

## Performance Optimization of Waste Bank and TPS3R in Jambi City

Winny Laura Christina Hutagalung<sup>1\*</sup>, Anggun Permatasari<sup>1</sup>, Rinaldi<sup>1</sup>

<sup>1</sup>Environmental Engineering Study Program, Faculty of Science and Technology, Jambi University, Muaro Jambi 36361, Indonesia

\*correspondence: [winny\\_laura.ch@unja.ac.id](mailto:winny_laura.ch@unja.ac.id)

Received: 11 September 2025

Accepted: 10 October 2025

**Abstract:** In Indonesia, there are two kinds of waste recycling site: waste bank (managed by community) and TPS3R (managed by government). Jambi City has 12 active waste banks and 9 TPS3R established to overcome the increasing waste generation every year. This study aims to analyze the amount of waste generation along with the composition, recycling rate, and recovery rate of waste in the waste bank and TPS3R. In addition, determination of the direct economic benefits and the SWOT analysis are being carried out to determine suitable strategies to optimize the two waste recycling sites. The study result shows the amount of waste generated in the waste bank averagely 37419.15 kg/month with the composition mostly iron material with an amount of 8119 kg/month. Waste generation in Jambi City TPS3R is 107,592.7 kg/month and the highest composition is organic waste with an amount of 94,244.7 kg/month. Recycling rate and recovery rate in the Jambi City Waste Bank whose value is equal to 0,268%. The value of the recycling rate and recovery rate of TPS3R in Jambi City is 0.096% and 0.770%. The economic benefits or benefits obtained are based on the value of benefit to cost ratio (B/C) in the Jambi City Waste Bank, which is less than 1, which means that the activity does not provide benefits or is not financially feasible, while for Jambi City TPS3R shows that the B/C value is greater than 1, meaning the activity provides benefits and is financially feasible. The SWOT analysis resulting in nine waste banks and eight TPS3R in Jambi City suggested on S-O strategy to optimize the management. Meanwhile, three waste banks and one TPS3R recommended on W-O strategy to optimize the management.

**Keywords:** recovery rate, recycling rate, SWOT, TPS3R, waste bank

### 1. INTRODUCTION

One way to overcome the urban waste problem is to make a recycling stations. In Indonesia, there are two kind of recycling sites, waste bank and TPS3R. Waste bank sites are managed by community. While TPS3R (*tempat pengolahan sampah 3R*, or waste management sites with reduce, reuse, recycle (3R) principles) sites are managed by government. Waste bank and TPS3R are waste processing models used to reduce the generation of waste that goes to TPA (*tempat pemrosesan akhir*, an Indonesian term for waste final processing or disposal). Both waste processing models reduce waste generation by processing waste that still has economic value. At a waste bank site, waste that has economic value is cleaned and sold to factories or third parties to

be processed in such a way. At a TPS3R site, organic wastes are being processed into compost which can be sold to local farmers to fertilize the soil. Meanwhile, inorganic wastes are being sold from TPS3R to third parties. It is said that household wastes have potential to be reduced (Widyawati, Hutagalung 2020). Furthermore, waste will be processed according to its type (Putri, et al 2024).

Both waste management models require costs to manage the waste. One of the costs incurred is the cost of transporting waste. Apart from costs, both waste management models also obtain income from the sale of waste which has economic value from recyclable waste. Knowledge of the recycling rate and recovery rate is important because it can help to know the amount of waste that can be managed and is appropriate for an area.

This research was conducted at the Waste Bank and TPS3R in Jambi City. Jambi City has a commitment to efforts to overcome waste problems, showed from the Jambi City Regional Regulation Number 8 of 2013 concerning Waste Management. Currently Jambi City has twelve waste banks and nine TPS3R. This research aims to determine the generation and composition of waste in the Waste Bank and TPS3R, and to determine the recycling rate and recovery rate of the Jambi City Waste Bank and TPS3R. This research also calculates the economic benefits and optimization of the waste management model at the Waste Bank and TPS3R in Jambi City.

## 2. MATERIALS AND METHODS

Recycling rate is the amount of waste that can be recycled divided by the resulting waste generation (EPA, 1994). The recycling rate does not include composted waste or waste used to produce energy. Recovery rate is the total amount of waste that is recycled and composted and waste that becomes raw materials for energy divided by the amount of waste generated (EPA, 1994). Optimization carried out for waste management with the Jambi City Waste Bank and TPS3R is using SWOT analysis. SWOT analysis is a classic strategic planning instrument. SWOT analysis is an analysis used to evaluate an activity based on strengths, weaknesses, opportunities, threats (Start and Hovland, 2004). In this research, the data obtained is in the form of qualitative data and quantitative data, so there are two ways to analyze the data. In this research, data on the number of Waste Banks and TPS3R owned by Jambi City was obtained from the Jambi City Environmental Service. From this data, the address or location of the Waste Bank and TPS3R Jambi City is also known. For the Waste Bank and TPS3R of Jambi City, the buying and selling price is obtained which is used to calculate the economic benefits obtained by the Waste Bank and TPS3R of Jambi City per year. In this research, it was obtained using a questionnaire from the Waste Bank and TPS3R in Jambi City. The data obtained will be analyzed to obtain the following parameters.

### 1. Recycling rate and recovery rate

$$\% \text{ Recycling rate} = \frac{\text{Waste generation for recycling}}{\text{Total waste generation}} \times 100\% \quad (1)$$

$$\% \text{ Recovery rate} = \frac{\text{Waste generation for recovery}}{\text{Total waste generation}} \times 100\% \quad (2)$$

2. Optimizing waste management using SWOT analysis and economic analysis of waste management models. SWOT analysis is an analysis used to evaluate an activity based on strengths, weaknesses, opportunities, and threats (Start & Hovland, 2004).
  - a. *Strength*: characteristics of an activity that provides benefits.
  - b. *Weakness*: characteristics of an activity that put the organization in a detrimental state.
  - c. *Opportunity*: existing opportunities that can be used to take advantage of performance.
  - d. *Threat*: threats that can cause problems for an activity.

By increasing strengths and taking advantage of opportunities and overcoming weaknesses and threats, the optimum state of a waste management model will be achieved.

3. Economic benefits, calculated by reviewing the profits and benefit/cost ratio from each waste management model. The formulas for calculating the two parameters are as follows.

$$\text{Profit} = \text{Income from selling wastes} - \text{Operational cost} \quad (3)$$

$$\text{Benefit/cost ratio (B/C)} = \frac{\text{Profit}}{\text{Investment cost} + \text{Operational cost}} \quad (4)$$

This profit is calculated per year, then the profit obtained during the year is used to find out and compare the two waste management models. The B/C value is carried out to determine the financial feasibility of a project or activity.

4. The level of public awareness of waste management, waste sorting, and public knowledge of waste management based on questionnaires results on the community. Descriptive statistical analysis then carried out by presenting the questionnaire results data in the form of a bar chart. Community respondents in the research were selected randomly and focused on communities who were not customers of the Waste Bank. Determination of the total number of samples was carried out using Slovin formula as the following equation.

$$n = \frac{N}{1 + N \cdot e^2} \quad (5)$$

with:

$n$  = number of sample

$N$  = number of population

$e$  = designated error

### 3. RESULTS AND DISCUSSION

#### 3.1 Waste Generation

Waste generation data was obtained using questionnaires aimed at the Waste Bank and TPS3R in Jambi City. The calculation results of the waste generation for recycling can be seen in Table 1 for Waste Bank and in Table 2 for TPS3R.

The total amount of waste recycled material generated in the Waste Bank was 37,419.15 kg/month. The highest amount of waste generation is at the Dream Waste Bank with a total generation of 13,220 kg/month. The smallest amount of recycled material generated is at the Bangkitku Waste Bank with a total generation of 105.15 kg/month.

The total amount of waste generated at TPS3R is 107,592.7 kg/month. The largest amount of generation among TPS3R in Jambi City is at TPS3R Sulus Berkah with a total generation of 30,912 kg/month. Judging from the service area, TPS3R Sulus Berkah has quite a large number. The

service area is a sub-district with a total of 650 families so that the amount of waste produced is also increasing. The lowest generation was at TPS3R Beringin Bersatu with a total generation of 2,507 kg/month. This is because the location of Beringin Bersatu is in the middle of Jambi City, where most of the residents have irregular residences. Therefore, people do not want to pay the operational costs set by TPS3R and most of them immediately throw their rubbish into TPS (Temporary Shelter) tanks.

**Table 1.** Amount of waste generation in Jambi City's waste bank sites

No.	Name of Waste Bank Site	Weight of waste generation for recycling (kg/month)
1	Dream	13220
2	Barokah Bersama	3410
3	Kemang	235
4	Mekar Sari	1095
5	Air	1130
6	Setia Budi	9780
7	Jujur	1180
8	Sinar Kenali	1077
9	Jaya Abadi	4996
10	Hijau 17	669
11	Sumber Rezeki	522
12	Bangkitku	105.15
Total		37419.15

**Table 2.** Amount of waste generation in Jambi City's TPS3R sites

No.	Name of TPS3R Site	Weight of waste generation for recycling (kg/month)
1	Sulur Berkah	30912
2	Makmur Jaya	3285
3	Mekar Sari	10410
4	Sinar Kenali	7747
5	Jaya Abadi	29042
6	Maidanul Ula	3306
7	Beringin Bersatu	2507
8	Pasar Mama	14895
9	Gading	5488.7
Total		107592.7

According to the Indonesian Minister of Environment Regulation No.13 of 2012, the types of waste that can be accepted and deposited in a waste bank are:

1. paper, which includes newspapers, magazines, cardboard, and duplex;
2. plastic, which includes clear plastic, plastic bottles, and other hard plastic;
3. metals, which include iron, aluminum, and tin.

Waste banks can accept other types of waste as long as they have economic value. The waste received at TPS3R is waste that has not been sorted and is still mixed. The waste will later be sorted by TPS3R workers based on its composition. The composition of waste in TPS3R consists of organic and inorganic waste. Overall, the total composition of waste produced by the Waste Bank in Jambi City can be seen in Figure 1.

The most common waste composition based on Figure 1 is iron waste material. The total amount of iron that can be collected in a month is an average of 8119 kg/month or 22% of the total composition of waste in the Jambi City Waste Bank. This is because the iron material collected is quite large in size, such as iron lumps from workshop waste in the form of car/motorcycle drums, and welding workshops in the form of used iron for making fences and other things. The weight produced is very large from other components or composition of waste. Data on the composition of waste in TPS3R as a whole can be seen in Figure 2.

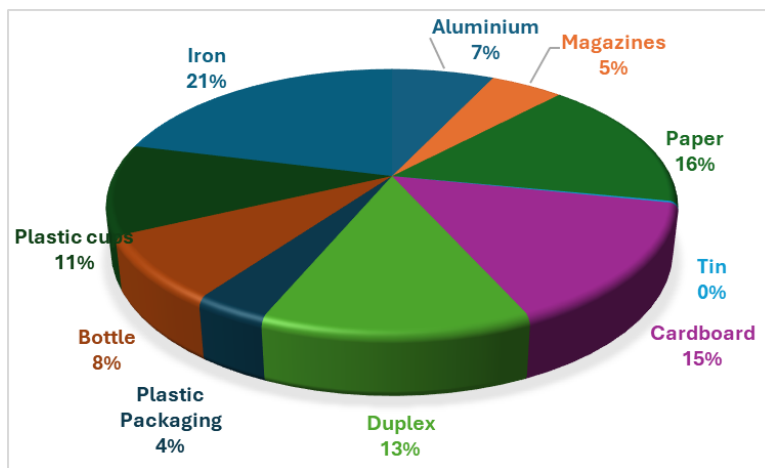


Figure 1. Waste composition from waste banks of Jambi City.

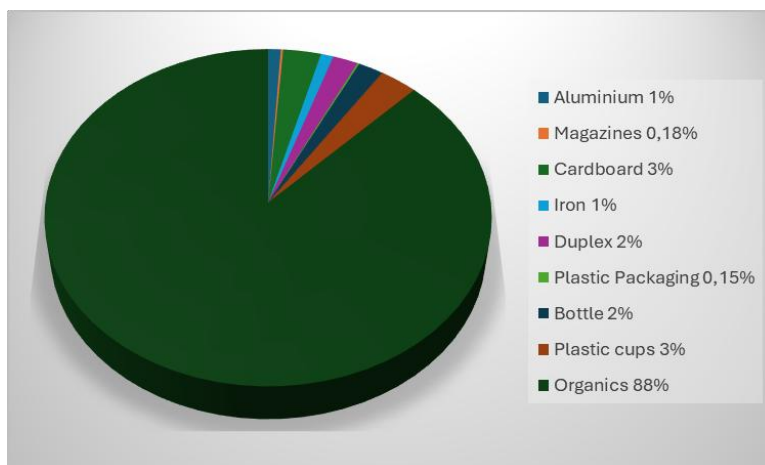


Figure 2. Waste composition from TPS3R sites of Jambi City.

### 3.2 Recycling Rate

Figure 2 shows that waste type managed by TPS3R sites in Jambi City was mostly organic waste. The organic wastes in the TPS3R sites are being processed into compost then sold or used by the communities around the TPS3R. The amount of organic waste that can be processed by TPS3R sites in Jambi City is 94244.7 kg/month or 88% of the total waste produced. The high number could be due to the wet food wastes significantly increasing the weight of the generated organic waste.

Recycling rate and recovery rate are useful for knowing the percentage of waste that can be managed by the Jambi City Waste Bank and TPS3R based on the waste generated in Jambi City. It is known that the waste generation in Jambi City is 13,970,814.73 kg/month (Jambi City Environmental Service Data, 2018). The greater the percentage produced, the greater the success of the waste management model program in reducing waste. The recycling rate and recovery rate obtained are the results of data processing based on equations 1 and 2. The recycling rate and recovery rate for the Jambi City waste bank is showed in Table 3, while for the Jambi City TPS3R is showed in Table 4.

**Table 3.** Recycling Rate and Recovery Rate from Waste Bank in Jambi City

No.	Waste Bank	Total managed waste (kg/month)	Recycling Rate (%)	Recovery Rate (%)
1	Dream	13220	0.095	0.095
2	Barokah Bersama	3410	0.024	0.024
3	Kemang	235	0.002	0.002
4	Mekar Sari	1095	0.008	0.008
5	Air	1130	0.008	0.008
6	Setia Budi	9780	0.070	0.070
7	Jujur	1180	0.008	0.008
8	Sinar Kenali	1077	0.008	0.008
9	Jaya Abadi	4996	0.036	0.036
10	Hijau 17	669	0.005	0.005
11	Sumber Rezeki	522	0.004	0.004
12	Bangkitku	105.15	0.001	0.001
Total		37419.15	0.268	0.268

**Table 4.** Recycling Rate and Recovery Rate from TPS3R in Jambi City

No.	TPS3R	Non-Organic (kg/month)	Organic (kg/month)	Recycling rate (%)	Recovery Rate (%)
1	Sulur Berkah	912	30000	0.007	0.221
2	Makmur Jaya	1285	2000	0.009	0.024
3	Mekar Sari	1410	9000	0.010	0.075
4	Sinar Kenali	1747	6000	0.013	0.055
5	Jaya Abadi	4996	24046	0.036	0.208
6	Maidanul Ula	756	2550	0.005	0.024
7	Beringin Bersatu	107	2400	0.001	0.018
8	Pasar Mama	495	14400	0.004	0.107
9	Gading	1640	3848.7	0.012	0.039
Total		13348	94244.7	0.096	0.770

Based on Table 3, waste banks in Jambi City have total recycling rate and recovery rate of same value, 0.268%. The recovery rate and recycling rate have same values because in the waste reduction process, the waste banks only accepted inorganic waste. Meanwhile, for Jambi City TPS3R, the overall recycling rate is 0.096% and overall recovery rate is 0.77%. The recycling rate value is obtained from calculating the type of waste that can only be recycled, while the recovery rate is obtained from calculating the type of waste that can be recycled and waste that can be composted. The recovery rate percentage value is higher because organic waste that can be composted is much more processed than non-organic waste.

The data obtained to determine the magnitude of the economic benefits of waste management were obtained from the results of a questionnaire at the Jambi City Waste Bank and Jambi City TPS3R). The profit obtained is the result of equation 3. Financial feasibility calculations were also carried out by calculating the B/C value from equation 4. The results of this research show that the activities in the Jambi City Waste Bank are not financially feasible, namely the B/C value in the Jambi City Waste Bank is less than 1, while the activities in the Jambi City TPS3R show that they are financially feasible. with a B/C value of more than 1.

### **3.3 Strategy for Optimization Waste Bank and TPS3R**

Optimization of waste management using the Jambi City Waste Bank and TPS3R was carried out using questionnaires to the community and SWOT analysis on the Jambi City Waste Bank and TPS3R. Questionnaire for the community to find out the community's views on community knowledge, attitudes and behavior in waste management, namely waste banks and TPS3R.

The SWOT analysis will show the strengths, weaknesses, opportunities and threats that exist in the Waste Bank and TPS3R of Jambi City. The SWOT analysis aims to obtain strategies that can be utilized to optimize the performance of the Jambi City Waste Bank and TPS3R. The SWOT analysis carried out at 12 Jambi City Waste Banks shows that 9 waste banks are in the "Progressive" position or quadrant 1 and the SWOT analysis carried out at 9 Jambi City TPS3R shows that 8 Jambi City TPS3R are in the "Progressive" position or quadrant 1. This shows that the waste bank and TPS3R are in a good position. The recommended strategy is the S-O strategy, namely socializing waste banks and TPS3R to residents to increase community participation in waste bank and TPS3R activities so that people can manage their own waste and can reduce the waste produced, increase the number of waste banks and TPS3R so that waste is more waste can be managed and will reduce the amount of waste entering the landfill, making the waste bank and TPS3R a waste management program and providing financial assistance in the form of tools so that it is more focused and has clear guidance, as well as synergizing the waste bank and TPS3R in managing the City's waste Jambi is improving the performance of waste banks and TPS3R to reduce waste entering the landfill.

The position of three waste banks and one other TPS3R is in a position to "Change Strategy" or quadrant 3, which means that the waste bank and TPS3R are in a weak position but have an opportunity. Suggestions that can be made are to implement the W-O strategy, namely improving the work system of activities that take place at the waste bank and TPS3R by instilling awareness of the importance of cleanliness among workers, conducting socialization about the waste bank and TPS3R, how it works and how to process/sort home waste. good steps so that people can sort their own waste, make the waste bank and TPS3R a waste management program so that it is more focused and has clear guidance, and synergize the waste bank and TPS3R in Jambi City waste

management to improve the performance of the waste bank and TPS3R so that can reduce waste going to landfill.

According to Bongers and Casas (2022), there are three things in the relationship between recycling rate and circular economy, namely a positive relationship to economic growth, the recycling process related to the circular economy can also solve environmental and waste problems and the recycling process can increase technological progress. The recycling rate in the results of this study is still very small so that it requires the participation of many parties, for example the Environmental Service, Waste Bank and TPS3R administrators, and public awareness. According to Putra W.T, 2020, there are several empowerment processes that can be carried out on waste banks, namely: raising awareness, educating the community, providing a sense of security and guarantees, providing guidance and support and maintaining good relationships.

#### **4. CONCLUSION**

The conclusion of this study are about the waste generation generated at the Jambi City Waste Bank is 37,419.15 kg/month and the total waste generation at TPS3R Jambi City is 107,592.7 kg/month. From that point, the composition of waste in the Waste Bank and TPS3R includes paper, plastic, metal and other materials. The highest amount of waste composition in the Jambi City Waste Bank is iron waste material and the largest waste composition in Jambi City TPS3R is organic waste material. The recycling rate at the Jambi City Waste Bank is 0.268% and the recovery rate is 0.268%. The recycling rate at TPS3R Jambi City is 0.096% and the recovery rate is 0.770%. The activities in the Jambi City Waste Bank show that it is not financially feasible, namely the B/C value in the Jambi City Waste Bank is less than 1, while the activities in the Jambi City TPS3R show that it is financially feasible with a B/C value more than 1. The SWOT analysis carried out at 12 Jambi City Waste Banks shows that 9 waste banks are in the "Progressive" position or quadrant 1 and the SWOT analysis carried out at 9 Jambi City TPS3R shows that 8 Jambi City TPS3R are in the "Progressive" position or quadrant 1. The position of 3 waste banks and 1 other TPS3R is in a position to "Change Strategy" or quadrant 3, which means that the waste bank and TPS3R are in a weak position but have an opportunity.

Suggestions from this research for the future research are designing socialization of waste banks and TPS3R to the community to increase community participation in waste bank and TPS3R activities, increase the number of waste banks and TPS3R and improve the existing waste management system. Improving waste processing can be done by better managing workers, increasing profits can be done by increasing the number of customers at the waste bank, and synergize waste banks and TPS3R in waste management by including them in the waste management program in Jambi City. The enthusiasm of customers or the community of waste banks and TPS3R in waste management activities can be maintained by providing guidance and counseling to the community.

#### **5. ACKNOWLEDGEMENT**

The authors are grateful to the Jambi City Environmental Service, waste bank sites, and TPST3R sites in Jambi City who had collaborated by providing data for this study.

## REFERENCES

- Ariefahnoor, D., Hasanah, N. & Surya, A., 2020. Pengelolaan sampah Desa Gudang Tengah melalui manajemen bank sampah. *Jurnal Kacapuri: Jurnal Keilmuan Teknik Sipil*, 3(1), pp.14–30. Available at: <http://dx.doi.org/10.31602/jk.v3i1.3594>.
- Aryenti, 2011. Peningkatan peranserta masyarakat melalui gerakan menabung pada bank sampah di Kelurahan Babakan Surabaya, Klaracandong Bandung. *Jurnal Pemukiman*, 6(1), pp.40–46.
- Auliani, R., 2020. Peran bank sampah induk dalam pengelolaan sampah Kota Medan. *Jurnal Abdidas*, 1(5), pp.330–338. Available at: <https://doi.org/10.31004/abdidas.v1i5.80>.
- Bongers, A. & Casas, P., 2022. The circular economy and the optimal recycling rate: A macroeconomic approach. *Ecological Economics*, 199, p.107504.
- Damanhuri, E., 2004. *Diktat Kuliah TL-3150 Pengelolaan Persampahan*. Bandung: Institut Teknologi Bandung.
- Damanhuri, E., 2010. *Diktat Kuliah TL-3104 Pengelolaan Sampah*. Bandung: Institut Teknologi Bandung.
- Departemen Pekerjaan Umum, 1999. *Tentang Sampah Sebagai Sumber Daya*. Jakarta: Departemen Pekerjaan Umum.
- EPA, 1994. *Waste Prevention, Recycling, and Composting Options: Lessons from 30 US Communities*. Washington, D.C.: United States Environmental Protection Agency.
- Peraturan Daerah Kota Jambi Nomor 8 Tahun 2013. *Tentang Pengelolaan Sampah*. Pemerintah Kota Jambi.
- Peraturan Menteri Lingkungan Hidup Nomor 13 Tahun 2012. *Pedoman Pelaksanaan Reduce, Reuse dan Recycle melalui Bank Sampah*. Kementerian Lingkungan Hidup Republik Indonesia.
- Peraturan Menteri Pekerjaan Umum Nomor 03 Tahun 2013. *Penyelenggaraan Prasarana dan Sarana Persampahan dalam Penanganan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga*. Kementerian Pekerjaan Umum Republik Indonesia.
- Peraturan Pemerintah Nomor 81 Tahun 2012. *Tentang Pengelolaan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga*. Pemerintah Republik Indonesia.
- Putra, W.T., 2020. Pemberdayaan masyarakat melalui pengelolaan sampah di bank sampah. *Jambura Journal of Community Empowerment*, pp.69–78. Available at: <https://doi.org/10.37411/jjce.v1i2.569>.
- Putri, P.A., Mutmainnah, E., Ramadhani, P.A., Viareco, H. & Hutagalung, W.L.C., 2024. *Sampah & Solusinya: Memahami Berbagai Metode Pengolahan*. Yogyakarta: EDU Publisher.
- SNI 19-7030-2004. *Spesifikasi Kompos dari Sampah Organik Domestik*. Badan Standardisasi Nasional.
- Start, D. & Hovland, I., 2004. *Tools for Policy Impact: A Handbook for Researchers*. London: Overseas Development Institute.
- Sugiyono, 2005. *Metode Penelitian Administrasi*. Bandung: Alfabeta.
- Suryani, A.S., 2014. Peran bank sampah dalam efektivitas pengelolaan sampah (studi kasus Kota Malang). *Jurnal Aspirasi*, 5(1), pp.72–75.
- Tchobanoglous, G., 1993. *Integrated Solid Waste Management*. New York: McGraw-Hill.
- Undang-Undang Nomor 18 Tahun 2008. *Tentang Pengelolaan Sampah*. Pemerintah Republik Indonesia.

- Vincent, 2013. Analysis and optimization of waste bank and material recovery facility performance in solid waste management at Beji Subdistrict City of Depok. *Analisis dan Optimasi Kinerja Bank Sampah dan Unit Bank Sampah (UPS) dalam Pengelolaan Sampah di Kelurahan Beji Depok*. [Skripsi] Jakarta: Universitas Indonesia.
- Widyawati, R., Rinaldi & Hutagalung, W.L.C., 2020. Analisis timbulan dan komposisi sampah untuk potensi reduksi sampah di Kelurahan Selamat. *Jurnal Engineering*, 2(2), pp.86–95.