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The Household Waste Management Strategy and Policy in Kupang City, Indonesia

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Abstract*—The availability and accuracy of information contained in the waste profile in a region is one of the keys to sustainable sanitation management. This study aims to not only identify the characteristics of waste infrastructure but also the characteristics of community behavior, institutional systems and funding capabilities and the effectiveness of waste regulations in Kupang City. Important and strategic issues obtained from the waste profile information are then used as the basis for determining strategies and policies and programs for sustainable waste management. The results of this study indicate that 1) although waste regulations already exist, the implementation mechanism is unclear, making it difficult to handle infrastructure and management institutions 2) Community behavior does not fully support waste management programs based on reuse, reduce and recycle 3) community and private participation in waste management is still very minimal, both in terms of payment of contributions and participation in waste management funding. The control policy is realized in the quick wins program which focuses on improving technical infrastructure, changing behavior and community participation.*

***Keywords*—** *Community behavior, funding, regulation, institutional arrangement, technical infrastructure.*

I. INTRODUCTION

Sanitation development that includes domestic waste management has been mandated as a concurrent government affair that is the authority of the region and is part of the mandatory government affairs related to basic services as stated in Law Number 23 of 2014 concerning Regional Government. Efforts to improve access to safe drinking water, sanitation, and hygiene can effectively reduce the death rate from diarrhea by up to 45% [1], [2]. In turn, improvements in the quality of health have an impact on welfare because for every USD $1 invested in sanitation, there is a profit of USD $5.50 from lower health costs, higher productivity and reduced premature deaths [3]. Access to safe water and sanitation is the foundation for other forms of development. Without easy access to safe water and sanitation, a lot of household time and income is spent on buying water and treating diseases, which cumulatively affects poverty alleviation efforts.

Sanitation development has also been included in the document resulting from Transforming Our World: The 2030 Agenda for Sustainable Development to end poverty, improve well-being, and protect the planet, in accordance with goal 6 of the Sustainable Development Goals (SDGs) 2030, namely: "Ensure availability and sustainable management of clean water and sanitation for all" and goal 11: "Make cities and settlements inclusive, safe, resilient and sustainable".

Regionally, the provincial government has a strategic role as regulated in Law Number 23 of 2014 and its implementation in Government Regulation Number 33 of 2018 concerning the Implementation of Duties and Authorities of the Governor as Representative of the Central Government. This role is not only related to embodying the duties, functions and authorities possessed in the development guidance and supervision alone. Based on this, this waste aspect study is a strategic sanitation planning document for the five-year medium term in sanitation management that is prepared and utilized to guide and provide direction for local governments and non-government parties in implementing accelerated development in Kupang City to create sustainable sanitation services for the period 2025-2029.

The objectives of this sanitation profile mapping are: 1. To carry out synchronization and integration of sanitation development management in implementing the 5 (five) year development plan based on information on the root of sanitation management problems in the Kupang urban area 2. To determine the vision, mission and direction of priority policies in implementing comprehensive and integrated sanitation development management in order to accelerate sustainable sanitation services in the Kupang urban area.

II. MATERIAL AND METHOD

The scope of discussion of this work includes aspects of Household Waste Management and Household Waste-like Waste. Each field is studied comprehensively for five (5) aspects [4], namely:

1. Regulatory Aspect: the study of the completeness of regional regulations and regional head regulations
management and levies in each district/city, including the availability of technical planning documents (waste masterplan,)
2. Institutional Aspect, namely the study of the institutional conditions of sanitation service operators, both in the local government and the community.
3. Infrastructure Aspect, namely the study of the completeness of the sanitation infrastructure that has been built as seen from the sanitation service chain management system.

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4. Community Behavior Change Aspect, namely the study of sanitation-related behavior changes activities that are routinely carried out by regional apparatus.
5. Funding Aspect, namely the study of government, non-government, and retribution funding carried out for the sustainability of sanitation development management.

TABLE I. The substance of data and analysis

No	Type of analysis	Data required
1	Analysis of Availability & Condition of Existing Sanitation Infrastructure Services	The real condition of household waste infrastructure as well as healthy living behavior.
2	Strategic issues, problems and challenges in managing existing sanitation systems	Interviews: regarding the level of achievement of sanitation strategic targets, implementation constraints and follow-up plans for managing the situation.
3	Analysis of opportunities for developing a sanitation system based on the existing funding system	Realization of indirect spending and capital spending (including transfers of provincial APBD funds to districts/cities) for the purposes of new investment, operations, maintenance, and development plans
4	Sanitation Vision-Mission	The issue of existing management and the Vision and Mission of the Regional Head as stated in the regional long-term development plan and regional work unit's strategic plan
5	Goals and Targets of Sanitation Management	Vision – Mission Sanitation
6	Sanitation Management Strategy and Policy	Internal conditions (strengths and weaknesses of the existing sanitation system) and external (opportunities and challenges/threats to sanitation system management)

III. Result and Discusion

A. *Existing Waste Management Profile*

1. Regulation
   Data shows that Kupang City already has a regional regulation and regional head regulation on waste as well as a waste master plan and has included aspects of waste management in the regional long term strategic plan and work unit's strategic plan [5].
   The incentive and disincentive aspects of household waste management have also been regulated, but unfortunately they are not equipped with implementation mechanisms (especially regarding who is responsible for monitoring waste disposal activities in random places and what types of sanctions are required, as well as who has the right to impose these sanctions).
2. Institution arrangement
   a) Government institution
   Kupang City has not yet separated the regulator and operator responsible for waste management with its institutional form, namely the Regional Technical Implementation Unit (UPTD), because only 3 districts have it, namely South-Central Timor, Sikka and Ngada districts. Waste management in Kupang City is still carried out under the coordination of the Environment and Forestry Service.
   b) Community institution
   Law No. 18 of 2008 concerning waste management also emphasizes the importance of community participation in waste management. Each district/city in East Nusa Tenggara (including Kupang City) has had at least 10 Community Self-Help Groups (CSG) and/or Waste Sorting and Collection Groups (WSCG), but information related to the volume of reduced waste is not yet available/still difficult to obtain, making it difficult to assess the impact of the presence of the CSG/WSCG on the total % reduction of household waste and waste similar to household waste in each district/city.
3. Technical infrastructure
   Currently, household waste is collected by each family in front of their respective homes in plastic bags. The waste is then transported by trucks or pick-ups periodically. Unfortunately, the frequency of waste transportation is irregular, causing an unpleasant odor and disturbing the aesthetics of the residential environment. In addition, a number of roads in the neighborhood are not served by these waste collection vehicles so that waste is burned in the yard and/or dumped on empty land around the residential area. Therefore, the government has added a type of waste collection fleet with a smaller dimension, namely garbage motorbikes, but the number is still relatively limited.
   In addition, Kupang City already has a final dumping area but its condition is very concerning (it is almost no longer functioning because it has been mixed with fecal sludge due to damage to the Fecal Sludge Processing infrastructure which is located in the same management area.
   a) Integrated Waste Processing Site (IWPS)/Recycling Center (RC)
   Waste management activities at IWPS with the main composting unit are basically not profit-oriented businesses, but rather a joint effort between the government and the community in order to create and better ensure the implementation of good and environmentally friendly waste management. Not all districts/cities have regional waste processing site/temporary regional waste infrastructure, so this is one of the factors in the still low rate of reduction and/or handling of household waste and waste similar to household waste in East Nusa Tenggara province.
   b) Garbage transportation fleet
   Assessment parameters for transportation infrastructure include taking into account the type, quantity and capacity of the transportation equipment operated, the capacity or percentage of services and the coverage of district/city services, including the safety aspect of the intended waste transportation. The availability of existing transportation facilities is not comparable to the service coverage area so that the average transportation capacity/percentage is below 50%. The use of garbage motorbikes is

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actually a strategic option to answer the aspect of waste transportation services to parts of the area that are difficult to reach by dump trucks and/or pick-ups and at the same time answer the aspect of the limited ability to provide more expensive dump trucks or arm-rolls.

4. Community behavior
   A large number of people assume that burning garbage, throwing garbage into ditches or drainage, and throwing garbage in rivers are the most practical waste management solutions. This misperception needs to be corrected through continuous education because:
   a) Although the government provides waste transportation services from homes to the landfill, however: 1) not all residents are willing to pay waste fees 2) not all neighborhood road networks are passed by garbage trucks so that waste transportation services are served by garbage motorbikes 3) the number and itineraries of garbage transportation services by garbage motorbikes are inadequate 4) the condition of the neighborhood road network is inadequate for the transportation fleet to pass through 5) not all residents throw away waste in plastic packaging/garbage bags so that the scattered waste is reluctant to be collected/picked up/thrown away by garbage truck officers
   b) Although the government provides temporary landfill (permanent or container), however: a) the number of temporary landfill is still lacking / does not meet needs so that waste disposal is still carried out in other places (roadside, nearby empty land, and the like), b) the temporary landfill's capacity is exceeded so that waste is not disposed of in trash bins / containers but on the side of the road c) the waste that is disposed of is not packed in trash bags / plastic bags so that the transportation and disposal process is difficult
   c) Although the government has regulated aspects of providing awards/incentives and sanctions/disincentives, however: 1) waste is still dumped carelessly because there is no mechanism for imposing sanctions and/or receiving incentives. 2) Efforts to raise awareness of the obligation to comply with waste regulations comprehensively to all levels of society, integrated and sustainable are still lacking. 3) the level of concern is still lacking due to the minimal involvement of the role and/or participation of residents in the incentive and disincentive schemes.
5. Funding
   The allocation/commitment of government and non-government funding is still relatively limited, so alternative schemes are needed based on micro-credit schemes, cooperation with the private sector, and from non-government grants, including waste management levies.

B. Vision and Mission of Household Waste Management

As stated in the Summary of the 2025-2029 National Long Term Development Plan (NLTDP) document, the vision is "Together with Indonesia Advancing Towards Golden Indonesia 2045". The NLTDP is an elaboration of the Vision-Mission and Program of the President of the Republic of Indonesia for the 2025-2029 period while still referring to the 2020-2045 long term regional plan is a guideline in the preparation of the Regional Strategic Planning and Government Work Plan and can be a reference for business entities/non-state actors.

Various steps and implementations towards the implementation of the National Program which must also be determined in the Regional Medium-Term Development Plan especially those focused on the aspect of Acceleration of Settlement Sanitation Development (ASSD) for the period 2025-2029. Adjustments to policies and strategies for achieving Development targets are also needed in Kupang as the capital city of East Nusa Tenggara, to support the direction of the Bali-Nusra region's Development as an "International-Standard Nusantara Tourism and Creative Economy Superhub".

Regardless of the demands for adjustment, the vision of the National Long-Term Development Plan is "Advanced, Sovereign and Sustainable Archipelago State", while the vision of the East Nusa Tenggara Provincial Long-Term Development Plan 2025 - 2028 is "Independent, Advanced and Sustainable East Nusa Tenggara to Realize Golden Indonesia 2045". In facing the increasing development and challenges of sanitation development, the formulation of the vision and mission of sanitation in Kupang City should be adjusted to the vision and mission of the East Nusa Tenggara Provincial Sanitation Roadmap 2025-2029, namely: "Realizing Total, Integrated and Sustainable Sanitation Development".

Steps required to realize the vision of sanitation development, the Mission has been prepared for the next five years, namely:

1. Creating widespread sanitation development guidance in accordance with norms, standards, guidelines and provisions for the implementation of sanitation development.
2. Realizing conducive policies and regulations for the implementation of sanitation development.
3. Creating sanitation supervision and development through strengthening institutional capacity and developing human resources.

C. Strategic Issue in Sanitation Development

Urgent problems or development issues are the gap between expectations and the realization of development goals achieved within a minimum of five years (2018-2023) as stated in the strategic sanitation document for each

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district/city. In addition, a number of considerations and/or criteria used to determine priority strategic issues are as follows:

1. has a very large influence on the acceleration of achieving safe access of sanitation's targets
2. is the main element/supporting element that has leverage on accelerating targets
3. easy to handle quickly because the handling opportunities can be carried out collaboratively

The results of the recapitulation of urgent issues in Kupang City are summarized into sanitation management issues (strategic issues) in Kupang City. The summary of strategic issues is described for each review parameter, namely from the regulatory, institutional, technical infrastructure, community behavior and funding aspects both at the East Nusa Tenggara provincial level and at the national level as seen in the following tables. Descriptions of similar issues at the national level are also presented as a comparison, at least to see whether or not there are similarities in the issues in East Nusa Tenggara and nationally. This is important to fight for the acquisition of APBN funding assistance, cooperation between local governments and business entities or with partner institutions and other potential funding alternatives.

TABLE II. Strategic issues on household waste management in Kupang City

Strategic Issues in Household Waste Management				
Regulation	**Technical Infrastructure**	**Community Behaviour**	**Funding**	**Institutional arrangement**
Regulations already exist but are not effective (they do not regulate how sanctions are imposed)	1. Limited waste management infrastructure 2. Development and strengthening of the Main Waste Bank 3. Improving the functioning of the built infrastructure of 3R landfill 4. Optimization of the waste transportation system and itinerary to landfill 5. Improving the waste data and information system	1. Increasing public awareness in waste disposal behavior 2. Strengthening the monitoring /supervision system attached to government and community institutions 3. Provision of stimulus in implementing an incentive system	1. Increasing the contribution of funding from the Provincial, Central and non-governmental financial resources 2. Improving cooperation and funding schemes (alternative funding based on grants and loans)	1. Improving the quality of human resources of operators and governance (landfill and Transportation) managed by local governments/communities 2. Arrangement of data and information systems for waste infrastructure (landfill 3R, Waste Bank) 3. Development of institutional status of waste service operators
The effectiveness of the regulatory implementation program is not measurable	Waste generation processed in waste processing facilities	Strengthening the role of the waste processing community	Strengthening the role of Waste Banks and increasing the benefits of management based on parent and unit waste banks	Operators and regulators have not been separated

D. Waste Management Strategy

The most dominant influence of internal (strengths and weaknesses) and external (opportunities and challenges) conditions on the preparation of waste management system strategies and policies in East Nusa Tenggara province are as follows:

1. Strength
   a. Political will (Waste Management Regulation/Masterplan available)
   b. Availability of infrastructure and human resources
   c. Funding policy support from central government / NGOs / and others
   d. Availability of Governor regulation 55/2018 concerning waste reduction and handling (as a reference for management)
2. Weaknesses
   a. There is no mechanism for imposing sanctions for violations
   b. Service routes and number of garbage trucks are inadequate
   c. Investment funds and OP are limited
   d. The number of CSG/WSCG is still limited
3. Opportunity
   a. Involvement of third-party participation in 3R (reduce, reuse, recycle)
   b. Potential for increasing family income / profit from waste management activities
   c. Optimizing the role of third parties in the planning/monitoring aspects of the negative impacts of existing waste management.
4. Treatment
   a. Citizen concern/participation, including in terms of payment of contributions
   b. There are no strict sanctions / mechanisms for imposing sanctions
   c. Population growth rate (waste production)
   d. Disparity (distribution) of residential locations vs reliability of road networks and waste transportation systems
   e. Number and Capacity of temporary landfill site based on 3R

E. Formulation of Waste Management System Strategies and Policies

Therefore, policies made to achieve the 1st strategy are: 1) Review of the substance of the regional regulation: optimization of the role of household waste control organizations at the government and private / NGO levels 2) Review and socialization of regional regulation especially regarding the mechanism of imposing sanctions for dumping waste in any place, 3) Strengthening the commitment of regional heads in the aspect of funding in the field of planning,

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development, utilization, and maintenance of waste infrastructure and continuous updating of regulations 3) Improving the performance / functional condition of infrastructure, 4) Strengthening the capacity of human resources and management institutions 5) Strengthening commitment and alternative funding and networks for mutually beneficial waste management cooperation between main waste bank and unit waste bank 6) Improving the quality of waste fleet services.

Subsequently, the policies made to achieve the 2nd strategy, are: 1) Improving management performance based on information systems 2) Separation of regulator-operator functions and implementation of operator performance assessment instruments and development facilitation 3) Strengthening campaign media and waste reduction education (Total Sanitation based on Community Pillars) in a scheduled institutional manner 4) Increasing commitment to providing incentives in massive waste management 5) Anticipating the rate of population growth through changes in orientation / focus of development on aspects of new facility construction.

Further, in order to achieve the 3rd mission, the following policies are needed: 1) waste funding workshops 2) Increasing the institutional capacity of entrepreneurs and business skills based on a circular economy from waste 3) Implementing a waste management cooperation system by the private sector, 4) Increasing the commitment to determining levies in accordance with laws and regulations, including the arrangement of the system and procedures for collecting waste levies.

F. Quick Wins

In the Technocratic Document of the 2025-2029 Regional Long Term Development Plan [5], a number of forms of General Interventions for Regional Development and Infrastructure Facilities have been determined in each province, where specifically for drinking water and sanitation management, the general form of intervention is the Fulfillment of access to safe, sustainable and climate-resilient drinking water and sanitation and Integrated waste management reform from upstream to downstream towards a circular economy.

Specifically in East Nusa Tenggara, the Policy Direction / Indications for Sanitation Development Interventions are focused on:

1. social transformation, through: handling stunting; equalizing and improving access and quality of health facilities; developing human resource capacity; fulfilling access to safe and proper drinking water and sustainable and inclusive safe sanitation
2. economic transformation, through: providing technical infrastructure in the development areas of new growth centers; including the development of renewable electricity for drinking water and sanitation services
3. transformation of governance, through: strengthening inter-regional cooperation; strengthening cooperation schemes with neighboring country Timor Leste (especially for sanitation management in border areas between countries)
4. transformation of the rule of law, stability and leadership of Indonesia through: enforcing the supremacy of regulation
5. transformation of social, cultural and ecological resilience through increasing the capacity and quality of sustainable sanitation system services (environmentally aware).

The preparation of the following sanitation management action plan and program is based on considerations of the achievement of sanitation access in the base year or baseline 2023: 1) households that have access to safe sanitation are only 2.5%, 2) % of RTs that have decent access are 75.67 percent, which indicates that there are still around 1 in 4 households that do not have access to decent sanitation; 3) the percentage of households occupying decent houses is only 42.7 percent.

Several factors that are estimated to be directly correlated with the level of success of safe sanitation management in the future are: 1) Demographic challenges 2) Physical conditions of the area (climate, topography, geology, etc.) 3) Institutional Governance 4) Funding and Budgeting 5) Community Participation in Sanitation Management and Community Lifestyle Behavior 6) Fulfillment of Minimum Service Standards 7) Latest Science and Technology Interventions to Reduce the Negative Impacts of Conventional Management Patterns 8) Regulatory support.

TABLE III. Waste Management Action Plan and Program

A	Regulation: Strengthening of regulations in the regions
1	Preparation of the Master Plan for Waste Management System
2	Detail Engineering Design Infrastructure Landfill
B	Collaborative Cooperation to Increase Synergy of Cross-Institutional Activity Outputs
1	Institutional strengthening: assistance in the formation of landfill operators, involvement of religious and community figures
2	Facilitation/Coordination of Cooperation and Establishment and Development of Regional Waste Management Institutions
C	Technical Infrastructure
1	Coordination (Circular) of Guidance and Monitoring Evaluation of Waste Management in Strategic Areas
2	Provision and/or improvement of processing infrastructure at the source of generation, storage, collection, temporary landfill site of reduce-reuse-recycle, transportation, & processing facilities (Residue Fill Land)
3	Development of Waste Management Information System
4	Implementation of Technical Guidance on Waste Management
D	Community Behavior
1	Preparation of campaign and education media guidelines
2	Technical guidance on campaign procedures
3	Implementation of waste reduction education in strategic areas
4	Campaign, Socialization of Environmentally Friendly Waste Management
E	Funding
1	Communication for waste management planning and budgeting
2	Technical guidance for entrepreneurship and sanitation skills based on a circular economy from waste

In relation to this, a number of urgent activities are needed to support the achievement of the 30% safe sanitation target in 2030 (quick wins) specifically for the waste sector, namely:

1) Development of regional waste management system. Development of monitoring and evaluation framework for sanitation management action plan (Preparation of

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waste management plan, policy, strategy and technique for landfill)
2) Dissemination of roadmap and distribution of targets to all stakeholder in an integrated manner (coordinated, systematic and sustainable)
3) Preparation of academic manuscripts and draft regional regulation (regulatory framework) and/or fulfillment of minimum service standards for sanitation management including facilitation of cross-district/city waste cooperation as well as technical guidance and community empowerment in Waste Management
4) Socialization and facilitation of the realization of funding efforts for each activity funding scheme under the authority of national funding resources, Cooperation between Regional Government and Business Entities or Partner Institutions

G. Monitoring and Evaluating the Achievement of Sanitation Target Implementation

The purpose of implementing monitoring and evaluation is not only to identify progress in the implementation of RSP directives but also to evaluate factors inhibiting success and at the same time factors supporting the success of its implementation [4], including:

1. Achievement of acceleration of increasing access to sanitation and support for non-technical aspects.
2. Improvement of sanitation infrastructure facilities and infrastructure.
3. Overview of the implementation of the RSP document implementation program and activities and its funding

This monitoring and evaluation activity is carried out by a working group on the progress of sanitation development implementation, including through the National Water and Sanitation Information Services (NaWASIS). Monitoring and evaluation of sanitation development is carried out by filling in several modules in NaWASIS, including:

1. Technical Data Modul (Access Sanitation)
   Through this module, districts/cities can monitor the increase in access to safe, adequate and basic sanitation in accordance with targets that have been agreed upon with the province
2. Apparatuses and Facility Modul
   This module contains information about the sanitation management system, types and quantity of existing infrastructure and also its needs in order to achieve the set targets, including aspects of the functionality and level of utilization of the sanitation infrastructure that has been built. The information generated from this module can be used by districts/cities in providing feedback for planning & budgeting.
3. Infestation Modul / Funding Program
   This module contains, among others, programs/activities in the planning documents, investment value (funding needs) based on sources, subsectors, beneficiaries, and outputs and outcomes of each program/activity. By utilizing this module, districts/cities can find out the amount and proportion of the sanitation budget, the increase in the sanitation budget, the progress of strategic sanitation implementation, and others.
4. Non-Technical Data Modul
   This includes data related to district/city profiles, institutions, and sanitation regulations. Through this module, districts/cities can review sanitation management policies that have not been and will be implemented by the district/city for improving and providing sanitation access services.

To realize data integration as stated in Presidential Regulation Number 39 of 2019 concerning One Data Indonesia, NaWASIS (National Water and Sanitation Information Services) supports collaboration with other sanitation information systems such as SMART Community-Based Total Sanitation (CBTS) at the Ministry of Health, the Sanitation Information System (SIS) at the Ministry of Public Work, and the Regional Development Information System (RDIS) at the Ministry of Home Affairs. Consequently, the East Nusa Tenggara provincial government must ensure the functional aspects of this monitoring and evaluation system by means of:

1. Increase the number of NaWASIS operators to a minimum of 2 people in each technical agency managing it (Regional Development Plan Board, Public Work, Health Office, and Environmental Department) to anticipate the impact of personnel mutations in the government unit's scenery
2. Allocate funds for monitoring and evaluating the functionality and/or effectiveness of the use of the NaWASIS platform regularly
3. Develop a NaWASIS platform protection system from hacker attacks

IV. CONCLUSION

There will be no more construction of new landfill, but rather Integrated Waste Processing Sites. Landfill is only to accommodate residue or waste that cannot be recycled / processed. Reduction and sorting activities are carried out at the source of waste production. Thus, the community / waste producers are required to reduce and sort waste before being transported to the landfill. Consequently, it is required to reform of Waste Management Governance in 5 aspects, namely policy (regulation), institutional arrangement, technical infrastructure development, funding flexibility space, and community empowerment as well.

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REFERENCES

[1] J. Wolf, A. Prus-Ustun, O. Cumming, and J. Batram, "Assessing the impact of drinking water and sanitation on diarrhoeal disease in low- and middle-income settings: systematic review and meta-regression," *Trop. Med. Int. Heal.*, vol. 19, no. 8, pp. 928–942, 2014.

[2] M. C. Freeman, M. E. Stocks, O. Cuming, and A. Jeandron, "Hygiene and health: systematic review of handwashing practices worldwide and update of health effects," Trop. Med. Int. Heal., vol. 19, no. 8, pp. 906–919, 2014.
[3] L. Fewtrell and J. Bartman, "Water Quality-Guidelines, Standards and Health: Assessment of risk and risk management for water-related infectious disease," 2001.
[4] Direktorat Jenderal Bina Pembangunan Daerah, "Pedoman Penyusunan Roadmap Sanitasi Provinsi." p. 57, 2013.
[5] Tim Pengarah Pembangunan Perumahan-Permukiman-Air Minum & Sanitasi dalam Program PPSP, "Manual Pengelolaan Program Percepatan Pembangunan Sanitasi Permukiman (MPP-PPSP) 2020-2024." pp. 1–102, 2024.