Geografika Journal (Geografi Lingkungan Lahan Basah)
Vol. 6, No. 1 - June 2025
Geography Study Program, Lambung Mangkurat University

EVALUATION STUDY OF THE IMPLEMENTATION OF WASTE BANK IN WASTE MANAGEMENT IN KOTA BALIKPAPAN

Jenika Cassey Putri[1], Rahmat Aris Pratomo[2]*
[1,2] Urban and Regional Planning Study Program, Kalimantan Institute of Technology, Balikpapan, Indonesia

*Correspondent Email: r.a.pratomo@lecturer.itk.ac.id

Received 2025-03-03 | **Revision** 2025-05-21 | **Accepted** 2025-06-30
Geography Study Program, Lambung Mangkurat University

Abstract: Kota Balikpapan will experience a population increase of 6,000 people in 2023, which results in an increasing amount of waste generation to 514.73 tons per day. One strategic solution to reduce the amount of waste generation at the Final Disposal Site (TPA) is through the waste bank program. However, based on DIKPLHD data in 2022, there has been a decrease in the number of active waste banks in Kota Balikpapan, with an estimated more than 25% inactive, so an evaluation of the implementation of waste banks is needed based on performance in existing conditions. This study aims not only to evaluate the implementation of waste banks in Kota Balikpapan but also to provide recommendations for improving the implementation of waste banks. The way data was collected involved two methods: first, gathering new information by observing and sending out questionnaires to each waste bank unit, and second, using existing information from the 2016–2021 Kota Balikpapan RPJMD document and earlier studies. The data was then analyzed using the mass balance analysis method and compliance with the SOP of Permen LHK No. 14 of 2021. The study results indicated that out of 50 waste bank units located throughout Kota Balikpapan, 70%, which equates to 35 units, are still operational. The active waste bank is considered to have effectively reduced waste by 93.369%, although the level of SOP compliance only reached 59.9%, or the fairly appropriate category. Recommendations for the implementation of waste banks in Kota Balikpapan are to maintain performance or develop several programs such as socialization, coaching, and digitalization.

Keywords: balikpapan; waste bank; evaluation; compliance; management

INTRODUCTION

Waste is human-made and not used or thrown away (Kurniawan & Santoso, 2020). According to Law Number 18 of 2008 concerning Waste Management, waste is defined as the remains of human daily activities or other processes in solid form. Indonesia has yet to fully resolve the challenge of waste management. One of the main factors influencing this condition is the population growth that continues to increase every year. Kota Balikpapan, one of the big cities in Kalimantan Timur, has experienced quite significant population growth. Being the gateway to the National Capital Region (IKN) influences this. In 2023, the population of Kota Balikpapan will increase by 6,000 people, from the previous 704,110 people to 710,000 people (Andryani dkk., 2024). This increase in population has an impact on increasing public consumption, which directly affects the volume of waste produced. Based on data from the Kota Balikpapan Environmental Service in 2023, the amount of waste generated in Balikpapan City reached 514.73 tons per day, with the majority coming from household waste of 361.85 tons per day, or around 70.3% of the total volume of waste. The increase in waste volume has the potential to reduce the quality and efficiency of the Manggar Final Processing Site (TPA) (Putri & Pratomo,

2024), which is predicted to reach full capacity in 2025 if not handled properly. To address this issue, the Kota Balikpapan Government implemented a solution by enacting Regional Regulation Number 4 of 2022, which revises Regional Regulation Number 13 of 2015 regarding the Management of Household Waste and Waste Similar to Household Waste. Article 7 regulates steps such as sorting, collection, transportation, processing, and final processing of waste. This approach is in line with the opinion of Morrissey & Browne (2004), which states that a sustainable system for managing waste in cities must be economically affordable, environmentally friendly, and socially acceptable.

The community can take a concrete step by implementing a waste bank program. A waste bank is a facility that functions as a place to collect waste that has been sorted and then distributed to various places, such as recycling craftsmen or waste collectors (Ariefahnoor dkk., 2020; Morrissey & Browne, 2004). Research conducted by Radityaningrum, (2017) proved that waste banks are effective in reducing the amount of waste produced by the community while reducing the volume of waste disposed of at the Final Processing Site (TPA). In its implementation, a good waste bank needs to have several criteria, such as having a legal entity, having an administration system, having a permanent collector, having a savings book, and having a responsible party (Nurunnisa dkk., 2024). Currently, the implementation of the waste bank program run by the Kota Balikpapan Government as an effort to overcome the waste problem is considered still ineffective and not optimal. This can be seen in the still high volume of waste entering the Final Processing Site (TPA) and the many waste banks that are no longer active (Hajimi dkk., 2024). Based on the Kota Balikpapan Regional Environmental Management Performance Information Document (DIKPLHD) in 2022, more than 25% of waste banks in Kota Balikpapan have stopped operating. This data is supported by the Kota Balikpapan Medium-Term Development Plan (RPJMD) for 2021–2026, which recorded a decrease in the number of waste banks from 126 units in 2017 to 107 units in 2020 and again decreased to 103 units in 2023 in all sub-districts (Nawangwulan & Sutriadi, 2015).

The 2021-2026 RPJMD document records the damage to numerous waste banks in Balikpapan, in addition to the decline in their numbers. The decline in the number of waste bank units each year shows that their performance is still ineffective, as indicated by the poor level of implementation; namely, only 27% of waste banks in Kota Balikpapan are functioning properly (RKMP, 2022). According to earlier research in Kecamatan Junrejo, Kota Batu, the evaluation found that many waste banks were not following the rules, which means that support from different groups is necessary (Astuti dkk., 2020). Meanwhile, until now in Kota Balikpapan itself, there has been no further research on the implementation of waste banks as a whole (Satori dkk., 2020). The research conducted by Asef Kurniyawan (2023) only discussed how to manage waste in general in Kota Balikpapan.

Seeing the existing problems and the handling that has been done until now, there has been no research that discusses in more detail the problems of waste banks, both from the aspect of Standard Operating Procedures (SOP) and in terms of the ability of waste banks to reduce waste. Therefore, the researchers want to study how waste banks are working to give suggestions that can help make waste banks in Kota Balikpapan run better and more sustainably by checking how well each waste bank reduces waste and how closely they follow the Standard Operating Procedure (SOP) set by the Regulation of the Minister of Environment and Forestry No. 14 of 2021.

LITERATURE REVIEW

Various factors, such as the increasing population in an area, influence waste management (Surjandari dkk., 2009). The higher the population of an area, the greater the amount of waste produced. The increasing amount of waste can result in increasingly complex problems in waste management (Mahyudin, 2014). Indonesia's population increases annually, leading to an augmented volume of waste and the limited capacity of the Final Disposal Site (TPA) to handle the daily refuse generated. As a result, the neighborhood benefits from effective trash management, which reduces the volume of refuse entering the TPA. Several countries in the world have made efforts to reduce the amount of waste disposed of in landfills by reducing waste at the source (source reduction), reusing trash or recycling, and producing energy from waste (Mahyudin, 2014) (2016).

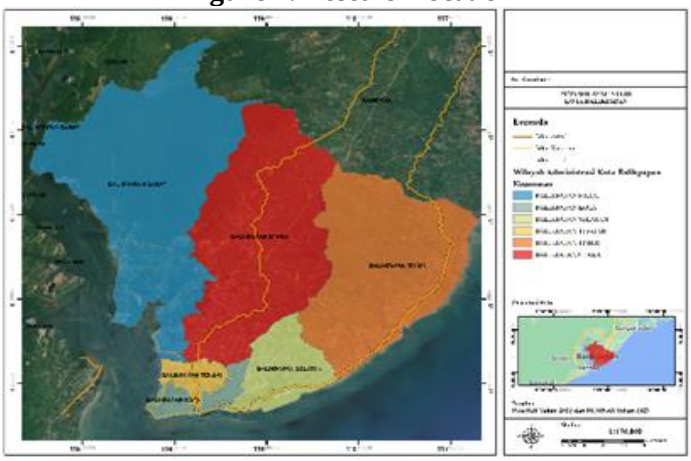
The Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. 14 of 2021 concerning waste management through waste banks establishes a facility designed to manage garbage by applying the 3R principle (reduce, reuse, recycle). Trash banks serve as instruments for education, economic development, and shifts in community perspectives on waste management, established by communities, businesses, partnerships, and local governments. Nonetheless, during its execution, some waste banks in Indonesia have encountered difficulties, such as waste bank units that are no longer operating actively due to a decline in quality and a lack of community involvement in helping to implement waste banks. The sustainability of the waste bank can be ensured by performing regular performance audits to examine its effectiveness and administration, utilizing waste reduction metrics to enhance services. (As'ari, 2019). Additionally, the operational quality of the waste bank can be assessed by evaluating how well it complies with the Standard Operating Procedure (SOP) outlined in the Regulation of the Minister of Environment and Forestry Number 14 of 2021 (Astuti dkk., 2020) (2015).

RESEARCH METHODS

1. Research Location

The research location is in Kota Balikpapan, which is the gateway to the National Capital (IKN) of the Archipelago in Provinsi Kalimantan Timur, which has an area of 503.3 km^2 with a population of 710,000 people. Kota Balikpapan comprises six sub-districts: Kecamatan Balikpapan Utara, Kecamatan Balikpapan Timur, Kecamatan Balikpapan Barat, Kecamatan Balikpapan Tengah, Kecamatan Balikpapan Selatan, and Kecamatan Balikpapan Kota. The research site is depicted in Figure 1 below.

Figure 1. Research location



Source: Author, 2025

2. Data Collection Method

This research used a mixed-methods approach. The principal data collection methods employed in this study are observational activities and the distribution of questionnaires to each waste bank unit in Kota Balikpapan. Primary data collection is conducted to acquire data in the form of text and photos, facilitating the resolution of existing issues and comprehension of the waste bank under investigation.

The distributed questionnaire contains variables used in analyzing the suitability of the open-ended Standard Operating Procedure (SOP) of the Waste Bank.

3. Mass Balance Analysis Method

The employed analytical method is mass balance analysis to assess the efficacy of waste banks in minimizing waste generation.

Table 1. Mass Balance Analysis

Waste Composition	Waste Weight (kg)	Rf (%)	Reduction Weight (kg)	Residue Weight (kg)
Paper	The weight of the waste	RF quantity (measurement of the weight of waste sorted at the waste bank)	Multiplication of the weight of the waste by Rf, then divided by 100%	Waste weight (kg) – Reduction weight (kg)
Plastic				
Cloth				
Wood				
Rubber				
Glass				
Metal				
Etc				
Total	**Σ Weight Rubbish**	**Σ Weight Rf**	**Σ Weight Reduction**	**Σ Residue Weight**

Source: Author, 2025

Information:

Rf = Recovery Factor

Σ = Total Amount

To calculate the recovery factor value, you can use the following formula (Kristanto, 2015).

$$\textbf{Rf} = X\ 100\% \frac{\text{Weight of sorted waste (kg)}}{\text{Wight of the waste (kg)}}$$

Meanwhile, to calculate the weight of waste reduction, you can use the following formula.

$$\textbf{Rf} = X\ 100\% \frac{\text{The waste weight (kg)}}{\text{Rf (\%)}}$$

After knowing the recovery factor value and waste reduction weight, an analysis of the suitability of the waste bank service performance standards can be carried out, which can be seen as follows.

Table 2. Waste Bank Service Performance Criteria

No	Percentage (%)	Criteria
1	30-50	Good
2	10-29	Pretty good
3	< 10	Not good

Source: Author, 2025

4. Standard Operating Procedure (SOP) Compliance Analysis Method

Comparing the suitability of the Standard Operating Procedure (SOP) in the implementation of waste banks in Balikpapan City with the Standard Operating Procedure (SOP) in the implementation of waste banks referring to the Regulation of the Minister of Environment and Forestry Number 14 of 2021 using the scoring method.

Table 3. Scoring Criteria Based on Standard Operating Procedure (SOP)

Variables	Information	Score
Operating Hours (A)	Operates once a week	3
	Operates 2 times a month	2
	Operating < 1 in a month	1
Customer Service (B)	There is a savings and withdrawal system (withdrawal of funds within a minimum of 3 months at the earliest), equipped with a savings book	3
	There is a savings and withdrawal system (disbursement of funds < 3 months), equipped with a savings book	2
	There is no savings and withdrawal system or provision of savings books	1
Pickup Service (C)	There is a pick-up service via telephone and an online system in the form of an application.	3
	There is a pick-up service by telephone	2
	There is no pick-up service	1
Type of Waste (D)	The types of waste that are saved consist of 5 types	3
	The types of waste that are saved consist of 3 types	2
	The types of waste that are saved consist of 1 type	1
Minimum Weight (E)	There is a minimum weight restriction on waste (10 kg)	3
	There is a minimum waste weight restriction of <10 kg	2
	There is no minimum weight restriction on waste	1
Pricing (F)	There is an agreement between the waste bank management and ASOBSI and it follows market prices.	3
	Following the selling price in the market	2
	There is no fixed price setting	1
Waste Condition (G)	Garbage in clean and intact condition	3
	The trash is still dirty but intact	2
	Garbage in dirty and incomplete condition	1
Waste Container (H)	There is a sorting based on 5 types of waste	3
	There is a sorting based on 3 types of waste	2
	Garbage is not separated or is still mixed	1
Profit Sharing System (I)	There is a profit sharing on a scale of 85:15%	3
	There is a profit sharing on a scale of 70-80:30-20%	2
	There is a distribution of results with a scale of < 70:30%	1
Employee Wages (J)	Managers & Employees get wages	3
	Only Managers get paid	2
	Managers & Employees do not receive wages	1

Source: Author, 2025

Then, the actual score percentage can be calculated using the following equation.

$$\text{Actual Score Percentage} = \frac{Total\ actual\ score}{Total\ ideal\ score}\ x\ 100\%$$

Table 4. Criteria for Suitability of Waste Bank Implementation

No	Percentage (%)	Criteria
1	33 - 55	It is not in accordance with
2	56 - 78	Quite Appropriate
3	79 - 100	In accordance

Source: Arikunto, (2009)(2001)

RESULTS AND DISCUSSION

1. Identification of the Implementation of Waste Banks in Balikpapan City

Based on the results of the field survey conducted in May 2024, a total of 50 waste bank units were recorded in the city of Balikpapan. Waste banks, as community-based waste management initiatives, play a crucial role in promoting environmental awareness and reducing the volume of waste that ends up in landfills. These institutions collect and manage recyclable materials, encouraging residents to participate in waste

segregation and recycling activities. The presence of these waste bank units reflects the city's commitment to sustainable waste management practices and community empowerment. Out of the 50 identified waste bank units, 35 are designated as active, maintaining regular community engagement and waste collecting operations. The remaining 15 units are classified as inactive due to several circumstances, including insufficient operational support, reduced public engagement, or constrained finance. This distribution underscores the necessity of ongoing support and oversight to guarantee the sustainability of waste bank initiatives. The comprehensive data concerning the state of these waste bank units is presented in Table 5 below.

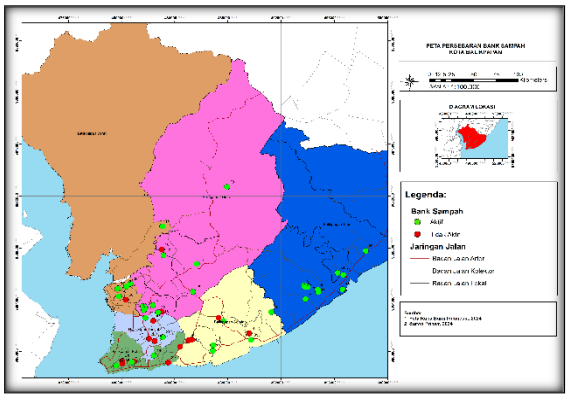
Table 5. Distribution of Balikpapan City Waste Banks

No	Name of Waste Bank	Subdistrict	Ward	Information	
				Active	Not active
1	Sampah Berkah Waste Bank	Balikpapan Selatan	Gunung Bahagia	√	
2	4 MB Waste Bank	Balikpapan Barat	Margo Mulyo	√	
3	Waste Bank 65	Balikpapan Utara	Batu Ampar	√	
4	Adipura Waste Bank	Balikpapan Tengah	Karang Rejo	√	
5	Amanah Waste Bank	Balikpapan Utara	Muara Rapak	√	
6	Asri Biru Waste Bank	Balikpapan Timur	Manggar	√	
7	Barokah Waste Bank	Balikpapan Timur	Manggar	√	
8	Berkah Beriman Waste Bank	Balikpapan Timur	Manggar	√	
9	Bina Mandiri Waste Bank	Balikpapan Kota	Klandasan Ulu	√	
10	Borneo Waste Bank	Balikpapan Barat	Baru Tengah	√	
11	Dharma Bakti Waste Bank 55	Balikpapan Utara	Muara Rapak	√	
12	Graha 05 Waste Bank	Balikpapan Utara	Graha Indah	√	
13	Grahin 57 Waste Bank	Balikpapan Utara	Graha Indah	√	
14	Griya Kariangau Baru Waste Bank (GKB)	Balikpapan Barat	Kariangau	√	
15	Kota Hijau Waste Bank	Balikpapan Selatan	Sepinggan	√	
16	Makmur Mandiri Waste Bank	Balikpapan Tengah	Gunung Sari Ilir	√	
17	Mekar Jaya Waste Bank	Balikpapan Utara	Batu Ampar	√	
18	Pager Ijo Waste Bank	Balikpapan Kota	Prapatan	√	
19	Pandan Wangi Waste Bank	Balikpapan Utara	Muara Rapak	√	
20	Pande Garbage Bank	Balikpapan Timur	Lamaru	√	
21	Perdana 30 Waste Bank	Balikpapan Tengah	Gunung Sari Ulu	√	
22	Permata Sehati Waste Bank	Balikpapan Tengah	Karang Rejo	√	
23	Pondas Jaya Waste Bank	Balikpapan Timur	Manggar	√	
24	Pondas Lestari Waste Bank	Balikpapan Timur	Manggar	√	
25	RSKD Waste Bank	Balikpapan Utara	Batu Ampar	√	
26	S-25 Waste Bank	Balikpapan Timur	Manggar	√	
27	Sejahtera Waste Bank 62	Balikpapan Timur	Manggar Baru	√	
28	Sekar 18 Waste Bank	Balikpapan Selatan	Sungai Nangka	√	
29	Semarang Mandiri Waste Bank	Balikpapan Utara	Karang Joang	√	
30	Sepoka Waste Bank	Balikpapan Selatan	Sungai Nangka	√	
31	SMP 03 Waste Bank	Balikpapan Utara	Muara Rapak	√	
32	Sri Rejeki Waste Bank	Balikpapan Barat	Margo Mulyo	√	

33	Trans Manggar Waste Bank	Balikpapan Timur	Manggar Baru	√	
34	Karya Mandiri Waste Bank	Balikpapan Timur	Manggar Baru	√	
35	Puskesmas Sepinggan Waste Bank	Balikpapan Selatan	Sepinggan	√	
36	Andro Meda Waste Bank	Balikpapan Kota	Telaga Sari		√
37	Bougainville Waste Bank	Balikpapan Selatan	Sepinggan		√
38	Cempaka Waste Bank	Balikpapan Tengah	Gunung Sari Ulu		√
39	Le Grandeur Hotel Garbage Bank	Balikpapan Kota	Damai		√
40	Kantor Catatan Sipil Waste Bank	Balikpapan Kota	Damai		√
41	Punai Garbage Bank	Balikpapan Selatan	Gunung Bahagia		√
42	Puskesmas Damai Waste Bank	Balikpapan Kota	Damai		√
43	Karang Rejo Health Center Waste Bank	Balikpapan Tengah	Karang Rejo		√
44	Mekar Sari Community Health Center Waste Bank	Balikpapan Tengah	Mekar Sari		√
45	Puskesmas Prapatan Waste Bank	Balikpapan Kota	Prapatan		√
46	Aditya Karya Waste Bank	Balikpapan Utara	Graha Indah		√
47	Rumah Sakit Tentara Waste Bank	Balikpapan Kota	Klandasan Ulu		√
48	SMP 6 Waste Bank	Balikpapan Utara	Gunung Samarinda		√
49	Tanjung Waste Bank	Balikpapan Kota	Damai Baru		√
50	Sidomulyo Waste Bank	Balikpapan Barat	Margomulyo		√

Source: Author, 2025

Figure 2. Map of Distribution of Kota Balikpapan Waste Banks



Source: Author, 2025

Figure 2 above shows the distribution of active and inactive waste bank locations in various subdistricts in Kota Balikpapan. In North Balikpapan Sub-district there are 10 active waste bank units and 3 inactive waste bank units; in East Balikpapan Sub-district there are 10 active waste bank units; in West Balikpapan Sub-district there are 4 active waste bank units and 1 inactive waste bank unit; in South Balikpapan Sub-district there are 5 active waste bank units and 2 inactive waste bank units; in Central Balikpapan Sub-district there are 4 active waste bank units and 3 inactive waste bank units; and in Balikpapan City Sub-district there are 2 active waste bank units and 6 inactive waste bank units. The following is data on the distribution of waste bank locations that are still active and inactive in Kota Balikpapan.

2. Mass Balance Analysis

Table 6. Calculation of Reduction & Residue of Active Waste Bank of Balikpapan City

Garbage bank	Waste weight (kg/week)	Total RF	Weight reduction		Residue weight	
			kg/week	%	kg/week	%
Sampah Berkah Waste Bank	33.95	77,938	24.46	77,938	9.49	27,952
4 MB Waste Bank	138.4	93,208	129	93,208	9.4	6,791
65 Waste Bank	70	97,857	68.5	97,857	1.5	2,142
Adipura Waste Bank	43.85	95,781	42	95,781	1.85	4,218
Amanah Waste Bank	63	92,857	58.5	92,857	4.5	7,142

Asri Biru Waste Bank	34,375	84	28,875	84	5.5	16
Barokah Waste Bank	170.35	92,764	158,025	92,764	12,325	39,471
Berkah Beriman Waste Bank	31,225	76,861	24	76,861	7,225	23,138
Bina Mandiri Waste Bank	35.05	94,151	33	94,151	2.05	5,848
Borneo Waste Bank	126.7	95,501	121	95,501	5.7	4,498
Dharma Bakti 55 Waste Bank	140.85	96,325	135,675	96,325	5,175	3,674
Graha 05 Waste Bank	85,275	87,364	74.5	87,364	10,775	12,635
Grahin 57 Waste Bank	60.5	94,214	57	94,214	3.5	5,785
Griya Kariangau Baru Waste Bank (GKB)	70	95,357	66.75	95,357	3.25	4,642
Kota Hijau Waste Bank	284.25	98,962	281.3	98,962	2.95	1,037
Makmur Mandiri Waste Bank	64,425	83,042	53.5	83,042	10,925	16,957
Mekar Jaya Waste Bank	69.75	90,931	63,425	90,931	6,325	9,068
Pager Ijo Waste Bank	49,175	94,204	46,325	94,204	2.85	5,795
Pandan Wangi Waste Bank	32.65	98,009	32	98,009	0.65	1,990
Pande Waste Bank	25.5	84,117	21.45	84,117	4.05	15,882
Perdana 30 Waste Bank	56.25	94,666	53.25	94,666	3	5,333
Permata Sehati Waste Bank	43,675	91,929	40.15	91,929	3,525	8,070
Pondas Jaya Waste Bank	63	95,238	60	95,238	3	4,761
Pondas Lestari Waste Bank	67.5	92,888	62.7	92,888	4.8	7,111
RSKD Waste Bank	74.45	93,586	69,675	93,586	4,775	6,413
S-25 Waste Bank	130.5	95,210	124.25	95,210	6.25	4,789
Sejahtera 62 Waste Bank	93.16	97,252	90.6	97,252	2.56	2,747
Sekar 18 Waste Bank	58.5	92,307	54	92,307	4	6,837
Semarang Mandiri Waste Bank	58.5	83,760	49	83,760	9.5	16,239
Sepoka Waste Bank	49,175	94,560	46.5	94,560	2,675	5,439
SMP 03 Waste Bank	56.25	89,937	50.59	89,937	5.66	10,062
Sri Rejeki Waste Bank	49,625	95,214	47.25	95,214	2,625	5,289
Trans Manggar Waste Bank	51	96,568	49.25	96,568	1.75	3,431
Karya Mandiri Waste Bank	40,875	94,189	38.5	94,189	2,375	5,810
Puskesmas Sepinggan Waste Bank	26.2	91,603	24	91,603	2.2	8,396
Total	**2547,935**	**93,369**	**2379**	**93,369**	**168,685**	**6,620**

Source: Author, 2025

Based on Table 6, the mass balance analysis shows that the active waste bank in Kota Balikpapan holds 2,547.935 kg of trash every week, while 2,379 kg of trash that has been recycled makes up 93.369% of the total trash that goes into each waste bank. As a result, the active waste banks in Kota Balikpapan have met the performance standards for waste bank services by cutting the amount of trash that comes into the banks by more than 30 to 50 %, which is a 93.36% decline rate. This analysis indicates that the overall residue generated by the Kota Balikpapan waste bank, subsequently delivered to the Manggar TPAS, constitutes 6.620% of the total garbage received, amounting to 168.685 kg every week.

3. Analysis of Compliance with Standard Operating Procedures (SOP)

In evaluating the performance of waste banks based on compliance with Standard Operating Procedures (SOP), the operational conditions of waste banks are compared with the legal basis, namely the Regulation of the Minister of Environment and Forestry Number 14 of 2021, and literature related to waste bank operations by scoring each variable evaluated (Purwaningrum, 2016).

The score results obtained will be calculated as an actual percentage and produce a value or percentage score to determine the evaluation results based on the criteria for the suitability of waste bank implementation in table 4.

Table 7.SOP Compliance Evaluation Results

Name of Waste Bank	Standard Operating Procedure (SOP)										
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**%**
Sampah Berkah Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	It is not in accordance with	It is not in accordance with	It is not in accordance with	53.33
4 MB Waste Bank	2	2	1	2	1	2	3	1	1	1	
65 Waste Bank	Quite Appropriate	Quite Appropriate	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	Quite Appropriate	In accordance	Quite Appropriate	It is not in accordance with	70
Adipura Waste Bank	2	2	2	3	2	2	2	3	2	1	
Amanah Waste Bank	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66
Asri Biru Waste Bank	1	2	2	2	1	2	2	2	2	1	
Barokah Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66
Berkah Beriman Waste Bank	2	2	1	2	1	2	2	2	2	1	
Bina Mandiri Waste Bank	It is not in accordance with	It is not in accordance with	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	53.33
Borneo Waste Bank	1	1	1	2	1	2	3	2	2	1	
Dharma Bakti 55 Waste Bank	Quite Appropriate	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
Graha 05 Waste Bank	2	2	2	2	1	2	3	2	2	1	
Grahin 57 Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	In accordance	70
Griya Kariangau Baru Waste Bank (GKB)	2	3	1	2	1	2	3	2	2	3	
Kota Hijau Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
Makmur Mandiri Waste Bank	2	3	1	2	1	2	3	2	2	1	

Name of Waste Bank	Standard Operating Procedure (SOP)										
	A	B	C	D	E	F	G	H	I	J	%
Mekar Jaya Waste Bank	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66
Pager Ijo Waste Bank	1	2	1	2	1	2	3	2	2	1	
Pandan Wangi Waste Bank	Quite Appropriate	Quite Appropriate	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	In accordance	In accordance	Quite Appropriate	In accordance	76.66
Pande Waste Bank	2	2	2	3	1	2	3	3	2	3	
Perdana 30 Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	In accordance	It is not in accordance with	Quite Appropriate	In accordance	In accordance	Quite Appropriate	It is not in accordance with	66.66
Permata Sehati Waste Bank	2	2	1	3	1	2	3	3	2	1	
Pondas Jaya Waste Bank	It is not in accordance with	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
Pondas Lestari Waste Bank	1	3	2	2	1	2	3	2	2	1	
RSKD Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
S-25 Waste Bank	2	3	1	2	1	2	3	2	2	1	
Sejahtera 62 Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66
Sekar 18 Waste Bank	2	2	1	2	1	2	2	2	2	1	
Semarang Mandiri Waste Bank	Quite Appropriate	In accordance	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	In accordance	In accordance	Quite Appropriate	It is not in accordance with	73.33
Sepoka Waste Bank	2	3	2	3	1	2	3	3	2	1	
SMP 03 Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	60
Sri Rejeki Waste Bank	2	2	1	2	1	2	3	2	2	1	
Trans Manggar Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	In accordance	70

Name of Waste Bank	Standard Operating Procedure (SOP)										
	A	B	C	D	E	F	G	H	I	J	%
Karya Mandiri Waste Bank	2	2	1	2	2	2	3	2	2	3	
Puskesmas Sepinggan Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	60
Sampah Berkah Waste Bank	2	2	1	2	1	2	3	2	2	1	
4 MB Waste Bank	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66
65 Waste Bank	1	2	1	2	1	2	3	2	2	1	
Adipura Waste Bank	In accordance	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	70
Amanah Waste Bank	3	3	2	2	1	2	3	2	2	1	
Asri Biru Waste Bank	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	53.33
Barokah Waste Bank	1	2	2	2	1	2	2	1	2	1	
Berkah Beriman Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	53.33
Bina Mandiri Waste Bank	2	2	1	2	1	2	2	1	2	1	
Borneo Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	60
Dharma Bakti 55 Waste Bank	2	2	1	2	1	2	3	2	2	1	
Graha 05 Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	In accordance	It is not in accordance with	63.33
Grahin 57 Waste Bank	2	2	1	2	1	2	3	2	3	1	
Griya Kariangau Baru Waste Bank (GKB)	Quite Appropriate	It is not in accordance with	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	It is not in accordance with	It is not in accordance with	46.66
Kota Hijau Waste Bank	2	1	1	2	1	2	2	1	1	1	

Name of Waste Bank	Standard Operating Procedure (SOP)										
	A	B	C	D	E	F	G	H	I	J	%
Makmur Mandiri Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	It is not in accordance with	In accordance	63.33
Mekar Jaya Waste Bank	2	2	1	2	1	2	3	2	1	3	
Pager Ijo Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	56.66
Pandan Wangi Waste Bank	2	3	1	2	1	2	2	1	2	1	
Pande Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
Perdana 30 Waste Bank	2	3	1	2	1	2	3	2	2	1	
Permata Sehati Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	56.66
Pondas Jaya Waste Bank	2	3	1	2	1	2	2	1	2	1	
Pondas Lestari Waste Bank	Quite Appropriate	In accordance	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	63.33
RSKD Waste Bank	2	3	1	2	1	2	3	2	2	1	
S-25 Waste Bank	It is not in accordance with	It is not in accordance with	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	It is not in accordance with	It is not in accordance with	It is not in accordance with	40
Sejahtera 62 Waste Bank	1	1	1	2	1	2	1	1	1	1	
Sekar 18 Waste Bank	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	50
Semarang Mandiri Waste Bank	1	2	1	2	1	2	2	1	2	1	
Sepoka Waste Bank	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	It is not in accordance with	Quite Appropriate	It is not in accordance with	53.33
SMP 03 Waste Bank	2	2	1	2	2	2	1	1	2	1	
Sri Rejeki Waste Bank	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	Quite Appropriate	It is not in accordance with	56.66

Name of Waste Bank	Standard Operating Procedure (SOP)										
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**%**
Trans Manggar Waste Bank	1	2	1	2	1	2	3	2	2	1	
Karya Mandiri Waste Bank	Quite Appropriate	Quite Appropriate	Quite Appropriate	Quite Appropriate	It is not in accordance with	Quite Appropriate	In accordance	Quite Appropriate	In accordance	It is not in accordance with	66.66

Source: Author, 2025

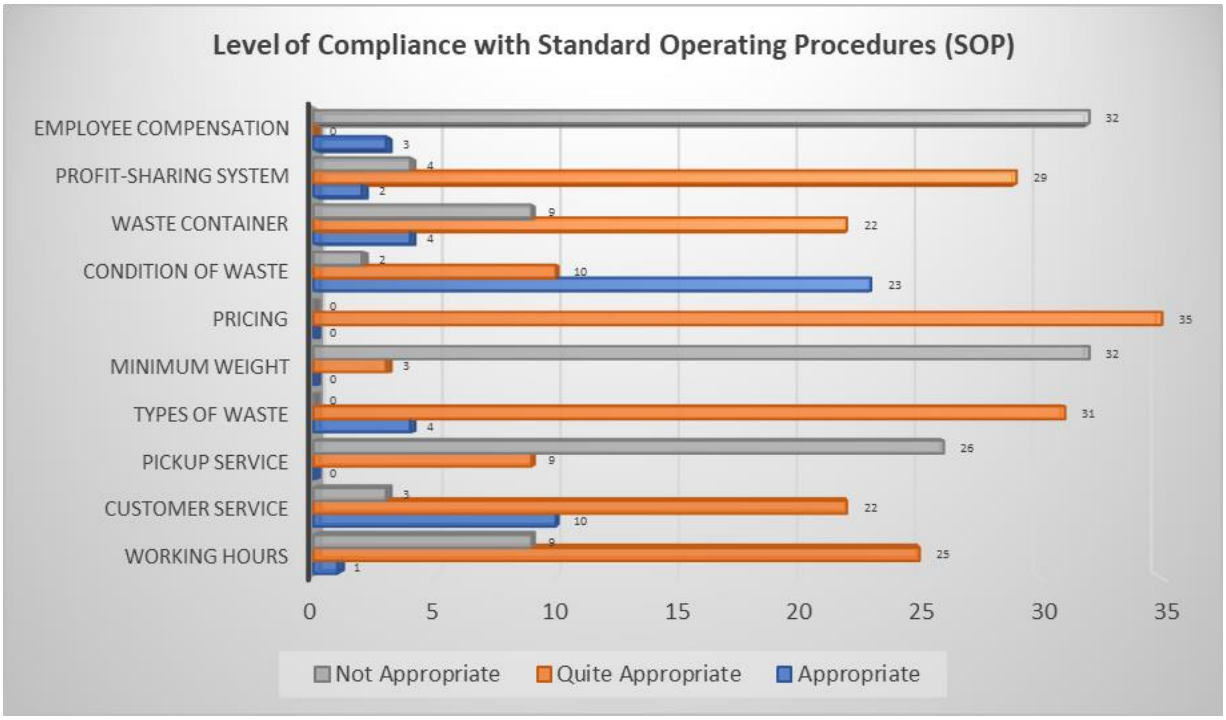
Based on Table 7, the results of the evaluation of the suitability of the implementation of waste banks to the Standard Operating Procedure (SOP) referring to the Regulation of the Minister of Environment and Forestry Number 14 of 2021 show that each waste bank has a variety of final evaluation score results; namely, the Tectona Grandis SMP 03 Waste Bank produced a score of 40%, which is included in the Not Appropriate category.

Then the RSKD Waste Bank produced a score of 46.66%, which is included in the Not Appropriate category. At the Sri Rejeki Waste Bank, a score of 50% was produced, which is included in the Not Appropriate category. The Berkah Waste Bank, Amanah Waste Bank, Perdana 30 Waste Bank, Permata Sehati Waste Bank, and Trans Manggar Waste Bank produced a score of 53.33%, which is included in the Not Appropriate category.

At the 65 Waste Bank, Adipura Waste Bank, Bina Mandiri Waste Bank, GKB Waste Bank, Pandan Wangi Waste Bank, Sejahtera 62 Waste Bank, Semarang Mandiri Waste Bank, and Karya Mandiri Waste Bank, a score of 56.66% was produced, which is included in the fairly appropriate category. At the Pondas Jaya Waste Bank, Pager Ijo Waste Bank, and Makmur Mandiri Waste Bank, the score was 60%, which is included in the fairly appropriate category. At the Sepoka Waste Bank, Sekar Waste Bank, S-25 Waste Bank, Pondas Lestari Waste Bank, Grahin 57 Waste Bank, Graha 05 Waste Bank, Berkah Beriman Waste Bank, and Asri Biru Waste Bank, the score was 63.33%, which is included in the fairly appropriate category.

At the Dharma Bakti 55 Waste Bank and the Sepinggan Health Center Waste Bank, the score was 66.66%, which is categorized in the fairly appropriate category. At the 4 MB Waste Bank, Barokah Waste Bank, Mekar Jaya Waste Bank, and Pande Waste Bank, the score was 70%, which is included in the fairly appropriate category. At the Green City Waste Bank, the score was 73.33%, and at the Borneo Waste Bank, the score was 76.66%, which is included in the fairly appropriate category.

Figure 3. SOP Compliance Chart



Source: Author, 2025

Figure 3 shows a graph of the suitability analysis results for each variable. It shows that the results for each variable's suitability to the Standard Operating Procedure (SOP) for organizing waste banks are still mostly made up of results that are quite suitable and not suitable. Based on the graph, it can be seen that the fairly appropriate category is shown in the pricing variable with the highest results, namely 35 waste bank units; the appropriate category is shown in the waste condition variable with the highest results, namely 23 units; and the inappropriate category is shown in the minimum weight variable and employee wages with the highest results, namely 32 waste bank units.

Previously, there was a study conducted in Junrejo District, Batu City, which showed that the level of suitability of waste bank implementation was 60%, or as many as 3 waste bank units. The variables with the lowest level of suitability were working hours and profit-sharing systems. When we look at the research on waste banks in Balikpapan City, we see that while the results are different from the study in Junrejo District, both indicate that improvements are needed for waste bank operations, which can be achieved by giving specific recommendations based on the analysis of each waste bank's situation.

The relationship between mass balance analysis and the suitability of the standard operating procedure (SOP) for the implementation of waste banks is based on the results of the analysis that has been carried out; each waste bank unit in Balikpapan City has shown its ability to reduce waste very well. This is due to the high level of waste sales from each waste bank unit to collectors, and the prices offered align well with the established waste price standards. Additionally, the condition of the waste collected at the waste bank meets the necessary standards, allowing it to be sold and reprocessed into several recycled products. Both variables have a fairly strong influence on the level of success of waste banks in reducing waste. On the other hand, many trash banks still don't follow the Standard Operating Procedure (SOP), which has rules about wrong working hours, minimum weights, and payments that aren't enough. A lot of trash cans no longer work because of this, which makes people in Kota Balikpapan wonder how well they're doing at reducing trash.

4. Recommendations for Improving the Implementation of Waste Banks

Recommendations for better implementing waste banks in Kota Balikpapan are split into 11 sections based on different factors (like how much waste is reduced, working hours, customer service, pick-up services, types of waste, minimum weight, pricing, waste conditions, waste containers, profit-sharing systems, and employee wages), and each factor is rated as appropriate, somewhat appropriate, or not appropriate. The recommendations given are as follows

Waste Reduction Level: All 35 active waste banks in Kota Balikpapan can maintain the quality of performance that has been carried out so that each waste bank can continue to help reduce the amount of waste generated and its implementation continues to run optimally and sustainably. **Working hours:** Can maintain the performance achieved and carry out development in the form of setting a routine schedule once a week every week.

Customer Service: Can sustain the attained performance and facilitate development via digitalization through applications that can reduce administrative errors in the established quarterly withdrawal schedule, while also providing savings books in various waste banks that currently lack them. **Pickup Service:** Can implement pickup services in accordance with the provisions, namely via telephone

and online system in the form of an application that can help and facilitate each customer and waste bank administrator.

Types of Waste: Can maintain the performance that has been achieved and carry out development in the form of adding types of waste that are saved and processing organic waste into compost or liquid fertilizer. **Minimum Weight:** Can enforce the determination of minimum weight according to the provisions, namely 10 kg for each waste bank customer, so that implementation and sales results can be maximized.

Pricing: Keeping up the same level of performance is important for the long-term success of trash banks. **Waste Condition:** Can keep up the same level of performance so that each active waste bank can continue to help lower the amount of each type of trash that is made at the Final Disposal Site (TPA). **Waste Containers:** It is essential to sustain present performance to ensure the viability of waste bank deployment. **Profit Sharing System:** Can execute development by aligning the conditions for result sharing with the 85:15 ratio as stipulated in the Regulation of the Minister of Environment and Forestry No. 14 of 2021. **Employee Remuneration:** Can budget for costs that can be given to waste bank administrators and employees as a form of appreciation for helping to manage the waste bank with waste bank customers.

CONCLUSION

A total of 50 waste bank units were spread out, and field surveys were conducted. There were 35 waste bank units that were still active and spread across several sub-districts, namely 10 waste bank units in North Balikpapan Sub-district, 10 waste bank units in East Balikpapan Sub-district, 4 waste bank units in West Balikpapan Sub-district, 5 waste bank units in South Balikpapan Sub-district, 4 waste bank units in Central Balikpapan Sub-district, and 2 waste bank units in Balikpapan City Sub-district that were classified as good, with the ability to reduce 93.369% of the total incoming waste. The residue that reached 6.620%, or the equivalent of 168.685 kg/week, was produced for transport to the Manggar Temporary Final Disposal Site (TPAS). Even though the active waste banks are doing a good job reducing waste, there are still many inactive ones, which highlights issues with following the Standard Operating Procedure (SOP).

The results of the analysis show that active waste banks in Kota Balikpapan have a level of conformity that still needs to be improved, namely the fairly appropriate category consisting of 10 variables. We consider several variables, including working hours, minimum weight, pick-up services, and employee wages, as still requiring improvement. The findings of this assessment are regarded as one of the contributing factors to the substantial number of inactive waste bank units in Kota Balikpapan. The implementation of waste banks can be enhanced by maintaining the current level of performance and implementing a variety of developments, including digitalization, employee compensation budgeting, and socialization.

THANK-YOU NOTE

The author would like to thank the parties who have assisted in this research activity, especially all the managers of the waste banks in Kota Balikpapan who have provided the opportunity for researchers to conduct direct observations.

REFERENCE

Andryani, N., Ariani, M., & Yuliani, T. (2024). Pengaruh Motivasi, Lingkungan Kerja, dan Disiplin Kerja Terhadap Kinerja Karyawan PT. Astra International Tbk-Auto2000 Cabang Balikpapan Sudirman. *MEDIA RISET EKONOMI [MR. EKO]*, *3*(2), 58–64.

Ariefahnoor, D., Hasanah, N., & Surya, A. (2020). Pengelolaan sampah Desa gudang tengah melalui manajemen bank sampah. *Jurnal Kacapuri: Jurnal Keilmuan Teknik Sipil*, *3*(1), 14–30.

Arikunto, S. (2009). *Prosedur Penelitian Suatu Pendekatan Praktik* (Revisi Ke). Rineka cipta.

Antin, T., Wahyuni, H. I., & Partini, P. (2019). Dinamika Peran Jejaring Pengelolaan Sampah Dalam Komunikasi Literasi Sampah. *Profetik: Jurnal Komunikasi*, *11*(2), 116-130.

Andini, S., Saryono, S., Fazria, A. N., & Hasan, H. (2022). Strategi pengolahan sampah dan penerapan zero waste di lingkungan kampus STKIP Kusuma Negara. *Jurnal Citizenship Virtues*, *2*(1), 273-281.

As'ari, H. (2019). Implementasi Kebijakan Tata Kelola Sampah di Kota Pekanbaru. *PROSIDING*, 83.

Astuti, H. W., Meidiana, C., & Wijayanti, W. P. (2020). Evaluasi Pelaksanaan Bank Sampah di Kecamatan Junrejo Kota Batu. *Planning for Urban Region and Environment Journal (PURE)*, *9*(2), 29–38.

Fauziyah, N., Sukaris, S., Rahim, A. R., & Jumadi, R. (2020). Peningkatan Kepedulian Masyarakat Terhadap Lingkungan Khususnya dalam Permasalahan Sampah. *DedikasiMU: Journal of Community Service*, *2*(4), 561-565.

Hajimi, H., Fauzi, M. R., & Salbiah, S. (2024). Overview of Waste Final Processing Place (TPA), Kubu Raya: A Descriptive Study. *Ahmar Metastasis Health Journal*, *4*(2), 88–97.

Hakim, M. Z. (2019). Pengelolaan dan pengendalian sampah plastik berwawasan lingkungan. *Amanna Gappa*, 111-121.

Juniartini, N. L. P. (2020). Pengelolaan sampah dari lingkup terkecil dan pemberdayaan masyarakat sebagai bentuk tindakan peduli lingkungan. *Jurnal Bali Membangun Bali*, *1*(1), 27-40.

Kurniawan, D. A., & Santoso, A. Z. (2020). Pengelolaan sampah di daerah sepatan kabupaten tangerang. *ADI Pengabdian Kepada Masyarakat*, *1*(1), 31–36.

Mahyudin, R. P. (2014). Strategi pengelolaan sampah berkelanjutan. *EnviroScienteae*, *10*(1), 33–40.

Morrissey, A. J., & Browne, J. (2004). Waste management models and their application to sustainable waste management. *Waste management*, *24*(3), 297–308.

Nawangwulan, G., & Sutriadi, R. (2015). Kajian Ketercapaian Kota Layak Huni (Liveable City) Kota Balikpapan. *Bandung: Institut Teknologi Bandung*.

Nurunnisa, F., Agusnia, F. D., Iswadi, M. D. N., Putra, M. R. A., Alan, T. A., Handayani, R., & Lestari, A. P. (2024). Pembentukan Program Bank Sampah Sebagai Penambah Pendapatan Bagi Masyarakat Pekon Teba Bunuk Kecamatan Kota Agung Barat Kabupaten Tanggamus. *BUGUH: JURNAL PENGABDIAN KEPADA MASYARAKAT*, *4*(3), 20–25.

Nainggolan, E. L., Lodan, K. T., & Salsabila, L. (2023). Menuju keberlanjutan lingkungan: Keterlibatan masyarakat dalam pengelolaan sampah Kota Batam. *PUBLIKA: Jurnal Ilmu Administrasi Publik*, *9*(2), 179-188.

Purwaningrum, P. (2016). Upaya mengurangi timbulan sampah plastik di lingkungan. *Indonesian Journal of Urban and Environmental Technology*, *8*(2), 141–147.

Putri, D. A., & Pratomo, R. A. (2024). Investigating the Operational Feasibility of Waste Management at Integrated Waste Management Sites in Balikpapan City. *Jurnal Geografika (Geografi Lingkungan Lahan Basah)*, *5*(1), 20–34.

Radityaningrum, A. D., Caroline, J., & Restianti, D. K. (2017). Potensi reduce, reuse, recycle (3R) sampah pada bank sampahBank Junk For Surabaya Clean (BJSC). *Jukung (Jurnal Teknik Lingkungan)*, *3*(1).

Shahreza, M., Sarwoprasodjo, S., Arifin, H. S., & Hapsari, D. R. (2020). Komunikasi Lingkungan Pengelolaan Sampah pada Bank Sampah di Tangerang Selatan. *Jurnal Penelitian Komunikasi*, *23*(2).

Satori, M., Amaranti, R., & Srirejeki, Y. (2020). Sustainability of waste bank and contribution of waste management. *IOP Conference Series: Materials Science and Engineering*, *830*(3), 032077.

Sugiyono. (2001). Statistika untuk Penelitian. *Bandung: Alfabeta*.

Surjandari, I., Hidayatno, A., & Supriatna, A. (2009). Model dinamis pengelolaan sampah untuk mengurangi beban penumpukan. *Jurnal Teknik Industri: Jurnal Keilmuan dan Aplikasi Teknik Industri*, *11*(2), 134–147.

Wararatna, M., & Subekti, R. (2022). Efektivitas dinas lingkungan hidup dalam mengelola sampah sebagai upaya perlindungan terhadap lingkungan. *Jurnal Komunikasi Hukum (JKH)*, *8*(2), 221-229.

Wilson, D. C., Rodic, L., Cowing, M. J., Velis, C. A., Whiteman, A. D., Scheinberg, A., Vilches, R., Masterson, D., Stretz, J., & Oelz, B. (2015). 'Wasteaware'benchmark indicators for integrated sustainable waste management in cities. *Waste management*, *35*, 329–342.