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Waste Management System: A Case Study of Waste Bank Management Toward a Circular Economy in Maros Regency

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ABSTRACT
Waste management has been in the spotlight recently due to the annual escalating volume of waste generated. The concept of a circular economy has emerged as a viable economic framework that aligns with sustainable development objectives, particularly those concerning responsible consumption and production practices to support local economies. This article seeks to assess the efficacy of waste bank management in fostering the development of an efficient municipal waste management system conducive to a circular economy with a robust waste recycling infrastructure. This study employed a descriptive qualitative interpretative approach underpinned by a phenomenological framework. Data were gathered from diverse reputable sources such as journals, books, and other relevant references, which the author subsequently analyzed. The findings indicate that waste management in Maros Regency has been operating optimally, driven by stakeholder involvement in promoting waste disposal practices within the community. Establishing the Turikale Main waste bank is a testament to the success of transitioning waste management towards a circular economy model. This initiative facilitates waste recycling and empowers the local economy, generating substantial monthly revenue independently. The significance of this research lies in its capacity to offer valuable insights and recommendations for researchers seeking to evaluate and formulate waste management strategies anchored in the concept of waste banks, which can be replicated in other regions.

A. INTRODUCTION

The issue of waste accumulation prevalent in urban areas stems from suboptimal waste management practices, posing significant environmental disruptions and challenges to human life. Urban waste management, in general, has not been effectively executed, making waste a critical problem across Indonesia, notably in the Maros Regency. These challenges predominantly revolve around operational techniques and waste handling. Limited land availability for landfills, particularly in urban locales, exacerbates waste generation. By Law No. 18/2008, waste management encompasses systematic, comprehensive, and sustainable activities encompassing waste reduction and handling (Qadri et al., 2020). Waste management in urban areas constitutes a complex system with interconnected components, striving toward

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specific objectives. It demands proficiency, enhanced comprehension, and skills to convert organic and plastic waste into valuable products with marketable value (Suryani et al., 2021).

Given the prevailing challenges, waste management necessitates concerted efforts from central and regional governments, adopting a comprehensive, integrated approach from upstream to downstream, guided by a circular economy paradigm (Tomić & Schneider, 2020). Such initiatives ensure economic profitability for local governments and communities and promote public health and environmental safety (Marves, 2021). It means that in measuring the improvement of public service performance, the government cannot do it alone; it needs community cooperation, so this needs to be the concern and participation of the community in governance in general and in the delivery of public services in particular.

The increasing complexity of waste underscores the need for tailored interventions. Poor waste management often results from the absence of integrated policies or programs and inadequate community support and involvement from businesses and the general public (Rifani & Jalaluddin, 2019). Failure to address these issues perpetuates inefficient waste management practices (Ajrina et al., 2020) and hampers effective waste segregation and community participation (Saputri et al., 2019).

 Wati et al. (2022) mentioned that waste bank utilization enables communities to identify valuable waste and receive monetary rewards, thereby augmenting community income and addressing local waste issues (Nur, 2021; Ariefahnoor et al., 2020; Santoso, 2020).

The implementation of waste bank management serves as an avenue to educate communities on discerning valuable waste suitable for depositing in waste banks. Community training on waste sorting enhances awareness and fosters economic growth within the circular economy framework. The circular economy model utilizes materials cyclically, minimizing waste generation through product and material collection and reuse (Wati et al., 2022). However, operational challenges, limited government funding, staffing, and equipment hinder effective waste management. Waste bank utilization enables communities to identify valuable waste and receive monetary rewards, thereby augmenting community income and addressing local waste issues (Nur, 2021; Ariefahnoor et al., 2020; Santoso, 2020).

Table 1. Waste Generation Per Sub-District in Maros Regency

No	District	Total Population (People)	Waste Generation (m³/day)
1	Dikirim	36,440	130
2	Moncongloe	17,614	63
3	Maros Baru	24,766	88
4	Marusu	25,926	93
5	Turikale	42,580	152
6	Empat	24,886	89
7	Bontoa	27,043	97
8	Bantimurug	28,669	102
9	Simbang	22,693	81
10	Tanralili	25,020	89
11	Tompobulu	14,460	52
12	Camba	12,793	46
13	Cenrana	13,948	50
14	Mallawa	10,949	39
Whole		327.787	1.171

Source: Maros District Environment Office, (2022)

Ratnawati, R. V (2021) outlined three critical objectives in waste management: enhancing local government commitment to utilizing waste as economic raw materials, fostering community participation in waste sorting endeavours, and encouraging producer and business engagement in green business practices by using waste as economic raw material. To achieve

these objectives, strategies such as facilitating waste transportation, promoting public awareness, optimizing funding allocation, and developing environmentally sound waste management infrastructure are imperative (Arda et al., 2021). Table 1 presents the waste generation in Maros Regency at the sub-district level based on the number of people using waste daily.

Based on the data presented in Table 1, the average daily waste generation across 14 sub-districts in Maros Regency exhibits considerable variation, particularly noteworthy in the Turikale Sub-district, which stands out as the most significant waste contributor. Conversely, the Kota Sub-district boasts the highest population among the 14 sub-districts, correlating with its status as the most significant waste producer, generating 152 m³ daily. When the total daily waste generation across the 14 sub-districts is aggregated, the average daily waste amounts to 1,171 cubits. This phenomenon underscores the need for innovative waste management strategies that capitalize on waste reuse, transforming it into a valuable asset for the community while promoting environmentally sustainable practices and stimulating economic activity.

One practical approach to mitigate the challenges posed by waste is adopting the 3R principle: reduce, reuse, and recycle. This principle, as advocated by Radityaningrum et al. (2017), aligns with the circular economy concept, offering an alternative to the conventional linear economic model. Unlike the linear model, which swiftly discards goods deemed useless, the circular economy model emphasizes maximizing the economic value of waste, thereby transforming waste into a resource that enriches human life. By embracing this concept, various societal sectors can harness the economic potential of waste, thereby not only curbing waste disposal but also generating economic benefits for society.

Addressing this issue constitutes a pressing concern for the Maros district government, particularly in harnessing the potential of waste banks to foster a robust circular economy. The provision of waste banks by the government has the potential to shift community behaviours regarding waste disposal, transforming waste into a valuable economic asset for residents. The establishment of the Turikale central waste bank and ten additional waste banks underscores the commitment of the Maros district government, with six active waste banks generating tens of millions in turnover monthly. This exemplifies a notable departure from conventional waste management practices. The implementation of waste bank management not only enhances the cleanliness and aesthetics of Maros City but also reduces waste disposal in landfills while concurrently delivering economic benefits that improve community welfare.

B. LITERATURE REVIEW

Performance is an assessment to determine the ultimate goal to be achieved by an individual, group, or organization. In this sense, performance is a tool to measure the level of achievement or policy of a group or individual. Several aspects of assessing performance results: a) Individual Performance describes the extent to which a person has carried out his main duties so that he can provide results that the group or agency has determined. b) Group Performance describes the extent to which a person has carried out his primary duties so that he can provide results determined by the group or agency. c) Organizational Performance, which describes the extent to which a group has carried out all major activities to achieve the vision and mission of the Institution. d) Program Performance, concerning the extent to which the activities in the program have been achieved (Kobogau et al., 2018). Furthermore, participation is also needed to show performance, namely increasing public awareness and trust in sorting household organic and inorganic waste and providing services for work activities (Rahmadan, 2020).

According to Gobai et al. (2020), poor waste management performance can significantly degrade environmental quality within urban areas. Hence, the success indicator of Waste Bank

service performance is highly contingent on the efficacy of the Waste Bank Unit (Fatmawati et al., 2019). Similarly, in a parallel study, waste management programs in urban areas encompass various activities, including strategic planning, regulatory and policy frameworks, community participation, financial management, institutional capacity building, research, and development, as well as inspection and corrective action (Margallo et al., 2019). Moreover, waste management performance must maintain a good rating and continually improve across all components of the waste management system, including operational and technical aspects, institutional frameworks, financial mechanisms, legal and regulatory frameworks, as well as public and private participation (Ajrina & Putri, 2020).

Sustainability-related performance indicators for circular economy programs are categorized into three groups: sustainability dimensions, business processes, and circular economy strategies. This classification facilitates assessing potential sustainability performance before implementation (Kravchenko et al., 2020). Additionally, it presents the primary indicators for each category, identifies gaps, and sets directions for future research. In response, the government plays a pivotal role in educating the community to minimize waste creation and transform waste into a resource to enhance the community's economy (Verawati et al., 2021).

The burgeoning concept of the circular economy is crucial to disseminate, underscoring the importance of individual involvement in realizing sustainable living for future generations (Harahap & Dwiningsih, 2022). Arista (2022) suggested that the circular economy concept holds promise for farmers, industries, producers, and consumers, facilitating zero waste production and product reuse. The circular economy model aims to optimize resource utilization by eliminating waste generation and prolonging resource functionality and benefits within production processes (Purnawan et al., 2020). It seeks to maximize material utilization from produced goods (Bucknall, 2020).

Innovative solutions in waste management, particularly concerning plastic waste, are encapsulated in the circular economy approach. By sorting, managing, and repurposing plastic waste, the circular economy principle transforms it into economically valuable products, bolstering community economic vitality (Darmastuti et al., 2020). Another finding from Firmansyah et al. (2021) underscored the benefits of the circular economy, fostering a clean environment while stimulating economic growth, as individuals derive income from waste savings, which can be allocated towards taxes, utilities, and household expenses.

C. METHOD

This research employed a qualitative-descriptive interpretive method with a phenomenological approach (Creswell & Poth, 2018), an assessment of the problems of the waste management system in Maros Regency as a support for the circular economy of the community. This research examined the waste management system in Maros Regency, focusing on the performance of governmental organizations in utilizing Waste Banks. The analysis centres on transforming waste into a circular economy and fostering effective, eco-friendly waste management through waste reduction, reuse, and recycling practices, ultimately aiming to generate value from recycled products. The study employs a literature review methodology, drawing data from various sources such as books, journals, official documents, online media, and other relevant materials. The data was analyzed and interpreted through multiple stages developed by Miles (2018): reduction, presentation, and verification, to produce conclusions in the form of new findings beneficial to readers.

Additionally, the research utilized the qualitative research tool Nvivo12Pro, recommended by Woolf & Silver (2017), to delve deeper into existing problems and attain robust conclusions. However, a limitation of this study lies in the potential for researcher bias during data

interpretation, which could skew results. Triangulation involves cross-referencing data with observations from different perspectives to enhance the study's credibility and validity.

D. RESULT AND DISCUSSION

Waste Management Performance in Maros Regency

Waste management in the Maros Regency through the waste bank system is considered one of the effective ways of handling waste in the Maros Regency area. The government organization responsible for waste management in Maros Regency is the Environmental Agency. The establishment of the Waste Bank program stems from the pressing issue of landfill overflow, which makes it unable to accommodate the escalating waste volume, necessitating focused attention (Darmawan, 2020). Evaluating waste management entails comparing organizational outcomes against pre-established targets within the waste management framework. Organizational performance assessment in waste management is closely related to service quality and community satisfaction (Usman, 2017).

One of the efforts made by the government to reduce the amount of waste entering landfills is to build waste management infrastructure in the form of Integrated Waste Management Sites (TPST) (Marlena et al., 2020). Effective and sustainable TPST operation requires robust asset management, although some TPSTs still operate below optimal capacity due to unmet facility and infrastructure requirements. An example of waste bank management performance contributing to community economic enhancement is the Turikale Waste Bank in Maros Regency, boasting an average monthly turnover of Rp. 50 million. Employing 18 personnel, each with an average income ranging from IDR 1.5 million to 2.5 million, Turikale Waste Bank serves 578 customers, including offices, schools, and individuals. Managing 1-2 tons of waste daily, Turikale Waste Bank handles four waste categories: paper (57%), plastic (31%), metal (7%), and bottles (5%) (Ratnawati, 2021).

The regulatory framework governing waste management is stipulated in Law No. 18 of 2008 on waste management, Government Regulation No. 27 of 2020 on specific waste management, and Ministry of Environment (MOE) Regulation No. 13 of 2012 on Guidelines for the Implementation of Waste Reduction, Reuse, and Recycling through Banking. Local regulations, such as Maros Regency Regional Regulation No. 4 of 2012 on Maros Regency Spatial Planning, complement national legislation. Consequently, the Maros Regency Government encourages waste reduction through proper waste sorting and diverting waste from reaching Final Disposal Sites (TPA). The regulations established and implemented by the Maros Regency government certainly have impacted economic growth in the last five years, as seen in Table 2.

Table 2. Economic Growth of Maros Regency 2017-2021

No	Output Component	Year and Percent (%)				
		2017	2018	2019	2020	2021
1	Household consumption	5.83	6.21	6.37	-1.20	0.88
2	LNPRT consumption	4.85	11.21	33.72	-1.67	1.66
3	Government consumption	2.23	7.40	11.78	0.70	-1.91
4	Fixed capital formation	9.76	4.84	8.22	8.74	2.91
	PDRB/ PDB	6.81	6.19	1.24	-10.87	1.36

Source: Maros Regency Central Bureau of Statistics (2022)

Table 2 shows that during the 2017-2021 period, the economic growth of Maros Regency tended to slow down, namely 6.81% in 2017, 6.19% in 2018, 1.24% in 2019, -10.87% in 2020, and 1.36% in 2022. Especially in 2020, it experienced a significant decline due to the COVID-

19 pandemic, resulting in a paralyzed economy that was quite influential for all regions in Indonesia, especially Maros Regency. However, it started to resolve in the following year (2021) due to the sloping COVID-19 pandemic, improving the economic growth of Maros Regency but not significantly.

Reporting from SINDO news showed the efforts made by the Maros Regency government in controlling the waste, namely the expansion of the landfill in Mandai District, which is currently unable to accommodate residents' waste production (Limonu et al., 2021). Although the existing landfill area is 10 hectares, it will not be able to accommodate waste production for at least the next two years. This means that the Maros Regency Government views waste as needing special attention, so various measures are being taken to address the waste problem in Maros adequately by involving the Sanitation and Environment Service and the community. Foggi & Beccarelloz (2021) argued that waste management capacity plays an important role in meeting circular economy goals, such as reducing municipal waste disposal by using landfills as a solution to reduce waste accumulation. It implies that the success of waste management necessitates concrete actions, considering multiple perspectives rather than focusing solely on one aspect. Adopting a holistic approach is crucial in implementing measures to reduce waste production without benefits.

Based on physical characteristics, the average household waste generation in Maros Regency is 276 m^3/day, with an average municipal waste generation transported to landfill amounting to 62 m^3/day. The landfill waste composition comprises 80.7% organic waste and 19.5% inorganic waste, with 0.5% representing other types of waste. Additionally, 3% constitutes inorganic waste, with a landfill waste density of 0.25 kg/ltr. The waste exhibits a moisture content of 76.92%, a volatile content of 18.325%, an ash content of 81.765%, and a calorific value of 859.825 Kcal/Kg. Furthermore, chemical characteristics include a carbon content of 1.105%, nitrogen content of 0.705%, phosphorus content of 902.645 ppm, and sulfur content of 0.145%. Based on these waste characteristics, composting, recycling, animal feed, and controlled landfilling emerge as viable alternatives for waste management at the Bontoramba landfill, while the combustion process is deemed inappropriate (Prayoga, 2014; Nur, 2021). Effective waste management aims to yield beneficial and economically valuable outputs, aligning with the goals of the circular economy to minimize waste disposal in landfills. Given their attributes, plastic plays a crucial role in advancing sustainability within the circular economy framework (Hahladakis et al., 2020).

Waste management performance can be analyzed using Nvivo 12 pro based on several data clusters obtained through Google Scholar and the Maros Regency government website. Figure 1 informs the implementation of waste bank management in Maros Regency.

(Source: Processed from Nvivo 12 Pro, 2022)

Figure 1. Waste Bank Management Performance in Maros Regency

Figure 1 shows that waste management in Maros Regency has been effectively executed, as depicted by the existing image data. Moreover, this initiative has influenced people's behaviours towards waste and facilitated the development of a circular economy. The active involvement of numerous stakeholders in managing waste banks in Maros Regency underscores the necessity to expand waste management education to other regions. This endeavour indirectly empowers all stakeholders, including regulators and waste sorting workers, contributing to a monthly turnover of tens of millions of rupiah.

Waste Bank Management Towards a Circular Economy

The circular economy paradigm in waste management necessitates significantly restructuring existing waste management systems and recovery methods, which may introduce new challenges, including heightened external costs for society. Factors such as insufficient community engagement in managing waste bank units and inadequate socialization regarding the existence of these units contribute to this issue. Therefore, long-term waste resource recovery endeavours can yield substantial returns by fostering increased investment in waste management infrastructure. This investment can transform waste management facilities into hubs for generating economic value from waste and promoting the development of waste-derived products, provided proper management practices are implemented.

Establishing a circular economy centred on a waste recycling model aims not only to prolong the utility of waste but also to serve as a platform for innovation and technological advancement (Nurani et al., 2020). This model aids customers and target groups in reducing waste, aiming to mitigate environmental degradation. It requires collective action, spanning individuals, households, communities, organizations, producers, and governments, to ensure the effective recycling of plastic waste and its pivotal role in environmental preservation, underscoring the dual objectives of maintaining economic viability and environmental integrity. The concept is to retain economic value and preserve the environment (Kasztelan, 2017).

Van Fan et al. (2020) highlighted the importance of an integrated waste management system design to support circular economy principles, advocating for practical decision support tools such as the P-graph framework for system planning. An integrated, computerized desktop-based information system for waste bank management can improve operations by providing comprehensive business management support (Soegoto et al., 2018). Such systems streamline waste bank operations, ensuring easy access to information on trash selling prices for all stakeholders involved. Thus, effective system design is imperative for enhancing and optimizing existing waste management frameworks. There are three ways to support a circular economy with a waste recycling system as a performance measure (Table 3).

Table 3. Pathways to a Circular Economy

No	Procedure	Explanation
1.	Reduce consumption	- The focus of the circular economy is to make better use of natural resources and not overconsume.
		- Consumption is rarely discussed, as selling as many products as possible is still the main principle of most business models.
		- Behaviour changes, campaigns, and political incentives are crucial in shifting behaviour in the right direction around fast food, plastics, food waste, and more.
2.	A better way to consume	- Choose products that are sustainably produced or recyclable.
		- Changing what you eat is like switching to a plant-based diet, which has many advantages over meat regarding emissions and other natural resources.

		-	Consumer pressure plays a significant role in pushing businesses to change how they do things and causing governments to take supportive measures.
3.	Creating systematic change	-	Since our economic system uses the take-make-waste method, consumers can't do much about it.
		-	The circular economy is based on the principle that products made from reusable components or materials should be made to last.
		-	It also requires enormous investment and recycling to thrive.

Source: Processed from Various Sources (2022)

Table 3 outlines strategies for implementing a circular economy through waste recycling, encompassing various facets such as consumption reduction, promoting sustainable behaviours, and systemic changes. The first approach involves reducing consumption, a central tenet of the circular economy, to optimize natural resource utilization. However, discussions surrounding consumption levels remain scarce, mainly due to the prevailing business model emphasizing maximal product sales. Encouraging behaviour change through campaigns and policy incentives, particularly regarding fast fashion, plastics, and food waste, is crucial in steering consumption habits in a sustainable direction. The second strategy entails adopting more sustainable consumption practices, such as opting for products produced sustainably or with recyclable materials. For instance, transitioning to a plant-based diet reduces emissions and minimizes the ecological footprint compared to conventional food choices. Consumers are pivotal in driving corporate and governmental action toward sustainable practices by exerting pressure and advocating for supportive policies. The third approach involves systemic changes to design a product-centric circular economy. Prioritizing durable components or reusable materials requires substantial investment in expanding infrastructure and recycling capabilities to ensure long-term success (Mayyas et al., 2019).

The realization of a circular economy can certainly generate great economic opportunities both now and in the long term (Somoza-Tornos et al., 2020). The transition to a circular economy presents significant economic opportunities in the present and future. As waste production continues to escalate alongside consumption growth, communities demonstrate an increasing capacity to sort and process waste, shifting perceptions from disdain to promise. To increase the understanding of the importance of utilizing waste banks to raise public environmental awareness, which is reflected in the desired role in developing waste management into a circular economy, of course, management and customers are knowledgeable, have concrete attitudes, and consistent behaviour (Putra et al., 2020;Van Fan et al., 2020). By fostering stakeholder collaboration and harnessing creativity, communities can achieve exemplary waste management performance, promoting economic prosperity. This collaborative effort should harmonize regulations, develop new business models, and enhance sustainability through integrated policy and practice solutions between economic blocks (Xavier et al., 2021).

In line with the existing conditions in the city, waste management is increasing because the waste problem is not only an environmental problem but also an economic and social one. Waste banks contribute to reducing recyclable waste up to 99.3 tons per day, or 6.7% of the total waste generation (Prayoga, 2014). However, ensuring the sustainability of waste banks requires their integration into municipal waste management systems and economic activities that support the circular economy. Adequate attention from the government regarding financing, infrastructure procurement, and human resource training is essential to this end (Satori et al., 2021). Supporting a circular economy necessitates collaborative efforts that leverage plastic waste as a driver of economic growth while curbing waste accumulation, fostering environmental preservation and enhancing economic value for communities.

Development of Waste Bank Management in Maros Regency

Waste management in Maros Regency necessitates ongoing efforts for enhancement and development, encompassing initiatives ranging from recycling waste into renewable energy sources and repurposing waste into economically valuable products to national campaigns aimed at reducing plastic consumption (Pasande et al., 2021). In this context, waste assumes a transformative role, shifting from discarded products to raw materials capable of bolstering socioeconomic dynamics. This potential is underpinned by the substantial volume of waste generated, with household waste alone accounting for 60% of national waste production. The community looks to the government for increased support in refining waste bank mechanisms and implementing a more equitable waste pricing model (Wulandari, Utomo, & Narmaditya, 2017). Governmental intervention is essential to instil awareness among the populace and encourage the utilization of household waste to generate economic value, thereby fostering community engagement in waste collection initiatives. While implementing waste collection bins has proven effective as a waste management strategy, certain challenges persist, including inadequate funding allocation for facility and infrastructure provision, logistical issues in waste transportation scheduling, and errors made by transportation personnel. Additionally, insufficient socialization efforts by city government authorities compound these challenges (Ridha et al., 2021).

This underscores the opportunity for waste bank development within the circular economy framework to create new value streams from reclaimed materials, transcending traditional waste management practices (Dhewanto et al., 2018). As elucidated by Romero & Romero (2018), these principles underscore the importance of design and production practices to eliminate the conventional notion of waste and repurposing resources from existing products as inputs for creating novel commodities.

The existence of waste banks can affect the behavioural and economic patterns of the community, so to achieve this goal, the business model of waste banks in Indonesia is analyzed by synthesizing secondary data related to waste bank strategies and impacts in Indonesia. Based on their business model, waste banks in Indonesia are classified into four groups: savings, health, community entrepreneurship, and energy (Dhewanto et al., 2018). It means that the development of waste banks for the circular economy has the opportunity to create new value streams from previous materials so that, in principle, the circular economy goes beyond traditional practices to improve waste management. These principles can emphasize design and production practices to eliminate the conventional concept of waste and reuse resources from products as raw material inputs to create new products (Romero & Romero, 2018).

Governmental strategies should prioritize affordability and tangible outcomes in waste management endeavours (Singh et al., 2014). Encouraging community participation in waste sorting activities is vital to curbing the influx of inorganic waste into landfills. It can inform predictions regarding potential waste reduction by establishing waste banks over the next decade (Kesauliyah et al., 2020).

Sustainable resource and waste management necessitates a systemic approach to addressing underlying issues. A critical aspect requiring attention is the development of comprehensive feedback mechanisms to illuminate the correlation between waste generation and consumption patterns (Singh et al., 2014). Governmental strategies should prioritize affordability and tangible outcomes in waste management endeavours. Encouraging community participation in waste sorting activities is vital to curbing the influx of inorganic waste into landfills. It can inform predictions regarding potential waste reduction by establishing waste banks over the next decade (Kesauliyah et al., 2020).

To minimize existing waste management, Purwendah & Wahyono (2021) argued that an effective waste management system encompasses several key aspects, including institutional

frameworks, financing mechanisms, and managing large volumes of waste, particularly in landfills. Therefore, establishing waste banks is a viable solution for the government and society to address the escalating waste generation. Community-based waste management, which hinges on active community participation, is an approach environmental managers should promote and implement to empower communities and enhance their access to environmental resources. Environmental considerations must be carefully integrated in the context of plastic waste management within a circular economy framework. Not all plastic waste is equally suitable for reuse, mainly when recycled plastic products are intended for food and beverage packaging. Such products must undergo rigorous testing and meet stringent safety standards (Balwada et al., 2021).

An optimization strategy for waste management involves adopting a waste-based recycling approach. By implementing sensors that monitor the fill levels of waste compartments in landfills, waste disposal from waste banks can be closely monitored over time (Pardini et al., 2020). This system facilitates accurate waste collection management and enhances service delivery to the community. Citizens can conveniently access information about public waste bins through mobile platforms or applications. This innovative approach is an early tangible example of smart waste container technology and application development. It fundamentally alters perceptions of waste and maximizes its potential as a valuable resource to support the community's economy.

The sustainability of waste management systems is a multifaceted concept that must be defined and addressed locally, with regions prioritizing solutions to their most pressing environmental challenges (Ikhlayel, 2018). Consequently, the performance evaluation of waste management agencies, such as related government agencies, should focus on waste management efficacy and consider the broader impact on community development (Morseletto, 2020). The Maros Regency Regional Government cannot shoulder effective waste management solely. Collaboration and concerted efforts involving various stakeholders are essential to achieve sustainable waste management practices and foster community well-being.

E. CONCLUSION

Waste management in Maros Regency, mainly through the Waste Bank program, has consistently improved economic outcomes. This progress is attributed to the active participation of the community in waste management activities. The engagement and contribution of various stakeholders in waste management development play a crucial role as participants and contributors to significant benefits that enhance governmental performance in waste management, consequently leading to improved cleanliness and waste control. The circular economy promotes sustainable production practices, mitigating environmental harm and enhancing environmental standards. Beyond its eco-friendly nature, the circular economy generates added economic value for communities, creates employment opportunities, fosters development, and serves as a crucial strategy in addressing ongoing climate change issues.

The concept of the circular economy aims to prolong the utility of waste management efforts, transforming waste into reusable materials or alternative raw materials for recycling into new products. This approach reduces production costs and yields products with high market value. While this article provides valuable insights, it acknowledges its imperfections, as waste remains a prevalent issue in almost every region and a global concern. The limitations researchers face, such as restricted access to data and inadequate information available through online media platforms, hinder a comprehensive analysis.

For future improvements in waste management, the Maros district government should consider implementing waste bank initiatives in every village and expanding the waste collection fleet. This will ensure proper waste management practices are adopted, preventing

indiscriminate disposal. Furthermore, efforts to broaden landfill capacities (TPA) should be prioritized to accommodate the growing waste volume.

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