

Enhancing Community Participation in Waste Management Through Waste Banks

I. D. A. A. Warmadewanthi^{1*}, Ary Mazharuddin Shiddiqi², Dian Saptarini³, Arvina Anggie Kharizma³, Nadia Sephia Audina³, and Bayu Arnel Premdan Afristo³

¹Environmental Engineering, Insititut Teknologi Sepuluh Nopember, Surabaya, Indonesia

²Informatics Engineering, Insititut Teknologi Sepuluh Nopember, Surabaya, Indonesia

³Biology, Insititut Teknologi Sepuluh Nopember, Surabaya, Indonesia

[*warma@its.ac.id](mailto:warma@its.ac.id)

Abstract: Mojoroto, as the most populated sub-district in Kediri, has a waste generation rate of 0.66 kg/person/day. This sub-district owns 26 waste bank units across 14 urban villages and actively buys and sells waste. The purpose of community service is to innovate in managing waste recycling in Kediri City by utilizing a digital waste recycling application called Apps4SWAM. Changing to a digital system is expected to simplify the waste recycling process and increase system transparency. The actors involved in this activity are customers and waste bank managers. Six active waste banks in the Mojoroto Sub-district participated in this community service activity. The Apps4SWAM application was developed based on input from all stakeholders who use the application. This application was socialized to the community, especially waste bank customers. A survey was also conducted to determine the community's willingness to manage waste and use this application. Two hundred respondents, consisting of waste bank customers and non-waste bank customers, were surveyed about their waste management behaviour and responses to the waste bank application. The results of this activity show that 80% of waste bank managers use this application to facilitate transactions in the waste bank. Customers also stated that the application system makes recording waste easier and faster, making the financial system more transparent. The increase in waste sales after using the app averaged 153%, and the total number of waste bank customers using the app reached 250. However, obstacles are still faced, ensuring all stakeholders involved in recycling in Kediri can fully switch to using the app for waste recycling activities. The government's readiness to continue this program also needs to be considered, while support from other stakeholders such as collectors and industries is also key. This app can potentially form a waste management network, especially in terms of recycling, in Kediri City.

Keywords: application; ransparent; recycling; waste bank

© 2024 Bubungan Tinggi: Jurnal Pengabdian Masyarakat

Received: 28 November 2023

Accepted: 18 June 2024

Published: 7 November 2024

DOI : <https://doi.org/10.20527/btjpm.v6i4.10997>

How to cite: Warmadewanthi, I. D. A. A., Shiddiq, A. A., Saptarini, D., Kharizma, A. A., Audina, N. S., & Afristo, B. A. P. (2024). Enhancing community participation in waste management through waste banks. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, 6(4), 805-812.

INTRODUCTION

Kediri City is a rapidly developing medium-sized city progressing toward becoming a major city in East Java Province, evidenced by its rising urban development index of 80.97% (BPS Kediri City, 2024). Kediri City spans an area of 63.4 km² and consists of three subdistricts: Mojoroto, Kota, and Pesantren. As of 2021, the population of Kediri City stands at 286,796, and it is expected to grow over time (BPS Kediri City, 2021). The residents of Kediri City generate a total of 173.87 tons of waste daily (SIPSN, 2023). The growing population in Kediri City will increase consumption, resulting in a significant waste generation rate.

Mojoroto Subdistrict is the largest subdistrict in Kediri City, covering an area of 2,693.4 hectares and consisting of 14 villages, including Pojok, Tamanan, Campurejo, Banjarnlati, Bandar Kidul, Lirboyo, Mojoroto, Sukorame, Bujel, Bandar Lor, Ngampel, Mrican, Gayam, and Dermo. Mojoroto Subdistrict has a population of 114,553, with a growth rate of 0.56% from 2019 to 2021 (BPS, 2021). With a population density of 4,657 people/km², Mojoroto Subdistrict generates a high rate of waste.

Most of the waste in Mojoroto Subdistrict comes from household waste. All the waste produced by the residents of Mojoroto Subdistrict is eventually disposed of at the Klotok Final Processing Site (TPA) in Pojok Village, which covers an area of 2.5 hectares. TPA Klotok uses the open dumping method, where waste is simply piled up without further processing. By the end of 2014, the height of the waste pile at TPA Klotok was predicted to reach 10.9 meters, exceeding the initial planned height of 10 meters (Krisnawati, 2014). If this continues, it could result in waste overflow due to the site's limited capacity.

Mojoroto Subdistrict has attempted to reduce waste through one 3R Transfer Station (TPS), one TPA, and 26 waste bank units. However, these waste management facilities have not effectively reduced waste in Mojoroto Subdistrict. Field observations indicate a reluctance to become waste bank customers, partly due to the manual recording system and the need for greater transparency.

Through the development of waste banks implemented in the community, waste banks can help reduce the amount of waste transported to final disposal sites (TPAs) (Hidayah et al., 2021; Kusminah, 2018; Widarti et al., 2017). According to other research, waste banks offer several benefits for humans and the environment, such as reducing waste and turning waste into economically valuable items (Suryani, 2017; Wardany et al., 2020; Wartama & Nandari, 2020). Moreover, managing waste banks requires labour from the local community, potentially reducing unemployment (Linda, 2016).

Community empowerment is crucial for the sustainability of waste bank programs. Research by Solihin et al., (2019) indicates that the sustainability of waste bank programs is influenced by various factors inherent in the local population, including economic, social, educational, and technological factors. Evaluating the local population's background and its impact on waste reduction through existing waste banks in the Mojoroto Subdistrict is necessary. Sustainable waste reduction efforts by waste banks support several Sustainable Development Goals (SDGs), specifically Goal 12, which focuses on sustainable consumption and production patterns. If consumption is excessive without waste reduction measures, it will lead to high waste generation, affecting the available disposal area. Additionally, failing to address waste reduction promptly will

impact Goal 15 of the SDGs, which concerns terrestrial ecosystems.

In the Industrial Revolution 4.0 era, information technology commonly collaborates with various fields, including waste management. Digitalization plays a crucial role in the waste management sector by building a sustainable global economy and changing the perspective of waste managers on organizing their operations (Wahyuni et al., 2022). Digital waste management can positively impact its users, and one example of digital waste management is the digitalization of waste banks. Currently, waste banks still use manual bookkeeping methods with many drawbacks, such as less valid calculations and lengthy bookkeeping processes, making digitalising management practices essential (Lelyani et al., 2022). Digital waste banks prioritize principles of automation, cloud data storage, and mobile phone-based digital integration (Taufiq et al., 2016).

Implementing digital waste banks offers several advantages, including ease in accurately recording the buying and selling of waste at each waste bank unit, with the data securely stored in the application's big data. Other benefits of digital waste bank implementation include practicality, transparency in customer data management, and data storage security (Taufiq et al., 2016). Additionally, digitalization makes it easier for staff to input customer data, collect and sell waste, and generate reports as the data is well-organized (Saputra et al., 2023). By utilizing digitalization, individuals and industries can easily find nearby waste banks and conduct waste transactions more efficiently. The positive impacts of using digital systems include integrated record-keeping between customers and waste banks, transparency in customer deposit data, and increased waste reduction (Silfiah et al., 2021).

To determine the potential for waste reduction at waste banks in the Mojoroto Subdistrict, digital waste banks can be utilized. Digital waste banks have been implemented in Kediri City through a waste bank application released by ITS, called "APPS4SWAM V.2.0," which stands for Solid Waste Management. This digital system uses smart technology to make it easier for waste bank managers and customers to find and conduct waste transactions. Through this application, it is expected that data on waste reduction via waste banks can be well-organized, thereby increasing the potential for waste reduction in the Mojoroto Subdistrict. The community service aims to implement the digital waste bank application, facilitating connections between waste banks and waste users, such as large collectors and industries. Transitioning to digital record-keeping is expected to enhance the performance of waste banks in Kediri City.

METHOD

The selection of the area for this study was conducted in Mojoroto Subdistrict, which hosts active waste banks. Mojoroto Subdistrict has a population of 114,553 inhabitants (BPS, 2021) and 26 waste bank units managed independently by the local community. However, out of these 26 waste banks, only a few actively buy and sell waste. In this study, the selection of waste banks is based on several criteria: the activity level of the waste banks in their operations, the number of customers they have, and the target status of being pilot projects for the Apps4SWAM V.2.0 application.

Based on these criteria, the research will focus on six waste bank units, including the main waste bank, Ridlho Berkah, and five other waste banks that are customers of this main waste bank. Sumber Rejeki, Dewi Sekartaji, Sri Wilis, Hijau Daun, and Melati are these five waste banks. The implementation

and socialization of the Apps4SWAM V.2.0 application target these six waste banks, including one main waste bank that also receives waste from other waste banks. Extension and practical methods are used in this research. These methods are commonly used to enhance community skills in transitioning to technology use to improve group performance efficiency (Hidayatullah et al., 2022). Increased monthly waste sales after using the waste bank application will indicate the study's success. Data analysis uses descriptive analysis methods.

After the socialization process and monitoring of application usage, community participation studies will be conducted with three respondent participation categories: (1) Customers at each waste bank in Mojoroto Subdistrict, totalling 100 customers involved. (2) Waste bank managers in Mojoroto Subdistrict, and (3) Non-customers of waste banks, totalling 100 respondents, need to understand the reasons for not wanting to join waste banks.

Surveys were conducted twice: before and after application implementation, especially for waste bank customers. The surveys used random sampling methods at study locations and visiting households. The instrument used was a questionnaire regarding waste processing behaviour, waste utilization, and customer opinions on using Apps4SWAM.

RESULTS AND DISCUSSION

Waste Management in Waste Banks

The rate of waste entering waste banks is influenced by several factors, one of which is customer activity. Customer activity is determined by the amount of waste generated in each household and the system operated by the waste banks. Waste bank customers collect waste generated daily and deposit it when the waste bank is operational. Six waste banks in Mojoroto Subdistrict have

operational schedules divided into daily and weekly operations. The average waste entering waste banks daily is 0.12 kg/customer.day or only 19% of the total household waste generated on average in Mojoroto Subdistrict, which is 0.66 kg/person.day.

As mentioned, two waste banks within the scope of this study are open daily: Ridho Berkah Waste Bank and Hijau Daun Waste Bank (Figure 1).

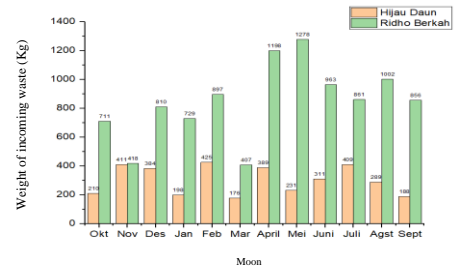


Figure 1 Amount of waste received by daily operating waste banks

Waste banks operating daily can collect more waste compared to those operating weekly. Specifically, Hijau Daun Waste Bank manages schools and receives waste from students and their parents. The proceeds from waste sales can also be used to pay school fees for the students. Ridho Berkah Waste Bank operates as the main waste bank on a city-wide scale. This waste bank can sell waste directly to industries and also serves as a recipient of waste from waste bank units in Mojoroto Subdistrict and even from all areas in Kediri City. Other waste banks in the Mojoroto Subdistrict receive waste once a week (Figure 2).

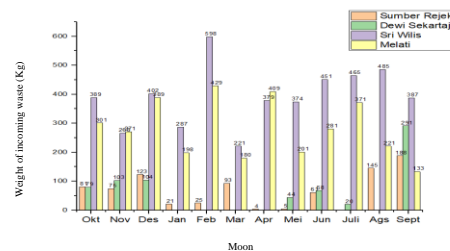


Figure 2 Amount of waste received by weekly operating waste banks

The frequency of waste bank operations significantly affects the rate of waste entering the banks. Waste banks operating daily receive a greater weight of waste than those operating weekly. In addition to the operational schedule factor, the number of customers who join and the years since the waste bank started operating also influence the weight of waste entering each waste bank.

The categorized waste is further adjusted according to the type of collector buying waste from the waste bank. The composition percentage of waste in waste banks varies depending on customer activities. Paper and cardboard waste have the highest percentage, at 59%, followed by plastic waste, at 25% (Figure 3), due to the majority of the population generating these types of waste daily.

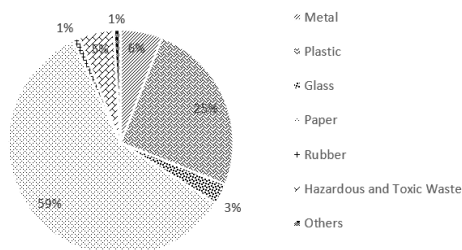


Figure 3 Waste composition in Mojoroto subdistrict waste banks

Not all types of waste deposited in waste banks can be sold, as people still tend to sell unsorted waste. The selling price for unsorted waste is much lower than that for sorted waste.

Based on the condition of unsorted waste collected from the community, waste banks will re-sort and clean the waste. This becomes a challenge because the land area is sometimes insufficient, and it is difficult to find sorting personnel who can handle large quantities of waste.

Community Participation in Waste Management

The results of community service conducted indicate that residents in Mojoroto Subdistrict still prioritize

depositing household waste at the Waste Collection Points (Figure 4).

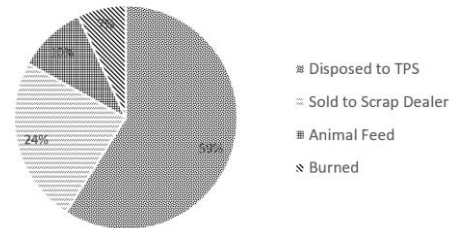


Figure 4 Community behaviour in waste management

In the practice of waste management, it is still found that some residents burn trash despite regulations that are contrary. Additionally, community participation in waste bank programs is limited. Observations show that the motivation for not participating in waste bank programs can be seen in Figure 5. These reasons indicate that selling waste to waste banks economically does not provide sufficiently attractive incentives, and the process is perceived as complicated and lacking transparency. This condition signifies that the community desires a simpler process. Therefore, implementing applications becomes an appealing alternative to facilitate recycling processes, including in the context of waste banks.

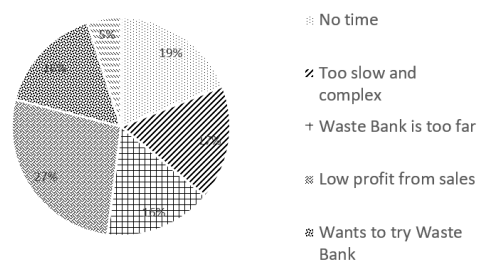


Figure 5 Reasons why people are unwilling to become waste bank customers

Use of Apps4SWAM Application

The Apps4SWAM application integrates information technology with waste management. In its operation process, this application is divided into two features tailored for use by waste bank

managers and customers. For the customer-facing application feature, there are several menus available such as the waste bank information list containing operation schedules, types of waste lists, waste pricing lists, and detailed addresses of the waste banks. Additionally, other menus include adding types of waste, selecting waste deposit schedules, a transaction result retrieval menu, and customer account settings. Furthermore, for the waste management side of the application feature, there are menus for customer deposit schedules, waste type and pricing settings, waste bank operation schedule settings, transaction history and volume, and waste bank account settings. Collectors, industries, and the government can follow the data in this application and directly contact waste banks to conduct transactions. The government can also monitor the sales progress of each involved waste bank.

Based on the questionnaire results filled out by waste bank managers, 87% of managers agree that using the Apps4SWAM application can significantly improve the efficiency of waste recording. Figure 7 shows the reasons why waste bank customers use this application.

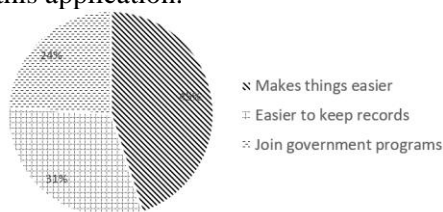


Figure 7 Reasons for waste banks using the application

With easier transaction processes through Apps4SWAM, waste bank managers can focus on servicing and managing waste bank stocks and selling raw materials to informal sectors and industries. As a result, the average transaction from waste bank customers has significantly increased by 151% (Table 1).

Table 1 Sales increase after application usage

Waste Bank	Sales Increase (%)
Hijau Daun	45%
Ridhlo Berkah	212%
Dewi Sekartaji	6%
Sumber Rejeki	310%
Sri Wilis	311%
Melati	24%
Average	151%

Continued efforts are needed to enhance waste reduction activities. Currently, 250 customers are using this application. One key factor in transitioning customers to online systems is the role of waste bank management. Waste bank managers find it easier when customers are willing to switch to digital systems. With Apps4SWAM, waste bank management can expedite the recording process because it is simpler, systematic, organized, and securely stored. With this ease, waste stock records can be meticulously maintained in the system without any data loss, providing clarity on the amount of waste that the waste bank can manage.

However, several challenges persist in using this recycling application, involving stakeholders such as waste banks and their customers. The Kediri City Government has also started using this application to monitor the amount of waste managed by waste banks. Waste collectors working with waste banks have been hesitant to use this application, and the community service activities are currently socializing with nine large and small waste collectors in Kediri.

Recommendations for Developing Waste Recycling Networks

This digital application requires continuous support and assistance from various relevant parties. Residents in Kediri City are beginning to change and use this application to simplify recycling systems on a city-wide scale. To support waste banks in using this application effectively, city-wide incentives must be

developed to encourage active use by waste banks. The application itself will help the Kediri City Government collect data and formulate policies for waste management.

Having central waste banks at the city level is essential for Kediri to maintain an effective waste bank system. Central waste banks will serve as hubs that can handle larger quantities of waste and achieve higher sales levels when selling to recycling industries. Central waste banks can also manage the application's use at the city level. Government support is crucial to build a strong network among all parties involved in waste recycling. Community readiness in using the application needs to be enhanced. Many waste bank customers are elderly, so the application must be user-friendly, and waste bank managers should primarily handle data input.

The community service on digitizing waste banks was conducted in Bali Province, and its implementation was influenced by various factors such as budget availability for development and operations, legal foundations, inter-agency cooperation, and the presence of socialization and monitoring (Sihombing et al., 2023). Recycling companies and community initiatives can play crucial roles in determining the success of application usage.

CONCLUSION

Over the past two years, community service activities dedicated to forming a recycling network, particularly waste banks in Kediri, have shown strong interest in testing innovations. The primary motivation behind adopting this application is to simplify transactions and enhance the overall transparency of the system.

However, there are still challenges indicating hurdles in using this application, especially regarding adjustments related to technology adoption. Waste bank customers and

other stakeholders involved in recycling efforts still require additional time to feel comfortable using this application. Local governments need to increase their capacity to manage this system effectively and ensure the sustainability of application usage in waste recycling management.

REFERENCES

- Hidayah, E. N., Maulana, A. A., & Cahyonugroho, O. H. (2021). Sosialisasi pengelolaan sampah kertas, plastik dan logam melalui bank sampah di kawasan perumahan. *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan*, 4(2), 108-112.
- Hidayatullah, M. R., Saputra, S. Y., & Anam, K. (2022). Pelatihan manajemen referensi "Mendeley" pada mahasiswa tingkat akhir Universitas Nahdlatul Ulama Nusa Tenggara Barat. *Abdinesia: Jurnal Pengabdian Kepada Masyarakat*, 2(1), 24-27.
- Krisnawati, L. D. (2014). Kajian volume sampah di Kota Kediri (Lokasi TPA Klotok). *Jurnal Ilmiah Berkala Universitas Kadiri*, 1(1).
- Kusminah, I. L. (2018). Penyuluhan 4R (Reduce, Reuse, Recycle, Replace) dan kegunaan bank sampah sebagai langkah menciptakan lingkungan yang bersih dan ekonomis di Desa Mojowuku Kab. Gresik. *JPM17: Jurnal Pengabdian Masyarakat*, 3(01).
- Lelyani, N. K., et al. (2022). Digitalisasi tata kelola bank sampah untuk mendukung Desa Riang Gede sebagai desa sadar sampah. *To Maega: Jurnal Pengabdian Masyarakat*, 5(3), 385.
- Linda, R. (2016). Pemberdayaan ekonomi kreatif melalui daur ulang sampah plastik (studi kasus bank sampah berlian kelurahan tangkerang labuai). *Jurnal Al-Iqtishad*, 12(1), 1-19.

- Saputra, F. O., et al. (2023). Pengelolaan sampah rumah tangga berbasis aplikasi pada seluruh bank sampah di Kecamatan Semarang Barat. *Jurnal Pengabdian Multidisiplin*, 3(2), 1–6.
- Sihombing, J., Wirantari, I. D. A. P., & Supriyanti, N. W. (2023). Evaluasi kinerja aplikasi SiDarling dalam pengelolaan bank sampah pada Dinas Lingkungan Hidup dan Kebersihan Kota Denpasar Provinsi Bali. *Ethics and Law Journal: Business and Notary*, 1(3), 180–194.
- Silfiah, R., Mohtarom, A., & Ulum, K. M. (2021). Digitalisasi bank sampah dengan penerapan sistem aplikasi Resik di Desa Karangsono Kecamatan Sukorejo Kabupaten Pasuruan. *Jurnal Aplikasi Dan Inovasi Ipteks "Soliditas" (J-Solid)*, 4(2), 143.
- Solihin, M. M., -, P. M., & -, D. S. (2019). Partisipasi ibu rumah tangga dalam pengelolaan sampah melalui bank sampah di Desa Ragajaya, Bojonggede-Bogor Jawa Barat. *Jurnal Ilmu Lingkungan*, 17(3), 388.
- Suryani, A. S. (2017). Peran bank sampah dalam efektivitas pengelolaan sampah (studi kasus bank sampah Malang). *Aspirasi*, 5(1), 71–84.
- Taufiq, A., Abdillah, G., & Renaldi, F. (2016). Sistem informasi terintegrasi pada proses pendaftaran dan menabung di Bank Sampah Induk Cimahi berbasis mobile. *Jurnal Teknik Informatika dan Sistem Informasi*, 2(3), 393–403.
- Wahyuni, et al. (2022). Optimalisasi penanganan sampah di Desa Sekaran melalui digitalisasi bank sampah menuju Desa Mandiri Sampah 2025. *BERNAS: Jurnal Pengabdian Kepada Masyarakat*, 3(4), 1000–1005.
- Wardany, K., Sari, R. P., & Mariana, E. (2020). Sosialisasi pendirian “Bank sampah” bagi peningkatan pendapatan dan pemberdayaan perempuan di Margasari. *Dinamisia: Jurnal Pengabdian Kepada Masyarakat*, 4(2), 364-372.
- Wartama, I. N. W., & Nandari, N. P. S. (2020). Pemberdayaan masyarakat dalam pengelolaan sampah rumah tangga melalui bank sampah di desa sidakarya denpasar selatan. *Parta: Jurnal Pengabdian Kepada Masyarakat*, 1(1), 44-48.
- Widarti, B. N., Ramadhani, N., & Meicahayanti, I. (2017). Efektivitas dalam mengurangi sampah dan nilai ekonomi pengelolaan sampah di bank sampah. *Info Teknik*, 18(Desember), 171–178.