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A Comparative Study of the Effectiveness of the Circular Economy Approach in China and the Community-Based Approach in Indonesia in Plastic Waste Management

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Abstract— Plastic waste remains a pressing global environmental challenge, with countries adopting various approaches to address it. This study aims to compare the effectiveness of China's circular economy (CE) strategy and Indonesia's community-based (CB) approach in managing plastic waste. Employing a qualitative comparative method, the research analyzes policy frameworks, case studies, and secondary data from both countries. The results reveal that China's CE model, supported by centralized policy integration and technological innovation, achieves a recycling rate of 31%, demonstrating national scalability and efficiency. Conversely, Indonesia's CB model promotes grassroots participation and behavioral change but faces limitations in policy consistency and scalability, with recycling rates ranging between 11–15%. Despite these differences, both approaches offer complementary strengths. China showcases systemic and industrial coordination, while Indonesia highlights the value of community engagement. This study recommends a hybrid strategy that combines China's policy-driven structure with Indonesia's participatory initiatives to create a more inclusive and sustainable plastic waste management model. The findings encourage policymakers and international agencies to promote knowledge exchange and develop integrated frameworks that balance regulation with public involvement.

Keywords: circular economy, community-based approach, and plastic waste management.

1. Introduction

Plastic waste management remains one of the most pressing environmental challenges globally, marked by increasing volumes of plastic pollution, inadequate recycling rates, and disparities in policy implementation across regions. At the core of this issue lies the urgent need to develop and evaluate effective models that not only reduce plastic waste but also align with principles of sustainability and community resilience. Two predominant paradigms have emerged in response: the circular economy (CE) model—adopted by countries such as China—and the community-based (CB) approach—prevalent in nations like Indonesia.

The general research problem addressed in this study concerns the comparative effectiveness of these two models in mitigating plastic pollution. Specifically, it raises the following questions: (1) To what extent has the CE model in China succeeded in achieving systemic efficiency and policy integration in plastic waste management? and (2) How do community-based strategies in Indonesia contribute to behavioral

change, economic viability, and environmental outcomes at the local level?

This investigation is urgent, considering that global plastic production exceeded 390 million tons in recent years, yet only a fraction is effectively recycled or recovered [3]. China's CE strategy, supported by regulatory mechanisms, industrial partnerships, and technological investments, has achieved significant material recovery results [1], [3], while Indonesia's CB model leverages grassroots mobilization, local wisdom, and social enterprises to foster participatory waste governance [2], [4], [5], [6], [7].

The novelty of this research lies in its integrated comparative framework, which synthesizes institutional, technological, economic, and socio-cultural dimensions to assess the strengths and limitations of both models. Previous studies have predominantly examined CE and CB approaches in isolation, often within narrow regional or disciplinary scopes [8]–[10]. This study, however, draws on cross-national evidence and applies a theoretical lens rooted in evolutionary game theory [1], community empowerment [4], [7], and multi-stakeholder collaboration [11], [12], to provide a more holistic evaluation.

The objective of this research is twofold: first, to analyze the effectiveness of China's centralized CE model in terms of policy coherence, technological integration, and scalability; and second, to evaluate Indonesia's CB approach with respect to its community participation, economic feasibility, and sustainability outcomes. This study also aims to propose a hybrid policy recommendation that combines the systemic strengths of CE with the participatory value of CB, thereby contributing to the development of inclusive and adaptive plastic waste governance frameworks globally.

By reviewing empirical data, financial metrics, and theoretical insights from a diverse set of sources [1]–[21], this research provides valuable contributions for policymakers, practitioners, and researchers seeking to address the complexity of plastic waste management through integrated strategies.

2. Method

To assess the effectiveness of plastic waste management strategies in China and Indonesia, this study adopts a qualitative comparative research design, drawing upon policy analysis, secondary data, and validated case studies. The methodology is grounded in interdisciplinary concepts such as evolutionary game theory, community empowerment, and circular economy mechanisms, as informed by the works of He et al. [1], Salau et al. [2], and Agamuthu et al. [3]. The first phase involved an in-depth policy and literature review based on peer-reviewed journals, international conference proceedings, and national strategic documents.

China's circular economy (CE) model was examined through institutional and industrial policy lenses, focusing on ESG strategy alignment involving multiple stakeholders. In contrast, Indonesia's community-based (CB) approach was analyzed within the framework of grassroots participation and decentralized environmental action [2]. Quantitative data from Agamuthu et al. [3] indicates that China recycles over 19 million tons of plastic annually with an efficiency rate of 31%, compared to Indonesia's estimated rate of 11–15%.

The second phase entailed selecting representative case studies and constructing a comparative framework. China's CE implementation was assessed through initiatives like the National Sword Policy and successive Five-Year Plans, which emphasize policy coherence and technological advancement. For Indonesia, examples such as the Cibodas TPS-3R and other community-based waste banks served to illustrate bottom-up engagement.

A standardized analytical framework was applied to evaluate five dimensions: technological efficiency, stakeholder collaboration, policy and regulatory integration, economic and environmental impact, and social participation. Supporting visual models of the waste flow in both contexts are illustrated in Figure 1 for China and Figure 2 for Indonesia.
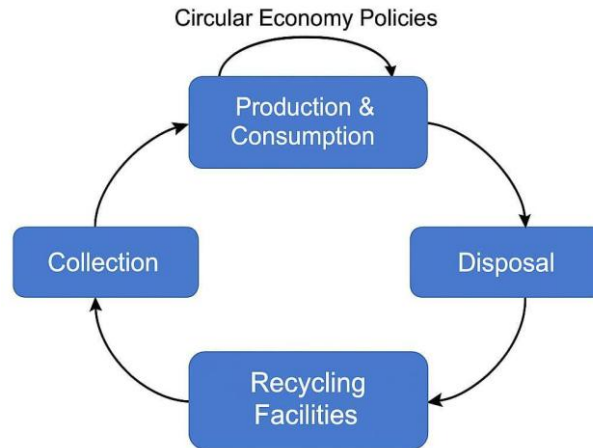
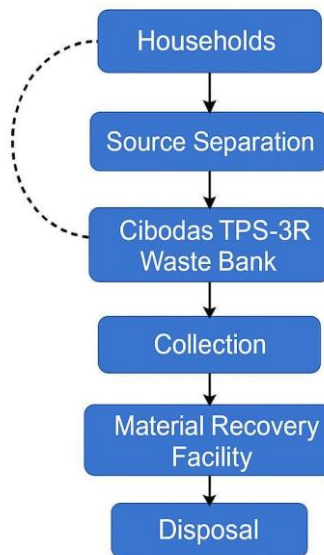Figure 1. Circular Economy Plastic Waste Flow in China

Figure 2. Community-Based Waste Management Model in Indonesia

In the third phase, an evaluation matrix was developed using evolutionary game theory to assess interactions among key actors—government, industry, and civil society. In China, the presence of strong regulatory incentives enhances industrial compliance and participation in CE initiatives. Indonesia, on the other hand, relies on community mobilization and localized leadership to sustain waste management efforts. A detailed comparison of the core indicators—such as recycling rates, economic feasibility, and scalability—is presented in Table 1.

Table 1. Comparative Evaluation of Plastic Waste Management Models

Evaluation Criteria	China (Circular Economy)	Indonesia (Community-Based)
Plastic Recycling Rate (%)	31% (Agamuthu et al., 2019)	11–15% (Cibodas TPS-3R)
Policy Integration	Strong (He et al., 2025)	Weak–Moderate (Salau et al., 2007)
Stakeholder Involvement	Industry + Government	Community + Local NGOs
Economic Feasibility	High (centralized funding)	Moderate (NPV IDR 78–465 million)
Scalability	National	Local/regional

While primarily qualitative, the study also integrates a financial assessment using the Net Present Value (NPV) approach to measure the economic viability of CB initiatives in Indonesia. This analysis considered a 10-year project horizon and an 8% discount rate to estimate long-term profitability. Findings reveal that

Indonesian waste banks vary in performance, with NPV values ranging from IDR 78 million to 465 million, depending on operational efficiency and public engagement.

Finally, by synthesizing theoretical frameworks and empirical insights from both centralized and decentralized models, this study offers a comprehensive understanding of how institutional design and local participation jointly influence sustainability outcomes in plastic waste governance. The integrative methodology provides a solid foundation for evaluating the potential of hybrid strategies that combine the systemic strengths of CE and the social adaptability of CB approaches.

3.   Result and Discussion

The comparative analysis between China's circular economy (CE) model and Indonesia's community-based (CB) waste management approach reveals substantial differences in scalability, effectiveness, and stakeholder engagement. China demonstrates a markedly higher plastic recycling rate, supported by strong regulatory frameworks and technological integration. Its success is attributed to centralized policy instruments that facilitate nationwide coordination, including structured incentive systems and strict enforcement mechanisms. In contrast, Indonesia's CB approach depends heavily on voluntary participation, with recycling rates varying significantly across local contexts. While this model encourages public involvement and environmental awareness, its reliance on informal structures limits its scalability and consistency.

Institutionally, the CE model is strengthened by national laws and development plans that mandate producer responsibility and promote industrial compliance. These are enforced through economic penalties and rewards, creating a stable operational environment for large-scale recycling initiatives. Meanwhile, Indonesia's CB model thrives on community mobilization and localized leadership, offering flexibility and social embeddedness. However, it often lacks comprehensive policy support and financial backing, resulting in fragmented implementation and variable outcomes.

Stakeholder dynamics further distinguish the two models. In China, collaboration between government, industry, and consumers is structured and strategic, creating synergies that enhance material recovery efficiency. Indonesia's model, while effective at fostering grassroots ownership, struggles with long-term sustainability due to limited coordination among stakeholders and insufficient economic incentives.

Financially, the feasibility of Indonesia's CB initiatives varies. Analysis of waste bank programs indicates a wide range of profitability outcomes, influenced by factors such as operational efficiency, participation rates, and waste collection volumes. These findings highlight both the opportunities for community-driven economic development and the vulnerabilities of decentralized systems in the absence of robust institutional support.

The implications of these findings suggest that China's model exemplifies how technology, infrastructure, and policy can work in synergy to drive system-wide transformation. Its emphasis on mechanical and chemical recycling, supported by digital tracking and centralized logistics, enables large-scale impact. Conversely, Indonesia's model showcases the potential of behavioral change and environmental education as tools for community empowerment. Yet without long-term policy integration and funding, these efforts remain limited in scope.

A hybrid approach that combines the structural efficiency of the CE model with the participatory strengths of the CB model may offer a more holistic solution to plastic waste challenges. Such a model could align national policy directives with local innovation, bridging the gap between institutional authority and public engagement. To move toward this vision, China may benefit from expanding inclusive community participation, while Indonesia should formalize support mechanisms that allow successful CB initiatives to be scaled and replicated.

At the international level, fostering collaboration and knowledge exchange between countries adopting CE and CB strategies could accelerate the development of adaptable, inclusive, and resilient waste management systems.

4. Conclusion

This study has provided a comparative analysis of two prominent models in plastic waste management: the circular economy (CE) approach implemented in China and the community-based (CB) approach practiced in Indonesia. The findings highlight that while the CE model offers significant advantages in terms of scalability, regulatory integration, and technological efficiency, the CB model excels in promoting grassroots participation, local ownership, and behavioral change. Each model presents unique strengths and limitations that reflect the socio-political and economic contexts in which they operate.

China's CE model demonstrates how strong institutional frameworks and technological investment can drive national-level outcomes in plastic waste reduction. Its centralized structure enables consistent policy enforcement and industrial collaboration. In contrast, Indonesia's CB approach proves effective in engaging communities and fostering sustainability values at the local level, although it faces challenges related to long-term funding, coordination, and policy support.

Importantly, this study concludes that neither model alone is sufficient to address the multifaceted nature of plastic waste management. Instead, a hybrid model that integrates the systematic efficiency of CE with the adaptive and participatory strengths of CB initiatives may offer a more balanced, inclusive, and sustainable solution. By combining top-down governance with bottom-up engagement, such an approach can support both national environmental targets and community resilience, ultimately contributing to more effective global strategies for plastic waste mitigation..

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