

OPERATIONAL TRANSFORMATION AND STRENGTHENING OF THE BUSINESS MODEL OF THE SAWO KENCANA WASTE BANK THROUGH THE DIGITIZATION OF WASTE SORTING SYSTEMS AND TECHNOLOGY INNOVATIONS BASED ON THE CIRCULAR ECONOMY

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Abstract. The Sawo Kencana Waste Bank plays a crucial role in community-based waste management. However, its development still faces challenges such as the low economic value of plastic waste, limited administration and financial management, the lack of documented standard operating procedures, suboptimal technology utilization, and limited digital marketing. This community service activity aims to strengthen partners' operational capacity and business models through system digitization and the implementation of circular economy-based waste management technology. The method used is a participatory approach through identification, interactive training, practice, and intensive mentoring. The material covers governance and operational management, administration and financial management, the circular economy, utilization of appropriate technology, occupational safety and health, and digital marketing. Evaluation was conducted through pre- and post-tests, observations, and practical assessments of 20 participants consisting of administrators and active members. The results of the activity showed an increase in participants' understanding of operational governance, financial management, technology utilization, and the application of circular economy concepts. In addition, an organizational structure and standard operating procedures (SOPs) were developed, and appropriate technology was implemented in waste management. This activity demonstrates that the integration of training, mentoring, digitalization, and appropriate technology can strengthen the operational capacity, productivity, and economic value creation of the Sawo Kencana Waste Bank.

Keywords: appropriate technology, operational management, circular economy, waste bank

Abstrak. Bank sampah Sawo Kencana memiliki peran penting dalam pengelolaan sampah berbasis masyarakat, tetapi pengembangannya masih menghadapi kendala berupa rendahnya nilai ekonomi sampah plastik, keterbatasan administrasi dan pengelolaan keuangan, belum tersedianya standar operasional prosedur yang terdokumentasi, pemanfaatan teknologi yang belum optimal, serta terbatasnya pemasaran digital. Kegiatan pengabdian kepada masyarakat ini bertujuan memperkuat kapasitas operasional dan model bisnis mitra melalui digitalisasi sistem dan penerapan teknologi pengelolaan sampah berbasis ekonomi sirkular. Metode yang digunakan adalah pendekatan partisipatif melalui identifikasi kebutuhan, pelatihan interaktif, praktik, dan pendampingan intensif. Materi meliputi tata kelola dan manajemen operasional, administrasi dan manajemen keuangan, ekonomi sirkular, pemanfaatan teknologi tepat guna, keselamatan dan kesehatan kerja, serta pemasaran digital. Evaluasi dilakukan melalui pre-test dan post-test, observasi, serta penilaian praktik terhadap 20 peserta yang terdiri atas pengurus dan anggota aktif. Hasil kegiatan menunjukkan peningkatan pemahaman peserta dalam tata kelola operasional, pengelolaan keuangan, pemanfaatan teknologi, dan penerapan konsep ekonomi sirkular. Selain itu, tersusun struktur organisasi dan SOP serta terimplementasi teknologi tepat guna dalam pengelolaan sampah. Kegiatan ini menunjukkan bahwa integrasi pelatihan, pendampingan, digitalisasi, dan teknologi tepat guna dapat memperkuat kapasitas operasional, produktivitas, dan penciptaan nilai ekonomi Bank Sampah Sawo Kencana.

Kata Kunci: bank sampah, ekonomi sirkular, manajemen operasional, teknologi tepat guna

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INTRODUCTION



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Community-based waste management is one of the approaches that can encourage the transformation of waste from mere residue to a resource that has economic value (Suryawan & Lee, 2025). Waste banks are a form of community institutions that play a role in encouraging waste sorting, collection, utilization, and processing while providing economic benefits for the community (Asteria & Herdiansyah, 2022). In its development, waste banks are not only required to be able to collect and sell waste, but also need to develop a more structured management system, utilize technology, and build business models that support circular economy principles (Astuti et al., 2024). The circular economy approach places waste as a resource whose use value can be maintained through reuse, processing, and recycling, so that dependence on new raw materials and final disposal can be reduced (Awino & Apitz, 2024). Community-based waste management activities (Colia et al., 2022) are also increasingly relevant when directed at creating economic value through processing waste into raw materials or value-added products (Government Regulation Number 81, 2012).

A waste bank is a form of community-based waste management that applies the principles of reduce, reuse, and recycle waste. According to Suwerda (2012), a waste bank is a waste management system that is carried out with a mechanism similar to banking, where the community plays the role of a customer who deposits segregated waste to obtain economic and environmental benefits. The existence of a waste bank not only serves as a means of reducing the volume of waste that ends up in landfills, but also as a medium for community empowerment through increasing environmental awareness and creating economic value from waste (Tola et al., 2023).

In the perspective of the circular economy, waste is seen as a resource that can maintain its use value through the process of reuse, repair, recycling, and processing into new products. According to the Ellen MacArthur Foundation (2015), a circular economy is an economic system designed to eliminate waste and maximize resource utilization through a sustainable material use cycle. This approach is different from a linear economy that uses a take-make-dispose pattern, because the circular economy emphasizes the reuse of materials to stay in the economic cycle for as long as possible (Valentine, 2024). The application of the circular economy concept to waste banks can increase the added value of waste through the process of processing it into raw materials and products that have a higher selling value (Sinaga, 2024).

The success of waste bank management is also influenced by organizational capacity and community empowerment. According to Adi (2013), community empowerment is a process of improving the ability of individuals and groups to identify problems, determine solutions, and manage their resources independently. In the context of waste banks, empowerment is carried out through increasing knowledge, skills, and institutional capacity so that the community is able to manage waste productively and sustainably (Noor et al., 2025). In addition, the development of information technology encourages the need for digitalization in the management of community organizations. Rogers (2003) explained that the adoption of technological innovations can increase the effectiveness of communication, the efficiency of work processes, and the ability of organizations to reach a wider market. In waste banks, digitalization can be applied in administrative records, member data management, financial reporting, and marketing of recycled products through digital media (Borchard et al., 2022). Thus, the integration of community empowerment, circular economy, and digitalization is an important factor in improving the performance and sustainability of waste bank management.

The transformation of waste bank management also needs to be supported by the use of digital technology. Digitalization can help increase the effectiveness of administration, transaction recording, communication with members, as well as promotional and marketing activities (Mulachela, 2021). Studies on the digitalization of waste banks show that management that is still carried out manually can cause limitations in recording, data tracking, transparency, and report preparation, while the implementation of digital systems can be part of strengthening waste bank governance and developing waste management based on a circular economy (Suwerda, 2012). Thus, strengthening waste banks requires an approach that is not only oriented to environmental aspects, but also integrates aspects of production, management, technology, and marketing so that waste management activities can develop sustainably.

This condition is relevant for the Sawo Kencana Waste Bank which has developed as a community-based waste management institution. This waste bank has 77 active members and since 2021 has been able to manage an average of around 250 kg of waste every month. Managed waste consists of various categories, with plastic waste being one of the types that still needs attention because it has characteristics that are difficult to decompose and require further processing processes. Management data in 2025 shows that the collected plastic waste will reach 1,132.53 kg or around 18.7% of the total waste managed. This condition shows that there is a large potential for raw materials to be developed through the processing and reuse process.

Partners have actually made a number of efforts to improve waste management. The Sawo Kencana Waste Bank already has appropriate technology in the form of a plastic shredding machine that is used to support waste sorting education and plastic waste processing. Before the use of the shredding machine, plastic bottle waste is sold to the parent waste bank at a price of around IDR 1,500-IDR 2,000/kg. Once chopped, plastic becomes easier to package and send and has the potential to be used as raw materials for recycled products. Partners have also conducted a simple experiment to produce plastic recycled sheets from shredded HDPE plastic using simple equipment. These efforts show that partners already have social capital, waste management experience, and early technology that can be the basis for the development of a circular economy model (Ratsimandresy & Miemczyk, 2024).

However, these various potentials have not fully resulted in an increase in added value and a sustainable business model. The results of the situation analysis show that there is a gap between the potential possessed and the management capacity of partners. In the production aspect, plastic waste still has a relatively low selling value, documented machine operational SOPs are not available, the quality of shredding products has not been standardized, and the development of derivative products such as plastic recycled sheets has not been carried out optimally (Raj, 2025). In the management aspect, the organizational structure is not fully based on productive functions, the division of production tasks, quality control, and marketing is not clear, and there is no adequate calculation of production costs, machine depreciation, cost of production, and business margins (Cooper & Yoshikawa, 1994). Meanwhile, in the marketing aspect, partners still depend on conventional marketing patterns and collectors and do not have official digital media that are actively managed to build an identity and expand the market for recycled products (Crinon et al., 2011; Minton et al., 2012).

These problems show that there is a gap between the availability of resources and technology and the ability of partners to optimize them. Shredding machines are available, but they are not supported by SOPs, production targets, cost management, and integrated marketing strategies. Similarly, social capital in the form of 77 active members and a waste management capacity of around 250 kg per month has not been fully converted into an economic force that is able to increase the added value of waste processing results. On the other hand, the limitation of technology literacy and digital marketing skills is an obstacle in building more planned communication and promotion (Royle & Laing, 2014). This condition shows that interventions that only focus on the provision of equipment are inadequate; it is necessary to strengthen the capacity of human resources, organizational governance, financial administration, operational standardization, technology utilization, and marketing in an integrated manner (Boufounou et al., 2024). Efforts to strengthen the capacity of partners are then carried out through community service programs with a participatory approach.

This approach places the Sawo Kencana Waste Bank as a subject directly involved in the process of identifying needs, implementing training, practices, and mentoring. The program is directed at operational transformation and strengthening business models through the digitization of waste management systems and innovations in waste management technology based on the circular economy (Kurniawan et al., 2022). Activities include strengthening governance and operational management, preparing organizational structures and SOPs, strengthening administration and financial management, utilizing appropriate technology, implementing occupational safety and health, and developing digital marketing (Almarri et al., 2025).

Thus, this service activity aims to strengthen the capacity of the Sawo Kencana Waste Bank in optimizing the resources and technology that it already has through the integration of training, practice, mentoring, digitalization, and the application of appropriate technology (Ratnawati et al., 2026). The strengthening is directed not only to improve the operational capabilities of partners, but also to encourage an increase in the added value of plastic waste, improve governance and business records, expand marketing access, and build a more productive and sustainable waste management model based on the circular economy (Prabawati et al., 2023). This approach is expected to bridge the gap between the potential of waste management that partners already have and the actual ability to generate economic and environmental benefits for the community.

METHOD

Community service activities at the Sawo Kencana Waste Bank use a participatory approach by actively involving partners in problem identification, implementation of activities, practices, and evaluation. The methods used include community education, consultation, training, science and technology substitution, and mentoring. The implementation of activities is carried out through several stages. The method of implementing community service activities begins with the identification and analysis of the situation through field surveys and discussions with partners to find out various problems faced in the aspects of production, management, and marketing. The analysis carried out includes waste management, organizational conditions, administration and finance, technology utilization, and marketing strategies that have been implemented. Based on the results of the identification, the service team with partners prepares a solution plan by determining the priority of the problem and designing a training and assistance program that includes operational management, preparation of standard operating procedures (SOPs), administration and finance, use of appropriate technology, application of circular economy concepts, and digital marketing.

The next stage is the implementation of training and practices aimed at increasing the capacity of partners in managing organizations and businesses. The materials provided include organizational governance, operational management, SOP preparation, administration and finance, circular economy, occupational safety and health, technology utilization, and digital marketing. Training activities are carried out through lectures, discussions, demonstrations, and direct practice so that participants can understand and apply the material provided. Furthermore, the application of appropriate technology is carried out through assistance in the use of plastic shredding machines to increase the effectiveness of the plastic waste processing process and generate added value using shredding products as raw materials for recycled products.

To ensure the sustainability of the program, the service team provides intensive assistance in the implementation of SOPs, administrative and financial records, production cost calculations, and the use of digital media as a means of promotion and marketing. This assistance aims to help partners implement the knowledge and skills that have been acquired during the training into daily operational activities. The entire series of activities is then evaluated through monitoring and evaluation carried out using pre-test and post-test, field observation, and practice assessment. The evaluation is used to measure the improvement of partners' knowledge and skills as well as assess the success rate of the application of technology and management systems that have been provided in the service program.

RESULTS AND DISCUSSION

The implementation of community service activities produced several main outputs directed at answering the problems of the Sawo Kencana Waste Bank in the aspects of production, management, and marketing. These outputs are not only in the form of providing technology, but also improving management skills, improving governance, and developing a waste management model based on a circular economy.

Strengthening Governance and Operational SOPs

The first output is to strengthen governance through the preparation of organizational structures, division of tasks, and Standard Operating Procedures (SOP). Prior to the activity, the organizational structure of partners was not fully based on productive functions and there was no special division of tasks in the production, quality control, and marketing sections (Balachandran & Eklund, 2024). This condition caused the management function to not run optimally.

Through training and mentoring, partners are directed to understand the division of work functions and the importance of SOPs as guidelines for the implementation of activities. SOPs are instruments to create process uniformity, especially in the operation of technology and waste management (Hilson & Nayee, 2002). With clearer governance, waste bank activities are expected not only to depend on certain individuals, but can be carried out based on the functions and responsibilities of each manager.



Figure 1. *Waste management*

The results of the service activities show that strengthening the capacity of the Sawo Kencana Waste Bank through training, mentoring, system digitization, SOP preparation, and the use of appropriate technology is able to improve organizational governance, financial administration, technology utilization, and the development of added value of plastic waste based on the circular economy (Hassan, 2025). In addition, this activity results in a clearer organizational structure, documented operational SOPs, and optimization of the use of plastic shredding machines to support the processing of waste with economic value.

These results are in line with the research and service conducted by Suwerda (2012) which states that the success of waste bank management is greatly influenced by good organizational governance, a structured administrative system, and active involvement of the community in the waste management process. The institutional strengthening carried out at the Sawo Kencana Waste Bank shows that organizational aspects and SOPs are important foundations in improving the operational effectiveness of waste banks (Jayanegara, 2026).

These findings also support the results of service which shows that the digitization of waste bank administration can increase transparency, ease of transaction recording, and efficiency of member data management (Borchard et al., 2022). In this activity, digitization is not only used for administrative and financial recording, but is also directed at the development of digital marketing media so that it provides broader benefits than conventional management (Telukdarie et al., 2023).

Application of Appropriate Technology of Plastic Shredding Machine

The main output in the production aspect is the optimization of the use of Appropriate Technology (TTG) in the form of plastic shredding machines. This technology is used to convert large plastic into smaller pieces so that it is easier to handle, package, and develop as raw materials for recycled products (Lange, 2021). Previous partners already have shredding

machines, but their use has not been supported by an optimal operational and production management system.

The application of shredding machines is a form of science and technology substitution because the plastic processing process is directed from simply sorting and selling raw materials to a processing process that produces materials with higher use value (Buekens & Zhou, 2014). The shredding products also have the potential to be used as raw materials for recycled products, such as plastic recycled sheets, accessories, keychains, and drinking mats.



Figure 2. *Application of TTTG in making accessories*

In terms of technology, the results of this service are in line with the research of Astuti et al. (2024) who explain that the use of appropriate technology in waste management is able to increase productivity and quality of processing results. The optimization of plastic shredding machines at the Sawo Kencana Waste Bank allows plastic waste not only to be sold as waste, but also processed into raw materials for recycled products that have higher economic value.



Figure 3. *Processing of plastic waste into shredded plastic and recycled product*

Circular Economy-Based Added Value Development

The application of enumeration technology does not stop at reducing the size of waste but is directed at increasing its added value. Before using the shredding machine, plastic bottle waste is sold to the parent waste bank at a price of around IDR 1,500–IDR 2,000/kg. After going through the enumeration process, the plastic can obtain a higher selling value and is easier to handle, store, and send to parties who need recycled raw materials (Alves et al., 2022).

The model shows the application of circular economy principles through efforts to maintain and increase material value so that it does not immediately end up as waste. Through the enumeration process, plastic waste is transformed into a more useful form that can be further utilized as a recycled raw material. The developed management flow can be described as follows:

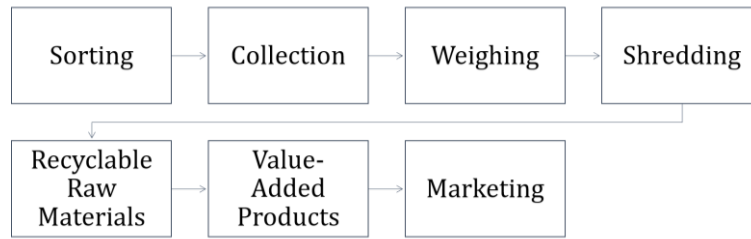


Figure 4. *Management flow*

This model is the basis for the development of waste banks from waste collection activities to activities that generate economic value through the processing and reuse of materials (Fatmawati et al., 2024). Furthermore, the application of the circular economy concept in this activity supports the findings of Colia et al. (2022), who stated that waste management based on a circular economy is able to extend the life cycle of materials through reuse and recycling so as to produce economic added value while reducing environmental burden. At the Sawo Kencana Waste Bank, plastic waste that was previously sold directly to collectors began to be directed to become raw materials for recycled products such as plastic recycled sheets and various other creative products

Strengthening Business Administration and Management

In the management aspect, activities are directed at improving the partner's ability to manage administration, recording, production costs, and business margins. Prior to the activity, partners had used electronic scales, had a sorting place, and made records, but did not have an adequate calculation of production costs that included electricity costs, machine depreciation, cost of production, and margins of derivative products. Strengthening management is important because an increase in the volume of waste processing needs to be followed by the ability to measure costs and economic benefits (Wikurendra et al., 2024). With more structured recording and calculations, administrators can find out the cost of processing, determine the selling price, and evaluate the profits of the products or materials from waste processing.

Digital Marketing Development

The next output is to strengthen marketing through the use of digital media. Before the activity, partners already had a WhatsApp account, but digital marketing activities had not been carried out in a planned manner and there was no content published consistently. These limitations are related to the unavailability of human resources who have digital marketing understanding and skills. Through training and mentoring, digital marketing is directed as a means of communication, branding, and promotion of waste management activities and products (Ratnawati et al., 2026). The development of digital media is expected to reduce partners' dependence on collectors and open up marketing opportunities to consumers and wider business partners (Sutrisno, 2023). This is in line with the program's target to provide digital marketing media as part of strengthening the business model of the Sawo Kencana Waste Bank.

Waste Management Achievements as the Basis for Program Development

The potential for the development of a circular economy model is supported by the volume of waste that has been managed by partners. By 2025, the Sawo Kencana Waste Bank manages several categories of waste with a total of 2,500.00 kg of organic waste, 1,805.76 kg of paper, 1,132.53 kg of plastic, 284.20 kg of glass, 164.52 kg of textiles, 144.52 kg of metal, and 21.55 kg of styrofoam. Plastic waste reaches 18.7% of the total recorded data, making it one of the potential materials to be developed through shredding technology and recycling processes.

The data shows that strengthening plastic processing has the opportunity to have an environmental as well as an economic impact. With the support of counting machines, SOPs, management capabilities, and digital marketing, materials that previously had limited selling

value can be directed to become raw materials for value-added products. Thus, the output of activities is not only in the form of improving technical capabilities, but also the formation of linkages between waste management, technology, management, and marketing in one circular economy model.

The main difference between this service and some of the previous activities lies in the approach used. Most previous programs focused on education on waste sorting or partial provision of technology. Meanwhile, this service implements a more comprehensive approach through the integration of institutional strengthening, the preparation of SOPs, financial management, system digitalization, the use of appropriate technology, digital marketing, and the development of business models based on the circular economy (Wikurendra et al., 2024). The integrated approach allows for organizational capacity building and economic value creation to take place in a sustainable manner (Alshukri et al., 2024).

Thus, the results of this service reinforce previous findings that the success of waste bank development is not enough only through the provision of technical facilities or training, but requires integration between strengthening management, technology utilization, digitalization, and business model development in order to be able to create sustainable economic and environmental benefits.

CONCLUSION

Community service activities at the Sawo Kencana Waste Bank show that strengthening waste management capacity needs to be placed as an integrative process that connects aspects of governance, technology, business management, and economic value creation. The application of a participatory approach allows appropriate technology not to stand alone, but to be integrated with SOPs, division of work functions, administrative and financial management, and digital marketing development. This integration strengthens the change in the orientation of waste management from material collection and sales activities to resource management that has the potential to add value through circular economy principles. Scientifically, this activity shows that the existence of waste management technology will be more meaningful when accompanied by adequate organizational capacity and business management capabilities, so that technology can be part of the community empowerment model, not just production equipment. The model applied to the Sawo Kencana Waste Bank has relevance for the development of community-based waste management that integrates environmental and economic dimensions, especially through the processing of plastic materials into more valuable raw materials and the use of digital systems to support governance and market access.

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