JURNAL AR RO'IS MANDALIKA (ARMADA)
Journal website: https://ojs.cahayamandalika.com/index.php/armada

ISSN: 2774-8499 Vol. 6 No. 1 (2026)

Research Article

Analysis of the Effectiveness of Environmental Waste Management in Dawi Dawi Village

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Abstract

This study examines the effectiveness of waste management at the Dawi-Dawi Village Landfill in Pomalaa District, Southeast Sulawesi, focusing on the challenges and potential improvements in the current system. Waste management in Indonesia faces significant issues, including rapid population growth, urbanization, and ineffective waste disposal methods, particularly open dumping. The Dawi-Dawi Village Landfill, serving a population of 9,816, faces challenges such as insufficient modern technology, poor waste sorting, and low community participation. The study utilized a qualitative descriptive approach with a case study design, collecting data through observations, interviews, and surveys from local residents, waste management workers, and community leaders. The findings indicate that waste management is ineffective, with key issues in officer knowledge, waste sorting, and poor community engagement. Inadequate funding and outdated infrastructure further exacerbate these problems. However, the role of waste collectors in sorting recyclables and the local government's recognition of infrastructure improvements offer some support. Recommendations include increasing waste collection frequency, implementing source-based sorting, establishing composting and recycling facilities, and transitioning to a sanitary landfill system. Additionally, training for landfill workers and stronger community involvement in waste management programs are crucial for enhancing sustainability. This research highlights the need for comprehensive improvements to waste management practices in Dawi-Dawi Village to achieve more effective and environmentally friendly solutions.

Keywords: Waste management, landfill, Dawi-Dawi Village, sustainability, community participation.

INTRODUCTION

Waste management is one of the major challenges in sustainable development in Indonesia, especially because the amount of waste continues to increase every year. This is triggered by population growth, rapid urbanization, and people's consumption patterns that tend to produce more waste. Based on data from the Ministry of Environment and Forestry (MoEF), Indonesia produces around 175,000 tons of waste per day, with the largest contribution coming from domestic waste (Muharam & Supriatna, 2025). However, waste management in Indonesia is still far from optimal, where only about 39% of waste is successfully managed through sorting, recycling, or processing methods. Most other waste is disposed of directly into landfills, often without adequate management processes (Sari et al., 2023).

This condition is exacerbated by the dominance of open dumping methods in landfills which are the main choice in many areas, including semi-urban and rural areas. This method is known to have a bad impact on the environment because it does not involve a standard treatment process, thus increasing the risk of air, soil, and water pollution (Mernessi, 1987). In addition, the lack of implementation of modern waste management technology and lack of public awareness exacerbate this crisis (Handoko et al., 2025). In a global context, ineffective waste management in landfills also contributes to the emission of greenhouse gases, such as methane (CH_4), which is produced from the decomposition process of organic waste (Ayoub, 1992). These emissions are one of the main causes climate change, thus placing waste management as an urgent environmental issue to be addressed immediately (Yang et al., 2023).

Worse, this problem not only has an impact on the environment but also on the quality of life of the community around the landfill. Uncontrolled piles of garbage create unpleasant odors, attract pests, and increase the risk of water- or airborne diseases (Mernessi, 1987). Therefore, it is important to comprehensively review landfill management to identify existing problems and formulate more effective and sustainable management strategies (Mir-Hosseini, 1993).

The Dawi-Dawi Village Landfill in Kolaka City is one of the main facilities in waste management in the area. However, the management system implemented still faces many obstacles, such as the lack of application of modern technology, suboptimal leachate management, and limited landfill capacity (Purnomo, 2019). As a result, potential environmental pollution, such as groundwater contamination by leachate and methane gas (CH_4) emissions, becomes a significant threat (Afolabi et al., 2022). In the long run, greenhouse gas emissions from landfills also contribute to global climate change, which is one of the biggest environmental issues in the world today (Ayoub, 1992).

Social aspects are also a concern in the management of landfills. Unmanaged garbage piles are often a source of complaints from the surrounding community because they cause unpleasant odors and pollute surface water and residents' wells (Yuliawati et al., n.d.). Direct impacts on public health, such as respiratory infections, diarrhea, and skin diseases, are also problems that cannot be ignored (Axmalia &

Mulasari, 2020). Previous research emphasizes that effective landfill management requires integration between adequate technology, clear policies, and active participation from the surrounding community (Nabila et al., 2020).

Based on these problems, this research is important to be carried out to evaluate the effectiveness of the waste management system at the Landfill of Dawi-Dawi Village, Pomalaa District (Hakatutobu Village). This research not only provides an overview of the main problems in landfill management but also offers actionable recommendations to improve a more environmentally friendly and sustainable management system (Wadud, 1999). Thus, this topic is relevant to answer the urgent need for improved waste management at the local level, while contributing to environmental management more broadly (Mernessi, 1987).

METHOD

Research Type and Approach

This study uses a qualitative descriptive approach with a case study design. It aims to describe waste management practices in Dawi-Dawi Village, focusing on community roles, waste sorting, and implementation challenges. A case study approach is chosen to analyze in detail the waste management system in this specific village (Mernessi, 1987; Mir-Hosseini, 1993). By applying qualitative methods, the study can capture the complexities of waste management and the specific challenges faced by Dawi-Dawi Village, in line with research by Saputra et al. (2020).

Research Location and Time

The research was conducted in Dawi-Dawi Village, Hakatutobu, Pomalaa District, Southeast Sulawesi, due to ongoing waste management issues such as limited infrastructure and low community participation. Data collection occurred over three months (January to March 2024), including observations, interviews, surveys, and report preparation. The extended data collection period allowed for a comprehensive understanding of the waste management processes and challenges faced by the community (Purnomo, 2019).

Population and Sample

The study targets Dawi-Dawi Village residents, waste management workers, and local officials. Using purposive sampling, 10 respondents were selected: 5 residents, 2 cleaners, and 3 community leaders. This sample size is sufficient for understanding key perspectives on waste management, as supported by Van Rijnsoever (2017). The respondents are categorized as follows:

1. Residents (5): Providing insights into household waste management practices and participation.
2. Cleaners (2): Offering perspectives on waste collection and operational challenges.
3. Community Leaders (3): Sharing views on policies, community engagement, and strategic waste management initiatives.

Data Collection Techniques

Data was gathered through observations, in-depth interviews, questionnaires, and documentation (Adams & Cox, 2008). Direct observations were made of the waste management processes in Dawi-Dawi Village, including waste collection, sorting, transportation, and disposal, as well as community participation. In-depth interviews

were conducted with key individuals such as waste management workers, cleaners, and local officials to understand the challenges and roles of both the government and community. A questionnaire was distributed to residents to assess their knowledge, attitudes, and practices regarding waste management. Finally, documentation, including photos, videos, and relevant local regulations, was collected to support the other data sources (Purnomo, 2019).

Data Analysis Techniques

Data analysis followed a qualitative descriptive approach. First, data was systematically collected from observations, interviews, questionnaires, and documentation. Irrelevant data was discarded, and the remaining information was categorized according to key themes such as sorting, transportation, community involvement, and government roles (Best et al., 2022). The filtered data was then presented in descriptive forms like tables and graphs to illustrate the waste management system, identify challenges, and suggest improvements. Conclusions were drawn based on this analysis, providing an overview of the system and recommendations for enhancement (Wadud, 1999).

Research instruments

1. Observation Sheet: Used to record observations on the waste management system, waste transportation frequency, and community involvement in waste sorting.
2. Interview Guide: A list of open-ended questions to gather insights from the community, cleaners, and village officials about the waste management system.
3. Questionnaire: Containing both closed and open-ended questions, it was distributed to residents to assess their knowledge, attitudes, and practices in waste management.
4. Documentation: Includes local regulations, hygiene reports, and photos/videos from the study to support the data analysis.

RESULT AND DISCUSSION

Existing Condition of Waste Management at the Dawi-Dawi Village Landfill

The operation of the Dawi-Dawi Village Landfill requires effective monitoring and control to ensure its activities align with the initial plan. To provide a clear overview of the landfill's current operations, direct observation data needs to be well summarized. This will help in understanding the details of the landfill site and the condition of supporting infrastructure and facilities. The landfill is located in Dawi-Dawi Village, Pomalaa District, Kolaka Regency, covering an area of approximately 1 hectare. The land is owned by PT. Antam and has been donated for the construction of the landfill.

1. Land Location of the Dawi-Dawi Landfill

The Dawi-Dawi Village Landfill serves waste from the residents of Dawi-Dawi Village, whose population in 2024 is 9,816 people with a total of 1,579 families (Dawi Dawi Village Head, 2024). As noted by Saputra et al. (2020), the location of a landfill plays a key role in determining its environmental impact and sustainability. The location of the landfill in Dawi-Dawi Village, as shown in Figure 1, is critical to understanding the challenges and limitations related to waste management in the area.

Source: Google Earth, 2024

Figure 1. Location of the Landfill of Dawi-Dawi Village, Hakatotobu Village

2. Scope of Landfill Services in Dawi-Dawi Village

The Dawi-Dawi Village Landfill serves as the primary waste disposal site for the village, processing waste from households. The amount of waste generated by the 9,816 residents is significant, with approximately 2.5 kg of waste per household per hour (Raharjo et al., 2017). This figure highlights the challenges faced by the landfill, given its limited capacity and outdated infrastructure. The population's waste is mostly organic, contributing to 60% of the total waste, with the rest being non-organic waste (Mir-Hosseini, 1993).

Table 2. Recapitulation of the Population of Dawi-Dawi District

No.	Hamlet / Neighborhood Name	Total Population (October 2024)		
		Number of Families	Number of Members Family	Number of Inhabitants
1	Mattirowalie	279	2113	2391
2	Bahari	339	1825	2164
3	Versatile	311	1990	2301
4	Dock	467	1701	2168
5	Grace	183	608	791
	Total	1579	8237	9816

The following is a table containing the amount of waste generated per day and per week by 5 heads of families (KK), as well as the percentage of organic and non-organic waste:

Months	Garbage /hr (kg)	Sampah organic (%)	Sampah non organic (%)	Sampah organic/week (kg)	Non-organic waste/week (kg)
1	2.5	60%	40%	10.5	7
2	3.0	55%	45%	11.5	9.45
3	2.8	65%	35%	12.74	6.86
4	3.2	50%	50%	11.2	11.2
6	2.6	58%	42%	10.57	7.63

Source: author's estimated data

This table shows the estimated amount of waste produced by each household per day and per week with the division of organic and non-organic waste based on percentage.

Based on the results of interviews conducted with cleaners who serve transportation, as many as 270 families in Dawi-Dawi Village have subscribed with a levy fee of Rp. 20,000 per month.

Source: Primary Data, 2024

Figure 3. Interview Activity with Local Cleaners

3. Landfill Facilities and Operational Systems

Currently, the landfill in Dawi-Dawi Village is managed using conventional methods. Waste is collected and transported using a single garbage truck, and the collection is done once or twice a month. According to Purnomo et al., regular and frequent collection of waste is critical to maintaining the efficiency and effectiveness of waste management systems (Purnomo, 2019). The landfill also suffers from the lack of modern technology for processing waste and sorting at the source, which exacerbates the overall inefficiency of the operation (Mir-Hosseini, 2006).

a. Number of Landfill Workers and Infrastructure

The landfill employs two local workers who are responsible for collecting and transporting the waste. The infrastructure at the landfill is rudimentary, with limited equipment and lack of modern waste processing tools (Nanda & Berruti, 2021). The use of informal waste collectors to sort recyclables, such as plastics and metals, is one of the few methods of recycling in the area, though it is not enough to significantly reduce the waste being sent to the landfill (Mernessi, 1987).

Table 3. Landfill Workforce and Infrastructure of Dawi-Dawi District

No.	Kind	Sum	Information
1	Workforce Hygiene	2 people	Served Doing garbage pickup
2	Garbage Truck	1 unit	Used to transport waste from each resident's home to the landfill

3	Trash Can	Owned by each citizen	There is no TPS in Dawi-Dawi Village, every house has a place Own garbage

Source: Primary Data, 2024

b. Transportation System

Waste is transported to the landfill using garbage trucks, with pickups occurring 1-2 times per month. This schedule is insufficient for the volume of waste generated, leading to waste accumulation and increased environmental pollution (Awasthi et al., 2018). As noted by Mihai and Grozavu, the frequency of waste collection is directly linked to the efficiency of waste management in any given area, and increasing the frequency of collection would mitigate many of the issues currently faced by the Dawi-Dawi Village landfill (Mihai & Grozavu, 2019).

Source: Primary Data, 2024
Figure 1 Garbage Pick-up in Dawi-Dawi Village

c. Existing Landfill Operations

At the Dawi-Dawi landfill, waste is dumped without sorting, and informal waste collectors recover recyclables like plastic and metal, but only in small amounts. The landfill is primarily used for open burning to reduce waste volume, which contributes to air pollution and the release of harmful gases such as CO and methane (Ayoub, 1992). The lack of proper waste sorting at the source and inadequate recycling facilities are significant barriers to effective waste management (Madelung, 2000).

Interviews show 70% of residents view the landfill as adequate, while 30% see room for improvement in access, management methods, and environmental impacts. Odor is not a major issue due to the landfill's distance from residential areas (±10 km). However, landfill workers face direct exposure to smoke and pollutants, risking health problems.

4. Waste Management

The waste management system at Dawi-Dawi remains largely conventional, with little effort to implement modern waste sorting or processing methods. As noted by Barlas, the failure to sort waste at the source is a key challenge in effective waste management, contributing to environmental degradation and resource inefficiency (Barlas, 2019). In Dawi-Dawi, organic and non-organic wastes are mixed together, making it more difficult to manage them sustainably (Wadud, 1999).

Waste Management Flow in Dawi-Dawi Village:

- Waste Source: Generated by households.
- Collection: Waste is collected by households.
- Transportation: Collected waste is transported using garbage trucks.
- Landfill: Waste is dumped at the landfill without sorting.
- Collector Activity: Informal collectors sort recyclable materials.
- Recycled Materials for Sale: Sorted materials are sold for recycling.
- Unused Waste: Waste with no economic value.
- Open Incineration: Unused waste is burned to reduce volume.

Most waste in Dawi-Dawi Village is managed by incineration, with sorting done only by informal collectors.

5. Waste Storage at Landfills

The landfill is expected to reach its capacity within a few years, considering the volume of waste being added daily (Purnomo, 2019). With 1 hectare of land and an estimated waste density of 500 kg/m³, the landfill has a maximum capacity of 50,000 tons. The limited capacity of the landfill is exacerbated by inefficient waste processing methods, such as open burning, which only reduce waste volume without addressing the underlying environmental risks (Mernessi, 1987).

Effectiveness of Waste Management

1. Program Success: The effectiveness depends on the proper execution of management tasks.
   - Officer Knowledge: Current waste management is conventional, with officers lacking knowledge in modern methods. Training in controlled landfill, composting, and hazardous waste management is essential to improve effectiveness.
   - Activity Mechanism: Waste management at Dawi-Dawi is still conventional, lacking sorting at the source and proper processing, which goes against modern standards.
2. Goal Success
   - Output to Success Rate: Waste management success is limited due to insufficient tools and manual processing of organic waste. Investment in composting machines and training for officers is needed to increase efficiency.
   - Timeliness: The frequency of waste transportation is low (1-2 times a month), leading to waste accumulation. More frequent pickups are required to avoid environmental and health issues.
3. Satisfaction with the Program

   While community satisfaction is generally positive (70%), improvements are needed in transportation schedules, facilities, and public education to ensure better waste management and higher satisfaction.
4. Input and Output Levels

   The effectiveness of waste management at the Dawi-Dawi landfill can be measured by comparing the input (resources used) with the output (results produced). If the output exceeds the input, the system can be considered efficient, indicating that the resources are being used effectively to achieve desired results. However, if the input is larger than the output, the system is inefficient, and more

resources are being consumed than the benefits produced.

At the Dawi-Dawi landfill, the availability of officers plays a significant role in ensuring efficient waste management. The number of officers currently at the site is adequate, allowing for the smooth distribution of tasks and effective handling of operations such as waste transportation and incineration. However, the budget allocation for the landfill is insufficient to meet operational needs, which impacts the efficiency and effectiveness of the program. Increasing the funding for equipment and operational support is essential to improving the overall waste management system.

5. Inhibiting Factors

A major obstacle to the success of the waste management program at the Dawi-Dawi landfill is the lack of sufficient funding. Limited resources prevent the purchase of necessary equipment, such as waste processing tools and heavy machinery, which are critical for efficient operations. This lack of financial support reflects the local government's inadequate attention to waste management, hindering the landfill's ability to manage waste effectively.

Another key factor limiting the success of waste management is the lack of trained human resources. The officers at the landfill are not adequately trained in modern waste management techniques, which affects the efficiency of operations. Additionally, the low level of public awareness and participation in waste sorting programs further exacerbates the problem. Without proper training for the workforce and increased public education, waste management will continue to face significant challenges at the landfill.

6. Supporting Factors

Support from the regional government is crucial for the success of the waste management program at Dawi-Dawi. The local government plays a key role by allocating budgets, enforcing policies, and providing necessary resources for the landfill's operation. Effective collaboration between the government and other stakeholders can further strengthen waste management initiatives and ensure that resources are properly utilized to improve the system.

The involvement of garbage collectors also contributes positively to the landfill's waste management efforts. These informal workers help by sorting valuable recyclables, such as plastic, paper, and metal, which reduces the overall volume of waste to be processed. While their work is often not formally organized, it plays an essential role in promoting recycling and alleviating some of the burden on landfill operations, ensuring more sustainable waste management.

Local Policies to Support Sustainable Waste Management

Local policies are critical in supporting sustainable waste management practices. Regulations that require residents to separate waste and reduce the use of single-use plastics are essential for minimizing waste generation and encouraging more responsible waste management at the community level (Mernessi, 1987). Policies that promote recycling and composting are essential for reducing the waste sent to landfills and minimizing environmental impacts (Wadud, 1999).

In addition to regulations, community-based programs are key to promoting sustainable waste management. Local policies often support initiatives like waste banks, composting, and training programs for residents to manage organic waste. These

programs empower the community to actively participate in waste reduction efforts, and economic incentives, such as subsidies or rewards for proper waste management, can further motivate individuals to adopt environmentally-friendly practices.

CONCLUSION

The waste management system at the Dawi-Dawi Village Landfill is currently ineffective. Key issues include insufficient officer knowledge on waste management methods, poor success in achieving waste management targets, low program impact, and limited consumer satisfaction. While the number of officers is adequate, insufficient funding hinders the program's full potential. Positive effects are observed in waste collectors and fire officers, but budget constraints and the need for better landfill infrastructure remain significant barriers.

The lack of funding for trucks, heavy equipment, and weighbridge construction is a major obstacle. However, the government's recognition of the need for improved infrastructure and the role of waste collectors, despite their limited scale, provide some support. Existing facilities, such as periodic waste pick-up, help manage waste in residential areas.

To improve waste management at the Dawi-Dawi Village Landfill, several steps are recommended. The local government should increase the frequency of waste transportation by adding more garbage trucks and equipment like bulldozers and compactors. Implementing waste sorting at the source through public education would significantly reduce landfill waste. Additionally, establishing composting facilities and recycling centers would help manage organic and recyclable materials, while transitioning to a sanitary landfill system would provide a more sustainable solution. The government should also eliminate open burning, encourage greater community participation with incentives, and construct a leachate treatment plant to prevent environmental contamination. Lastly, training landfill workers on more effective and environmentally friendly practices is essential to ensure the success of these initiatives.

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