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Analysis of Community Participation in Urban Waste Management Transformation: A Case Study of Zero Waste City Implementation in Depok City

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ABSTRACT
The City of Depok is currently facing a serious waste management crisis, as the Cipayung Landfill has exceeded its capacity and receives approximately 1,200–1,500 tons of waste per day. In this context, community participation in waste segregation at the source plays a crucial role in reducing the pressure on landfill facilities. This study aims to examine the dynamics of community participation in waste management in Depok City and to identify the key factors that encourage and hinder such participation. Using a qualitative descriptive approach with a case study method, data were collected through field observations, in-depth interviews with waste bank managers and Black Soldier Fly (BSF) maggot processing operators, as well as an analysis of secondary data obtained from the National Waste Management Information System (SIPSN) 2024. The findings reveal that community participation in Depok is strongly driven by economic incentives, particularly through the presence of more than 400 waste banks and innovations in BSF maggot bioconversion. However, the sustainability and consistency of public participation are constrained by systemic challenges, especially the downstream waste transportation system that continues to mix segregated waste during collection and transport. Overall, the study concludes that community participation in waste management in Depok has reached a level of collective awareness, yet it requires stronger policy and logistical synchronization from the city government, particularly through the implementation of segregated waste collection schedules, to ensure long-term sustainability.

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INTRODUCTION

The waste problem in Indonesian urban areas has reached a critical point, and Depok City has become one of the epicenters of this crisis. As a satellite city of Jakarta with rapid population growth, Depok faces a serious environmental dilemma at the Cipayung Final Disposal Site. Most urban waste is still managed using an end of pipe approach, where waste is collected, transported, and disposed of at the Cipayung landfill without processing at the source (Utomo

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et al., 2024). With waste piles reaching heights of more than thirty meters, this landfill has technically been declared overcapacity (Dinas Lingkungan Hidup dan Kebersihan Kota Depok, 2023). The volume of waste entering the site reaches approximately one thousand two hundred to one thousand five hundred tons per day (Kementerian Lingkungan Hidup dan Kehutanan, 2024).

Dependence on the conventional collect transport dispose method has proven ineffective in addressing waste growth that increases in line with population growth. Advanced technological approaches such as the construction of waste to energy power plants can indeed reduce waste accumulation at landfills. Waste to energy facilities offer potential waste volume reduction and energy conversion, but their effectiveness as a comprehensive solution remains questionable. A study by Pratiwi and Suryani (2022) in the Journal of Envirotek shows that waste to energy plants face major challenges related to efficiency, operational costs, and public acceptance. In addition, this technology tends to require mixed waste with high calorific value, which can hinder efforts toward waste segregation and source based processing (Aliansi Zero Waste Indonesia, 2025).

Therefore, a paradigm shift toward community based waste management has become a necessity. Community participation in household level waste segregation is the main key to reducing waste input to landfills, as mandated in Law Number 18 of 2008 on Waste Management.

METHODS

This study employed a qualitative research design with a case study approach to capture the complexity of community participation in urban waste management transformation. A qualitative strategy was considered appropriate because the research sought to understand social processes, perceptions, and everyday practices that shape community involvement in waste segregation and management rather than to measure variables statistically. The case of Depok City was selected purposively, as it represents an urban area facing acute waste management challenges while simultaneously promoting a zero waste city agenda through community based initiatives.

The research setting focused on neighborhoods actively involved in waste banks and organic waste processing programs, particularly maggot based waste treatment initiatives. These locations were chosen to reflect different forms of community participation and to provide a rich context for understanding how residents interact with waste management programs in their daily lives. The diversity of settings allowed the study to explore variations in participation patterns across communities with different social and institutional characteristics.

Primary data were collected through in depth interviews with key informants, including waste bank managers, community leaders, local environmental activists, and residents who actively participate in waste segregation. The interviews were conducted in an open and conversational manner to encourage participants to share their experiences, motivations, and concerns freely. This approach helped uncover not only formal practices but also informal norms and emotions that influence participation.

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In addition to interviews, non participant observation was carried out to document routine waste management activities at the household and community levels. The researcher observed how waste was sorted, collected, and processed, paying attention to interactions between residents and waste management actors. These observations provided contextual insights that complemented interview data and helped verify whether reported practices aligned with actual behavior.

Secondary data were also used to enrich the analysis and strengthen contextual understanding. Policy documents, local government reports, and official waste management statistics were reviewed to trace the institutional framework governing waste management in Depok City. These documents helped situate community participation within broader regulatory and policy dynamics.

Data analysis was conducted using a thematic analysis approach. Interview transcripts, observation notes, and documents were read repeatedly to identify recurring patterns and meaningful themes related to participation, incentives, institutional support, and systemic barriers. The coding process was iterative, allowing themes to emerge naturally from the data while remaining informed by relevant theoretical perspectives on participation and governance.

To enhance the credibility of the findings, data triangulation was applied by comparing information from different sources and methods. Insights from interviews were cross checked with observations and documentary evidence to reduce bias and improve interpretive accuracy. Prolonged engagement in the field also enabled the researcher to build trust with participants and gain a deeper understanding of local dynamics.

Ethical considerations were carefully addressed throughout the research process. All participants were informed about the purpose of the study and provided voluntary consent prior to participation. Anonymity and confidentiality were maintained to protect participants' identities, and the research was conducted with sensitivity to local norms and community relationships.

RESULTS AND DISCUSSION

Waste Bank Dynamics

Community participation in waste management often presents a major challenge, particularly in densely populated areas with high consumption levels. One approach that has proven effective is the application of economic incentives through waste banks, where residents can deposit inorganic waste such as plastic, paper, and metal, which is then converted into financial value. This mechanism not only changes public perceptions of waste but also creates a reciprocal relationship between household economic interests and environmental concern. Depok City has a relatively progressive management structure through the presence of more than 400 active waste bank units (Dinas Lingkungan Hidup dan Kebersihan Kota Depok, 2023), although field observations indicate that the number of active waste banks fluctuates annually.

According to Afdhal (2024), waste banks play an important role in strengthening local economies while simultaneously building sustainable environments. A study in Ambon shows

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that the success of waste banks depends on a combination of technical, institutional, and social interaction factors, with economic incentives serving as the main driver of community engagement. This finding is consistent with Burhan (2025), who emphasizes that digital based waste bank innovation and circular economy approaches can increase community participation in household waste segregation. Through digital savings systems, residents perceive greater ease and transparency in accessing the economic benefits of the waste they collect. Furthermore, Sasoko (2023) emphasizes that the sustainability of waste bank programs in densely populated areas requires a multifaceted approach, including behavioral, infrastructural, and socio economic factors. Economic incentives have proven to be one of the most effective factors in changing community behavior because they provide direct motivation to participate. In other words, residents are driven not only by environmental awareness but also by the tangible benefits gained from waste management activities.

The impact of economic incentives through waste banks can be observed in several aspects. First, increased community participation, as more residents are willing to sort and collect waste due to financial benefits. Second, local economic empowerment, particularly for housewives and vulnerable groups who can use waste savings to meet daily needs. Third, reduction in waste volume, supporting national waste management targets and circular economy policies. Fourth, social behavioral change, where communities begin to view waste as an asset rather than merely as waste. In several urban villages, the presence of waste banks has been able to reduce waste volume by up to 15–20 percent before reaching the landfill (Kementerian Lingkungan Hidup dan Kehutanan, 2024).

However, the sustainability of this program still depends on institutional support and local government policies. Without strong marketing networks for recyclable materials, economic incentives may remain limited to short term motivation. Therefore, integration between economic incentives, environmental education, and policy support is essential for waste banks to truly function as instruments of social and environmental change.

Thus, economic incentives through inorganic waste savings in waste banks are not merely a technical strategy but a socio economic approach capable of mobilizing sustainable community participation. This approach bridges individual interests with collective goals while strengthening the foundation for a more environmentally conscious and economically empowered society.

Organic Innovation

Organic waste management is highly significant ecologically, socially, and economically. First, this is due to its large volume and rapid decomposition. Organic waste contributes more than 60 percent of total domestic waste and is easily biodegradable. If not managed promptly, it decomposes quickly, generates unpleasant odors, produces leachate, and triggers the proliferation of disease vectors. The Leuwigajah landfill tragedy in 2005 serves as evidence that unmanaged organic waste accumulation can lead to socio environmental disasters.

Second, there is significant potential for conversion into resources. Organic waste has high economic value when properly processed. Technologies such as composters, biodigesters, and Black Soldier Fly maggot cultivation enable the conversion of waste into organic fertilizer, biogas energy, and protein rich animal feed. Kodrianingsih et al. (2023) note

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that maggots can decompose 2–5 kilograms of waste per day and produce residual frass that improves soil fertility.

Third, organic waste is easier to manage at the community level. Decentralized management is particularly ideal for organic waste. Community groups, waste banks, and youth organizations can actively participate in source separation and processing. A study by Agusti and Wibawani (2023) in a waste education village shows that community involvement in composting and maggot cultivation increases social ownership of environmental programs and strengthens local networks.

Fourth, there is cost efficiency and direct impact. Community based organic waste management has proven to be far more cost effective than incinerators or modern landfills. A study by CPI (2025) indicates that community management costs range from USD 28–63 per ton, compared to private operators that reach USD 74–324 per ton. At the same time, activities such as maggot cultivation can generate additional income, strengthen local food security, and create environmentally based employment opportunities.

Depok City has begun adopting bioconversion based participation using Black Soldier Fly maggots to process organic waste at the community level through the construction of maggot houses in several urban villages, following earlier initiatives by residents who independently developed maggot cultivation. This step represents a concrete solution to reduce waste accumulation at the Cipayung landfill while simultaneously opening economic opportunities for residents. This effort aligns with national trends seeking alternative solutions beyond waste to energy plants. Black Soldier Fly technology offers a more affordable, environmentally friendly, and community based decentralized approach. If expanded to all urban villages, Depok has the potential to become a model for Black Soldier Fly based organic waste management in Indonesia.

Field findings indicate that maggot houses increase community participation in waste segregation among targeted residents, generally those living near the maggot facilities. However, participating residents often remain uncertain about the direct economic incentives they receive. Unlike waste banks, where increases in inorganic waste savings are clearly recorded, organic waste delivered to maggot houses is not recorded on an individual participant basis. Economic calculations from maggot cultivation also require time and involve many components. Residents tend to perceive that profits are obtained by maggot house managers during harvest periods, while profit sharing mechanisms for household level participants have not yet been formulated.

Systemic Barriers

Urban waste management efforts in Depok City continue to face various systemic barriers that reduce policy effectiveness and weaken community participation. One frequently observed phenomenon is that waste which has already been sorted by residents is mixed again by waste collection workers. This situation generates frustration and reduces residents' motivation to continue sorting waste, as their efforts are perceived as futile. Another important field finding is the lack of integration between the waste transportation unit and the waste management education unit within the local environmental agency. In meetings addressing complaints about unmanaged waste in certain areas, transportation officers often

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encourage residents to simply collect waste at a single point to be transported to the landfill with a service fee in accordance with local regulations. This approach offers a quick solution to complaints but contradicts efforts to increase community participation in household and neighborhood level waste sorting and processing.

Another significant issue is the diversity of waste management practices at the neighborhood level. In many areas, waste is collected from individual households by informal waste workers using handcarts. These informal workers are not always under the coordination of neighborhood leaders. Their knowledge of proper waste management is generally limited, and their role is often restricted to collecting waste at a single point, sorting recyclable materials for additional income, and waiting for municipal collection. In some cases, waste is simply piled up and burned.

The lack of institutional integration means that the city government often fails to involve the informal sector in policy planning, resulting in their potential being underutilized. There have been no serious efforts to improve their knowledge or provide them with operational guidelines for waste management. As a result, their significant contributions occur without social protection, adequate incentives, or capacity building. Yet empowering this sector could substantially improve the sustainability of urban waste management.

Research by Muhammad Rapii et al. (2021) in Rumbuk Village demonstrates that the success of community based integrated waste management strongly depends on the involvement of informal workers. They act as a bridge between residents and the waste management system, ensuring that sorted waste actually enters the recycling chain. Without their role, community participation tends to weaken due to the absence of assurance that sorting will be consistently maintained.

Maryani Ayu Rahmawati and Hendri Hermawan Adinugraha (2023), in their study on the transformation of waste processing facilities, emphasize that inconsistency in the waste transportation chain represents a major barrier. Residents who have already sorted waste feel they lack adequate institutional support, leading to declining community participation. This finding highlights a coordination gap between government policies, facility managers, and field workers.

Poor coordination between local government and sanitation workers causes waste sorting practices to break down during the transportation stage. As a result, residents lose trust in the existing waste management system, and their motivation to sort waste declines sharply. Systemic barriers are further exacerbated by the absence of integrated transportation standard operating procedures, weak supervision, and minimal incentives for workers. Without performance based incentives, workers have little motivation to maintain sorting consistency. These barriers indicate that waste management problems are not merely technical but also institutional and governance related.

These systemic issues have serious implications for the sustainability of urban waste management programs. First, community participation becomes fragile because residents feel their efforts are not valued. Second, the effectiveness of waste management policies declines because the transportation chain does not support source separation. Third, public trust in local government weakens, making long term collaboration difficult to build.

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Thus, systemic barriers such as the re mixing of already sorted waste demonstrate that the success of urban waste management depends not only on technology or infrastructure, but also on institutional consistency, coordination among actors, and clear incentive mechanisms. Without systemic improvements, community participation will continue to decline, and the goals of sustainable waste management will remain difficult to achieve.

CONCLUSION

This study demonstrates that the transformation of urban waste management in Depok City is strongly influenced by the quality of community participation and the consistency of institutional arrangements. Community based initiatives such as waste banks and organic waste processing have shown significant potential in encouraging residents to engage in waste segregation and reduction at the source. Economic incentives provided through waste banks have been particularly effective in motivating participation, strengthening local livelihoods, and reshaping social perceptions of waste as a valuable resource rather than a burden. Similarly, organic waste innovation through bioconversion approaches has contributed to reducing landfill pressure while opening opportunities for environmentally based economic activities. However, the findings also reveal that community participation remains vulnerable when not supported by coherent governance systems. The absence of integrated waste transportation, weak coordination between policy makers and field level actors, and limited involvement of the informal sector undermine the continuity of waste segregation practices. When sorted waste is mixed again during collection, public trust declines and motivation to participate diminishes. These systemic inconsistencies highlight that technological solutions and community awareness alone are insufficient to ensure sustainable outcomes. Therefore, effective urban waste management requires an integrated governance approach that aligns community initiatives, institutional coordination, and incentive mechanisms across all stages of waste handling. Strengthening collaboration among government agencies, community groups, and informal workers is essential to maintain consistency, build trust, and sustain participation. Without such systemic alignment, the long term goals of sustainable and participatory urban waste management will remain difficult to achieve.

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