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TECHNICAL ASPECT EVALUATION OF SOLID WASTE MANAGEMENT IN TAMAN SARI DISTRICT, WEST JAKARTA

Grace Celline Simatupang[1,*], Pramiati Purwaningrum[1], Lailatus Siami[1], Astari Minarti[1]

[1,]Environmental Engineering, Faculty of Landscape Architecture and Environmental Technology, Trisakti University, West Jakarta, 11440, Indonesia

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Abstract. The solid management system in Taman Sari district, West Jakarta still uses collect-transport-dispose system. The population of Taman Sari District is 130,110 people with a total waste generation of 399,96 m^3/day. This study aims to evaluate the operational technical aspects of the waste management system in Taman Sari district, which includes solid containerization, collection, and transportation of waste to final disposal at TPST Bantargebang. This research was conducted using primary data collection methods and secondary data obtained by conducting interviews, questionnaires, and field observations. The sampling method used is the Stratified Random Sample technique using the variable income level of the community at the sampling location, *low income*, *middle income*, and *high income*. The Taman Sari district sampling location selected 3 (three) locations namely Pinangsia Village, Krukut Village, and Keagungan Village which resulted in 45 samples for domestic waste and 26 samples for non-domestic waste. The observation results show that the aspect of waste disposal in low-income settlements is inadequate, while the aspect of disposal in middle-income and high-income settlements and commercial areas already has adequate disposal. The solid collection aspect of Taman Sari district consists of direct individual, indirect individual, and direct communal patterns. However, the solid transportation pattern in low – high income settlements only has 1-2 rounds which results in TPS overload. Therefore, the solid management system implemented in Taman Sari district needs to be evaluated to determine suitable alternatives for improving the existing conditions of the operational technical aspects of waste management in Taman Sari district.

[*]Corresponding author: pramiati@trisakti.ac.id

1 Introduction

As a result of urbanization and population growth, waste management will continue to be a significant issue [17]. According to statistics from the DKI Jakarta Environmental Agency, the Bantar Gebang TPST received an average of 6700 tons of waste per day in 2019. Due to excessive trash generation and poor waste management, a large amount of waste enters the final processing site [1].

Waste is stuff that is deemed useless but must be managed to protect the environment and the general public's health. In actuality, however, Indonesians themselves continue to be unwilling to handle garbage, both organic and inorganic.[5] The Ministry of the Environment and Forestry's National Waste Management Information System (SIPSN) reports that the waste reduction rate in Indonesia in 2021 was only 15,56%. Recycling garbage is crucial to environmentally friendly waste management and preservation [9]. Recycling garbage is a good strategy for lowering waste production [5]. The benefits of recycling and reuse extend throughout the entire waste management process, from lowering the level of residual garbage to generating employment in the recycling industry [17].

Waste Banks are an effective way to encourage the collection of recyclable waste and educate people about how important recycling is.[2] As a result, by putting the 3R concept into practice, waste banks can be a solution to the municipal garbage problem.[17] Recycling efforts can lower production costs and lessen environmental damage [14]. For example, the paper industry is the third-largest polluter of air, water, and soil, it can reduce air pollution from paper production by 95% by recycling waste paper [6].

The Law No. 18/2008 on Solid Waste Management in Indonesia moves the focus away from waste disposal and toward waste recycling [12]. The reduction of waste by 30% by 2025 is the goal of Presidential Regulation of the Republic of Indonesia Number 97 of 2017 concerning National Policy and Strategy for the Management of Household Waste and Waste Similar to Household Waste. By understanding the potential of waste that may be recycled, it is vital to determine

the composition of waste as the first step in creating a waste management system to achieve success in the waste management system [11].

Taman Sari district has an area of 4.36 km^2 and a population of 130,110 people with a population density of 14,133 people/km^2. Most parts of the Taman Sari district still use the outdated paradigm for waste management (collect-transport-dispose). In the Taman Sari district, organic waste is processed using Black Soldier Fly, and inorganic trash is processed using Waste Bank. The objective of this study is to assess the practical waste management practices in the Taman Sari district.[1]

2 RESEARCH METHODOLOGY

2.1 Research Time and Location

The research was conducted from November 19 to November 26, 2021. The research was conducted in Taman Sari district, geographically located between 106° 22'42" EL and 5°19'12" SL.

2.2 Method

Data collected in this research consist of:

- The population data and general description obtained from Taman Sari District
- Data of waste generation and composition rates of residential waste produced in Taman Sari district, which acts as primary data by perfoming waste sampling on selected households. Household samples were determind based on SNI 19-3964-1994 on Methods of Taking and Measuring Examples of Urban Waste Generation and Composition. Waste sampling is carried out for 8 consecutive days.
- Data of waste management existing conditions in Taman Sari District, which includes data on facilities and infrastructure for waste management, and waste proccesing. Data regarding waste collection pattern in Taman Sari

Disctrict is catogerized as primary data, which obtained through direct field observation.

2.3 Data Analysis Method

The data analysis used is The use of stratified random sampling method to determine the sample size is a sampling method that is considered heterogeneous, with all individuals having the same opportunity. The number of samples is calculated based on the economic level of the population. Therefore which will be analyzed descriptively, and quantitatively, including waste generation, waste composition, and waste recycling potential.[3] Data on the number of residents per urban village/village from the last ten years will obtain the percent population growth rate to calculate population projections up to end the planning year. SW Generation is calculated and waste composition each of which can be seen below;

$$\text{SW generation rate} = (\%\ \text{domestic area} \times a) + (\%\ \text{non domestic area} \times b) \quad (1)$$

$$\text{SW Generation} = \text{SW } \textit{generation rate} \times \textit{Population} \quad (2)$$

where:
a = domestic waste generation rate;
b = non domestic waste generation rate.

$$\text{SW Composition} = \textit{(a} \times 100\%\textit{)/(Total Weight of SW)} \quad (3)$$

where:
a = waste weight of each component (kg)

According to Damanhuri and Padmi (5), types of organic waste and anorganic waste recycling potential. The recycling potential of organic waste is determind through composting to process organic waste such as rice, vegetables, fruits, fish, meat, and garden leaves. The formula is applied to calculate organic waste recycling potential:

$$\%RP = \frac{a}{b} \times 100\% \quad (4)$$

Where %RP = Recycling Potential, a = weight processable organic waste; and

b = weight of total organic waste

For anorganic waste, the potential for waste recycling is determined based on the types of waste that can be sold to waste banks. In addition, types of non-organic waste, such as hazardous waste can also be reprocessed by the DKI Jakarta Environment Agency through a third party.

3. Results and Discussion

3.1 Waste Generation and Composition

Taman Sari District generates waste from two sources: domestic and non-domestic. Based on the sampling results, the waste generation rate in Taman Sari District with a population of 130,110 people in 2021 is 2,37 L/people/day, the amount of waste generation in Taman Sari District With a 93% service level.

Furthermore, the highest average value of waste generation is obtained by the highest civilian income in Taman Sari Sub-district. The composition of waste in Taman Sari. Based on highest civilian income in Taman Sari sub-district waste generation rate is 0,23 kg/people/day or 2,60 l/people/day. Table 3 shows the rate of waste generation in Taman Sari sub-disctirct based on settlement types.

Table 2. The Rate of waste generation in Taman Sari Sub-District bassed settelement types

Settlement Types	Waste Generation Rate	
	kg/people/day	l/people/day
Low Income	0,30	2,00
Middle Income House	0,26	2,50
High Income House	0,23	2,60
School	0,02	0,14
Store	1,41	3,18
Office	0,25	0,75
Traditional Market	0,03	0,80
Restaurant	0,30	2,49
Road Sweeping	0,01	0,15

**STD* : *Standard Deviation*

Domestic and Non Domestic waste consists of any material that vary in composition, depending on the civilian's income, lifestyle and the level of education. The compositon of domestic and non domestic in Taman Sari sub-district consist of 30% organic waste and 70,8% anorganic waste.

Table 3. The Solid waste composition in Taman Sari sub-dictrict

No	Composition	Domestic source (%)	Non-Domestic source (%)	Average (%)
1	Food Waste	28,73%	29,77%	29,25%
2	Plastic Waste			
	a PETE/PET	7,87%	10,43%	9,15%
	b HDPE	6,32%	5,33%	5,83%
	c V/PVC	0,00%	0,00%	0,00%
	d LDPE	9,09%	3,71%	6,40%
	e PP	1,88%	1,16%	1,52%
	f PS	4,35%	3,58%	3,96%
	g Other	9,23%	7,08%	8,16%
3	Kertas			
	a Writing Paper	7,88%	12,00%	9,94%
	b Carton	4,03%	1,36%	2,23%
	c *Kraft Paper*	3,88%	6,21%	5,05%
	d Box	4,02%	4,97%	4,50%
4	Fabric/Textile	0,48%	0,00%	0,24%
5	Can	1,19%	2,56%	1,87%
6	Rubber	0,93%	0,21%	0,57%
7	Glass	0,66%	0,00%	0,33%
8	Wood	0,00%	1,38%	0,69%
9	B3	2,50%	2,57%	2,54%
10	Other	3,18%	1,47%	2,33%
	Total Anorganic Waste	71,27%	70,23%	70,76%

Based on the measurement of waste composition in organic waste has the potential to be processed into compost, while anorganic waste such as newspapers, magazines, clothing can be recycled or sold to the resellers and recyclers. In Table 3 shows that the largest component of anorganic waste is categorized as other component.

Table 4 Solid waste recycling potential in Taman Sub-district

No	Composition	Component (%)	Accepted in Waste Bank	Processable	Recycling Potential (%)	Residue (%)
1	Food Waste	29,25%		√	23,40%	5,85%
2	Plastic Waste					
	a PETE/PET	9,15%	√		6,41%	
	b HDPE	5,83%	√		4,08 %	
	c V/PVC	0,00%			0,00%	
	d LDPE	6,40%	√		4,48%	
	e PP	1,52%	√		1,06%	
	f PS	3,96%				3,96%
	g Other	8,16%	√		5,71%	
3	Kertas					
	a Writing Paper	9,94%	√		3,98%	
	b Carton	5,05%	√		2,02%	
	c *Kraft Paper*	2,70%	√		1,08%	
	d Box	4,50%	√		1,80%	
5	Fabric/Textile	0,24%				0,24%
6	Can	1,87%	√		1,50%	
7	Rubber	0,57%				0,57%
8	Glass	0,33%	√		0,23%	
9	Wood	0,69%				0,69%
10	B3	2,54%		√	0,00%	
11	Other	2,33%				2,33%
	Anorganik Total	70,75%				
	Total Potensi Daur Ulang dan Residu				57,73%	42,27%

In Table 4 shows that the Waste recycling potential refers to the ability of waste from the source to be reused or processed into a useful form, while also reducing the amount of waste transported to TPST Bantargebang. According to the sampling results, the largest waste component in Taman Sari district is organic waste, which includes food waste as well as leaves and twigs. Based on this situation, efforts to reduce the amount of organic waste generated in the Taman Sari district are required.

Because not all types of anorganic waste can be sold to a waste bank, the potential must first be determined by looking at the types of waste that can be sold to a waste bank. Plastic waste, paper waste, metal waste, and glass waste are descriptions of anorganic waste that can be sold in waste banks. PET, HDPE, LDPE, PP, and other types of plastic waste are among those that can be sold. Meanwhile, white writing paper, and Kraft paper are among the types of paper waste that can be sold. In addition, types of anorganic waste, such as hazardous waste can also be reprocessed by the DKI Jakarta Environment Agency through a third party.

The potential of organic waste that can be reprocessed in Taman Sari Sub-district is 80% of the composition of organic waste consisting of food waste and leaves and twigs. Processing of organic waste Taman Sari sub-district using the composting method and maggot cultivation is still actively carried out at the Taman Sari sub-district. The potential of anorganic waste that can be saved in waste banks is 34,34% of the total inorganic waste. The total organic and non-organic waste that can be recycled in the Taman Sari sub-district is 57,73% and the residue generated is 42,27%. Table 4 shows the potential for waste recycling in Taman Sari sub-district.

4 Conclusions

The potential for waste reduction in Taman Sari sub-district is 42,47%. Based on the waste recycling potential, it is possible to plan the construction of processing facilities and infrastructure to transport anorganic waste to waste banks in each Taman Sari sub-district customer. Solid waste operational techniques in Taman Sari sub-district are partially adapting operational technical systems as regulated in SNI 19-2454-2002. The waste optimum recycling rate, socialization, education, assistance and monitoring to community are needed on an ongoing basis to implement waste of organic and inorganic waste.

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