community Behavior in Environmental Sanitation Management (Y)

The total score of the community behavior variable in environmental sanitation management (Y), calculated from 17 questionnaire items and 90 respondents, ranges from 17 to 85 with a standard deviation of 9.64. After dividing this score by the number of questionnaire items (17 items), an average of 70.6 is obtained. This value indicates that, on average, communities in the five sub-districts studied have a relatively high behavior in handling environmental sanitation, with the frequency distribution shown in Table 4.5 below:

Table 1. Frequency Distribution of Behavior in Environmental Sanitation Management

No	Interval	category	Frequency	Percentage	Desc
1	73-86	Very high	38	42%	
2	59-72	High	41	46%	
3	45-58	Busy	11	12%	
4	31-44	Low	0	0	
5	17-30	Very Low	0	0	
Amount			90	100%	

Source: Primary Data, 2025

Based on Table 1, the frequency distribution of community behavior in handling environmental sanitation shows that the high category dominates with 41 respondents (46%), indicating that most respondents have already implemented good sanitation behavior. This is followed by the very high category at 42% and the medium category at 11%. This indicates that behaviors in handling environmental sanitation are in line with expectations.

Results of Strength, Weakness, Opportunity, Threat (SWOT) Analysis
Based on the determination of priority areas, a plan for handling environmental sanitation was formulated, covering four main sectors: clean water, toilets, waste management, and wastewater disposal systems. The strategy for handling environmental sanitation is developed based on the level of need within the research area, so that it aligns with previously implemented programs, enabling continuity in accelerating environmental sanitation management.

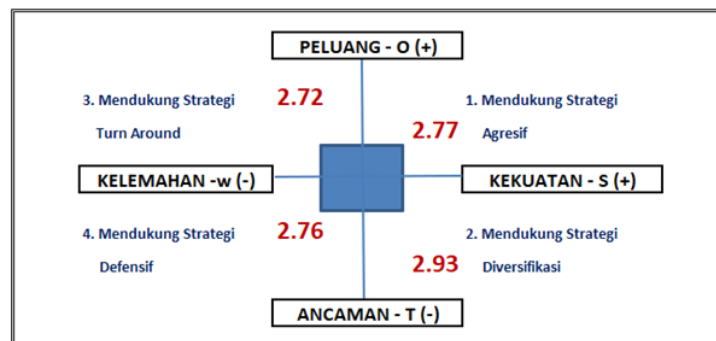


Figure 3. SWOT Matrix of Domestic Wastewater Management

Based on Figure 3. the SWOT (IFAS–EFAS) matrix diagram above for wastewater management in Pantoloan Boya Subdistrict, it can be concluded that the strategic position is in quadrant II (diversification strategy) with the highest score of 2.93 in the Strength-Threat (ST) combination. This indicates that wastewater management in the area has fairly good internal strengths, such as the presence of a Sanitation Working Group, institutional support from the Public Works Department, and increasing community participation. However, this situation also faces external threats in the form of population growth, limited land for the construction of treatment facilities, and potential environmental pollution.

Table 2. SWOT of Domestic Wastewater

IFAS EFAS	Strengths	Weaknesses
Opportunities	Strategy (SO) 2,77	Strategy (WO) 2,72
Threats	Strategy (ST) 2,93	Strategy (WT) 2,76

Source: Primary Data, 2025

Pretest Based on the SWOT table above, it can be interpreted as:

a) SO Strategy

Using internal strengths to take advantage of external opportunities.

- Increasing public awareness through education and community-based sanitation programs to expand the reach of wastewater services.
- Developing cross-sector cooperation (government, private sector, and community) to accelerate the provision of adequate household sanitation facilities.

b) ST Strategy

Using strengths to overcome threats.

- Promoting the establishment of Regional Technical Implementation Units (UPTD) specifically for wastewater management to strengthen institutional capacity.
- Conducting training and capacity building for sanitation personnel in the operation and maintenance of wastewater treatment facilities.

c) WO Strategy

Reducing internal weaknesses to take advantage of opportunities.

- Already in place to anticipate the increase in waste volume due to urbanization and population growth.
- Strengthening and utilizing institutional strengths and sanitation networks with inter-agency coordination in wastewater quality monitoring and environmental law enforcement to reduce pollution risks in coastal areas.

d) WT Strategy

Reducing weaknesses to prevent existing external threats.

- Formulating regional regulations on domestic wastewater management, including technical standards, permits, and violation sanctions.

DISCUSSION

Discussion Based on Research Variables

Based on the research results, the distribution of environmental sanitation behavior shows that the majority of respondents (41%) fall into the high category, while (38%) are in the very high category, and only around (11%) are in the moderate category. These results indicate that the level of community environmental sanitation behavior in the working area of Pantoloan Boya Health Center is relatively very good. This community behavior reflects that the community has been fairly proficient in sanitation practices such as using MCK facilities, managing waste, and maintaining environmental cleanliness. However, even though the majority are in the high and very high categories, there is still a small portion (7%) that falls only into the moderate category. This is a concern, as less than optimal sanitation behavior could become a cause of higher environmental health risks. This can also be caused by differences in access, resources, or levels of understanding among individuals. Other research also shows that poor sanitation behavior is closely related to the incidence of environmentally-based diseases, such as diarrhea. An unhealthy environment and unhygienic behavior are closely associated with diarrheal diseases (Qisti et al., 2021). This is also supported by Riskesdas data, which states that health is influenced by behaviors that uphold cleanliness.

Environmental Knowledge (X1)

Based on research data, the environmental knowledge of the community in the Pantoloan Boya Health Center area is classified as very high, with 79% or 71 respondents, 13% in the high category or 12 respondents, 6% in the medium category, and 2% in the low category. This indicates that the community in the six research locations has sufficient awareness and understanding of environmental issues such as wastewater management, waste disposal, and the impact of sanitation on health.

This high level of knowledge is very positive, as knowledge serves as the main foundation for changes in sanitation behavior. A study conducted in Palu City by (Miswan & Rasyid, 2020) found that environmental knowledge has both a direct and an indirect influence (through attitude) on environmental sanitation handling behavior.

From a policy perspective, integrating sanitation programs with public health activities at community health centers supports the implementation of the City Sanitation Strategy (CSS) and the Sustainable Development Goals (SDGs) agenda, specifically Goal 6, which is "Clean Water and Sanitation for All." A cross-sectoral approach involving the health department, environmental agency, and village government will strengthen program sustainability and prevent overlapping interventions (Sihombing & Hanani, 2024). Furthermore, advanced education on drainage systems and wastewater management also has strategic value in preventing environmentally-based diseases such as diarrhea, leptospirosis, and dengue fever. This aligns with the findings of Nasith (2024), which state that increasing technical sanitation knowledge can reduce the risk of waterborne diseases by up to 30% when accompanied by consistent hygienic behavior. Ultimately, this strategy not only increases the effectiveness of sanitation policies but also strengthens environmental resilience and urban

public health in the long term. By building a connection between knowledge, practice, and structural support, community health centers (Puskesmas) can become hubs of synergy between medical, educational, and social aspects in achieving sustainable development goals in sanitation and environmental health.

Environmental Sanitation Knowledge (X2)

Based on research data, environmental sanitation knowledge (X2) in this study at the Puskesmas Pantoloan Boya area is considered very high, with 81% or 73 respondents, 11% in the high category or 10 respondents, and 8% in the moderate category. This indicates that the majority of the community has a good understanding of proper sanitation concepts. The high level of environmental sanitation awareness provides great potential for community-based sanitation development. People who understand the risks of poor sanitation are likely to be more cooperative in developing local sanitation facilities (healthy toilets, drainage channels) and more consistent in using them.

From a policy perspective, the positive attitude of the community can serve as a basis for arguments for health centers and village governments to allocate larger budgets for sanitation infrastructure, as the community is already mentally and morally ready to participate. Community-based programs such as STBM can be strengthened or further adopted, utilizing social capital and citizens' commitment. Furthermore, technical literature also supports the integration between community attitudes and technology. For instance, in the evaluation study of communal wastewater treatment plants (Sanimas), success is not only determined by technical aspects but also by community participation in maintenance and management after construction (Mulyatna et al., 2017). Thus, the positive attitude of Bahodopi residents can be an important asset in managing technical sanitation systems sustainably.

Discussion Based on Structural Equation Modeling Analysis

The results of the Structural Equation Modeling (SEM) analysis conducted show that the relationship between environmental knowledge (X1), environmental sanitation knowledge (X2), attitude in environmental management (X3), and environmental sanitation behavior (Y) forms a hierarchical pattern that explains sanitation behavior. This model conceptually aligns with the Knowledge–Attitude–Behavior (KAB) theory, which emphasizes that increasing knowledge is the foundation for attitude formation, and a positive attitude will encourage healthier behavioral changes (Ajzen, 1991; Fishbein & Ajzen, 2010).

Analysis of Direct and Indirect Effects

The analysis of direct and indirect effects in the Structural Equation Modeling (SEM) aims to understand how each variable affects other variables both directly and through certain mediators. In this study, the main mediator variable is attitude in environmental management (X3), which connects knowledge (X1 and X2) with environmental sanitation behavior (Y).

1. An R^2 value of 0.63 indicates that 63% of the variation in environmental sanitation knowledge (X2) can be explained by environmental knowledge (X1). This figure is considered very high in the context of social and behavioral research, indicating a strong relationship between general knowledge and specific knowledge. These results reinforce the argument that improving general environmental literacy will significantly promote the increase of community knowledge regarding sanitation (Kristiyono & Felim, 2021; Nasith, 2024). In the context of urban communities, environmental knowledge can be obtained from various sources, such as digital media, government programs, or public campaigns related to green living (Sadewa et al., 2022). Therefore, this model successfully demonstrates the close link between general cognitive domains and more practical technical aspects in daily behavior. In addition, these results are also consistent with the findings of Angelia et al. (2024). which uses the PLS-SEM approach to study the acceptance of domestic waste management technology in Pontianak City. The study found that the general level of environmental knowledge is the main determinant of community acceptance of modern sanitation innovations such as local wastewater treatment systems. Thus, the strong relationship between X1 and X2 has a solid empirical basis.
2. Interpretation of R^2 on the Environmental Management Attitude Variable (X3) An R^2 value of 0.32 indicates that 32% of the variation in environmental management attitudes (X3) is explained by the combination of environmental knowledge (X1) and environmental sanitation knowledge (X2) variables. This figure is categorized as moderate, indicating that an individual's attitude towards environmental management is influenced not only by knowledge but also by other psychosocial factors such as subjective norms, cultural values, personal experiences, and social environment (Fishbein & Ajzen, 2010). The study by Marpaung & Kusumapradja (2025) Supporting this, it has been shown that although knowledge makes an important contribution to shaping attitudes, direct experience and support from public facilities are additional variables that play a significant role. In urban environments, communities often face cognitive dissonance between environmental awareness and the reality of infrastructure that does not support environmentally friendly behavior. For example, Purwanto's (2018) study on riverside communities found that although residents understood the importance of cleanliness and pollution prevention, limitations in facilities such as poor drainage and inadequate waste disposal means their positive attitudes were not followed by actual practice. A similar situation was also

identified by Sadewa et al. (2022) in Makassar, where community knowledge about clean water and sanitation only leads to positive attitudes if accompanied by access to adequate facilities. Thus, the R^2 value of X_3 , which is moderate (0.32), indicates that although environmental knowledge and sanitation knowledge are important factors, forming a positive attitude toward sanitation in urban areas requires stronger social and structural support.

3. Interpretation of R^2 for Environmental Sanitation Behavior Variable (Y)

The R^2 value for the Y variable is only 0.03, indicating that only 3% of the variation in environmental sanitation behavior can be explained by the combination of the three independent variables (X_1 , X_2 , X_3). This value is considered low, suggesting that there are many other external factors influencing urban community behavior. This condition illustrates the “knowledge-attitude-behavior gap” phenomenon that has long been discussed in environmental behavior literature (Kollmuss & Agyeman, 2002). Good knowledge and attitudes do not always guarantee appropriate behavior, especially when there are external barriers such as cost or public policies, the lack of sanitation facilities, or social pressure to conform to the unhygienic behaviors of the majority. Research by Sihombing & Hanani (2024) on the implementation of the “Kota Tanpa Kumuh (KOTAKU)” program in Semarang supports this finding. They found that the success of community sanitation behavior is more influenced by policy interventions, government supervision, and community involvement than by individual knowledge levels. Similarly, Nasith (2024) indicates that changes in sanitation behavior in newly urbanized areas will only be significant when communities are provided with role models and tangible facility support, such as the provision of healthy toilets and integrated domestic waste management, as well as continuous education. Without such systemic support, knowledge and positive attitudes alone will not be sufficient to change behavior. Thus, the low R^2 value for sanitation behavior in this study is not a weakness of the model, but rather an indicator of the complexity of human behavior in urban environments. Models that involve only cognitive and affective variables are indeed not fully capable of capturing the structural, social, and policy dynamics present in the field.

4. Overall Effectiveness of the SEM Model Overall, the SEM model used in this study can be categorized as moderate in terms of effectiveness. The relationships between variables are partially significant, and the direction of the relationships aligns with environmental behavior theory. This model is valid for explaining how knowledge serves as a basis for attitude formation, although it is not yet strong enough to explain actual behavior. In the methodological context, the use of Partial Least Squares Structural Equation Modeling (PLS-SEM) is very suitable for social research like this because it can accommodate complex relationships with relatively small samples and non-normal data (Hair et al., 2017). The application of SEM also provides a comprehensive structural overview between cognitive, affective, and behavioral aspects. This study contributes to the development of sanitation

behavior theory by showing that environmental knowledge plays a fundamental role, but does not act alone in shaping community behavior. To enhance the effectiveness of the model, further research can add external variables such as perceived behavioral control, local government support, and environmental social norms (Hanasti et al., 2025).

5. Discussion of Strength, Weakness, Opportunity, and Threat (SWOT) Analysis. Pantoloan Boya Subdistrict is one of the coastal areas in Tawaeli District, Palu City, which has experienced significant growth in social and economic activities as well as population increase over the past decade. The increase in population and economic activities has resulted in greater pressure on the environment, particularly in the aspects of drainage, waste management, and domestic wastewater. These three aspects are interconnected and serve as key indicators for maintaining residential environmental quality and supporting sustainable development in coastal areas. In general, the results of the internal and external factor analysis (IFAS-EFAS) indicate that these three environmental management sectors have good development potential. Based on the weighted scores, the management of drainage and wastewater falls into the diversification strategy position (each with a score of 2.93), Meanwhile, waste management occupies an aggressive strategy position (highest score 3.55). This indicates that, in general, Pantoloan Boya Sub-district has significant internal strengths and external opportunities to develop an integrated, adaptive, and sustainable environmental management system.

Domestic Wastewater

Wastewater management in Pantoloan Boya Sub-district is still traditional, where most households do not yet have adequate treatment systems. Household liquid waste is largely discharged directly into drainage channels, potentially polluting water bodies. Based on the SWOT analysis results, wastewater management falls under a diversification strategy (score 2.93). The main strengths lie in institutional support and community awareness of cleanliness, Meanwhile, threats arise from the lack of communal WWTP infrastructure and the potential for coastal environmental pollution. Research by Indrawati et al. (2022) shows that the implementation of communal WWTP technology and anaerobic biofilters effectively reduces pollutant loads by up to 60%. Meanwhile, Yulianti & Kusuma (2023) emphasize the importance of integrating drainage systems and wastewater management to prevent cross-contamination. The community-based sanitation model (Sanimas) reviewed by Hidayat et al. (2024) has been proven to improve the effectiveness of wastewater management in densely populated settlements. Based on these findings, the wastewater management diversification strategy in Pantoloan Boya includes: 1. Construction of communal WWTPs in densely populated settlement points, 2. Implementation of household biofilters and sealed septic tanks, 3. Strengthening sanitation institutions at the village level, and 4. Education and outreach on wastewater management for the community.

This strategy is expected to be able to transform the wastewater management system from a traditional model to an integrated management system based on sustainable sanitation, which supports environmental quality and public health.

Waste

Management: The results of the IFAS–EFAS analysis indicate that waste management in Pantoloan Boya Subdistrict falls into the aggressive strategy category (score 3.55). This means that the area has strong internal strengths and broad external opportunities to be developed. The main strengths include government institutional support, the availability of waste collection fleets, and community participation in maintaining environmental cleanliness. On the other hand, opportunities arise from support for integrated waste management policies, partnerships with the private sector, and increasing public awareness about recycling. The challenges faced include suboptimal TPS (temporary waste disposal site) facilities, limited service areas, and uneven community participation in household waste sorting.

Interpretation of R² Values and the Effectiveness of the SEM Model

The R² value (coefficient of determination) in Structural Equation Modeling (SEM) analysis is an important indicator that explains the proportion of variance in an endogenous variable that can be accounted for by its predictor variables. In this study, the obtained R² value shows the model's ability to explain variations among the variables of community sanitation behavior.

Drainage System

The drainage system in Pantoloan Boya Village functions as a controller of surface water flow, especially during heavy rainfall and rising sea tides. However, the existing conditions show several obstacles, including blockages in secondary and tertiary channels, high sedimentation levels, and reduced infiltration areas due to increased residential development. The SWOT analysis indicates that the drainage system is under a diversification strategy, which means there are internal strengths that can be utilized to address external threats. These strengths include support from the local government, community awareness regarding the cleanliness of channels, and a relatively good primary channel network. Meanwhile, the threats include reduced soil absorption capacity, extreme rainfall, and uncontrolled changes in land use.

According to Rahmawati et al. (2021) in the Journal of Civil and Environmental Engineering, a sustainable drainage system requires an integrated approach between spatial planning, infrastructure, and community behavior. Research by Pratama & Wibowo (2022) adds that the implementation of the eco-drainage concept can reduce flood risk by up to 25% in densely populated urban areas.

In the context of Pantoloan Boya, the diversification strategy is directed toward:

1. Rehabilitation of secondary and tertiary channels using environmentally friendly materials;
2. Implementation of infiltration wells and retention ponds to capture rainwater runoff;
3. Community-based maintenance as proposed by Setiadi et al. (2023) in the Journal of Green Infrastructure; and
4. Integration of the drainage system with green spatial planning to strengthen the ecological function of coastal areas.
5. Through this strategy, the drainage system is expected to support flood control and improve the quality of sustainable residential environments.

CONCLUSIONS

Based on the results of research and discussion on Environmental Sanitation Management Strategies Post-Earthquake in the Work Area of Pantoloan Boya Public Health Center, Palu City, Central Sulawesi, it can be concluded that:

1. There is a positive relationship between the level of community knowledge and behavior in managing environmental sanitation. Communities with good knowledge about the importance of sanitation and its impact on health tend to exhibit more hygienic behavior and responsibility towards environmental cleanliness. However, some members of the community with low knowledge still engage in less healthy sanitation practices.
2. Specific knowledge about environmental sanitation, such as clean water management, wastewater management, and the use of healthy latrines, has a significant influence on community behavior. The higher the understanding of proper sanitation principles, the better the community's behavior in maintaining cleanliness and preventing environment-based diseases.
3. Community attitudes show a strong influence on sanitation behavior. Respondents with a positive attitude towards cleanliness, environmental health, and the use of adequate sanitation facilities are more consistent in practicing clean and healthy living behaviors. Conversely, apathetic or indifferent attitudes towards environmental cleanliness become a major barrier to the implementation of good sanitation behavior.

RECOMMENDATIONS

- a. environment for sustainable sanitation management. The suggestions that the researcher can provide in this study are as follows: 1. For Local Government a. Local governments are expected to strengthen policies and community-based sanitation development programs through the Community-Led Total Sanitation (CLTS) and Community-Based Total Sanitation (STBM) approaches. b. There needs to be an increase in budget allocation for the development of clean water facilities, wastewater disposal channels, and healthy toilet facilities in disaster-affected areas. c. Cross-sector coordination is required between the Health Office, Environmental Agency, and other relevant institutions to ensure the sustainability of sanitation programs as well as to conduct regular monitoring and evaluation. 2. For Academics (Universities)
- b. Campuses are expected to play an active role in research and community service related to environmental sanitation, especially in post-disaster areas. c. Academics can be partners to the government and community health centers in providing scientific guidance, policy studies, and environmentally friendly technological innovations.

FURTHER STUDY

This research still has limitations so that further research is needed on the topic of Environmental Sanitation Handling Strategy Post-Earthquake in The Working Area of Pantoloan Public Health Center to perfect this research and increase insight for readers and writers.

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