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The Role of Waste Banks in Supporting Circular Economy: A Business Sustainable Perspective

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ABSTRACT

The concept of a circular economy emphasizes the optimization of resource use by minimizing waste generation, reusing materials, and promoting recycling. Waste banks play an essential role in supporting this framework by encouraging community participation in sustainable waste management. This study explores the potential of waste bank in promoting circular economy practices. A qualitative research method was employed through in-depth interviews with stakeholders, supported by field observations to validate the findings.

The results indicate that waste banks contribute significantly to environmental sustainability and economic empowerment by fostering awareness, behavioral change, and the creation of added value from recyclable materials. However, several challenges persist, such as limited infrastructure, lack of technology, and inconsistent community participation in waste sorting. The study highlights that collaborative efforts among local governments, waste banks, and communities are essential to strengthening waste management systems. Moreover, investment in recycling technologies and continuous public education are vital for ensuring long-term sustainability.

Overall, the study concludes that waste banks serve as effective instruments in advancing the circular economy at the community level, offering both environmental and economic benefits. Strengthened governance, technological support, and community empowerment are necessary to maximize their potential and ensure a sustainable circular waste management ecosystem.

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INTRODUCTION

The concept of a circular economy aims to enhance process productivity by minimizing, reusing, and recycling by-products, which are closely related to sustainability (Mehta,

2025). Waste banks play a crucial role in promoting the development of efficient municipal waste management systems that are conducive to a circular economy through robust recycling infrastructure (Fatmawati et al., 2024). Research has shown that waste banks can lead to economic improvement, environmental preservation, and acceleration in achieving development goals, particularly in reducing greenhouse gas emissions (Hidayatullah, 2023). Implementing a circular economy approach through waste management systems such as waste banks presents both challenges and incentives to improve waste management infrastructure (Grabowski, 2021).

The waste bank model has been identified as one of the most appropriate approaches to effectively implement the circular economy concept (Rimantho, 2023). For example, the success of the Anyelir Waste Bank in processing waste into compost and recycled creations contributes significantly to the circular economy movement (Auliani et al., 2023). Other studies suggest that waste bank programs improve the quality of life by enhancing members' knowledge, skills, and economic well-being while creating a circular economy within the community. A waste management system that adopts circular economy principles can maximize the value of waste by encouraging recycling, data sharing, stakeholder collaboration, and regulatory harmonization (Ozili, 2021).

In conclusion, waste banks can serve as effective instruments in promoting a circular economy by encouraging waste minimization, reuse, and recycling, thereby contributing to environmental sustainability, economic development, and the achievement of sustainable development goals. However, challenges remain in maintaining waste banks and realizing the full potential of the circular economy, which must be addressed to ensure long-term effectiveness. One critical gap identified is the lack of research on the governance frameworks necessary for circular economies Oliveira et al., 2019). Governance plays a vital role in facilitating the transition toward sustainability within the circular economy framework. Furthermore, there is a gap in understanding the impact of circular economies on culture and social equity (Beamer, 2023). These gaps highlight the need for further exploration of how circular economic practices intersect with and influence social structures and cultural norms. In addition, limited knowledge about the concept and characteristics of the circular economy persists, as the field remains in its early stages of development (Barbaritano, 2019). This gap underscores the need for more comprehensive research to deepen our understanding of the fundamental principles in circular economy implementation

LITERATURE REVIEW

Waste Management

Waste management is a critical aspect of environmental sustainability and public health. It encompasses processes such as waste segregation, collection, transportation, storage, disposal, minimization, and reuse (Ngwuluka, 2011). Sustainable waste management practices have been identified as an effective approach to reducing costs associated with waste collection, transportation, and processing (Damanik, 2017). Integrated waste management aims to achieve sustainability by reducing waste disposal in landfills, maximizing recovery for recycling, and minimizing contamination.

Research has demonstrated that proper waste management practice es are essential for public health. For instance, a study in Unyani, Ghana, highlighted a correlation between household waste management practices and related health outcomes, emphasizing the

importance of proper collection, storage, transportation, and disposal of waste (Addo et al., 2017). Similarly, in Nigeria, the operational performance of hotels in Lagos State was linked to their waste management practices, underlining the importance of efficient waste management systems within organizations (Chikezie et al., 2023).

Household waste management represents a vital component of overall waste management strategies, encompassing social, behavioral, and environmental factors influencing waste generation, collection, segregation, disposal, and recovery practices (Treyes et al., 2023). To effectively manage household waste, a comprehensive understanding of waste characterization and composition is necessary to develop sustainable management strategies (Mbeng, 2012). Applying the principles of reduction, reuse, and recycling (3R) in waste management can address household waste challenges and transform waste into products with greater economic value (Supinganto et al., 2022).

Effective household waste management practices include collection, transportation, processing, recycling, disposal, and monitoring of waste materials (Sultana et al., 2021). Waste segregation at the household level is a crucial aspect of waste management and forms the foundation for efficient practices (Donacho, 2023). Strategies such as prevention, minimization, reuse, recycling, and recovery are essential for sustainable waste management (Ishak, 2024). Community perceptions regarding waste management practices also significantly influence behavior and outcomes (Olukanni, 2020). Furthermore, education, awareness programs, and the use of appropriate technologies are key to improving waste management practices at the community level (Sultana et al., 2021; (Oktaviani et al., 2023).

Implementing the 3R (Reduce, Reuse, Recycle) principles in household waste management can significantly contribute to sustainable waste practices and alleviate the burden on municipal waste systems (Ridayati & Yunastiawan, 2021). Initiatives promoting community empowerment, such as converting organic waste into compost using techniques like the Takakura method, provide viable alternatives for effectively managing household organic waste (Husna, 2023). Additionally, increasing awareness, providing training, and educating households about proper waste management practices are essential steps to improve waste handling and mitigate environmental impacts (Oktarizal et al., 2021).

In conclusion, waste management is a multifaceted process that requires an integrated approach, stakeholder involvement, and sustainable practices to reduce environmental impacts and safeguard public health. Emphasizing waste characterization, source separation, 3R principles, community empowerment, and awareness campaigns enables households to contribute substantially to sustainable waste management practices and environmental preservation.

Collaboration between the government, the private sector, and the community offers various benefits for the development of waste banks, such as funding assistance, the provision of waste management technology, business management training, and the expansion of markets for recycled products. Such support is a key factor in enhancing the capacity and competitiveness of waste banks so they can grow sustainably. With technological support and cross-sector collaboration, waste banks have the potential to become a key pillar in supporting the implementation of a circular economy and sustainable waste management systems in Indonesia.

Future Development Opportunities for Waste Banks

The development of waste banks in the future has great potential to support the implementation of the circular economy and sustainable development in Indonesia. Waste banks no longer function solely as waste collection points, but have begun to evolve into sustainable business models capable of creating economic, social, and environmental value simultaneously. (Patmawati & Nurba, 2025) In the concept of a circular economy, waste is viewed as a resource that still has utility value and can be reprocessed through recycling, reuse, and conversion into new products with economic value. Therefore, the existence of waste banks becomes an important element in reducing waste volume while supporting efficiency in resource utilization.

One of the biggest opportunities in the development of waste banks is the implementation of digital technology in their operational systems. Digitization enables more effective, efficient, and transparent management of waste banks (Wulandari & Alam, 2018). Digital systems can simplify the recording of customer transactions, waste data management, and the calculation of the economic value of recycled products. Additionally, the use of digital applications also makes it easier for the public to monitor their waste savings, deposit schedules, and real-time waste price information.

According to research (Sinaga, 2024) in an article titled "The Role of Digital Waste Banks in Creating Added Value in the Circular Economy," digital waste banks are capable of creating economic added value through app-based transaction and record-keeping systems. These systems help managers handle customer data, the amount of waste collected, and the economic value generated from the recycling process in a more structured and accurate manner. Digitalization also increases community participation because service processes become more practical and modern.

In addition to digitalization, opportunities for the development of waste banks are also closely linked to the implementation of ESG (Environmental, Social, Governance) principles. From an environmental perspective, waste banks contribute to reducing pollution and minimizing the volume of waste that ends up in landfills (Morseletto, 2020); (Geissdoerfer et al., 2017). From the social aspect, waste banks empower communities through job creation, increased environmental awareness, and waste recycling and processing activities (Sujauddin, 2008). Meanwhile, from the governance aspect, waste banks promote the creation of a more transparent, structured, and accountable management system (Gillan et al., 2021).

In their research Analysis of the Implementation of the Circular Economy System in Waste Banks, (Najwati & Kholmi, 2025) explain that the implementation of a circular economy system in waste banks can strengthen environmental sustainability while creating positive socioeconomic impacts for the surrounding community. The development of recycled products also opens up new business opportunities that can create jobs and improve the well-being of local communities.

Opportunities for the development of waste banks are growing stronger as the government and the private sector increasingly focus on implementing a circular economy in Indonesia. Currently, various companies are beginning to support the transformation of waste banks through corporate social responsibility (CSR) programs and green investments. One example (Kompas, 2024) is the support provided by Coca-Cola Europacific Partners Indonesia, which offers business training, capacity building in management, and support for the development of waste recycling chains. This

collaboration helps waste banks improve management quality, expand marketing networks for recycled products, and strengthen the sustainability of their operations.

Impact of Waste Management on the Circular Economy

Waste management plays a vital role in the transition toward a circular economy. The circular economy model focuses on reducing waste generation, maximizing resource potential, and promoting sustainable practices (Ranjbari et al., 2021). An effective waste management system is essential to achieving the goals of the circular economy, such as minimizing landfill disposal, increasing economic value, and preserving the environment (Madyaningarum, 2024). Both private and public sectors have recognized the significant financial benefits of efficient waste management strategies, and additional gains can be achieved by adopting a holistic circular economy approach (Omar Romero-Hernández, 2018)

Within the framework of a circular economy, waste management goes beyond disposal, it involves transforming waste into valuable and economically beneficial outputs (Fatmawati, 2024). By implementing circular strategies such as waste reduction, material reuse, and efficient resource management, the guiding principles of the circular economy can be realized (Haumahu, 2023). Furthermore, the recovery of valuable by-products from waste contributes to the transition toward a circular economy by reducing waste generation, maximizing resource utilization, and minimizing costs (Ranjbari et al., 2021).

To successfully implement a circular economy, it is essential to address challenges such as the complexity of waste streams, diverse regulatory frameworks, and the need for effective urban waste management systems (Løkke, 2023). Circular economy principles including reduction, reuse, and recycling emphasize the importance of long-term planning and community engagement in waste management (Kumba, 2024). Moreover, community involvement in waste management and circular economy initiatives is critical for effective planning and successful implementation in urban areas. (Izdebska & Knieling, 2020).

In summary, waste management is closely interconnected with the circular economy. Effective waste management practices serve as the cornerstone for achieving circular economy objectives. By adopting circular strategies, maximizing resource potential, and engaging stakeholders at multiple levels, the transition toward a circular economy can be facilitated—leading to sustainable and efficient waste management practices.

RESEARCH METHODS

Research Design

This study employed a qualitative approach to explore the potential of Bank Sampah Induk Karya Mandiri New in Tebing Tinggi City in supporting the implementation of circular economy practices. A qualitative design was selected because the study aimed to understand the waste bank's operational processes, stakeholder roles, and implementation challenges in their real-life context.

Research Site

The research was conducted at Bank Sampah Induk Karya Mandiri New, located in Tebing Tinggi City, Indonesia. This site was selected because the waste bank has been involved in community-based waste management and has collaborated with the local government since 2019.

Informants

The study involved four informants who were directly related to the waste bank's activities. The main informants included Mr. Iskandar, the founder and head of Bank Sampah Induk Karya Mandiri New, and Mrs. Khairani, the Head of Lalang Subdistrict in Tebing Tinggi City. Other participants were selected from waste bank members to obtain community-level perspectives. Until the completion of the study, only four informants were identified as relevant and accessible sources of information. This condition represents a limitation of the research due to the restricted number of primary data sources. The limited availability of informants may have reduced the diversity of perspectives and the breadth of information obtained during the data collection process.

Data Collection

Data were collected in October 2023 through in-depth interviews and direct observation. First, direct observation was conducted to examine the waste management process at the site. The researcher observed waste collection, sorting activities, storage conditions, and the tools used in daily operations. This process helped verify the information obtained from interviews and provided contextual evidence regarding the actual condition of the waste bank. After that, each interview was conducted individually using the same set of questions to ensure consistency while allowing each participant to express different perspectives. The interviews explored waste bank operations, community participation, institutional support, and challenges in implementing circular economy practices.

Data Anaylst

The data were analyzed using a qualitative descriptive approach. Interview and observation data were organized, reduced, and interpreted based on recurring themes related to waste management practices, 3R implementation, community participation, infrastructure limitations, and institutional support. The findings were then linked to the concept of circular economy to assess the role and limitations of the waste bank.

Data Validity

Data validity was strengthened through triangulation between interview results and field observations. This triangulation allowed the researcher to compare participants' statements with actual operational conditions at the waste bank. The use of multiple data sources improved the credibility and depth of the research findings.

RESULTS AND DISCUSSION

Waste Bank

Waste banks have great potential to support the implementation of the circular economy because they can shift the paradigm of waste management from a linear system to a sustainable system. The establishment of waste banks demonstrates the government's commitment to encouraging community participation in household waste management. Similar to conventional financial institutions, waste banks function as collection centers where household waste can be "deposited" and later processed into various products that extend its life cycle, thereby reducing waste accumulation. However, not all types of waste are accepted, only sorted waste can be deposited into the waste bank.

Ideally, the sorting process should be carried out at the household level to cultivate a sense of individual responsibility. Since 2017, Bank Sampah Induk Karya Mandiri New has actively guided local communities in separating their household waste. According to the head of the waste bank, Mr. Iskandar:

> *"We continuously provide education about the 3R principles (reduce, reuse, recycle), hoping that people will eventually become consistent in sorting their own household waste."*

Household waste segregation is considered a fundamental step toward realizing a circular economy. By applying the 3R concept, waste management activities become smarter, more efficient, and systematic. When implemented effectively, this system creates an ideal waste management model for the community. Therefore, the local government has taken initiatives to encourage active community participation, as stated by the Head of Lalang Subdistrict, Mrs. Khairani:

> *"We provide basic household necessities such as cooking oil and sugar as rewards for households that properly sort and deliver their waste to the waste bank."*

In line with this statement, community members have also expressed the benefits of the waste bank's presence. One resident, Siti, noted:

> *"The subdistrict head often reminds us when she sees piles of garbage. It can be annoying, but we're happy when the waste can be exchanged for sugar or oil."*

These statements illustrate the waste bank's commitment to assisting the community in adopting better waste management practices. Nevertheless, the researcher observed that most residents remain indifferent to waste sorting. Some still burn, pile up, or dispose of waste into rivers—actions that pose serious environmental risks. Consistent discipline and commitment are needed to make sorting a part of daily behavior. As the head of the waste bank, Mr. Iskandar added:

> *"People are difficult to monitor. Even after multiple reminders, the results are far from optimal because of their habits. For example, when we encouraged them to make ecobricks, the activity only lasted for a while, even though the goal was for them to continue independently."*

Similarly, Mrs. Khairani agreed that behavioral factors remain the biggest obstacle to achieving effective community-based waste management.

Waste Management and the Circular Economy

The circular economy offers a promising alternative for addressing waste management challenges by extending product life cycles through sustainable design, production, and consumption. Unlike the linear economy—which ends in waste accumulation—the circular economy provides solutions for minimizing waste generation and mitigating environmental impacts.

From a community perspective, the faster they experience economic benefits, the more motivated they are to participate. One community representative explained:

> *"We usually sort used bottles, cartons, and plastic caps, but it's more profitable to sell them directly to scrap dealers."*

This statement suggests that while households are capable of sorting waste, reusing or recycling it is not yet their primary choice. Therefore, the existence of waste banks is seen as a practical solution to address waste management challenges. According to the

Ministry of Environment (2023), Tebing Tinggi City generates approximately 46,131 tons of waste, with plastic waste being the most critical issue due to its long decomposition time—at least ten years.

Recognizing this, Bank Sampah Induk Karya Mandiri New has encouraged residents to recycle certain types of household plastic waste. Recycling activities have proven effective in raising awareness about the benefits of reuse. However, over time, new problems emerged. As Mrs. Khairani explained:

> *"Currently, the waste bank no longer accepts plastic bottles because they just pile up here. We don't want the waste bank to become another dumping ground since the management activities only last during the socialization period."*

As a result, collected waste often ends up being stockpiled without further processing, as illustrated in Figure 1.

Figure 1. Bank Sampah Karya Mandiri New, Tebing Tinggi

The accumulation of waste shown in Figure 1 indicates that the operational performance of the waste bank has been significantly constrained. Waste management activities, which should involve sorting, processing, and recycling, have not been implemented optimally, reflecting the waste bank's limited capacity to generate added value from the collected waste. This condition highlights a gap between the initial objectives of establishing the waste bank and its actual implementation in practice. Moreover, the lack of supporting facilities worsens its performance. Mr. Iskandar explained:

> *"At the moment, we don't have a plastic shredding machine, and it's impossible to shred manually. Making ecobricks alone doesn't generate economic value. Ideally, a waste bank should have a shredder machine to produce marketable recycled products."*

This statement demonstrates that the absence of adequate infrastructure has hindered the waste bank from developing recycling activities with higher economic potential. As a result, most collected waste remains stored without further processing that could support sustainable resource circulation. Based on these findings, the researcher concludes that

Bank Sampah Induk Karya Mandiri New in Tebing Tinggi is still undergoing a prolonged transition process in implementing the 3R principles (reduce, reuse, recycle). If similar conditions persist, the waste bank risks losing its primary function as a community-based instrument for waste reduction and the promotion of circular economy practices. Stronger institutional synergy and concrete support from stakeholders are therefore required to strengthen operational capacity and encourage the development of a more sustainable waste management system.

Discussion

The Potential and Challenges of Waste Banks in the Circular Economy

Bank Sampah Induk Karya Mandiri New in Tebing Tinggi City has shown active involvement in encouraging households to sort their waste through the 3R approach (Reduce, Reuse, and Recycle). This approach aligns with circular economy principles, which emphasize waste reduction, material reuse, and recycling to minimize environmental impact and enhance resource efficiency (Radityaningrum et al., 2017; Ghisellini et al., 2016). Previous studies have also demonstrated that the implementation of 3R systems in waste banks can increase community awareness of the importance of sustainable waste management (Maharja et al, 2022). However, despite its significant potential, the challenges associated with waste banks as part of the circular economy remain considerable.

One of the main challenges is the community's low awareness and discipline regarding waste segregation. Studies reveal that even after repeated educational efforts, the results remain suboptimal because behavioral change is difficult to achieve (Novega Santosos dan Farizal, 2016). Environmentally harmful practices, such as open burning and indiscriminate dumping, still occur, indicating that environmental awareness within communities must be strengthened (Ramadan et al., 2022).

The interviews also revealed a gap between the readiness of waste banks and the level of community participation. Previous research has shown that adequate infrastructure is essential to ensure the success of waste bank programs and to enhance their effectiveness (Kartika & Puspikawati, 2021). One potential strategy to overcome these challenges is the integration of technology in waste management. The use of shredding machines and other recycling technologies can improve efficiency, increase productivity, and generate recyclable products with higher market value. Studies have shown that appropriate recycling technologies not only reduce environmental pollution but also promote sustainable waste management (Taswin, 2023; Pahrijal, 2023). However, investment in such technologies often requires financial support from both the private sector and the government, given the high initial costs and the need for ongoing maintenance and training (Chamdra, 2015).

Beyond technological aspects, strengthening community participation is equally vital. Intensive community empowerment programs—such as training on composting organic waste and crafting with inorganic materials—can raise awareness and encourage deeper engagement. Research has found that communities actively involved in waste management programs tend to have a better understanding of waste segregation and processing (Nurhasanah, 2023; Hutabarat, 2022). Consequently, they are more likely to perceive tangible economic benefits from their efforts, which in turn encourages long-term sustainable behavior (Sawitri, 2022).

Furthermore, applying the 3R principles in waste management produces positive outcomes. Studies have shown that adopting the 3R concept reduces waste volume and enhances management efficiency (Istiqomah et al., 2019; Juliandi, 2023). In certain regions, such as Kampung Pulo Geulis, communities have successfully established waste banks that serve as structured and economically beneficial waste management platforms (Ningrum & Istiqomah, 2020). This demonstrates that, with sufficient support, communities can play an active role in waste management and create economic value from waste materials. Overall, the combination of appropriate technology and active community participation can establish a more sustainable and effective waste management system. Collaboration among government bodies, private sectors, and communities is therefore critical in overcoming the existing challenges and achieving circular economy goals (Kristianto & Nadapdap, 2021; Sunarto & Sulistyaningsih, 2018).

The Role of Government and Stakeholders

Active participation of local governments is a key element in the success of waste banks, as demonstrated in this study. The provision of incentives such as basic household necessities offered in exchange for properly sorted waste has proven to motivate communities to participate in waste management systems (Nurhajati, 2022). Research by Handayani & Agussalim (2023) revealed that the level of public participation in waste management remains moderate; although participation exists, implementation is still predominantly driven by government initiatives. This indicates that while governmental incentives can enhance community engagement, they are not sufficient to ensure the long-term sustainability of waste management systems.

Stakeholders including the government, waste banks, and local communities must work synergistically to achieve circular economy objectives. Previous studies emphasize that waste banks are expected to reduce the volume of waste sent to landfills, making public participation a crucial component of their implementation (Nurcahya et al., 2020). To achieve this, waste banks need to improve their operational capacity through investments in better waste management infrastructure, such as plastic shredding machines (Widhiastuti et al., 2023).

At the same time, communities must be empowered through intensive and continuous education. This means achieving balance in stakeholder readiness: the government should provide regulatory and infrastructural support, the waste bank should improve technical efficiency, and the community should sustain its behavioral commitment. Collaborative governance ensures that each actor contributes effectively to a sustainable waste management ecosystem.

CONCLUSION

This study highlights the crucial role of waste banks in supporting the circular economy, particularly in the context of household waste management. Despite facing multiple challenges such as limited community awareness, inadequate infrastructure, and insufficient technological support waste banks remain a promising solution for reducing waste generation and promoting environmental sustainability. The active involvement of stakeholders is essential in improving the effectiveness of waste banks. Economic incentives and technological investments can enhance community engagement and operational efficiency, while education and awareness programs can foster behavioral change toward sustainable waste practices. By strengthening collaboration among the

community, government, and waste banks, as well as utilizing appropriate technologies, the circular economy can be effectively realized. Ultimately, this study concludes that waste banks can serve as a practical instrument in the transition toward a circular economy, providing significant economic and environmental benefits to society. Future research is encouraged to explore more effective and sustainable waste management models and to examine their impacts on local economies and community resilience.

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