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Waste Management Based On Community Participation In Depok City

Hashifati Ajrina
BAPPEDA Kota Depok, Jl. Margonda No.54, Depok, Kec. Pancoran Mas, **Kota Depok**, **Indonesia**
Email: ajrina.litbang@gmail.com

Hashifati Ajrina
Email: ajrina.litbang@gmail.com
Affiliation: BAPPEDA Kota Depok, Jl. Margonda No.54, Depok, Kec. Pancoran Mas, Kota Depok, Indonesia.

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Abstract

Community-based waste management is an effective and sustainable approach to addressing waste problems. Through active citizen participation, the program promotes environmental awareness, collective responsibility, and efficient waste management at the local level. This research uses a mixed method with interviews and SWOT analysis to produce a picture of the waste condition in Depok City. Community-Based Waste Management is a waste management that involves all levels (active participation) of society with the aim that people realize that waste problems are the responsibility of all levels of society. The purpose of this research is to provide real efforts in tackling existing waste with community participation. Based on the research conducted, it is concluded that integrated waste management with the 3R principles (reduce, reuse, and recycle) has been implemented in all sub-districts in Depok City. Waste management is also carried out with the formation of waste banks in each neighborhood (RW). The community is involved through the sorting of organic, inorganic and residual waste. This research focuses on the main approach, namely physical and biological waste management strategies. Physical and biological waste management is differentiated on an individual scale and an area scale to overcome the problem of waste that is directly disposed of in landfills.

Keywords: Community-Based Waste Management, Depok City, Zero Waste City

I. INTRODUCTION

Population growth, changes in consumption patterns, and people's lifestyles have increased the amount of waste generation, types, and diversity of waste

characteristics. Based on data from the Depok City Environmental and Hygiene Office (DLHK) in 2019, the amount of waste generation in Depok City has reached more than 1350 tons per day. With a population of 2.2 million, it is estimated that each person produces 0.6 to 0.8 kilograms of waste per day. Meanwhile, of the 1350 tons of waste handled, more than 900 tons go to landfills, 90 tons go to waste processing units (UPS) and 120 tons are processed in waste banks, especially for inorganic waste. This will certainly have a negative impact not only on the environment but also on public health and long-term economic losses.

The Depok City Government has a mandate to manage waste independently, as stated in Regional Regulation Number 5 of 2014 concerning Waste Management. In improving waste management services, it is influenced by various aspects such as regulatory, institutional, financial, technical, and community participation. To support the program, Depok City has implemented a waste sorting program, encouraged the separation of organic and non-organic waste, and established 600 waste recycling banks so that residents can exchange waste for money.

Depok City still has a big task to achieve the title of **zero waste city**. The key for a city to achieve the zero-waste city condition. First, it is to change people's behaviour to have a lifestyle of sustainable consumption. Second, expanding the range of producer responsibility to be more environmentally friendly. Third, one hundred percent recycling of municipal solid waste. Fourth, make stricter arrangements to eliminate zero landfill and incineration. Finally, one hundred percent recovery of resources in the environment from waste pollution.

Based on the explanation above and reinforced by Depok City Government Regional Regulation Number 5 of 2014 concerning Waste Management, the waste problem is no longer just a hygiene and environmental problem, but has become a social problem whose handling is not only from the government side but also requires the participation and role of the community at large.

This research can provide more specific and relevant insights into real efforts to tackle existing waste with community participation. Research conducted in Depok City can explore the potential of waste management and develop appropriate community-based waste management strategies in Depok City.

Zero Waste City is a waste management concept that aims to achieve zero waste that is disposed to landfills or burned. The main goal of Zero Waste City is to create a sustainable waste management system, by applying the principles of circular economy and waste minimization throughout the product life cycle. The Zero Waste City program is one of the Depok City government's flagship programs in encouraging the realization of a waste-free Depok city. Zero Waste is a waste-free concept that means managing waste into zero or no waste conditions so that the city of Depok can be free from various waste. (Depok City Government, 2021). With the implementation of the Zero Waste concept program, the environment will be spared from various piles of garbage so that it can avoid environmental damage or environmental pollution. The role of DLHK of Depok City as a policy creator is to

participate in initiating the Zero Waste City Program in Depok City together with the Depok City Government, in this case the Mayor of Depok City, participating in forming the Jakstrada (Regional Strategy Policy) document related to waste management. (Depok City Government, 2021). After one year of implementing the Zero Waste City program policy, in 2017, Depok City was awarded the Adipura Cup for the first time in the Metropolitan City category. However, in reality, as an Adipura award-winning city, there are still problems regarding waste management in several sub-districts of Depok City. These sub-districts include Pancoran Mas, Sukmajaya, Cimanggis, Tapos, and Sawangan.

To effectively implement a zero-waste city program, it is crucial to adopt a comprehensive waste management concept that emphasizes waste reduction, reuse, recycling, and responsible disposal practices. Community-Based Waste Management is waste management that involves all levels (active participation) of society with the aim that people realize that waste problems are the responsibility of all levels of society (Cecep, 2012). Human resources according to (Hamali, 2016) is one of the resources contained in the organization, including all people who carry out activities. Meanwhile, non-human resources include capital or budget, machinery, technology, materials and others. In terms of implementation in community-based waste management, community empowerment is the main key by making the community have the power or power to be able to manage waste so that it becomes something useful and valuable. As stated by Edi Suharto, empowerment refers to the ability of people so that they have the ability to meet basic needs, increase income, and to participate in the development process (Suharto, 2009). (Suharto, 2009). In the context of community empowerment, the contribution of each actor is needed, namely the government, the community and the private sector to form an expected partnership model. The role of the government is more in determining the signs and rules of the game in general. The private sector plays a role in the implementation of policy action with the community. Meanwhile, the community plays a role in the form of participation, both at the level of formulation, implementation, monitoring and evaluation. Forming a partnership aims to achieve better results, by providing mutual benefits between partnering parties. The form of partnership takes understanding from the world of organisms and can be divided into Pseudo Partnership (Pseudo Partnership), Mutualism Partnership (Mutualistic Partnership), Conjugation Partnership (Partnership through Fusion and Development). While the phenomena of inter-organizational cooperative relationships include Subordinate Union of Partnership, Linear Union of Partnership, Linear Collaborative of Partnership. (Ambar, 2004)

II. METHODS

The method used in this research is a combination of quantitative and qualitative methods. The quantitative method was used to determine the number of residents within five years in the population projection analysis. Meanwhile, the qualitative method was carried out by processing primary data collected from interviews and *Focus Group Discussions* (FGDs) and analyzed using SWOT analysis. SWOT analysis involves recognizing the strengths, weaknesses, opportunities, and threats that determine future performance. The results of the SWOT analysis will be used to determine appropriate strategies to improve community-based waste management in Depok City.

III. RESULTS AND DISCUSSION

Identification of Solid Waste Condition in Depok City

Population growth in Depok City, accompanied by economic growth, has resulted in an increase in waste generation. While the condition of Cipayung Landfill is overloaded, so efforts are needed for waste segregation, waste management starting from the source. Cipayung landfill is a final waste processing site that has been operating since 1984. The total area of the Cipayung landfill waste processing area reaches 11.2 hectares with a landfill area of 5.1 hectares.

Figure 1.

Cipayung landfill condition

Source: Observation Results, 2022

Depok produces 1,200 tons of waste every day, of which 700 tons are sent to the overloaded Cipayung landfill and the rest is processed at the Kelurahan and Kecamatan UPS.

Table 1.
Waste Management in each Sub-district in Depok City

No	Administrative Region	Generation (m3/day)	Resolved	Not Yet Addressed
1.	Sawangan	366,83	65,72	301,11
2.	Bojongsari	295,79	85,52	210,27
3.	Pancoran Mas	624,89	277,48	347,41
4.	Cipayung	379,72	92,52	287,2
5.	Sukmajaya	688,37	479,68	208,69
6.	Cilodong	294,5	129,8	164,7
7.	Cimanggis	717,46	202	515,46
8.	Tapos	640,88	188,72	452,16
9.	Beji	493,79	322,92	170,87
10.	Limo	233,89	82,2	151,69
11.	Cinere	210,01	80,44	129,57
Total		4.946,12	2.007,02	2.939,12
Percentage		100%	40,58%	59,42%

Source: Depok City Waste Management System Master Plan, 2016

Integrated waste management techniques are the best way to process waste using the 3R principles (reduce, reuse, and recycle). Before being processed, the types of waste waste is sorted between those that can be reused (with or without treatment) and those that are completely discarded. The reusable waste can produce products, while the rest is treated by decomposition, incineration (e.g. by incenerators), and landfilling. This technique greatly saves the volume of final waste, but requires large capital and operational costs. (Mulyono Sadyohutomo, 2008).

Table 2.
Residential Neighborhood Areas that have Implemented the 3R Principles in Depok City

No	District	Location
1.	Sawangan	Swangan Lama, Cinangka
2.	Bojongsari	Bojongsari Baru, Pondok Petir, Duren Seribu, Bojongsari,
3.	Pancoran Mas	Depok City Hall
4.	Cipayung	Cipayung, Bojong Pondok Terong, Permata Regency, Ratujaya 1, Pondok Jaya, Bulak Timur, Cipayung Jaya
5.	Sukmajaya	Merdeka Hangar, Sadewa
6.	Cimanggis	Brimob, Gunadarma, Mekarsari
7.	Tapos	Sukatani, Cilangkap 17, Cilangkap 10
8.	Beji	Jl.Jawa, University of Indonesia
9.	Limo	Grogol, Kp.Sasak Limo, Meruyung
10.	Cinere	Jati Base

Source: Depok City Waste Management System Master Plan, 2016

SWOT Analysis

The following are the factors that become the potential, problems, opportunities, and threats of waste management in Depok City based on the results of observations and presented in the form of a table below.

Table 3.
SWOT Analysis of Waste Management in Depok City

	Helping Achievement	Achievement Challenge
Internal	STRENGTHS ● Have awareness of waste management ● Waste bank already established ● Government support	WEAKNESS ● Increase in population ● Inadequate landfill conditions ● Lack of municipal solid waste infrastructure and facilities ● Basic physical condition of the city (river system) ● Technology implementation is not yet optimal
External	OPPORTUNITIES ● Cooperation with surrounding areas ● Waste management regulations	THREATS ● Location of Depok City as a buffer zone of Jakarta

Source: Analysis Result, 2022

Based on the results of the SWOT analysis, alternative strategies for Community-Based Solid Waste Management in Depok City can be presented.

S-O Strategy

- Increasing Community Awareness and Participation:
- Developing Infrastructure and Technology (Increasing the number of waste banks, Implementation of waste processing technology)
- Capitalizing on Economic Opportunities

W-O Strategy

- Improving Coordination and Collaboration
- Building Partnerships with NGOs

S-T Strategy

- Strengthening Policies and Regulations
- Building an Efficient Waste Collection System
- Building a Market Network for Recycled Products

W-T Strategy

- Improved fulfillment of waste infrastructure and facilities
- Building an Integrated Waste Management System
- Improving Human Resources Capacity

More specifically, strategies to reduce the generation and volume of household waste and increase community participation can be done through physical and biological sorting and management.

Physical waste management

Physical waste management carried out by the community is divided into 2 scales, including the following:

1. Individual Scale:

Management that is directly carried out by waste generators (households, offices) by sorting or disposing of waste based on its category into bins (organic waste / inorganic waste) or (wet waste / dry waste) which will later be transported by janitors according to a schedule based on its category which will later be recycled in TPS and TPA.

Figure 2.
Community-based Physical Waste Management in Cinere Sub-district

(Documentation Source: Observation Results, 2022)

2. Area Scale

Management carried out to serve an environment / area (housing, offices, markets etc.). Carried out at TPST (Integrated Waste Management Sites) by sorting, re-shredding waste that has been carried out in households to make it more organized by the community or TPST management before transportation to landfill by city cleaners. In addition, area-scale management can also carry out the process of recycling inorganic / dry waste that can still be used to make crafts or goods that have resale value.

Waste management in Depok City is segregated into three categories: organic, inorganic and residue. Organic waste is channeled to UPS to be processed into high-quality compost. Inorganic waste is channeled through several channels, namely: Waste Bank, Drop off system and scavengers. All inorganic waste collected will then be reused by the recycle industry. Non-recyclable waste or residual waste consists of several types. Waste cooking oil, hazardous waste and electronic waste (e-waste) will be channeled to waste banks or drop off points to be channeled to special processing sites. Other residues are channeled to landfill to be processed into energy (waste to energy) and/or other products.

Figure 3.
Community-based Physical Waste Management in Cipayung District (PBB Waste Bank)

(Documentation Source: Observation Results, 2022)

BIOLOGICAL WASTE MANAGEMENT

Just like physical waste management, biological waste management carried out by the community is divided into 2 scales, including the following:

1. Individual Scale

Management that is directly carried out by waste generators (households, offices) by sorting food waste or wet waste which is later composted individually. The results of the composting can be used as fertilizer for plants in the yard or sold to collectors to meet other basic needs.

Figure 4.
Community-based Biological Waste Management in Panmas Sub-district

(Documentation Source: Observation Results, 2022)

2. Area Scale

Management carried out to serve an environment / area (housing, offices, markets etc.). Carried out at TPST (Integrated Waste Management Sites) by sorting, re-shredding waste that has been carried out in households to make it more organized by the community or TPST management before transportation to landfill by city cleaners. Biological management at the regional scale is usually food waste (organic) made into compost which is later sold or distributed to the surrounding community

for plants or made into magot cultivation which can later be sold to farmers or surrounding communities who have farms.

Figures 5.

Community-based Biological Waste Management in Pancoran Mas Sub-district

(Documentation Source: Observation Results, 2022)

Processing organic waste organically is also carried out by the community using the BSF method. The Balck Soldier Fly (BSF)/ Maggot method at UPS is one of the waste reduction efforts implemented in Depok City. One of the benefits of BSF waste management is that these larvae can decompose organic waste (generally nitrogen-rich waste, such as food waste) quickly. The treatment of organic waste through maggot caterpillars has also been socialized to RT and RW, with the aim of educating and implementing organic waste treatment at the RW level.

IV. CONCLUSIONS

Population growth in Depok City, accompanied by economic growth, has resulted in an increase in waste generation. While the condition of Cipayung Landfill has been overloaded so that efforts are needed for sorting, waste management starting from the source. The waste problem should be a common problem and be done with the active role of all parties including the community. One of the efforts to deal with waste is through community-based waste management.

Based on the results of the identification of waste conditions in Depok City, integrated waste management with the 3R principles (reduce, reuse, and recycle) has been implemented in all sub-districts in Depok City. Waste management is also carried out with the establishment of waste banks in each neighborhood (RW). The community is involved through the sorting of organic, inorganic and residual waste. Waste is sorted starting from the household level. Organic waste can be processed through the use of BSF Magot and inorganic waste collected will be reused by the recycle industry.

Based on the results of the SWOT analysis, community-based waste management in Depok City has great potential to succeed. However, it requires concerted efforts from the government, the community, and the private sector to overcome weaknesses and threats, and capitalize on existing opportunities. The strategies in the study focus on two approaches: physical and biological waste management strategies. The study examines the implementation of these methods at the individual and community scales, highlighting the potential for community-based solutions to address waste management challenges.

There are two weaknesses of this study. First, the sampling was imperfect. Samples were not selected proportionally based on the type of location and conditions in the community. The locations selected were only pilot locations in community-based waste management such as Pancoran Mas and Cinere sub-districts. Secondly, the quantitative and qualitative methods used are very simple, namely descriptive statistical analysis and SWOT analysis. Strategies in SWOT analysis are not discussed in depth because this research focuses on the main approach, namely physical and biological waste management strategies. Physical and biological waste management is differentiated based on individual scale and regional scale to overcome the problem of waste that is directly disposed of to landfills.

Community-based waste management has great potential to improve environmental quality and create new economic opportunities. However, the program also faces various challenges, such as lack of resources, and public awareness. To overcome these challenges, a joint effort from the government, the community, and the private sector is needed to improve the effectiveness of community-based waste management programs.

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