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INNOVATION IN WASTE MANAGEMENT METHODS IN MAMUJU REGENCY, SOUTH SULAWESI PROVINCE

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ABSTRACT

Waste management remains a major challenge in Indonesia, including in Mamuju Regency, due to the increasing volume of waste and low public awareness of sorting practices. Conventional "collect–transport–dispose" systems are insufficient to achieve sustainability, thus requiring innovative, community-based approaches. This research aims to analyze the implementation and obstacles of waste management in Mamuju Regency and identify innovations in management methods applied, especially through the existence of the Mamuju Keren Waste Bank (BSMK). The method used is a descriptive qualitative approach with data collection techniques in the form of in-depth interviews, observations, and documentation to analyze the implementation and challenges of the Mamuju Keren Waste Bank (BSMK). The findings show that BSMK has successfully applied the 3R (reduce, reuse, recycle) principle, directly engaged the community through customer schemes and pick-up services, and reduced 9,203.3 kg of waste over the last two years. However, its effectiveness is constrained by limited human resources, infrastructure, and operational time. This study concludes that innovation in community-based waste management methods, such as BSMK, needs to be continuously supported in order to play a greater role in realizing a sustainable waste management system.

KEYWORDS: Waste Bank, Discontinues Innovation, Direct Interaction.

1. INTRODUCTION

Human activities today are increasingly numerous and varied, as a consequence of the increasing and varied human needs, and some of them are human activities that cause waste, such as household activities, mining, transportation, livestock, development, trade, industry, agriculture, fisheries, and others. The number of human activities will correspond to the high volume of waste produced, and as a consequence, will be in line with the increase in the number of people who are waste producers (Tchobanoglous, 2022). Waste that is not managed properly will certainly hurt environmental pollution, human health (disease), and infrastructure damage.

The condition of regional waste in Indonesia still faces several challenges. Based on data from the National Waste Management Information System (SIPSN) in 2024, more than 34 million tons of waste are generated each year, but only about 60% is successfully managed, while the rest remains unmanaged (Lingga, et al., 2024). If humans as waste producers continue to increase without proper waste management, the volume of waste from year to year will continue to increase. It seems that the volume of waste in Indonesia is getting out of control because only some people care about the importance of environmental cleanliness, especially those related to good and correct waste management. The low public concern for waste, among other things, can be seen from the habit of people who immediately dispose of waste without sorting it first. There are still many people who throw garbage in the right place, such as in culverts, on the road, in rivers, and even in the sea.

To overcome the above waste problems, Indonesia has for 3 (three) decades implemented a waste management system with the end-of-pipe method. This method relies heavily on the Final Disposal Site (TPA), even though the landfill has limited land. This method is also considered a traditional method that does not think about its impact on the future. Because of this weakness, the government innovated by changing the end-of-pipe method to the reduce, reuse, recycle (3R) method, where waste management not only focuses on the final stage but also the early stages, namely the community (Rohmasari, 2018). This 3R method includes limiting landfills, reusing waste, and recycling waste. In this context, we no longer view waste as something worthless, but as a resource that has high economic value if processed properly and correctly. So, a waste bank is a place for sorting and collecting recyclable and/or reusable waste that has economic value.

Related to the above, the government of Mamuju Regency, West Sulawesi Province, responded to a policy from the Ministry of Environment and Forestry/Environmental Control Agency, which will provide technical support and regulatory assistance for waste management in the region (Purtri, Ganing, Akbar, and Chairani, 2024). The argument in response to this policy is that if regions do not start now, then the target of zero landfills by 2030 will not be achieved (Astuti and Kamil, 2024), and the solution is no longer to dump waste in landfills, but how regions manage from upstream (Wijaya, Nurasa, and Susanti, 2022).

Based on the author's preliminary survey, the Mamuju Keren Waste Bank (BSMK), as an innovation process for waste management in Mamuju Regency, is one of the pioneer waste banks in this area and also as one of the segregated waste collection institutions in the city of Mamuju. BSMK was established in 2019, where it was initially a Unit Waste Bank (BSU), and in 2022, it transformed into the Main Waste Bank (BSI), which coordinates several unit waste banks in Mamuju Regency, such as the Manakarra Unggul Lestari Waste Bank (BSMUL) (Results of an interview with the Director of BSMK Mamuju Regency, December 10, 2024). However, in the course of this BSMK activity, it is inseparable from several operational obstacles faced, such as limited human resources, equipment, the number of waste bank management staff, and the time of waste bank activity (Results of an interview with the Head of the Environment and Hygiene Office/DLHK of Mamuju Regency, December 14, 2024). Thus, in this research, it is necessary to conduct a more in-depth analysis to find out the implementation and obstacles of waste management and the innovation of its methods in Mamuju Regency.

Previous research. Some of the research related to waste management innovations and waste banks are: (1) Research by Padliani (2020) with the title The Role of Waste Banks on Community Economic Empowerment in an Islamic Economic Perspective Review, (2) Research by Amrina (2020) with the title Performance of the Bangkitku Waste Bank in Increasing the Economic Value of Families in Pal V Village, Jambi City, (3) Research by Hasrilia (2021) with the title Community Empowerment Through The Gade Clean And Waste Bank Program Gold in Kitiran Yosoroto Village, (4) Apriany Research (2024) with the title Collaborative Dynamics in the Management of the Sipamandaq Main Waste Bank in Poliwali Mandar Regency, (5) Rohmasari (2018) with the title Public Service Innovation in Waste Management (Study on the Malang Waste Bank), (6)

Purtri Research, et al. (2024) with the title Management of Waste Banks in Mamuju Regency, (7) Azis (2022) with the title Development of the Management Capacity of the Sipamandaq Waste Bank in Improving Community Economics in Polewali Mandar Regency, West Sulawesi Province, (8) Research by Tiawan et all. (2023) with the title Digitization of Waste Banks as Optimizing Waste Management and Community Empowerment in Pejaten Village, Kediri District, Tabanan Regency, Bali, (9) Asteria Research (2015) with the title Waste Bank as an Alternative to Community-Based Waste Management Strategy in Tasikmalaya, (10) Research by Prayati et all. (2018) with the title Analysis of the Influence of the Waste Bank Program on the Income of Waste Bank Customers in Denpasar City, and (10) Pratama and Ihsan (2017) with the title Opportunities for Strengthening Waste Banks to Reduce Urban Waste Generation Case Study of the Malang Waste Bank.

Previous studies on waste banks in various regions have focused more on economic aspects, community empowerment, or the effectiveness of 3R in general. There have not been many studies that specifically examine the dynamics of community-based waste management innovation in the context of developing regions such as Mamuju, with all its limitations in terms of resources and infrastructure. Therefore, this study makes a new contribution by emphasizing the analysis of waste management innovation and the obstacles faced by BSMK, while also providing an empirical picture of how participatory innovation can be applied on a local scale.

This research aims to analyze in depth the implementation of waste management in Mamuju Regency and identify various obstacles faced in the process. In addition, this study also aims to explore innovative forms of waste management methods applied, especially through the activities of the Mamuju Keren Waste Bank (BSMK) as a pioneer in system change from the conventional approach of "collect-transport-discard" to the 3R (reduce, reuse, recycle) system. With this approach, it is hoped that the research will be able to provide a comprehensive picture of the transformation of waste management based on community participation, as well as the implications of discontinuous innovation and interactive innovation on increasing the effectiveness of sustainable waste management systems at the local level.

2. METHODS

The approach of this research is qualitative and descriptive because social research is often heavily influenced by the components of society (Bless and Smith, 2021). In the context of this research, the descriptive is intended to describe the focus of this research, namely, the implementation and constraints of waste management and the innovation of its methods in Mamuju Regency.

The sampling strategy was carried out using purposive sampling, which involves selecting informants who are considered to have the best understanding of and direct involvement in the waste management process. The criteria for selecting respondents included: (1) officials and staff of the Mamuju District Environment and Sanitation Agency (DLHK) who were involved in the formulation and implementation of waste management policies, (2) managers of the Mamuju Keren Waste Bank (BSMK), (3) BSMK customers who actively deposited waste, and (4) representatives of the general public who were customers of the waste bank service.

There were 18 informants in this study, consisting of: 2 DLHK officials, 5 BSMK management staff, 8 active customers, and 3 representatives of the general public. This number was selected to ensure the representation of various actors involved in waste management in Mamuju.

The interview guide was designed to explore several key aspects, namely: (1) the implementation of daily waste management, (2) obstacles and challenges faced in the operation of BSMK, (3) innovations in management methods applied, and (4) public perceptions of the existence of waste banks. The interviews were conducted in a semi-structured manner to allow informants space to explain their experiences and views.

Fieldwork was conducted over a period of three months, from December 2023 to February 2024. In addition to in-depth interviews, data was also obtained through direct observation of BSMK activities (the process of sorting, weighing, recording, and distributing waste) and documentation studies (DLHK reports, BSMK activity records, and SIPSN data).

The data analysis in this study follows the stages of data analysis by Strauss and Corbin (2020) in grounded theory, namely data analysis in grounded theory, also known as the coding process, which actually runs simultaneously with the above collection series. The stages of the analysis process are: (1) open coding (conceptualizing by separating the results of interviews and finding categories), (2) axial coding (focusing on determining category specifications), (3) selective coding (examining core

categories that are systematically related to other categories), and (4) theoretical analysis (analyzing data through related theories).

3. RESULT AND DISCUSSION

3.1. Implementation and Constraints of Waste Management

The waste management program in Mamuju Regency is a collective waste management system with the principle of recycling. In 2024, as many as 6 (six) Unit Waste Banks have been formed, but only 2 (two) Unit Waste Banks are active and have reduced by 13% of the total generated. The waste production that can be reduced over the last 2 years (2023 and 2024) is 9,203.3 Kg. However, when looking at the amount of waste generated regionally, during the 2023–2024 period, the total waste generated in Mamuju Regency was recorded at 110,034 tons. Of this amount, Bank Sampah Mamuju Keren (BSMK) was able to reduce around 9,2033 tons, or only around 0.00836% of the total regional waste generation in the last two years. This figure is relatively small, but it still shows BSMK's real contribution in reducing waste while changing the community's paradigm from the conventional "collect-transport-dispose" system to a participatory 3R-based approach.

The Mamuju Keren Waste Bank (BSMK) of Mamuju Regency serves the collection of segregated types of waste from waste-producing sources, namely households, offices, private businesses, hospitals, and schools. Some of the government and private offices that have become customers of the BSMK waste bank include the Mamuju Post Office, Mamuju Detention Center, the Mamuju Regency Regional Financial and Asset Management Agency (BPKAD), the Mamuju Regency Environment and Hygiene Service (DLHK), the Mamuju Sub-district office, the Simboro sub-district office, the Mamuju Regency Hospital, the West Sulawesi Provincial Hospital, and the Mamuju Regional Terminal office. In addition, several private businesses that are customers of BSMK's waste bank include PT Rekind Daya Mamuju (PT RDM), PT Semen Tonasa UPS Mamuju, and Mitra Manakarra Hospital. As for schools that have become BSMK customers, they are SD IT Wildan, SMK Ponpes DQHNW Gentungan, and SMAN 1 Mamuju. Until now, the number of customers of the Mamuju Keren waste bank is 266 customers, with 20 active customers, or around 18.17% of BSMK Mamuju Regency customers.

BSMK is located on Jalan Soekarno Hatta, next to the office of the Housing, Settlement and Land Office (Perkimta) of Mamuju Regency, about 1 km from the Mamuju Regent's office. BSMK occupies the DLHK environmental laboratory building in Mamuju Regency, and all activities related to waste banks are carried out in this building. All BSMK activities, ranging from segregated waste collection, waste weighing, waste recording, waste cleaning, and grouping of waste by type to storage of packaging waste (based on type), are carried out entirely in this DLHK laboratory building. BSMK manages segregated waste that has economic value to support circular economy policies. The types of segregated waste that are collected and managed include: (a) plastic type: bottles, glasses, blows, instant noodle packaging, and leaf plastic, (b) paper type: HVS, printed books, duplexes, magazines, and newspapers, (c) aluminum type: milk packaging and canned beverage packaging, (d) cardboard, and (e) used cooking oil (cooking oil that is no longer used or frying containers).

Since the establishment of BSMK until now, it has managed 35 tons of sorted waste. The dominant waste managed is paper and plastic waste, with percentages: paper (69.41%), plastic (20.60%), cardboard (9.86%), and cans (0.12%). When compared to the potential for segregated waste that can be managed in Mamuju Regency, which is around 10,000 tons more, the potential for the development of BSMK and other Unit Waste Banks is still large in the future. As the forerunner of the Main Waste Bank (BSI), BSMK also serves the transportation of segregated waste from community groups, schools, offices, and other facilities such as hospitals. The activity of picking up segregated waste from segregated waste-producing sources strongly supports the increase in interest in sorting waste from waste-producing sources.

Meanwhile, the Manakarra Keren-Mamuju Regency Environment and Hygiene Agency (DLHK) managed to collect more than 1 ton of sorted waste in a day in December 2024. The sorted waste collected was dominated by paper waste, which came from institutional customers, namely PT POS Indonesia Mamuju Regency, as much as 1,093 kg. In addition, in the same month (August), the Manakarra Keren Waste Bank also added 1 (one) new individual customer. Siti Rahmiah from Mamuju, who immediately deposited 16 kg of sorted household waste. The total amount of curb waste collected in August was 1,109 kg or 1.1 tons.

Related to the condition of its sales turnover, which includes the sale of waste such as plastic (blow), duplex, paper waste, cardboard, plastic bottles, organic glasses, and cans. The working hours of the Waste Bank are assumed to be 7 hours and

operational 2 times a week, so the monthly income is Rp. 12,000,000. Waste is collected 12 times with the money obtained, Rp. 12,000,000. Meanwhile, there are operational costs at the Waste Bank. This expenditure includes the wages of 10 workers/employees, transportation, and other operational costs such as maintenance. The problem is because the amount of expenditure is greater than the income, where the profits obtained every month are used for the operational purposes of the Waste Bank, with the amount of waste obtained not fixed, the profits obtained fluctuate. Related to fluctuating waste prices, following market prices and prices are determined based on the demand for raw materials from waste by companies, both domestic and foreign.

The interest of the people of Mamuju city in sorting the household waste produced began to increase (although not significantly), as seen from the amount of sorted waste managed by the Manakarra Keren Waste bank began to increase. It is hoped that with the presence of the Manakarra Kerr Waste Bank, it will continue to encourage the people of Mamuju city, specifically to start sorting the household waste produced, thereby reducing the amount of household waste that is not managed or that is transported to the Final Processing Site (TPA) of waste. This is intended to support the growth of the circular economy in Mamuju Regency, including the realization of a clean and comfortable area for its residents in the future. The following is the implementation of waste management activities in Mamuju Regency, as shown in Figure 1.

Figure 1: Implementation of Waste Management Activities in Mamuju Regency, 2024.

Then, in the course of BSMK activities, it is inseparable from several obstacles faced. The operational constraint of BSMK is the limitation of human resources and equipment. Some waste bank customers are large-scale waste sorters, such as schools, offices, or communities, that collectively in one community sort waste. Due to the large volume of segregated waste, customers often ask the waste bank management to pick up the collected waste. However, due to limited human resources, especially those who handle sorted waste pickup, as well as limited pick-up operational vehicles, often, pick-up is often not carried out according to customer expectations. This certainly contributes to the interest of the community and other customers in sorting waste and collecting sorted waste in the future.

Another obstacle is the existence of a building for waste bank activities. So far, BSMK activities have occupied the environmental laboratory building of DLHK Mamuju Regency. Seeing the potential for an increase in the amount of segregated waste in the future, the DLHK laboratory building that was temporarily used for waste bank activities was felt to no longer be able to cover all BSMK activities. This is because this building is intended for environmental laboratory activities, and also an increase in the amount of sorted waste collected at BSMK, including the condition of the building that was damaged after the Mamuju earthquake in 2021. Thus, now and in the future, the DLHK laboratory building will no longer be representative of BSMK activities. To support waste sorting activities by BSMK, it is necessary to find solutions related to the operational buildings of waste banks. Moreover, BSMK can be

said to de facto have started to have the status of a Main Waste Bank (BSI), where it serves and collaborates with several Unit Waste Banks (BSU). Especially for BSMK infrastructure, the office location is also a place to carry out waste processing activities, in addition to the unavailability of processing machine technology, such as plastic shredding machines and paper shredding machines. So, the Mamuju Regency government must provide representative land as a waste shelter for customers.

Likewise, the obstacles faced are also the limited number of waste bank management staff and the time of waste bank activities. Both the number of staff on duty and the limited time the waste bank operates are also obstacles to the implementation of segregated waste collection activities at BSMK. Often, it happens that there are people who have time and come to bring sorted waste outside of the waste bank's activity days, and cannot be served by the waste bank, so that people are no longer motivated to sort waste because of the limited opening time of the waste bank. The limited opening time of the bank occurred because most of the staff who were active in the waste bank were also active as ASN at DLHK Mamuju Regency. BSMK staff currently totals 10 people, who are in charge of transportation, weighing, sorting, cleaning, packing, storage, and administration of the entire waste bank process. The operational time of the waste bank is also limited, which is only 2 days (Tuesday and Thursday) a week. Therefore, in the future, it is expected to increase the operational time of the Waste Bank, which was previously only operating 2 times a week, to 5 days a week, namely Monday to Friday.

The various obstacles above have also not been supported by the participation and awareness of all Mamuju Regency people who are high in processing the waste they produce. This can be observed from the still found piles of garbage on the side of the highway that are often passed by the community. In fact, this crosswalk is considered by most local people as a Temporary Shelter (TPS), so it is very unsettling for the community, as the smell of unpleasant and the environment looks unattractive. Therefore, it is important to socialize for the community to socialize the Waste Bank program and the application of the 3R principle. As for the Mamuju regional government, there is still a lack of coordination between institutions in the government at the sub-district level, namely, coordination between BSI/BSU and sub-districts.

3.2. Innovation In Waste Management Methods

Waste management innovations by BSMK Mamuju Regency tend to lead to the category of discontinued innovation. This is because waste management carried out by BSMK is completely different from waste management before the existence of BSMK. The difference in waste management can be seen from the service or product, and also in the resources. Waste management before the existence of BSMK was carried out by DLHK with the collection-transport-waste method, which is a method that only focuses on the final stage. The first process of this method is to collect waste from waste sources, namely settlements, schools, street vendors (street vendors), government agencies, markets, and roads. Garbage from markets and streets is collected by the yellow troops by sweeping, while for garbage from settlements, it is the responsibility of each region so that those who are obliged to collect and transport the garbage to the polling station. The second process is the transportation of waste from the TPS to the TPA. The waste that has been collected at the TPS is sorted into organic and inorganic. Organic waste is separated and then processed into compost. Meanwhile, other waste is put into containers and then transported to landfills. For the third process, waste disposal at the landfill. Waste from the TPS is transported and disposed of in the landfill and will be processed by the landfill control system. Sistem control landfill is a way of managing waste in landfills by disposing of waste into active cells, after which the waste will be piled up with soil after 2-3 days.

Furthermore, waste management by BSMK is carried out using the 3R method (reduce, reuse, and recycle). This method focuses not only on the final stage, but also on the initial stage or from the source, i.e., the community itself. Waste management by BSMK involves the active role of the community, namely in terms of waste sorting. The first stage of waste management by BSMK is that waste is sorted by people who have become members of BSMK or so-called customers. The second stage is that after the waste is sorted by the community, the waste can be deposited directly to BSMK by the community by the way customers come to BSMK, or BSMK takes waste to customers' homes. The third stage is that waste that has been deposited or taken by officers from BSMK will be sorted into 80 types of waste. Paper waste that has been sorted is immediately arranged in the warehouse, while plastic waste that has been sorted is weighed first before entering the warehouse. The fourth stage is that some of the waste is processed by BSMK into shredded plastic, while some of the rest is sold directly to factory suppliers, household industries, and consumers/communities.

The shredded waste is clean plastic bottle waste, which is a plastic bottle whose label and lid have been separated.

So, the products of waste management before BSMK and after BSMK are very different. In addition to products, other differences from waste management before BSMK and waste management by BSMK can be seen from the difference in resources, both human resources and resources in terms of funding. Before the existence of BSMK, the human resources who carried out waste management were the government or civil servants, namely employees of DLHK Mamuju Regency. The waste management resources by BSMK are carried out by non-civil servants. For resources in terms of funding (budget) for waste management carried out before the existence of BSMK Mamuju Regency are sourced from the government, in this case through DLHK Mamuju Regency. The resources in terms of funding for waste management by BSMK are sourced from grants provided by DLHK at the beginning of the formation of BSMK.

BSMK cannot rely on assistance from other parties because the assistance is limited, and what BSMK needs to do to be able to continue to run is to do business ventures that can generate profits. The profits obtained by BSMK are from the price difference between the purchase price and the selling price, as well as from the waste sorting carried out and from the waste management carried out, namely by chopping plastic bottles. Profits in the waste management process are the main source of financing from BSMK, so that if the waste management process incurs losses, BSMK can be threatened with closure.

Then, related to the innovation of waste management service methods is innovation in terms of interaction with customers, or in terms of providing services. DLHK Mamuju Regency, in providing waste management services, is limited to collecting, transporting, and disposing of waste to landfills. So, DLHK does not interact directly with the local community. The community is only limited to paying the waste levy through taxes, and then DLHK does its duty to manage waste, namely collecting, transporting, and disposing of waste. In addition, indirect interaction between DLHK and the community can also be seen from the waste collection process in residential areas. The collection of waste in residential areas to the polling station is the responsibility of each of the regions or sub-districts, while DLHK only forwards the waste that they have disposed of at the polling station.

The Mamuju Regency BSMK, in carrying out waste management, interacts directly with the community, because the waste management carried out by BSMK is inseparable from the active role of the community. This interaction occurs when the community registers as a member of BSMK or a so-called customer. To become a customer at BSMK, the public must register directly by coming to the BSMK office. The direct interaction between BSM and customers also occurs when the customer deposits waste in BSMK. Waste deposit can be done in two ways, namely, customers come directly to BSMK or BSMK takes waste to the customer's house. These two ways of depositing waste still result in direct interaction between BSMK and customers. Direct interaction also occurs when customers save or take money from the sale of waste, because saving and taking money using a manual system requires customers to come directly to the BSMK office. In addition, direct interaction between BSMK and customers also occurs if customers want to buy waste at BSMK. The process of buying waste at BSMK is carried out by the way customers come to BSMK and have waste to be purchased in the warehouse.

4. DISCUSSION

The findings of this study show that the existence of the Mamuju Keren Waste Bank (BSMK) provides a tangible contribution to community-based waste management in Mamuju Regency. During the 2023–2024 period, BSMK succeeded in reducing approximately 9.2033 tons of waste. When compared with the total regional waste generation of 110,034 tons in the same period, this contribution amounted to only about 0.00836%. Although the figure appears small, this achievement marks a paradigm shift from the conventional collect–transport–dispose system to a participatory system based on the 3R (reduce, reuse, recycle) principle. This shift is significant because, in the waste management literature, long-term success is not only measured by the magnitude of physical reduction but also by behavioral changes and increased public awareness (Rohmasari, 2018; Asteria, 2015).

The contribution of BSMK becomes more significant when viewed from the internal operational scale of the waste bank. Out of a total of about 70.8 tons managed by two active Waste Bank Units in Mamuju over two years, BSMK was able to reduce approximately 13%. This figure better reflects program effectiveness at the directly managed scope, even though the scale is still limited compared to the total regional waste generation. This fact illustrates the distinction between macro-level (regional) and micro-level (internal waste bank) achievements. This

finding is consistent with Apriany (2024), who argued that the effectiveness of waste banks largely depends on operational capacity, infrastructure support, and the scope of service coverage.

In terms of innovation, BSMK has introduced a different approach compared to the previous waste management system. While DLHK previously focused solely on collection, transportation, and final disposal, BSMK instead emphasized direct interaction with the community. Through customer schemes, waste pick-up services, and savings systems from the sale of waste, BSMK has built closer relationships with the community. This interaction-based innovation shifts the role of the community from being mere recipients of services to becoming active agents in waste management. This model aligns with the community-based waste management approach that has proven effective in other regions (Tiawan et al., 2023; Prayati & Kartika, 2018).

Nevertheless, this study also underscores that BSMK's achievements still face various structural limitations. First, limited human resources remain the main constraint. With only 10 active staff members and operations limited to two days per week, BSMK cannot accommodate the wider potential community participation. Second, infrastructure constraints, particularly the use of DLHK's laboratory building damaged by the earthquake, restrict the capacity for storage and waste processing. Third, the absence of processing technologies (such as plastic and paper shredders) means that most waste can only be sold in raw form, reducing its economic value. These limitations are consistent with the findings of Azis (2022) in Polewali Mandar, which highlighted that the sustainability of waste banks is heavily influenced by infrastructure and technological support.

From a social perspective, the level of community participation in Mamuju remains relatively low. Although BSMK has 266 registered customers, only about 20 (18.17%) are active. This low figure indicates that public awareness in waste sorting still requires strengthening through continuous socialization and education. This condition is consistent with Hasrilia (2021), who emphasized that waste bank programs can only succeed if supported by collective community awareness, not merely institutional initiatives. In addition, the low participation rate is also influenced by limited services, such as unmet requests for waste pick-up due to a shortage of vehicles and workers.

This discussion highlights a gap that needs to be bridged. On the one hand, BSMK has demonstrated the potential for innovation in community-based waste management with significant reductions at the internal scale. On the other hand, its contribution at the regional level remains very small. This shows that for waste banks to play a greater role, policy interventions are needed, including: (1) increased budget support for infrastructure and processing technology, (2) expansion of operating hours and additional staff, (3) strengthening social campaigns to improve community participation, and (4) enhanced coordination between waste banks, local government, the private sector, and educational institutions.

With these strategies, BSMK has the potential to become a participatory waste management model that not only contributes to reducing waste generation but also supports the development of a circular economy in Mamuju Regency. This model also enriches the academic literature on community-based waste management innovation, particularly in developing regions with limited resources. Thus, this study emphasizes that the success of waste management innovation cannot be measured solely by reduction figures, but also by the extent to which such innovations change community behavior, strengthen collective awareness, and drive transformation toward a more sustainable waste management system.

5. CONCLUSION

Waste management innovation by the Mamuju Keren Waste Bank (BSMK) of Mamuju Regency is classified as a discontinued innovation category. This is because waste management carried out by BSMK (using the reduce, reuse, recycle/3R method, through waste bank activities) is different from waste management before BSMK (using the end-of-pipe method, i.e., collect-transport-throw method). The difference is reflected in the service, products, and resources. Another innovation is related to service methods, where before the existence of BSMK, waste management did not interact directly with the community, while waste management by BSMK had direct interaction with the community or customers. Related to this innovation, the activities of the Mamuju Keren Waste Bank (BSMK) of Mamuju Regency seem to have begun to make the local community aware of taking direct responsibility for the management of the waste they produce, although it is not significant. So far, most of the people of Mamuju Regency are of the view that household waste is the business of the local government, because the community has paid the levy. However, with the existence of BSMK, little by little, the local

community began to be enlightened with a new perspective that the waste they produce must be managed first before being thrown into the trash can to be transported to the Final Disposal Site (TPA). The performance of BSMK is not so high because it still experiences various obstacles in carrying out its activities such as limited human resources (the number of waste management staff), the building used is no longer representative, there is no equipment technology, the waste bank's operating time is only 2 (two) days, public participation and awareness are not significant, and the intensity of coordination between waste management implementers is still lacking. Therefore, it is recommended that the local government of Mamuju Regency continue to maintain the innovation of waste management methods with the 3R principle through BSMK activities. In addition, local governments also need to support adequate budgets to support BSMK's higher performance, especially by preparing budgets for building procurement, employee payroll, and equipment technology purchases. Then, it is also necessary to coordinate and collaborate with various stakeholders more intensively, as well as conduct campaigns and socialization to maximize the awareness of the local community about the consistency and importance of the sustainability of BSMK Mamuju Regency activities.

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