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Characteristics of Sustainability Factors of Business Models in Community-Based Waste Management in Purwokerto City

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ABSTRACT

Objectives: *This study aims to analyze the sustainability of the community-based waste management (CBWM) business model in Purwokerto City, with a focus on aspects of funding sources and financing mechanisms.*
Methodology: *Through case studies, this study examines the sustainability of business models that can be applied in Purwokerto City. Data were collected through in-depth interviews with actors, direct observation, and documentation studies. Data analysis was carried out qualitatively to identify the sources of funding used, the financing mechanisms applied, and the factors that influence the sustainability of the business model.*
Finding: *The study results show that several factors, including the availability of sustainable funding sources, effective financing mechanisms, and support from the government and the community, influence the sustainability of the CBWM business model in Purwokerto City.*
Conclusion: *This study concludes that the CBWM business model has the potential to be a sustainable solution to overcome waste problems in Purwokerto City. However, further efforts are needed to improve the sustainability of this business model, such as diversifying funding sources, developing value-added recycled products, and increasing community capacity in managing waste.*

Keywords: *Waste Management; Business Model; Community-based Waste Management; Sustainability*

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INTRODUCTION

The waste problem has become an increasingly urgent global crisis. In Indonesia, the waste problem is also a serious challenge, especially in urban areas. Large cities with rapid population growth and increased economic activity face significant pressure in managing domestic and industrial waste. The culture that generates waste is reflected in it, and it has an impact on the environment and community health. Globally, people are throwing away more and *more* waste, and the composition is more complex, as *the* use of plastic and electronic items is increasing (Vergara & Tchobanoglous, 2012).

This crisis presents an opportunity to restructure and increase the strength of waste management systems if managed properly (Fan et al., 2021). Results Razzaq et al. (2021) show that substantial changes in economic growth rates and carbon emissions are the outcome of any policy intervention in waste recycling. These results give policymakers important information on how to manage recyclable waste to reduce carbon emissions while still producing substantial economic benefits.

The ecosystem is negatively impacted by the sharp rise in plastic production, particularly when it comes to micro and nanoplastics. The biological function of natural ecosystems is severely harmed by both kinds of plastic. Climate change and the Sustainable Development Goals (SDGs) are linked to plastic pollution (Kumar et al., 2021).

Uncontrolled piles of garbage not only pollute the environment but also threaten public health, as they become breeding grounds for various types of diseases. Flies, mosquitoes, and rats that live around landfills can be vectors of diseases such as dengue fever, malaria, and leptospirosis. In addition, dust particles carried by the wind from the landfill can cause various respiratory problems. Furthermore, methane gas produced from the process of decaying waste can contribute to global warming.

Plastic waste, for example, is a major concern because of its difficult-to-decompose nature and has a bad impact on the environmental ecosystems. The development of new and sustainable technologies for recycling mixed plastics and other forms of complex plastics needs to be intensified (Sharma et al., 2020). Mechanical recycling can be likened to chemical recycling since its effectiveness and quality have a big impact on performance. Furthermore, sensitivity analysis showed that the quality and makeup of garbage determine how chemical and mechanical recycling affects climate change (Jeswani et al., 2021).

In the collaborative waste management concept, addressing home trash issues successfully collaboratively requires community-level leadership (Ngambut et al., 2022). The fundamental idea is that every person can help minimize waste, increase productivity, end the production cycle, and maximize the economic worth of materials and goods retained (Morseletto, 2020). Consumer awareness of plastic waste is still low, despite their understanding of its dangers. However, after green marketing was implemented, which educated consumers about the risks of plastic waste and the limited use of plastic, the behaviour of avoiding plastic products gradually started to increase (Ramli et al., 2020).

To address the issue of excessive trash production, a waste management model is essential (Drahansky et al., 2016). A management team, treatment plan, technology, funding, use, and cooperation are all part of the waste management concept. It has been demonstrated that waste management strategies, including several stakeholders and inclusive community involvement, lower poverty and stunting (Rahmawati et al., 2023). Thus, management can assess the level of resources required for the waste management system (Tirkolaee et al., 2021)

Ineffective waste management has serious consequences not only for the environment, which can cause various negative impacts, ranging from environmental pollution to public health problems. Waste piles in landfills that are not properly managed can cause soil, water,

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and air pollution. Liquid waste from landfills can seep into the soil and pollute groundwater sources, threatening the availability of clean water.

The results of previous research found that the implementation of management in general has not gone well. This is because there are still obstacles in terms of communication, resources, and commitment. Communication has not been carried out properly, and some people still do not know about waste management programs. Likewise, the availability of human resources in quantity is still lacking. Facilities and infrastructure or facilities are also not available properly to support the implementation of the universal waste program, and well is a lack of transparency of implementing actors in managing the available funds (Nurhastuti, Syahrani, & Paselle, 2019).

Various waste management efforts have been made to overcome waste problems, one of which is by actively involving the community. The community as a waste producer has a very important role in waste management efforts. CBWM is considered more effective because it involves direct participation from the waste producers themselves. Actively involving the community is expected to increase awareness of *the* importance of protecting the environment and reducing waste production. Community participation can be done through various ways, such as sorting waste from sources, making compost, and recycling.

Metals, plastics, chemicals, paper, wood, textiles, stones, food, ceramics, glass, candles, and cooking oil are among the waste materials generated by the community. Additionally, this leads to waste-related concerns like sickness, health catastrophes, contamination of the environment, CO2 emissions, and the extinction of marine life. Recycling, waste separation, sorting, reuse, and composting are a few examples of waste management techniques that can be implemented (Derhab & Elkhwesky, 2023).

A CBWM business model has emerged as an alternative solution. This business model is expected to provide added economic value while maintaining environmental sustainability. A community-based approach can also strengthen people's sense of ownership and responsibility for the environment. When people are directly involved in waste management, they will be more concerned about the surrounding environment and motivated to maintain cleanliness.

The city *of* Purwokerto was chosen as the unit of analysis because it has shown significant efforts in involving the community in waste management. Initially, the Regional Government had experienced the problems that Yogyakarta and Bandung are now facing, namely the accumulation of waste due to the closure of the landfill (Hamid, 2023). The difference is, in Purwokerto, the closure of the landfill facility is not a matter of capacity, but because of the protest of residents. They protested to block the dump truck route that carried hundreds of tons of waste to the landfill. Residents' protests finally expanded because there was a buildup in all Temporary Disposal Sites (*Tempat Pembuangan Sementara*/TPS). This study focuses on analyzing the characteristics of factors that support the sustainability of CBWM business models in Purwokerto City. The results of this research are expected to contribute to the development of a more sustainable CBWM business model. In addition, this research is also expected to be a reference for local governments, non-governmental organizations, and other related parties in designing and implementing effective waste management programs.

LITERATURE REVIEW

The waste problem is a very important issue that is increasingly complex and urgent to be overcome immediately. Rapid population growth, industrialization, and unsustainable consumption patterns have led to a significant increase in waste production. This has an impact

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on the environment, public health, and the economy. This makes effective and sustainable waste management one of the top priorities in sustainable development. This refers to the Regulation of the Minister of Public Works of the Republic of Indonesia Number 03/PRT/M/2013, concerning the Implementation of Waste Infrastructure and Facilities in the Handling of Household and Similar Waste.

Refer to Lenkiewicz (2016) collection, transportation, maintenance, and disposal of waste are all included in waste management, which also includes waste management rules and monitoring. Achieving several goals, particularly sustainable development, requires sustainable waste management. One way that the 12th SDGs have been implemented is through sustainable waste management, which is a kind of accountability for production and consumption.

In Indonesia, waste management is still a big challenge. Many regions, including big cities, still have difficulties in managing waste optimally. So far, waste management is often considered the responsibility of the government. However, this top-down approach is less effective in overcoming the waste problem as a whole. One interesting alternative to overcome the waste problem is to apply a community-based approach. By involving the community directly, it is hoped that it can increase public awareness of *the* importance of good waste management and reduce the burden on the government.

The waste management strategy known as CBWM is focused on the requirements and desires of the community and is planned, carried out (if practical), monitored, and assessed by the community (Ismail, 2019). As a whole, the CBWM business strategy is focused on initiatives to decrease the buildup of plastic trash by converting it into valuable products. Numerous sub-programs within the program have generated derivative activities that have been shown to significantly improve people's lives.

Previous research related to CBWM has been carried out extensively. Several studies show that community participation in waste management can increase effectiveness and efficiency in reducing waste volume (Wahyono et al., 2016). In addition, research also shows that several factors, such as government support, community involvement, and the existence of an adequate incentive system, influence the success of CBWM (Pratama, 2020). CBWM involves the active participation of the community in the process of reducing, collecting, and processing waste. This approach is expected to increase public awareness of the importance of protecting the environment and reducing the burden on the government in waste management.

Rahmawati et al. (2023) assert that one of the most important elements in solving waste issues is community involvement in waste management. Waste management in villages should be focused on producing value-added waste that will boost the local economy and the standard of living for residents, for instance. Additionally, through a system of community participation, analysis, and discussion, public policy promotes legislation on segregation measures and the upgrading of the informal hygiene sector to the official sector (Drahansky et al., 2016).

To sustainably accomplish global development goals, scaling up global efforts to manage plastic waste must take into account plastic pollution as a multifaceted issue, including evaluating the financial and social costs of implementing (or not implementing) mitigation strategies as well as the impact of mitigation strategies on the economy, social justice, health, and environment (Borrelle et al., 2020).

Creating value for customers is essential for organizations considering changes in current business models to fit environmental sustainability criteria (Plekhanov et al., 2023). Cultural paradigms must alter for innovation to occur in all areas, and for government agencies, corporate strategies, educational institutions (which determine the supply of new goods and services), and society as a whole to move to a circular urban economy (Gravagnuolo et al., 2019). Go green is a movement to preserve the environment (Purnomowati & Asrihapsari,

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2021). Consumers must better understand the advantages of green marketing for environmental sustainability (Genoveva & Samukti, 2020). Product innovation and green marketing knowledge have a positive impact on consumers' intentions to purchase products.

(Rasmen Adi et al., 2022).

Environmental, social, cultural, and economic factors influence the choice of technology and regulations for waste management (Vergara & Tchobanoglous, 2012), so no one solution is suitable for all regions. In the context of CBWM, Sukunan village in Yogyakarta, Indonesia, is currently encouraging trash reduction at its source by organizing local communities for garbage recycling and separation (both organic and non-organic). Currently, Sukunan village (Yogyakarta, Indonesia) promotes waste reduction at its source in the context of CBWM by mobilizing local communities for waste separation and waste recycling. This results in the annual avoidance of about 0.2 million Mt of CO2-eq emissions from nearby landfills. Village communities' economic gains from recycling initiatives also lead to a 30% decrease in garbage generation. This CBWM program prolongs the life of nearby landfills while also saving the government money for garbage collection, transportation, and disposal (Kurniawan et al., 2021).

In CBWM, waste banks are widely recognized and being utilized more and more, both as a tool to improve the environment and as a means to increase public awareness of the environment through education (Yandri et al., 2023). CBWM has evolved and produced various management patterns. The concern and awareness of the community in managing waste proves that the community has local knowledge and culture that support environmental protection (Pamuji et al., 2023). TPS3R (*Tempat Pengolahan Sampah* Reduce, Reuse, and Recycle/Waste Treatment Plants 3R) is CBWM, which is pertinent to Babakan, uses the reduction, reuse, and recycling strategies to achieve zero waste (Nurpagi et al., 2022), and it is one potential municipal waste management tactic to lower waste levels (Cahyonugroho et al., 2024).

Sustainability transformation can change revenue streams and cost structures (Palmié et al., 2024). Context-based relationality, community-based governance, education, language, health, and quality of life, and the collective understanding of the environment as a source of life are some of the fundamental components of the concept of sustainability (Virtanen et al., 2020). Each member strictly follows the rules and regulations of society that guide their actions towards a shared vision for socio-cultural and economic sustainability (Suriyankietkaew et al., 2022).

Previous research has placed more emphasis on the technical aspects of waste management by the government, while the role and dynamics of local communities in maintaining the sustainability of the program have rarely been studied. There is still a gap between government-based waste management policies and community-based implementations that emphasize citizen participation and empowerment. There has not been much research that integrates social, economic, and environmental dimensions simultaneously in a community-based waste management model.

The state of the art of this research is that there are no research results that reveal the results of the implementation of CBWM in Purwokerto City, thus providing new insights into waste management in other areas. The novelty of this research lies in the development of a community participation model based on social capital and technology in waste management, which has not been widely studied in Indonesia. The research paradigm can be depicted in Figure 1.

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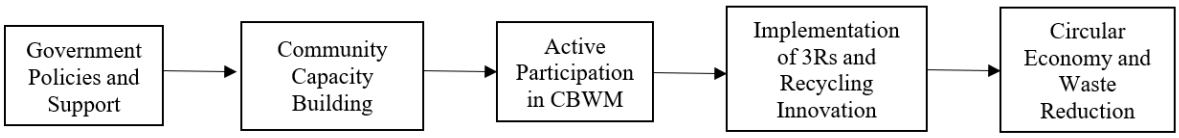
Figure 1 Research Paradigm



METHOD

This study will be limited to the analysis of the sustainability of the CBWM business model that has been running in Purwokerto City. The focus of the study will be directed at factors that have influenced the sustainability of the CBWM business model. Primary data was obtained through interviews with relevant stakeholders. In-depth and structured interviews were conducted with community-based waste managers, namely TPST (*Tempat Pengolahan Sampah Terpadu*/Integrated Waste Treatment Site*)* Kedungrandu dan TPA BLE (*Tempat Pengolahan Akhir Berbasis Lingkungan dan Edukasi/*Environment and Educational Based Final Processing Waste), to explore the perception, role, participation, and constraints of the community in waste management. Direct observation at the waste management location, waste processing site, and other relevant locations to see the actual conditions.

Secondary Data is obtained from literature, documents, and related reports, including statistical data related to population, waste generation, waste composition, and other relevant data from related institutions. In addition, documents related to waste management policies, previous research reports, and applicable laws and regulations are provided. The validity and reliability test of the data was carried out by triangulating the source, method, time, researcher, and theory. This study's methodology combines case studies with a qualitative approach. Several community organizations in Purwokerto City that have adopted a CBWM business model were the subject of case studies. Analyzing the viability of the CBWM business model in Purwokerto City was the aim of the study.

Atlas.Ti was used to perform descriptive data analysis (Afriansyah, 2016), which is one of the popular software used to analyze qualitative data. This software is very helpful in managing, coding, and analyzing text, image, audio, and video data generated from various qualitative data collection methods such as interviews, observations, and documents. Atlas.Ti provides the possibility to create networks between different codes so that more complex relationships and patterns of data can be seen. The results of data analysis are carried out to identify the sources of funding used, the financing mechanisms applied, and the factors that influence the sustainability of the business model (Warsono et al., 2022).

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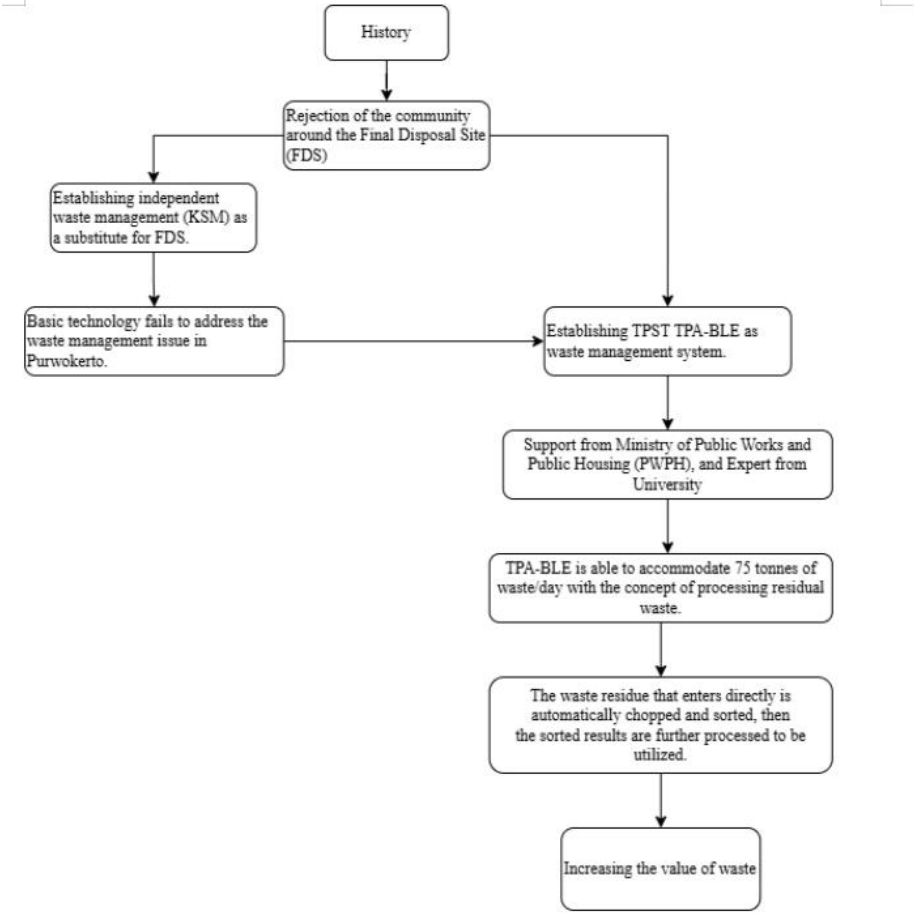
RESULTS AND DISCUSSION

Environmental sustainability is currently a crucial topic of discussion, even in business relationships. This relates to institutional efforts to develop and encourage the use of environmentally friendly innovation techniques to improve performance while positively impacting the environment (Suprapti et al., 2025).

The results of the analysis show that several factors, including the availability of sustainable funding sources, effective financing mechanisms, and support from the government and the community, influence the sustainability of CBWM's business model in Purwokerto City. This study concludes that the CBWM business model has the potential to be a sustainable solution to overcoming waste problems in Purwokerto City.

One of the cities in Central Java, Purwokerto, likewise has difficult waste management issues. The City of Purwokerto has taken several steps to address this issue, including closing the TPA (*Tempat Pembuangan Akhir/Final Disposal Site*), as seen in Figure 2, and the construction of the TPH (*Tempat Pengolahan Hasil*/Product Management Site). However, the sustainability of these efforts still needs to be improved. However, further efforts are needed to improve *the* sustainability of this business model, such as diversifying funding sources, developing value-added recycled products, and increasing community capacity in managing waste.

Figure 2 Overview of the Waste Management Process in Purwokerto City



Source: Results from Atlas.Ti

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Initial condition: The closure of the TPA in 2018 became the starting point for the change in the waste management system. It was explained that previously, in 2018, Purwokerto City relied on the TPA as the main solution in waste management.

Public rejection of landfills: This demonstrates that people are aware of the harm that landfills cause to the environment and human health. Due to the increasingly limited capacity of landfills and public rejection of the existence of landfills, local governments are encouraged to seek better alternatives.

Process: The transition process from landfills to TPH includes several stages, starting from waste selection, waste processing, to utilization of processed products. The diagram above visually illustrates the stages that are passed through in the process.

The existence of TPH: This is a solution offered to replace landfills, namely by processing waste into valuable products. The processing process at TPH aims to increase the economic value of waste. However, it turns out that waste selection at TPH is still not optimal. Therefore, TPH was closed in early 2024. This indicates a change or further development in the waste management system. A TPST and TPA BLE system is needed.

Government Efforts: In response to the problem of overcapacity of the landfill and rejection by the community, the Purwokerto City Government has made various efforts to improve the waste management system. One of the efforts made is to close the landfill. Therefore, the Regional Government decided to immediately build a TPST.

Support from Various Parties: In addition to the Regional Government, the success of this waste management program is also inseparable from the support of various parties. The central government, through the Ministry of Public Works and Public Housing (*Pekerjaan Umum dan Perumahan Rakyat/*PUPR), provides technological support to improve efficiency and accuracy in sorting waste. The Ministry of PUPR assists in the form of waste sorting machines and financial assistance for the development of TPST. In addition, there is other support such as assistance from academics and Community Self-Help Groups (*Kelompok Swadaya Masyarakat*/KSM). This result is in line with Pratama's (2020) research that government support, community involvement, and the existence of an adequate incentive system contribute to CBWM.

Results achieved: Thanks to the joint efforts of stakeholders, the Purwokerto City Government has achieved several successes, such as reducing the volume of waste disposed of at the landfill, increasing the economic value of waste, and improving environmental quality. The Purwokerto City TPST is now a pilot project for a CBWM business model for other regions.

Purwokerto City has successfully developed an integrated waste management program after the closure of the TPA in 2018. By adopting a hierarchical approach to waste management, the Regional Government seeks to reduce dependence on TPA and increase the added value of waste. Figure 2 illustrates the stages in the waste management process, from waste sorting to utilization of processed products. It is anticipated that this study will aid in the creation of more sustainable waste management policies in other areas. Research by Purnomowati & Asrihapsari (2021) has shown that realizing a green city in Solo requires collaborative action between the government and the community for the program to be effective. Eco-friendly businesses can be chosen to encourage voluntary community participation and provide both environmental and economic benefits. Although the government has established top-down plans for realizing a green city, bottom-up initiatives from the community are preferred.

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Discussion

The flow chart in Figure 2 shows the factor characteristics of the CBWM process, which includes several stages. Beginning with the waste collecting procedure, sorting, and processing, to marketing recycled products to increase their economic value. This is in line with the waste management strategy put forward by Derhab & Elkhwesky (2023), including recycling, separation, sorting, reuse, and composting of waste.

Each stage always involves community participation (Mahlil et al., 2021). Furthermore, the figure illustrates how different stakeholders, including municipal governments, non-governmental organizations, and the community, are involved in the waste management process. The stakeholders' participation in the creation of a sustainable waste management business model is the element that contributes to Purwokerto City's waste management success. This demonstrates how academics, local governments, and federal governments work together to find CBWM solutions (Cupian et al., 2019).

With significant changes in waste management from the conventional landfill system, Purwokerto City has successfully switched to a CBWM system with a focus on processing. Tangible positive impacts on sustainability include wastewater management initiatives to lessen adverse environmental effects (Prasanti & Yudhastuti, 2023).

The form of CBWM in Purwokerto City consists of three levels, namely the community, which contributes to waste contributions to TPST, and the separation of organic and inorganic waste. In the middle, there is a TPST managed by a KSM, sorting waste into inorganic and organic categories and processing it with the support of technology into value-added products. At the downstream level is the TPA BLE, which processes waste residues from the landfill. CBWM has evolved and produced one potential waste management strategy to lower the amount of waste using different management patterns (Cahyonugroho et al., 2024). These results are in line with research by Yandri et al. (2023) that CBWM may be used to raise public understanding of the value of waste management through education. The community has local knowledge and culture that support environmental protection (Pamuji et al., 2023) and implements reduce, reuse, and recycle towards zero waste (Nurpagi et al., 2022).

Intensification of the application of technology and sustainability to recycle waste, as stated by Sharma et al.(2020) applied in Purwokerto City towards zero waste with the establishment of TPST and *TPA* BLE with investment from the Ministry of PUPR and the local government. Waste reduction at the source in the framework of CBWM is implemented by involving the community in waste separation and recycling (Kurniawan et al., 2021). Involve the community to participate in the movement to preserve the environment actively (Purnomowati & Asrihapsari, 2021) and increase knowledge of the advantages of green marketing (Genoveva & Samukti, 2020) and product innovation (Rasmen Adi et al., 2022).

Waste processing at TPST and TPA BLE produces compost, paving blocks, and plastic tiles as well as RDF (Refused Derived Fuel) as a synthetic fuel, as a processing product that can contribute to income, and as an effort to transform sustainability (Palmié et al., 2024). Community-based governance, health and quality of life, and an understanding of the value of preserving the environment as a source of life are some of the fundamental aspects of sustainability that are at play (Virtanen et al., 2020). The human resources involved in the management of TPST and TPA BLE are scavengers who previously did not have a fixed income but are used to working with waste. Each member is required to commit to a common vision for socio-cultural and economic sustainability (Suriyankietkaew et al., 2022). Further efforts to improve the sustainability of business models are still needed, for example, diversification of

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funding sources, development of value-added recycled products, and increasing community capacity in managing waste.

CONCLUSION

This study has successfully identified the characteristics of sustainability factors of community-based waste management business models in Purwokerto City. The study results indicate that the availability of sustainable funding sources, effective financing mechanisms, and support from the government and the community greatly influence the sustainability of this business model. The CBWM business model has great potential to be a sustainable solution in overcoming waste problems in Purwokerto City, considering the limited land for TPA and the growing understanding among the general population of the significance of waste management.

However, this study also revealed several challenges that still need to be overcome to improve the sustainability of this business model. Among them are wider diversification of funding sources, development of recycled products with high added value, and increasing the capacity of communities to manage waste independently. To encourage the development of this business model, the government, business players, and the community must also work together more effectively.

As a recommendation, further research can be conducted to explore the potential for developing high-value-added recycled products, as well as evaluating the social and environmental impacts of implementing a CBWM business model. In addition, it is necessary to conduct a longitudinal study to observe the long-term sustainability factors of the CBWM program and its influence on behavioral changes and community welfare. Green innovation will be a crucial variable in future business management. Therefore, this mindset needs to be developed to open new markets and create long-term social and economic impact. Thus, it is hoped that a more comprehensive understanding of the sustainability of this business model can be obtained and can be used as a basis for developing better waste management policies in the future.

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