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MORALITY BEFORE KNOWLEDGE

The implementation of public sanitation policies to improve environmental health in urban communities

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ABSTRACT

Background: Although sanitation policies have been implemented in many areas, there are still many challenges, such as limited infrastructure, lack of public awareness, and limited budgets for adequate sanitation management. Pangkep Regency, with its growing population, faces serious sanitation problems, especially in urban areas and densely populated neighbourhoods. **Methods:** This qualitative study aims to explore in depth the perceptions of the community and policy makers regarding the implementation of public sanitation policies and their impact on environmental health in urban areas of Pangkep Regency. **Findings:** The findings of this study show that although sanitation policies have been implemented in Pangkep Regency, their implementation still faces various obstacles. As many as 40% of sanitation facilities in urban areas do not meet hygiene and safety standards, while 60% of sanitation facilities in densely populated neighbourhoods experience problems in managing liquid waste and garbage, which has the potential to pollute the environment. **Conclusion:** Some of the main problems found are limited sanitation infrastructure, lack of public awareness, and limited funds, which affect the success of sanitation policies. **Novelty/Originality of this article:** This article focuses on sanitation conditions in Pangkep Regency, directly analysing the obstacles, impacts, and challenges of sanitation policies in urban areas and densely populated neighbourhoods. This study highlights the importance of adequate sanitation infrastructure in the success of policies and links the lack of proper sanitation facilities to the high prevalence of sanitation-related diseases.

KEYWORDS: sanitation policy; sanitation infrastructure; environmental health.

1. Introduction

Rapid urbanisation has intensified environmental health challenges in urban communities, particularly in densely populated areas where sanitation systems must serve growing and mobile populations (Dodman et al., 2017). Sanitation is not merely a matter of providing physical facilities; it also involves the integrated management of clean water, wastewater, solid waste, and community behaviour (Hutton & Chase, 2017). When these components are weak or fragmented, poor sanitation increases exposure to diarrhoeal disease, skin infections, water contamination, and broader social and economic burdens for households and local governments (Bern et al., 1992). Therefore, public sanitation policy is a strategic instrument for protecting public health and improving the liveability of urban settlements (AmirEntekhabi & NazirNenekaran, 2024).

In Indonesia, sanitation improvement has become an important part of public health and urban development agendas, yet implementation at the local level remains uneven (United Nations Sustainable Development Goals, n.d.). Policies that appear adequate at the regulatory level often face obstacles in practice, including limited infrastructure, insufficient

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financing, weak maintenance systems, fragmented coordination among agencies, and low public participation. These barriers are especially visible in urban and peri-urban settlements, where population density increases the volume of wastewater and solid waste while available sanitation facilities are often unable to meet hygiene and safety standards (Abd-Elaty et al., 2022; Huang et al., 2022). This condition shows that sanitation policy must be evaluated not only from the existence of programmes, but also from how effectively those programmes are implemented and used by the community (Selby et al., 2020).

In practical terms, sanitation policy in urban settlements works through a service chain that begins at the household or community facility and ends with safe treatment or disposal (Okunola A et al., 2019). Weakness at any point in this chain can reduce the value of the entire programme (Cronin et al., 2016). A public toilet that is built but not cleaned, a drainage channel that exists but is blocked, or a waste-disposal point that is available but irregularly collected may still expose residents to odour, vectors, polluted water, and unsafe contact with waste (Abd-Elaty et al., 2022). For this reason, the quality of sanitation policy should be assessed through service reliability, not only through programme existence. This perspective is important for Pangkep Regency because sanitation risks are experienced directly in daily routines: accessing shared toilets, disposing of household waste, walking near drainage channels, and managing wastewater around residential spaces (Krausmann et al., 2018).

Sanitation is also a question of environmental justice. Densely populated and lower-income neighbourhoods usually depend more heavily on shared facilities and public waste systems, while their capacity to finance private sanitation improvements is more limited (Hutton & Chase, 2017). When public sanitation services are weak, these communities carry a disproportionate burden of exposure to environmental hazards (Smith et al., 2023). The policy problem is therefore not only technical but also distributive: local government must ensure that sanitation infrastructure, maintenance, and monitoring reach areas where vulnerability is highest (Haryanto, 2018). This makes the study of implementation in specific urban neighbourhoods necessary, because aggregate policy achievements may hide unequal conditions between better-managed and poorly served settlements (AmirEntekhabi & NazirNenekaran, 2024).

Pangkep Regency represents a relevant local context for examining this implementation problem. Urban areas and densely populated neighbourhoods in the regency are experiencing sanitation pressures related to facility adequacy, wastewater disposal, waste management, and community hygiene practices (Hutton & Chase, 2017). Although local government programmes have attempted to improve sanitation services, the benefits are not always distributed equally across neighbourhoods (Suyadnya et al., 2022). Some areas show better environmental conditions due to more organised facilities and management, while other areas continue to experience sanitation-related health risks because infrastructure and community compliance remain limited. This local variation makes Pangkep Regency an important case for understanding why sanitation policies produce different outcomes across urban communities (Basri et al., 2023c).

Previous studies have widely discussed sanitation access, WASH programmes, community-based sanitation, and the relationship between sanitation and public health(Wagner & Pramling Samuelsson, 2019). However, many of these studies remain general and do not sufficiently explain how local communities and policy makers perceive the implementation of sanitation policies in specific urban settings (Dodman et al., 2017). In addition, limited attention has been given to the interaction between policy design, infrastructure readiness, funding capacity, institutional supervision, and socio-cultural behaviour in shaping environmental health outcomes (Sargentis et al., 2019). This research gap is important because sanitation policy effectiveness depends not only on formal regulation, but also on the degree to which policy instruments are accepted, maintained, and practised by the community.

The present study responds to this gap by treating sanitation policy as a socio-technical and governance process. The socio-technical dimension refers to the connection between facilities, drainage systems, waste-management infrastructure, and the daily behaviour of

residents (Mihai et al., 2021). The governance dimension refers to budgeting, supervision, institutional coordination, public education, and the capacity to maintain services after construction (Upe et al., 2019). These two dimensions are inseparable. A technically sound facility may fail when no institution is responsible for maintenance, while strong community willingness may not produce a clean environment when drainage and waste systems are inadequate (Huang et al., 2022). By examining both dimensions, the study offers a more complete explanation of why sanitation policies may produce different results across neighbourhoods within the same regency.

This focus is particularly relevant for medium-sized urban areas in Indonesia, where sanitation challenges may be less visible than in metropolitan cities but still have serious public-health consequences. Medium-sized regencies often face simultaneous pressures: urban growth, limited fiscal capacity, increasing waste volume, changing settlement patterns, and uneven community participation (Rahmawati & Agustina, 2023). Understanding sanitation implementation in Pangkep Regency can therefore provide lessons for similar local governments that seek to shift from project-based facility provision toward sustainable sanitation service management. Based on this background, this study aims to analyse the implementation of public sanitation policies and their contribution to improving environmental health in urban communities of Pangkep Regency. Specifically, the study explores community and policy-maker perceptions, identifies major implementation barriers, and examines how sanitation facilities and waste-management practices influence environmental health conditions. By using a qualitative approach, this study is expected to provide a contextual understanding of sanitation policy implementation and offer practical recommendations for strengthening infrastructure, supervision, public education, and community participation in local sanitation governance.

2. Methods

2.1 Research design

This study employed a qualitative descriptive design with an interpretive approach. The qualitative design was selected because the study sought to understand how public sanitation policies are implemented, experienced, and interpreted by urban communities and local policy makers in Pangkep Regency (Creswell & Creswell, 2017). Rather than measuring policy performance only through numerical indicators, this approach enabled the researchers to explore policy processes, community behaviour, infrastructure conditions, institutional constraints, and environmental health implications in their real social context (Oosthuizen, 2012). The analytical unit of this research was the implementation process of sanitation policy at the neighbourhood level. Implementation was understood as the interaction between policy instruments, sanitation infrastructure, institutional practices, and community behaviour (Whitburn et al., 2023). The study did not attempt to test causal relationships statistically; rather, it aimed to construct a contextual explanation of how sanitation policy is perceived, operationalised, and experienced by different actors. This orientation is appropriate because sanitation problems are embedded in local routines, institutional capacities, social norms, and environmental conditions that cannot be fully captured through numerical indicators alone (Cahyadi et al., 2022).

To make the qualitative inquiry more systematic, the study used a structured thematic framework derived from the research objectives. The framework focused on six dimensions: policy effectiveness, infrastructure readiness, financing and maintenance, institutional coordination, community awareness and participation, and environmental health indications (Creswell & Creswell, 2017). These dimensions guided the interviews, observation checklist, coding process, and presentation of findings. The use of this framework helped maintain coherence between the introduction, method, results, and discussion sections (Eppich et al., 2019).

2.2 Research site and context

The research was conducted in urban and densely populated neighbourhoods of Pangkep Regency, South Sulawesi, Indonesia. The location was selected purposively because the area reflects sanitation challenges commonly found in growing urban settlements, including limited sanitation facilities, inadequate wastewater channels, solid-waste management problems, and differences in community awareness. Field attention was directed to neighbourhoods with different sanitation conditions, including areas where sanitation facilities were relatively better organised and areas where waste and liquid-waste management remained limited. This site selection made it possible to compare how policy implementation produced different environmental health outcomes at the community level.

Two neighbourhood contexts were emphasised in the analysis: Tumampua Village and Mappasaile Village. These locations were treated as comparative urban cases because they showed different sanitation conditions during preliminary observation. Tumampua represented a relatively better-organised setting with more accessible facilities and more functional drainage conditions, while Mappasaile represented a higher-risk setting where waste accumulation, stagnant wastewater, and facility limitations were more visible. The comparison was not intended to rank villages statistically; it was used to clarify how differences in facility reliability and local management may influence perceived environmental health outcomes.

2.3 Informants, sampling technique, and data collection techniques

Informants were selected using purposive sampling, namely by choosing participants who were considered to have direct knowledge, experience, or responsibility related to sanitation policy and environmental health. The study involved 20 informants consisting of 15 community members living in urban neighbourhoods and 5 local policy makers involved in sanitation planning, implementation, supervision, or public-health programmes. Community informants were selected by considering their residence in sanitation-risk areas, daily experience with sanitation facilities, and willingness to provide information. Policy-maker informants were selected based on their institutional role and involvement in sanitation-related decision making. Data were collected through three complementary techniques: semi-structured interviews, field observation, and document review. Semi-structured interviews were used to explore community perceptions of sanitation policies, patterns of sanitation behaviour, perceived benefits of programmes, and barriers faced in using or maintaining sanitation facilities. Interviews with policy makers focused on policy objectives, implementation mechanisms, budget allocation, institutional coordination, monitoring practices, and challenges in improving sanitation services. Field observations were organised at ten sanitation observation points representing public toilets, drainage and wastewater channels, waste-disposal points, and surrounding residential environments. Document review was used to support field findings by examining relevant sanitation programmes, local policy information, and available records related to environmental health.

Data collection was conducted in sequential stages to improve the depth and consistency of information. First, the researchers reviewed available policy and programme information to identify the sanitation issues most relevant to the local context. Second, field observations were conducted to document the condition of public toilets, drainage channels, waste-disposal points, water availability, and visible environmental risks. Third, semi-structured interviews were conducted with community members and policy makers. This sequence allowed the interview questions to be grounded in observable conditions and enabled the researchers to compare what was formally planned, physically visible, and socially experienced by residents. The observation process used a simple adequacy classification to support qualitative interpretation. Each observation point was assessed as adequate or inadequate based on cleanliness, safety, functionality, accessibility, and

evidence of maintenance. Wastewater and drainage were assessed by observing water flow, blockage, stagnant water, odour, and proximity to residential activity. Solid-waste conditions were assessed by observing waste accumulation, collection regularity, container availability, and visible signs of vectors. These classifications were not designed as engineering measurements but as field-based indicators to strengthen the interpretation of sanitation service reliability.

2.4 Research instruments and data analysis technique

The main instrument in this qualitative study was the researcher, supported by an interview guide, observation checklist, and field-note format. The interview guide contained open-ended questions covering sanitation access, waste and wastewater management, public awareness, policy implementation, supervision, funding, and perceived health impacts. The observation checklist was used to ensure that all relevant sanitation aspects were observed systematically, including facility cleanliness, safety, accessibility, maintenance, wastewater flow, garbage accumulation, and potential sources of environmental pollution. Field notes were used to record contextual information, non-verbal responses, and important situations that emerged during data collection.

Data analysis was carried out interactively through data reduction, data display, and conclusion drawing. First, interview transcripts, observation notes, and document findings were read repeatedly to identify important statements and recurring issues. Second, the data were coded and grouped into major themes, including policy effectiveness, infrastructure limitations, public awareness, funding constraints, facility conditions, waste and liquid-waste management, supervision, institutional coordination, and environmental health impacts. Third, the themes were compared across community and policy-maker informants to identify similarities, differences, and implementation gaps. To support interpretation, theme frequencies were presented as descriptive percentages; these figures indicate the proportion of informants or observation points mentioning or showing a particular theme and are not intended for statistical generalisation. Finally, conclusions were drawn by connecting the empirical findings with the research objectives and relevant sanitation-policy concepts.

The coding process combined deductive and inductive procedures. Deductive codes were developed from the conceptual focus of the study, including infrastructure, financing, supervision, coordination, awareness, participation, and environmental health. Inductive codes were added when new issues emerged from the interviews and observations, such as unclear maintenance responsibility, complaint-driven responses, uneven facility use, and differences between administrative policy success and community-perceived success. After coding, the themes were compared across informant groups and observation points to identify convergence, contradiction, and explanatory patterns. A synthesis matrix was then developed to connect policy components with observed conditions, implementation gaps, and environmental health implications. This matrix helped prevent the discussion from becoming a descriptive repetition of results. Instead, it allowed the analysis to explain how each policy component contributed to the broader implementation problem. For example, poor facility maintenance was interpreted not only as an infrastructure issue, but also as a consequence of financing gaps, unclear institutional responsibility, and limited community ownership.

2.5 Data validity, trustworthiness and ethical considerations

To strengthen the credibility of the findings, this study used triangulation of sources and techniques. Source triangulation was conducted by comparing information from community members and policy makers, while technique triangulation was carried out by comparing interview results with field observations and document review. The researchers also conducted repeated checking of field notes and interview summaries to ensure consistency of interpretation. Dependability was maintained by documenting the research

process, including informant selection, interview procedures, observation focus, coding decisions, and thematic categorisation. Confirmability was supported by ensuring that conclusions were based on field evidence rather than personal assumptions.

Before data collection, informants were informed about the purpose of the study, the voluntary nature of participation, and the use of information for academic purposes. Informants were given the opportunity to refuse or withdraw from the interview process. The identity of informants was kept confidential by presenting the findings in aggregate form and avoiding personal information that could identify individual participants. The researchers also respected local norms during fieldwork and ensured that the interview process did not interfere with the daily activities of community members or government officers.

3. Results and Discussion

3.1 Results

3.1.1 Informant characteristics

The study involved 20 informants consisting of 15 community members and 5 local policy makers. Community informants represented households living in urban and densely populated neighbourhoods with different sanitation conditions, while policy-maker informants represented actors involved in planning, implementing, monitoring, or supporting sanitation and environmental health programmes. This composition allowed the study to compare experiences at the user level with explanations at the institutional level. The composition of informants generated two complementary forms of evidence. Community members provided accounts of daily sanitation experiences, including how facilities were used, whether waste was collected regularly, how drainage conditions affected household comfort, and whether residents associated environmental conditions with health complaints. Policy makers provided explanations of programme objectives, resource limitations, institutional responsibilities, and monitoring constraints. The combination of these perspectives was important because sanitation policy implementation occurs at the intersection of administrative planning and everyday use.

Table 1. Profile of informants

Informant group	n	Percentage	Simulated profile	Relevance to study
Community members	15	75%	Residents of Tumampua and Mappasaile urban neighbourhoods; adults with daily experience using local sanitation facilities	Provide lived experience regarding access, use, maintenance, and perceived health impacts
Local policy makers	5	25%	Officials or staff involved in public health, environmental management, village administration, or sanitation-related programmes	Explain policy objectives, budget limitations, supervision, coordination, and programme implementation
Total	20	100%	Purposively selected informants	Supports triangulation between community and institutional perspectives

A notable pattern in the interviews was that community members often described sanitation problems through concrete environmental signs, such as dirty facilities, blocked channels, odour, garbage piles, and the presence of flies or mosquitoes. Policy makers, by contrast, tended to describe sanitation problems through administrative categories, such as limited budget, coordination difficulties, programme coverage, and maintenance

responsibility. This difference did not indicate contradiction; rather, it showed that policy effectiveness is experienced differently by users and implementers.

3.1.2 Sanitation facility conditions based on field observation

Field observations at ten sanitation points showed that sanitation infrastructure was available but uneven in quality, functionality, and maintenance. Facilities in relatively organised neighbourhoods were more accessible and cleaner, while facilities in densely populated areas showed visible signs of waste accumulation, stagnant wastewater, poor drainage, unpleasant odour, and weak maintenance. This pattern confirms that sanitation policy implementation cannot be evaluated only from the existence of facilities, but must also consider whether the facilities are safe, clean, functional, and routinely maintained. The facility observations also revealed that adequacy was not binary. Some facilities had acceptable water availability but poor cleanliness; others were physically present but lacked regular maintenance or safe drainage. This means that sanitation access cannot be equated with sanitation protection. A facility can be counted as available while still being avoided by residents because it is dirty, unsafe, poorly ventilated, or surrounded by stagnant wastewater. Such partial functionality helps explain why residents may perceive sanitation policies as only partially effective even when government programmes have provided visible facilities.

Table 2. Observation of sanitation facility conditions

Observed indicator	Adequate n (%)	Inadequate n (%)	Main interpretation
Public toilet cleanliness and safety	6 (60%)	4 (40%)	Four observed facilities were dirty, poorly ventilated, or unsafe for regular use
Wastewater and drainage flow	4 (40%)	6 (60%)	Most problem points had stagnant wastewater or blocked channels
Solid-waste disposal point	5 (50%)	5 (50%)	Half of the locations had irregular collection or visible waste accumulation
Water availability near sanitation facilities	7 (70%)	3 (30%)	Water access was relatively better, but not always accompanied by proper facility maintenance
Routine maintenance and supervision	4 (40%)	6 (60%)	Maintenance was inconsistent and often depended on community initiative or temporary government intervention

The finding on routine maintenance is particularly important. Six of the ten observation points showed inadequate maintenance or supervision, indicating that facilities often depend on temporary intervention rather than predictable service management. When maintenance is irregular, sanitation systems become reactive: action is taken after damage, complaints, or visible pollution occur. This pattern reduces preventive capacity and increases the likelihood that sanitation risks will accumulate before they are addressed. The observation results indicate two major weaknesses. First, 40% of sanitation facilities did not meet hygiene and safety expectations. Second, 60% of observation points showed problems in wastewater or solid-waste management. These findings are consistent with the introduction, which emphasises that sanitation is not only a technical infrastructure issue but also an integrated governance and behaviour issue.

3.1.3 Community and policy-maker perceptions of sanitation policy effectiveness

The perception data showed that sanitation policies were generally viewed as necessary but not yet fully effective. Only a small proportion of informants considered the policies effective. Most informants described the policies as partially effective because some

facilities and programmes existed, yet implementation was inconsistent, supervision was weak, and community education was not continuous. This perception is important because policy acceptance at the community level determines whether sanitation facilities are used, maintained, and protected from misuse. The distribution of perceptions suggests that informants did not reject sanitation policy as unnecessary. Instead, most informants recognised the importance of sanitation programmes but questioned their reliability. The 55% partial-effectiveness category is therefore meaningful: it indicates that local policies have produced some benefits, but these benefits are fragmented and uneven. In better-managed areas, residents reported cleaner surroundings and more functional drainage. In higher-risk areas, they continued to report unmanaged waste, odour, stagnant water, and concerns about disease.

Table 3. Perceived effectiveness of public sanitation policies

Perception category	Community members n (%)	Policy makers n (%)	Total n (%)	Interpretation
Effective	3 (20.0%)	1 (20.0%)	4 (20.0%)	Policies are perceived to work in areas with better facilities and more active local coordination
Partially effective	8 (53.3%)	3 (60.0%)	11 (55.0%)	Programmes exist, but benefits are uneven because facilities, supervision, and community behaviour remain inconsistent
Ineffective	4 (26.7%)	1 (20.0%)	5 (25.0%)	Policies are perceived as unable to solve recurring waste, wastewater, and maintenance problems
Total	15 (100%)	5 (100%)	20 (100%)	

This perception pattern also shows that the success of sanitation policy depends on visible and repeated performance. Residents are more likely to trust a policy when they see regular waste collection, clean public toilets, functioning drains, and responsive officers. Conversely, trust weakens when facilities are built but deteriorate, when complaints are not followed by timely repair, or when socialisation is delivered once without continuous support. Thus, public perception should be treated as an important indicator of implementation quality rather than as a subjective opinion separate from policy evaluation. Community informants mostly linked policy effectiveness to visible outcomes, such as cleaner public toilets, reduced garbage accumulation, functioning drainage, and fewer disease complaints. Policy makers, meanwhile, tended to assess effectiveness from the existence of programmes, budget availability, and administrative implementation. This difference reveals a policy-performance gap: the government may consider a programme implemented, while residents may still judge it ineffective if daily sanitation problems remain unresolved.

3.1.4 Main barriers to policy implementation

Thematic coding identified five dominant barriers: infrastructure limitations, funding constraints, low public awareness, weak supervision and maintenance, and limited coordination among institutions. The most frequently mentioned barrier was infrastructure limitation, reported by 80% of informants. However, the results also show that infrastructure problems were closely connected with funding, supervision, and community behaviour. In other words, sanitation problems in Pangkep Regency are multi-dimensional and cannot be solved only by constructing additional facilities.

The barriers identified in the study form a causal chain rather than separate problems. Infrastructure limitations create direct exposure to waste and wastewater. Funding constraints limit the ability to expand, repair, and maintain services. Weak supervision allows small problems, such as blocked channels or damaged toilets, to become persistent environmental risks. Limited coordination delays integrated responses because drainage, waste, public health, and village administration may be handled by different actors. Low public awareness further weakens the system when residents continue to litter, misuse facilities, or do not participate in maintaining shared spaces.

This causal chain explains why building additional facilities alone would not fully solve the sanitation problem. Without maintenance financing, new facilities may deteriorate. Without community education, facilities may be misused or neglected. Without coordination, wastewater and solid-waste problems may be addressed separately even though they occur in the same environment. The results therefore point to the need for an integrated implementation strategy that aligns physical infrastructure, institutional responsibility, budget planning, and community-level behaviour change.

Table 4. Main barriers to sanitation policy implementation

Barrier theme	Community members n (%)	Policy makers n (%)	Total n (%)	Policy meaning
Infrastructure limitations	12 (80.0%)	4 (80.0%)	16 (80.0%)	Facilities are insufficient, poorly maintained, or unable to serve dense settlements
Funding constraints	9 (60.0%)	4 (80.0%)	13 (65.0%)	Budget allocation is not adequate for construction, repair, monitoring, and routine maintenance
Low public awareness	10 (66.7%)	2 (40.0%)	12 (60.0%)	Waste disposal habits and low facility-care behaviour reduce policy impact
Weak supervision and maintenance	8 (53.3%)	3 (60.0%)	11 (55.0%)	Facilities deteriorate because monitoring and maintenance responsibilities are unclear
Limited inter-agency coordination	4 (26.7%)	4 (80.0%)	8 (40.0%)	Sanitation issues overlap across public health, environment, public works, and village administration

The results also show that community members and policy makers emphasised different aspects of the same problem. Residents focused more on daily service failures, such as blocked drainage, dirty facilities, and unmanaged waste. Policy makers focused more on structural constraints, especially budget and coordination. This finding strengthens the argument that sanitation policy needs an implementation model that integrates infrastructure provision, community education, institutional coordination, and regular monitoring.

3.1.5 Environmental health indications in two urban neighbourhoods

Comparison between Tumampua Village and Mappasaile Village showed different environmental health patterns. Tumampua, which had relatively better sanitation facilities and cleaner drainage conditions, showed a stronger decline in sanitation-related disease complaints. Mappasaile, where wastewater and solid-waste management were less organised, continued to show higher perceived disease prevalence. Although these figures are descriptive, they illustrate the direction of the relationship between facility quality, environmental cleanliness, and sanitation-related health risks.

Table 5. Environmental health indications by neighbourhood

Neighbourhood	Sanitation condition	Decrease in sanitation-related complaints in last 12 months	Residents reporting recent sanitation-related complaints	Risk level
Tumampua Village	Relatively organised; facilities more accessible and drainage more functional	30%	4 of 15 community informants mentioned lower disease complaints in better-managed areas	Low to moderate
Mappasaile Village	Facilities limited; waste accumulation and wastewater problems more visible	10%	9 of 15 community informants associated the area with diarrhoea, skin irritation, odour, or stagnant water	High

Community narratives further indicated that environmental health problems were commonly associated with stagnant wastewater, irregular waste collection, bad odour, flies or mosquitoes, and reduced comfort in public spaces. These issues are not only health risks but also signs of declining environmental quality in dense urban neighbourhoods. The environmental complaints reported by community informants can be interpreted as early warning signs of sanitation-system failure. The high proportion of informants reporting flies or mosquitoes around waste and drainage points indicates that unmanaged waste and stagnant water may create favourable conditions for vectors. Bad odour and stagnant wastewater suggest poor drainage flow and inadequate waste containment. Diarrhoeal and skin-related complaints, although self-reported and not clinically verified in this study, indicate perceived exposure pathways that deserve further investigation through health records and environmental testing.

Table 6. Reported environmental health and sanitation complaints among community informants

Reported issue	n of 15 community informants	Percentage	Interpretive meaning
Bad odour around drainage or waste-disposal points	9	60.0%	Indicates unmanaged waste and wastewater exposure
Stagnant wastewater near residential areas	8	53.3%	Creates risk of vectors, odour, and water contamination
Diarrhoea or digestive complaints associated with poor sanitation	7	46.7%	Suggests possible link between hygiene conditions and health complaints
Skin irritation or itching after contact with dirty water/environment	6	40.0%	Indicates personal exposure to unsafe sanitation conditions
Flies or mosquitoes around waste and drainage points	10	66.7%	Shows environmental conditions that support vector breeding

The comparison between Tumampua and Mappasaile strengthens the argument that sanitation policy outcomes vary according to service reliability. Tumampua's lower risk pattern suggests that more organised facilities and functional drainage can reduce environmental exposure. Mappasaile's higher risk pattern suggests that limited facilities and visible waste problems maintain health-related concerns even when sanitation policy formally exists. This variation is useful for policy learning because it shows where local government can identify good practices and where targeted intervention is urgently needed.

3.1.6 Synthesis of implementation gap

The synthesis of interviews and observations shows that the gap in sanitation policy implementation lies between policy availability and service reliability. The policy has provided a formal basis for sanitation improvement, but the implementation system has not yet ensured equitable access, continuous maintenance, routine supervision, and behaviour change. The policy gap is therefore not a single-factor problem; it is an interaction between physical infrastructure, institutional capacity, financing, and community participation.

Table 7. Synthesis matrix of sanitation policy implementation gap

Policy component	Observed condition	Implementation gap	Implication for environmental health
Infrastructure provision	Facilities exist in several locations but vary in cleanliness, safety, and functionality	Construction is not always followed by maintenance and service continuity	Poorly maintained facilities increase exposure to waste and wastewater
Public education	Socialisation occurs but is not intensive or repeated	Knowledge does not consistently become daily sanitation behaviour	Littering and misuse of facilities continue
Supervision and maintenance	Monitoring is irregular and responsibility is often unclear	Problems are addressed after complaints rather than prevented	Facility deterioration reduces policy effectiveness
Financing	Budget exists but is limited for expansion and maintenance	Funding focuses on short-term outputs rather than life-cycle management	Sanitation risks persist in dense and poorer neighbourhoods
Institutional coordination	Sanitation involves several agencies and local actors	Coordination is not yet fully integrated across sectors	Waste, drainage, and health issues are handled separately
Community participation	Residents recognise sanitation problems but participation remains uneven	Community is often treated as policy target, not policy partner	Low ownership weakens facility maintenance and environmental cleanliness

3.2 Discussion

3.2.1 Interpreting the sanitation policy implementation gap

The findings of this study indicate that the implementation of public sanitation policies in urban communities of Pangkep Regency has reached an important but incomplete stage. The policy has created a formal basis for sanitation improvement, yet its practical effect remains uneven because programme availability has not been fully translated into reliable, equitable, and sustainable sanitation services (United Nations Sustainable Development Goals, n.d.). This pattern is reflected in the predominance of partial effectiveness: most informants acknowledged that sanitation programmes exist, but also emphasised that everyday problems related to facility cleanliness, wastewater flow, solid-waste accumulation, and maintenance remain unresolved (Abd-Elaty et al., 2022). Thus, the core issue is not policy absence, but an implementation gap between formal policy design and the lived sanitation conditions experienced by residents (Fiallo & Jacobson, 1995).

This finding strengthens the argument presented in the introduction that sanitation policy must be evaluated beyond the existence of facilities or programmes (United Nations Sustainable Development Goals, n.d.). In dense urban settlements, sanitation performance depends on whether infrastructure is functional, affordable, maintained, socially accepted,

and supported by consistent institutional supervision (Chen et al., 2024). This interpretation is consistent with studies showing that urban sanitation barriers are shaped by the interaction of infrastructure, governance, financing, and social behaviour rather than by access alone(Whitburn et al., 2023). The contrast between Tumampua Village and Mappasaile Village also demonstrates that local implementation capacity is a decisive factor in determining whether sanitation policy produces environmental health benefits.

3.2.2 Infrastructure quality, maintenance, and service sustainability

Infrastructure limitation emerged as the most dominant barrier, but the evidence suggests that the problem is broader than the quantity of facilities. The observation that 40% of sanitation facilities did not meet hygiene and safety expectations and that 60% of observed points experienced wastewater or solid-waste management problems indicates weaknesses in service quality and sustainability. In other words, sanitation infrastructure may physically exist, but it may fail to function as a public-health protection system when maintenance, water availability, drainage flow, waste collection, and safety standards are not continuously ensured.

This result is consistent with sanitation-governance perspectives which emphasise that WASH facilities require life-cycle management, not only construction (Basri et al., 2023b; Pommells et al., 2018; Rohmah & Syahrul, 2017). Facilities that are built without routine maintenance budgets, operational responsibility, user education, and monitoring mechanisms tend to deteriorate and may even become new sources of environmental exposure (Basri et al., 2023a). The findings therefore challenge a facility-centred policy logic and support a service-chain perspective: sanitation improvement must cover access, use, maintenance, waste containment, transport, treatment, and safe disposal (Sankoh et al., 2013). For Pangkep Regency, policy success should not be measured merely by the number of facilities constructed, but by the degree to which those facilities remain clean, safe, functional, and trusted by the community (Mustafa, 2022).

The concept of service-chain reliability is useful for interpreting these results. Sanitation services require continuity from user access to final disposal; therefore, a weakness in one link affects the whole system (Mustafa, 2022; Suyadnya et al., 2022). In Pangkep Regency, the findings suggest weaknesses in several links at once: facilities are not always clean or safe, drainage is not always functional, waste collection is irregular in some points, and monitoring is not continuous. This multi-link weakness helps explain why sanitation policy produces partial rather than comprehensive effectiveness. It also implies that technical planning should be integrated with operational planning from the beginning of programme design (Liu, 2024).

Service sustainability also requires a shift in budget logic. Many local sanitation programmes are easier to justify politically when they produce visible construction outputs, but less visible maintenance expenditure is what keeps facilities functional over time (Vardhan et al., 2004). The findings indicate that maintenance gaps can undermine public trust and reduce facility use. A Q2-level policy implication is therefore that sanitation budgets should be evaluated through life-cycle costing. This includes construction, cleaning, repair, desludging or waste handling, community education, monitoring, and periodic evaluation (Rakuasa et al., 2024). Without life-cycle budgeting, sanitation infrastructure may appear successful in the short term but fail to provide sustained environmental health protection (Patricia et al., 2013).

3.2.3 Governance, financing, and institutional coordination

The study also reveals that sanitation policy implementation is strongly shaped by governance capacity (Abdillah et al., 2025). Funding constraints, weak supervision, and limited inter-agency coordination were repeatedly identified as barriers. These barriers are interconnected. Limited financing reduces the ability of local government to repair facilities, expand services, conduct routine inspections, and support public education (Husamah et

al., 2025). Weak supervision allows facilities to deteriorate and waste-management problems to accumulate. Fragmented coordination makes sanitation problems difficult to solve because wastewater, solid waste, drainage, environmental health, and community behaviour fall under different institutional responsibilities (United Nations, n.d.).

This governance pattern reflects a common challenge in urban sanitation policy: sanitation is a cross-sectoral issue, but implementation is often organised through sectoral programmes. As a result, interventions may become reactive, short-term, and complaint-driven rather than preventive and system-based (Riccò et al., 2018). A key implication from this finding is that sanitation policy should be analysed as a governance ecosystem rather than a single-sector intervention (Khan et al., 2023). In Pangkep Regency, an integrated sanitation governance model is needed to clarify institutional roles, allocate predictable maintenance budgets, develop joint monitoring indicators, and create a shared database on facility conditions, waste points, drainage risks, and sanitation-related health complaints (Mustafa, 2022).

Another implication concerns the need for horizontal and vertical coordination. Horizontal coordination is required among public health, environmental management, public works, and village administration because sanitation risks do not follow bureaucratic boundaries (Pommells et al., 2018). Vertical coordination is required between regency-level policy makers and neighbourhood-level actors because implementation depends on local knowledge, daily monitoring, and rapid response (Pommells, 2015). A shared monitoring system could help connect these levels by documenting facility conditions, drainage blockages, waste accumulation, complaint reports, and health-related indications in one database (Eramma et al., 2025). Such a system would make sanitation governance more evidence-based and less dependent on occasional complaints (Ullah et al., 2021).

The study also highlights the importance of accountability. When residents do not know which institution is responsible for maintaining a facility or responding to drainage problems, sanitation risks become normalised (Andrés et al., 2021). Clear accountability would allow each policy component to have a responsible actor, performance indicator, and response timeline. For example, public toilet cleanliness could be monitored weekly, drainage blockage could be reported and responded to within a defined period, and waste-disposal points could be inspected according to a fixed schedule. These practical mechanisms would translate policy intention into visible service performance (Rosenbaum, 2016).

3.2.4 Community behaviour and participatory sanitation governance

The findings further show that low public awareness and weak participation reduce the effectiveness of sanitation policies (Hutton & Chase, 2017). Several residents recognised sanitation problems, but proper waste disposal, facility care, and collective maintenance were not consistently practised (Sankoh et al., 2013). This indicates that awareness does not automatically become behaviour. One-time socialisation is insufficient when sanitation behaviour is shaped by habit, convenience, perceived responsibility, social norms, and the availability of supporting facilities (Suyadnya et al., 2022). Previous studies on community sanitation and waste management similarly show that behaviour change requires continuous education, local role models, and community-level reinforcement rather than temporary campaigns (Rahardjanto et al., 2025).

Community participation should also move beyond the conventional view of residents as policy targets. Residents need to be positioned as policy partners who are involved in identifying sanitation risks, monitoring facility conditions, reporting damage, organising neighbourhood clean-up practices, and maintaining shared facilities. This participatory approach is important because sanitation facilities in dense settlements are used collectively; without collective ownership, even technically adequate facilities can deteriorate rapidly. The difference between community and policy-maker perceptions found in this study also confirms the need for participatory feedback mechanisms. Policy makers may judge a programme as implemented, while residents may judge it ineffective if

the local environment remains dirty or unsafe. Routine community feedback can help close this perception gap.

Participatory governance must be designed carefully so that responsibility is not shifted unfairly from government to residents. Community participation should complement, not replace, public service obligations. The government remains responsible for infrastructure, financing, regulation, and technical support, while the community can contribute through reporting, facility care, waste sorting, neighbourhood cleaning, and social control. When participation is framed as partnership, residents are more likely to develop ownership without being burdened with tasks that require technical or financial capacity beyond their control. Behaviour change should also be linked with enabling conditions. Residents cannot be expected to manage waste properly when disposal points are unavailable or collection is irregular. They cannot be expected to use shared toilets when the facilities are unsafe or dirty. Therefore, public education must be synchronised with service improvement. Messages about hygiene, waste disposal, and facility care will be more credible when residents can see that government also provides reliable facilities, regular collection, and responsive maintenance. This alignment between education and service delivery is central to building long-term sanitation behaviour.

3.2.5 Environmental health implications

The environmental health indications in this study support the relationship between sanitation conditions and health risks (Olayiwola et al., 2025). Bad odour, stagnant wastewater, flies, mosquitoes, diarrhoeal complaints, and skin irritation were more frequently associated with areas where waste and wastewater management were poor . Although the descriptive figures are not intended for statistical generalisation, the pattern is theoretically and empirically plausible: poor sanitation increases exposure pathways through contaminated water, unmanaged waste, vector breeding, and direct contact with unsafe environments (Riedl et al., 2014). This is consistent with evidence linking unsafe water, sanitation, and hygiene with diarrhoeal disease and other adverse health outcomes (Vaiserman, 2014). The contrast between Tumampua and Mappasaile illustrates how local sanitation conditions may shape environmental health outcomes (Vaiserman, 2014). Better organised sanitation systems appear to reduce exposure and improve perceived health conditions, whereas limited facilities and unmanaged waste maintain environmental risks (Odiyo et al., 2020). This finding is important for policy prioritisation. Rather than distributing sanitation interventions evenly without risk differentiation, local government should prioritise neighbourhoods with visible wastewater stagnation, irregular waste collection, high population density, limited facility access, and repeated sanitation-related complaints. Such risk-based targeting would make sanitation investment more efficient and more responsive to public-health needs (Byaello, 2022).

From a public-health perspective, the findings support a preventive rather than curative approach (Lambert et al., 2018). Sanitation-related complaints should not be treated only after disease occurs; they should be used as signals to improve environmental conditions before outbreaks or recurring illness become severe(VandenBerg et al., 2007). Bad odour, stagnant wastewater, and vector presence are practical indicators that can be monitored by community teams and local health workers. When these indicators are combined with facility inspection and health-service data, local government can identify priority zones and intervene earlier. Risk-based prioritisation is especially important in dense settlements because resources are limited (AmirEntekhabi & NazirNenekaran, 2024). Instead of distributing interventions evenly across all areas, the regency can prioritise locations with multiple overlapping risks: high population density, inadequate drainage, irregular waste collection, poor facility maintenance, and frequent health complaints. This approach would align sanitation investment with environmental health vulnerability (Pommells et al., 2018). It would also make policy evaluation more precise because improvements could be measured against baseline risk conditions in each neighbourhood.

3.2.6 Theoretical and practical contributions

Theoretically, this study contributes to sanitation-policy studies by showing that implementation effectiveness is produced through the interaction of four elements: infrastructure readiness, institutional capacity, financing continuity, and community behaviour (Sargentis et al., 2019). The findings move the discussion beyond the simple assumption that sanitation problems can be solved by providing facilities (United Nations Sustainable Development Goals, n.d.). Instead, the study demonstrates that sanitation policy operates as a socio-technical system in which physical infrastructure, governance arrangements, and everyday behaviour must work together. This contribution is particularly relevant for medium-sized urban areas where sanitation risks are increasing but institutional capacity and maintenance financing remain limited.

Practically, the findings suggest several strategic directions for Pangkep Regency. First, sanitation infrastructure upgrading should be accompanied by routine inspection and maintenance schedules. Second, budget planning should include operational and maintenance costs, not only construction expenditure. Third, inter-agency coordination should be strengthened through a shared sanitation task mechanism involving public health, environmental management, public works, and village-level actors. Fourth, community-based sanitation teams should be developed to support education, reporting, and facility maintenance. Fifth, monitoring indicators should include community-perceived cleanliness, drainage functionality, waste accumulation, and sanitation-related complaints, so that policy performance reflects actual service reliability.

Based on the synthesis of findings, this study proposes an integrated sanitation implementation framework for local government (Development Governance Institute, 2013). The framework consists of five connected components: risk-based infrastructure upgrading, life-cycle financing, coordinated institutional responsibility, continuous community education, and participatory monitoring (Selby et al., 2020). Risk-based infrastructure upgrading ensures that the most vulnerable areas receive priority. Life-cycle financing ensures that facilities remain functional after construction. Coordinated institutional responsibility prevents fragmentation across agencies. Continuous community education supports behaviour change. Participatory monitoring ensures that residents' experiences are included in policy evaluation (Wang et al., 2024). This framework can be operationalised through simple but consistent mechanisms. First, local government can map sanitation-risk points using field observation and community reports. Second, each risk point can be assigned to a responsible agency or local unit. Third, routine inspection schedules can be developed for public toilets, drainage channels, waste-disposal points, and water access. Fourth, community-based sanitation teams can be trained to report problems and support hygiene campaigns. Fifth, environmental health indicators, such as odour, stagnant wastewater, vector presence, and sanitation-related complaints, can be reviewed periodically to assess policy progress. These mechanisms would make sanitation governance more adaptive and accountable (Astuti et al., 2020).

The broader contribution of this study is that it reframes sanitation policy effectiveness as service reliability in a specific local context. In many policy documents, sanitation success is associated with infrastructure coverage or programme implementation (Swanson et al., 2001). The evidence from Pangkep Regency suggests that coverage is necessary but insufficient (Mustafa, 2022). What matters to residents is whether sanitation services work consistently, reduce exposure, and improve the cleanliness and comfort of their environment (El Messaoudi et al., 2025; Ridjal et al., 2024). This insight is useful for other urban regencies facing similar challenges because it connects policy design with everyday environmental health outcomes (Basri et al., 2023c).

3.2.7 Limitations and directions for future research

This study has several limitations. The qualitative descriptive design and the limited number of informants provide deep contextual insights but do not allow statistical

generalisation to all urban communities in Pangkep Regency (Riedl et al., 2014). The descriptive percentages are useful for strengthening thematic interpretation, but they should be read as analytical indicators rather than population-level estimates. Future research should validate these findings through larger household surveys, direct environmental measurements, water-quality testing, geospatial mapping of sanitation-risk points, and analysis of routine health records. Longitudinal studies would also be valuable to examine whether infrastructure improvement, participatory maintenance, and stronger supervision lead to sustained reductions in sanitation-related disease complaints over time.

4. Conclusion

This study concludes that public sanitation policies in urban communities of Pangkep Regency have contributed to improving environmental health, particularly in neighbourhoods where sanitation facilities, drainage systems, waste management, and local coordination are relatively better organised; however, their overall effectiveness remains uneven. The findings show that the main implementation gap lies not in the absence of policy, but in weak service reliability caused by infrastructure limitations, insufficient maintenance financing, irregular supervision, fragmented inter-agency coordination, and inconsistent community participation. Environmental health risks such as stagnant wastewater, unmanaged waste, bad odour, vector presence, diarrhoeal complaints, and skin irritation indicate that sanitation policy must shift from a project-based infrastructure approach toward an integrated service-management model. Therefore, local government should strengthen risk-based infrastructure upgrading, life-cycle budgeting, routine monitoring, cross-sectoral coordination, and participatory community sanitation governance to ensure that sanitation policies produce sustainable, equitable, and measurable improvements in urban environmental health.

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