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# Strategic SWOT Analysis of Municipal Solid Waste Management and Waste Bank System in Bandung City: Toward a Circular and Sustainable Urban Future

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ABSTRACT

Bandung City faces escalating municipal solid waste challenges driven by rapid urban growth, consumption patterns, and limited treatment capacity. In response, waste banks (bank sampah) have emerged as community-based initiatives that promote recycling and waste segregation; however, their performance varies widely across districts due to institutional, financial, and technological constraints. This study aims to evaluate the strategic role of waste banks within Bandung's municipal solid waste management system through a structured SWOT analysis. A descriptive qualitative approach was applied, utilizing secondary data from journal articles, government reports, and credible news sources published between 2015 and 2025. Findings reveal strong community participation, environmental awareness, and institutional support as core strengths, while weaknesses include inadequate infrastructure, inconsistent funding, and the absence of digital monitoring systems. Opportunities are found in circular economy policies, CSR-based partnerships, and technological innovations for data management. External threats include fluctuating recyclable prices, landfill capacity limitations, and policy instability. Based on these insights, strategic recommendations were formulated, including the integration of waste banks into formal municipal planning, digital platform adoption, standardized operating procedures, and cross-sector collaboration. The study concludes that waste banks hold significant potential to support Bandung's transition toward a circular and sustainable urban waste-management model, provided that institutional strengthening and technological innovation are prioritized. This research serves as a practical reference for policymakers, academics, and community stakeholders in addressing urban waste challenges.

Keywords: Waste Bank, SWOT Analysis, Circular Economy, Urban Sustainability

## INTRODUCTION

Rapid urbanization and consumption growth have intensified municipal solid waste challenges worldwide, with global waste generation projected to nearly double by 2050 if current trends persist. In developing-country cities, limited infrastructure and financing often mean that collection, treatment, and final disposal lag far behind the pace of waste generation, exacerbating environmental and public-health risks (Todaro et al.,

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2025; UNEP, 2024). Bandung, the capital of West Java, exemplifies these dynamics as a fast-growing metropolitan area whose economic vibrancy and demographic expansion are accompanied by mounting waste pressures. As a UNESCO City of Design with more than 2.5 million inhabitants and high population density, Bandung must reconcile its creative, service-oriented economy with sustainable urban environmental management. This article situates Bandung's waste crisis within the broader literature on municipal solid waste management (MSWM) in rapidly urbanizing regions, arguing that a structured SWOT analysis can reveal strategic pathways toward more resilient and circular systems.

Within Bandung, municipal solid waste generation is estimated at roughly 1,500–1,600 tons per day, with organic waste constituting the largest fraction of the waste stream (Marešová et al., 2023; Mulianingsih, 2019). Yet only around 60–63% of this waste is reported as formally collected or handled, leaving a substantial residual fraction that is either mismanaged, openly dumped, or leaked into waterways and informal spaces (Pebester et al., 2024). Previous studies of Bandung's MSWM have highlighted persistent gaps in collection coverage, segregation at source, and downstream treatment capacity, especially at the neighborhood level (Farras et al., 2022; Muliawaty, 2020). These structural weaknesses, combined with limited landfill capacity and uneven public participation, underscore the need for an integrated strategic assessment that goes beyond technical fixes to consider institutional, social, and economic dimensions of waste governance in the city.

Scholars have long examined Bandung as a laboratory for urban waste management, exploring integrated resource recovery, institutional arrangements, and regional cooperation for landfill use. Early work on urban solid waste management in Bandung emphasized the potential of resource-recovery systems and community-based initiatives to reduce the burden on final disposal site (Poerbo, 1991). More recent research has evaluated the implementation of MSWM policies and infrastructure, concluding that Bandung's system remains sub-optimal due to inadequate facilities, human resources, and coordination among stakeholders (Derakhshan et al., 2019; Muñoz-Torres et al., 2025). Case studies focusing on specific facilities and programs such as TPS 3R schemes and neighborhood-scale waste reduction efforts provide important insights, but they often analyze isolated components rather than the citywide configuration of strengths, weaknesses, opportunities, and threats (Gurel, 2017; Puyt et al., 2023).

In parallel, a growing body of Indonesian research has used SWOT analysis to evaluate particular waste-management interventions in and around Bandung, including bank-sampah initiatives and 3R (reduce–reuse–recycle) facilities. For instance, studies on the Bank Sampah Induk in Sadang Serang and 3R sites in the Greater Bandung region have identified both the potential of community-based recycling and the constraints posed by institutional support, market access, and public awareness (Dwicahyani et al., 2022; Putra & Ismaniar, 2020). Another line of research from Bandung-based universities has applied SWOT to municipal waste systems in nearby districts, showing how technology, stakeholder collaboration, and policy frameworks interact to shape performance (Srivastava et al., 2005). However, these works tend to be sectoral or facility-specific, leaving room for a comprehensive SWOT that treats Bandung's MSWM as an integrated socio-technical system embedded in wider regional and national dynamics (Longsheng et al., 2022; Zhang et al., 2024).

The urgency of a renewed strategic assessment is underscored by recent waste crises in Bandung during 2025. As reported in national media, by February 2025 the city

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recorded around 136 waste accumulation points, leaving more than 400 tons of garbage temporarily unattended in streets and public spaces during peak disruptions (Farhan & Nurhayati, 2025). Provincial and municipal authorities have repeatedly declared "waste emergency" situations as quotas for disposing Bandung Raya's waste at the regional Sarimukti landfill were tightened, constraining the city's ability to transfer refuse out of urban neighborhoods (Rani, 2025b; Simorangkir, 2025). These conditions have led to visible piles of garbage in residential and commercial areas, prompting the Bandung City Government and West Java Province to announce accelerated response measures to clear accumulated waste (Fahmi, 2025; Rani, 2025a).

Recent news also reveals how seasonal consumption patterns and operational constraints interact to intensify Bandung's waste challenges. During Ramadan and Eid al-Fitr, the volume of waste in Greater Bandung has been reported to rise by around 40%, driven by increased shopping and food consumption that generate more plastic and organic waste. At the same time, restrictions on landfill capacity and temporary disruptions at Sarimukti have limited the ability of municipal services to absorb these surges, contributing to recurrent backlogs. Such episodes highlight systemic vulnerabilities that cannot be solved merely by extending collection hours or adding trucks; instead, they call for strategic, citywide rethinking of waste reduction, segregation, treatment, and disposal pathways under conditions of uncertainty and growth.

From an environmental and public-health perspective, the costs of inaction are considerable (Jaime et al., 2023; Robinson et al., 2019). Reviews of solid-waste management in developing countries consistently show that open dumping and uncontrolled burning of waste lead to air, water, and soil pollution, heighten disease burdens, and exacerbate climate-related risks. In dense urban environments like Bandung, mismanaged waste is closely linked to clogged drainage channels, increased flood risk, and exposure to pathogens and toxic emissions, particularly in low-income neighborhoods. These environmental-health impacts align with global assessments that call for rapid improvement of MSWM to meet the UN Sustainable Development Goals and to avoid sharp increases in the economic costs of pollution, poor health, and climate change associated with improper waste disposal (Chen et al., 2024).

At the same time, Bandung's situation also presents important opportunities. The city's large student population, active civil society, and growing culture of environmental literacy create fertile ground for innovation in waste reduction, recycling, and circular economy initiatives. Recent research has documented community participation in sanitation and waste programs, as well as efforts to streamline household waste flows using lean-process approaches and better coordination among actors along the collection chain. Technological experiments such as smart trash bins equipped with Internet-of-Things (IoT) sensors and mobile applications for real-time monitoring signal emerging strengths in Bandung's capacity to integrate digital solutions into urban environmental management. Harnessing these assets while addressing persistent weaknesses in infrastructure, finance, and governance is central to the city's transition from crisis response toward long-term sustainability.

Against this backdrop, the present article adopts SWOT analysis as its primary analytical lens to systematically map Bandung's waste-management landscape. Building on city-level data, policy documents, and recent empirical studies, the analysis identifies internal strengths and weaknesses within Bandung's MSWM system such as existing

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collection networks, institutional arrangements, and technological pilots while also characterizing external opportunities and threats stemming from regulatory changes, market dynamics, and environmental pressures. By explicitly linking the 2025 waste emergencies and ongoing innovations to broader structural factors, the article aims to produce an integrated strategic picture that can inform both municipal decision-makers and community stakeholders. In doing so, it responds to the gap in the literature for a holistic, citywide SWOT assessment of Bandung's MSWM, rather than fragmented evaluations of individual projects or facilities.

Taken together, the literature and 2025 news synthesized above demonstrate that Bandung's waste-management system is characterized by a complex mix of entrenched weaknesses, emerging strengths, acute threats, and promising opportunities. On one hand, recurrent waste emergencies, landfill constraints, and seasonal surges in waste generation reveal structural vulnerabilities and the limits of business-as-usual approaches. On the other hand, the mobilization of additional cleaning crews, experimentation with IoT-based monitoring, and growing public awareness of environmental issues suggest that Bandung possesses important assets that can be leveraged for transformative change.The subsequent sections of this article therefore employ SWOT analysis to systematically classify these internal and external factors and to propose strategic options that can guide policymakers, practitioners, and community actors toward a more sustainable and resilient waste-management future for Bandung.

## METHODOLOGY

This study employs a descriptive qualitative design using a SWOT framework to analyze Bandung's municipal solid waste management system based solely on secondary data. The research does not involve interviews, surveys, or other forms of primary data collection; instead, it synthesizes existing evidence from peer-reviewed journals, government regulations, municipal technical reports, and credible news portals. SWOT is used to structure information on internal strengths and weaknesses (e.g., collection coverage, institutional arrangements, technology) and external opportunities and threats (e.g., policy shifts, market incentives, environmental risks) in line with previous applications of SWOT in municipal waste management and urban environmental planning (Verma et al., 2016).

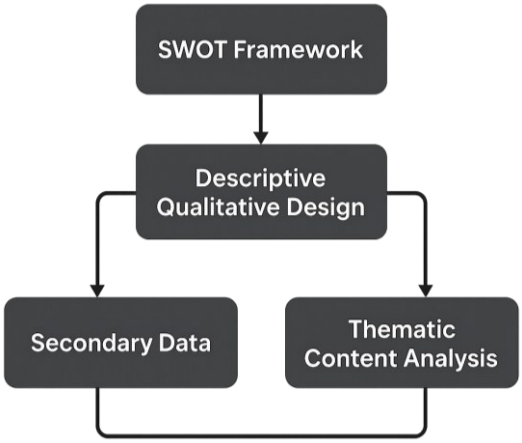


Figure 1. Research Methodology Flowchart
Source: Author, 2025

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Secondary data are compiled from studies on Indonesia's municipal solid waste management, national policy documents, and case studies focusing on West Java and Bandung's disposal infrastructure. Priority is given to recent work that discusses Indonesian waste governance and treatment options, including landfill-based systems, waste reduction strategies, and food-waste management scenarios, as well as analyses of Sarimukti and other landfills serving Greater Bandung. Documents are selected if they report quantitative indicators (e.g., waste generation, composition, and treatment capacity) or qualitative descriptions (e.g., institutional challenges, regulatory gaps, and community practices) relevant to Bandung's waste system, and if they were published mainly between 2015 and 2025 to capture recent dynamics. All information is extracted into structured evidence tables to facilitate transparent comparison across sources.

The analytical procedure begins with thematic content analysis of the evidence tables to identify recurring issues related to performance, constraints, and innovation potential in Bandung's waste-management chain. These themes are then classified as internal factors (strengths and weaknesses) or external factors (opportunities and threats) through iterative reading and cross-checking between Indonesian and international case studies that also use SWOT to guide strategic recommendations in waste and environmental management. Simple comparisons between reported waste loads, treatment capacities, and policy targets are used to substantiate qualitative judgments, but no numerical weighting scheme is applied; instead, emphasis is placed on interpretive synthesis that highlights feasible strategic options for local government and community actors.

## RESULTS AND DISCUSSION

### 1. General Overview of Waste Banks in Bandung City

Waste banks (bank sampah) in Bandung City represent a grassroots movement aiming to reduce waste through community-based recycling and economic incentives. They collect sorted materials such as plastic, metal, paper, and cardboard which are then exchanged for savings or monetary value. This model reflects an emerging circular economy approach, encouraging residents to perceive waste as a resource rather than a burden. As of 2025, the number of waste banks has significantly increased, particularly in densely populated areas.

Table 1. Waste Bank Points in Bandung City (2025)

| No | District (Kecamatan) | Waste Bank Name | Status | Estimated Daily Collection (kg) |
|---|---|---|---|---|
| 1 | Cicendo | Bank Sampah Cempaka | Active | 120 |
| 2 | Sukajadi | Bank Sampah Harapan Baru | Active | 95 |
| 3 | Cibiru | Bank Sampah Melati | Semi-active | 60 |
| 4 | Coblong | Bank Sampah Bersih Kota | Active | 150 |
| 5 | Buahbatu | Bank Sampah Mandiri | Active | 110 |

Source: Author, 2025

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These waste banks vary considerably in terms of institutional capacity, participation rates, and operational efficiency. Districts like Cicendo, Coblong, Sukajadi, and Buahbatu demonstrate relatively stable operations supported by local communities and structured management. However, certain waste banks remain "semi-active" due to limited funding, volunteer turnover, and the absence of standardized procedures. These differences indicate disparities in access to infrastructure, government support, and market linkages. Beyond waste collection, many waste banks function as centers for environmental education and social mobilization. They introduce the 3R principles (Reduce, Reuse, Recycle) and encourage household-level segregation practices. Some initiatives collaborate with schools, community groups, and religious institutions to build long-term behavioral change. However, systematic monitoring and inter-district collaboration are still lacking, making it challenging to evaluate overall citywide performance.

Technological integration and data monitoring are also major challenges. Most waste banks still rely on manual recording methods, which limit their ability to track waste reduction accurately. Without digital systems, it is difficult to coordinate activities, manage finances, or assess the real contribution of waste banks to Bandung's waste-reduction targets. These challenges reduce efficiency and hinder strategic policymaking. Overall, waste banks possess strong potential to support Bandung's waste-management goals but require institutional strengthening, formal integration into municipal plans, and consistent capacity-building programs. With improved coordination, infrastructure support, and digital innovation, they could become a key pillar of Bandung's circular economy strategy.

2. SWOT Analysis of Waste Bank System in Bandung City

The SWOT analysis is applied to comprehensively evaluate the internal and external conditions influencing the effectiveness of waste banks in Bandung City. This analytical approach helps identify key strengths and weaknesses within the operational system while simultaneously recognizing potential opportunities and external threats that may affect long-term sustainability. By systematically categorizing these factors, decision-makers can formulate strategic interventions for institutional strengthening, community engagement, infrastructure improvement, and digital innovation. The SWOT framework is therefore essential not only for mapping current conditions but also for generating strategic directions that support Bandung's transition toward a circular economy and decentralized waste-management model.

a. Strengths (S); Waste banks in Bandung City possess strong community support, with increasing local participation in districts such as Coblong, Sukajadi, and Cicendo. The presence of active waste banks indicates growing environmental awareness, particularly driven by educational campaigns, school-based programs, and youth involvement. Additionally, waste banks function as decentralized points for waste segregation and recycling, helping to reduce the workload of municipal solid waste collection systems. Some well-managed waste banks also demonstrate the potential to become local micro-enterprises that generate household income through recyclable sales. Bandung's environmental agencies have shown support through pilot projects and training initiatives, reflecting the existence of institutional entry points for further integration. These strengths provide a solid foundation for scaling waste-bank initiatives into a formal component of the city's waste-reduction strategy.

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b. Weaknesses (W); Despite their potential, many waste banks in Bandung lack adequate infrastructure, stable funding, and technical capacity. Manual sorting methods and limited storage facilities reduce operational efficiency and lead to material degradation, especially when waste remains unsold for extended periods. The absence of a centralized database or digital monitoring system also prevents proper tracking of contributions to waste reduction, making policy-based evaluation difficult. Volunteer turnover and inconsistency in management affect operational stability, while market price fluctuations reduce economic motivation for participation. These weaknesses indicate the need for standardized operating procedures, funding mechanisms, and digital tools for monitoring and evaluation. Without institutional strengthening, waste banks may remain informal and struggle to make a measurable impact on municipal waste management.
c. Opportunities (O); There are strong opportunities for improving the waste-bank system through digital innovation, industry partnerships, and policy integration. Digital platforms and reward-based applications can increase community participation, particularly among younger demographics. Collaboration with private sectors such as packaging industries and recycling companies could stabilize market prices and ensure consistent waste collection. The concept of the circular economy, increasingly promoted in Indonesian policy frameworks, presents significant prospects for integrating waste banks into economic and environmental planning. Additionally, government initiatives related to Extended Producer Responsibility (EPR) may create funding opportunities for waste banks through corporate CSR programs. With proper scaling, Bandung's waste banks can become part of a larger urban sustainability model that combines economic incentives with environmental goals.
d. Threats (T); External threats include volatile market prices of recyclable materials, which directly influence participation rates and operational sustainability. Policy instability and limited political commitment at the municipal level also create barriers to formal inclusion within Bandung's waste-management structure. If urban population growth continues without effective waste-reduction strategies, the city may face a greater burden on its landfill capacity, particularly at the Sarimukti disposal site. Climate-related factors, such as increased rainfall or flooding, can disrupt sorting and transportation activities. Furthermore, the rise of informal waste pickers working outside the waste-bank system may create competition for recyclable materials, limiting the flow of waste into managed facilities. These threats suggest that waste banks must adopt adaptive and scalable strategies to remain resilient within Bandung's broader waste-management ecosystem

SWOT analysis reveals that the waste bank system in Bandung holds strong potential to become a strategic pillar in municipal waste management through community engagement, environmental education, and decentralized operations. However, its sustainability relies heavily on institutional strengthening, infrastructure support, and digital innovation. Opportunities arising from circular economy initiatives, CSR programs, and technological tools must be maximized to overcome existing weaknesses and external threats such as market instability and policy uncertainty. Therefore, if strategic integration between government, communities, industries, and digital platforms is implemented effectively, Bandung's waste banks can transform from informal grassroots initiatives into a structured and scalable model that supports long-

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term urban sustainability and contributes significantly to achieving the city's waste-reduction targets.

Table 2. SWOT Matrix for Waste Banks in Bandung City

| Strengths (S) | Weaknesses (W) |
|---|---|
| Strong community engagement | Inconsistent funding and infrastructure |
| Educational campaigns improving awareness | Lack of digital monitoring and data systems |
| Potential as micro-enterprise initiatives | Skill gaps and volunteer turnover |
| Decentralized waste segregation points | Market fluctuations affecting participation |
| Growing institutional support | Absence of standardized operating procedures |
| **Opportunities (O)** | **Threats (T)** |
| Digital platforms for waste tracking | Price fluctuations of recyclable materials |
| Corporate/industry partnerships (CSR, EPR) | Policy instability at local government level |
| Circular economy integration | Landfill capacity pressure (Sarimukti) |
| Policy alignment with sustainability targets | Climate and logistical disruptions |
| Youth participation & school-based programs | Competition from informal waste collectors |

Source: Author, 2025

3. Integrated Strategic Framework (SO–ST–WO–WT)

Based on the SWOT analysis conducted, strategic recommendations are required to strengthen the role of waste banks in Bandung City and ensure the sustainability of their operations within the municipal waste-management framework. The integration of internal and external factors allows for the formulation of four strategic approaches SO, ST, WO, and WT that are tailored to the specific conditions and challenges faced by waste banks. These strategies not only provide a structured pathway for improvement, but also serve as decision-making guidance for policymakers, community organizations, educational institutions, and private-sector stakeholders. By adopting these strategies, waste banks can move beyond the stage of informal community initiatives and become structured units supporting Bandung's transition toward a circular economy and environmental resilience.

a. SO (Strength–Opportunity) Strategy: The SO strategy leverages internal strengths to capitalize on external opportunities. Waste banks in Bandung already demonstrate strong community engagement, environmental awareness, and institutional support, which can be further enhanced through digital platforms, school collaborations, and partnerships with private recycling industries. By integrating waste banks into circular economy programs and CSR-funded sustainability projects, Bandung can upgrade waste banks into official waste-reduction units. The government can also provide incentives for households that participate regularly through digital reward systems, increasing participation and waste segregation rates across neighborhoods.
b. ST (Strength–Threat) Strategy: The ST strategy focuses on using existing strengths to counter external threats such as price fluctuations, policy inconsistency, and

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competition from informal waste pickers. Strong community participation and decentralized collection systems can be combined with government policies that stabilize recyclable price ranges through contractual agreements with industries. Coordinated monitoring mechanisms and data dashboards would help mitigate operational uncertainty during economic instability or climate-related disruptions. By building reliable logistic systems and formalizing partnerships with recycling companies, waste banks can strengthen resilience and ensure consistent waste flow despite external fluctuations.

c. WO (Weakness–Opportunity) Strategy: The WO strategy aims to minimize weaknesses by exploiting available opportunities. Current gaps in infrastructure, data management, and operator skills can be addressed through digital tools, standardized training modules, and internships with educational institutions. Partnerships with universities can generate innovation hubs that develop technology-based solutions for waste monitoring and sorting efficiency. Collaborating with CSR programs and government grants could provide funding for infrastructure upgrades like weighing tools and storage systems. By targeting these weaknesses through structured support, waste banks can transition from semi-active operations into fully functional waste-management units.
d. WT (Weakness–Threat) Strategy: The WT strategy seeks to mitigate the combined impact of internal limitations and external pressures. To overcome limited infrastructure and economic instability, Bandung must develop risk mitigation mechanisms such as microfinancing schemes and community-based emergency funds. Regulations should formalize waste-bank roles to reduce vulnerability to policy changes, while coordination platforms must be established to avoid operational fragmentation across districts. Encouraging stable leadership, digital record keeping, and inter-district collaboration will further reduce dependence on volunteers and increase institutional resilience. By addressing both internal and external barriers simultaneously, waste banks can gradually shift toward a sustainable, policy-supported waste-management model.

Formulation of SO, ST, WO, and WT strategies provides a comprehensive direction for improving the effectiveness and sustainability of waste-bank operations in Bandung City. Each strategy offers a practical approach to enhancing institutional capacity, increasing community participation, building market resilience, and developing technological innovation. The integration of these strategies into local government policies and community programs can significantly accelerate the transition toward a circular economy and reduce dependence on landfills. Therefore, the implementation of strategic interventions based on SWOT results is crucial not only for waste reduction but also for strengthening environmental governance and fostering social and economic benefits for Bandung's residents.

## CONCLUSION

The findings of this study demonstrate that Bandung City faces complex challenges in municipal solid waste management due to rapid population growth, high consumption patterns, and limited treatment capacity. Within this context, the waste bank system emerges as a strategic community-based mechanism that supports waste segregation, recycling, and environmental awareness. The SWOT analysis reveals that strong community participation, institutional support, and public awareness serve as key

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internal strengths, while weaknesses include limited infrastructure, unstable funding, and the absence of integrated digital monitoring systems.

Significant opportunities are available through circular economy policies, digital innovation, academic partnerships, and private-sector collaborations—particularly through CSR and Extended Producer Responsibility (EPR) schemes. However, the system also faces external threats such as fluctuating recyclable market prices, policy inconsistency, and pressure on landfill capacity, especially at the Sarimukti landfill site. The SO, ST, WO, and WT strategies formulated in this study offer a structured direction for strengthening waste bank operations and positioning them as formal components of Bandung's waste-management system.

Therefore, waste banks have the potential to evolve from informal community initiatives into strategic urban environmental management units provided that institutional reinforcement, technological integration, and governance coordination are consistently implemented. The application of SWOT based strategies can not only reduce pressure on landfills but also enhance environmental literacy, economic empowerment, and long-term urban resilience. This research serves as a foundation for future studies that may incorporate quantitative assessments or decision-making models such as AHP or MOORA to determine more precise strategic priorities for waste-bank development in Bandung City.

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