

From Participation to Sustainability: The Role of Social Capital in Batam's Solid Waste Management System

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ABSTRACT

This study examines how social capital mediates the relationship between citizen participation and sustainability in Batam's SWM system. Using a qualitative case study approach, data were collected through semi-structured interviews, focus group discussions, participant observation, and document analysis. The findings reveal that while regulatory frameworks and community-based initiatives such as waste banks and TPS3R units exist, their effectiveness is constrained by weak institutional capacity, inconsistent implementation, and limited public trust in government services. Social capital—manifested through networks of trust, reciprocity, and community monitoring—emerged as a critical factor in sustaining participation, particularly where formal governance structures were ineffective. However, the exclusion of informal waste actors and fragmented coordination among municipal stakeholders continue to undermine policy outcomes. The study concludes that Batam's SWM must be reframed as a governance challenge rather than solely a technical issue, requiring stronger institutional arrangements, inclusive collaboration with informal sectors, and greater investment in social capital to transform episodic participation into long-term sustainability. These insights contribute to broader debates on participatory governance and the pursuit of Sustainable Development Goals in rapidly urbanizing cities.

Keywords: Solid Waste Management; Social Capital; Public Participation; Sustainability; Batam City

A. INTRODUCTION

The rapid pace of urban growth in many Southeast Asian cities has made solid waste management (SWM) a pressing governance challenge. In Indonesia, rising urban populations,

industrial expansion, and changing consumption patterns have contributed to the generation of over 60 million tons of municipal waste per year, a figure that continues to increase (Ministry of Environment and Forestry [MoEF], 2022). The

issue is especially pronounced in medium-sized and rapidly expanding municipalities, where infrastructure often struggles to keep pace with the scale of waste produced.

Batam, the largest city in the Riau Islands Province and a designated free trade zone, illustrates these dynamics. From fewer than 100,000 residents in 1980, the population grew to more than 1.19 million by 2020, driven largely by internal migration (Badan Pusat Statistik [BPS], 2021). This demographic transformation has fueled rising waste volumes; municipal records estimate that Batam currently produces 700–800 tons of solid waste daily, with year-on-year growth averaging 4–5% (Batam Environmental Agency, 2022).

Much of this waste is directed to the Telaga Punggur landfill, which is nearing its design capacity. Limited segregation at the household level, inadequate enforcement of 3R (reduce, reuse, recycle) practices, and continued reliance on open dumping have exacerbated environmental risks, including water contamination and odor pollution (Susanto & Haryanto, 2021). Efforts to diversify disposal through waste banks (*bank sampah*) and community-based TPS3R initiatives have been launched, but their reach remains modest. City data show that only 7% of waste was managed through 3R mechanisms in 2021, increasing to 16.5% by 2023 (Batam City Environmental Dashboard, 2023).

Research from other parts of Indonesia suggests that social capital is critical for addressing these challenges. Social capital,

generally understood as networks of trust, shared norms, and reciprocal relationships within communities, has been identified as an important driver of sustained participation in environmental governance, including waste management. Studies demonstrate that neighborhoods with stronger bonding, bridging, and linking forms of social capital achieve better outcomes in waste segregation, recycling, and cooperative waste management schemes (Permana, Towoloe, Aziz, & Ho, 2015; Sembiring & Nitivattananon, 2010). However, Batam represents a unique case because its population is predominantly composed of migrants, with high levels of mobility and cultural diversity. This demographic complexity tends to weaken place attachment and reduce the stability of social ties, making it more difficult to cultivate the trust and reciprocity needed for collective environmental action.

At the same time, Indonesia has developed an extensive regulatory framework designed to promote sustainable waste management. National laws, particularly Law No. 18 of 2008 on Waste Management and the National Waste Management Policy and Strategy 2017–2025, emphasize the central role of community participation and the adoption of 3R practices as key pillars of waste governance (MoEF, 2017). In practice, however, Batam has struggled to translate these policies into meaningful outcomes, as participation remains uneven and often confined to pilot projects or temporary programs. The mismatch between policy expectations and local realities raises important questions about the

social dynamics that shape environmental governance outcomes in the city.

The persistence of these challenges underlines several key problems. Community-based initiatives in Batam, such as waste banks, often struggle to maintain consistent engagement over time, pointing to weaknesses in social cohesion and incentives. The demographic composition of the city, characterized by diversity and mobility, complicates the establishment of the trust and cooperation necessary for long-term environmental management. While the legal framework mandates public participation, there is a notable implementation gap, and the specific contribution of social capital to the sustainability of community-based initiatives has not been systematically analyzed. Furthermore, much of the academic literature on social capital and waste management in Indonesia has concentrated on cities in Java, leaving Batam underexplored despite its unique status as a strategic border city.

Against this background, the present study addresses several critical research questions. It seeks to explore how social capital is manifested within Batam's communities in relation to waste management, how these forms of social capital influence public participation in waste segregation, recycling, and waste-bank activities, and how they contribute to the transformation of temporary participation into long-term sustainability. It further examines what lessons Batam's experience can provide for strengthening participatory waste governance in other urbanizing Indonesian cities and similar contexts in Southeast Asia.

The objectives of this study are therefore fourfold. First, it aims to identify and analyze the types and levels of social capital within Batam's communities in relation to solid waste management. Second, it seeks to investigate the relationship between social capital and patterns of public participation in community-based initiatives. Third, it examines the extent to which social capital contributes to sustaining these initiatives over time. Finally, it aims to generate practical recommendations for local policymakers and stakeholders to enhance participatory and sustainable waste governance in Batam and comparable urban environments.

This research is geographically limited to Batam City, with emphasis on neighborhoods that engage in waste banks, TPS3R, and other community-based programs. The analysis involves various stakeholders, including households, community leaders, municipal agencies, NGOs, and private operators. While the study acknowledges that technical, financial, and institutional factors are relevant to waste governance, its primary concern is the social dimension, particularly the ways in which social capital shapes participation and sustainability. As such, economic and technological aspects are treated as contextual rather than central components of the analysis.

The conceptual framework guiding this research integrates theories of social capital with models of participatory governance. It posits that social capital—operating through bonding (intra-community trust), bridging (networks across

diverse groups), and linking (connections with formal institutions)—influences the depth and quality of participation in waste management activities. Participation, in turn, is expected to lead to sustainable outcomes, including reduced dependence on landfills, improved recycling rates, and enhanced compliance with local regulations. In this framework, social capital functions as the enabling mechanism that transforms individual actions into collective and durable practices. By testing this framework in Batam, the study seeks to contribute to both theoretical debates on environmental governance and practical strategies for urban sustainability in rapidly growing and socially complex cities.

B. METHOD

This study adopts a qualitative case study approach to investigate how social capital influences participation in community-based solid waste management (SWM) initiatives in Batam and how such participation contributes to sustainability outcomes. A case study design is particularly appropriate because it allows for in-depth exploration of complex social processes situated within a real-life urban context (Yin, 2018). Batam was selected as the empirical site due to its rapid demographic growth, migrant-dominated population, and ongoing challenges in waste governance, which together create a distinctive environment for analyzing the interplay between social capital, participation, and sustainability.

The research employs an exploratory case study that integrates semi-structured interviews, focus group discussions (FGDs), participant

observation, and document analysis. The triangulation of methods enhances validity by capturing diverse perspectives and reducing reliance on a single data source (Creswell & Poth, 2018). By situating these data within the theoretical framework of social capital (bonding, bridging, and linking), the study seeks to explain both the mechanisms of participation and the conditions under which these mechanisms generate sustainable outcomes.

Data analysis followed a thematic coding strategy. Interview transcripts, FGD notes, and observational records were transcribed and coded using NVivo software. Initial codes were generated inductively from the data and then organized around the analytical categories of social capital (bonding, bridging, linking), participation (waste segregation, recycling behavior, program membership), and sustainability outcomes (continuity of initiatives, reduction of landfill dependence, compliance with regulations).

The analysis proceeded in three stages. First, descriptive coding identified patterns of participation and forms of social capital within communities. Second, axial coding explored relationships between social capital and participation outcomes. Third, selective coding examined how these relationships contributed to sustainability, with particular attention to the role of trust networks, social norms, and institutional linkages. Cross-case comparison was used to highlight similarities and differences across neighborhoods with varying levels of program success.

1. Sustainable development: An Overview

All nations are striving to achieve the Sustainable Development Goals (SDGs) as part of a global commitment to future well-being (Keesstra et al., 2016). Sustainability can be understood as the principle of conserving and managing resources so that their benefits remain available for generations to come (Chanhthamixay, Vassanadumrongdee, & Kittipongvises, 2017). Development, on the other hand, represents a gradual transformation in which societies advance through economic, social, political, cultural, and demographic changes aimed at continuous improvement (Turner & Hulme, 1997). In essence, the concept of sustainable development emphasizes safeguarding the capacity of future generations to enjoy the same quality of life and opportunities as those living today (United Nations, 2020).

The pathways governments choose to pursue development are critical because, as Turner and Hulme (1997) describe, development can function as a “double-edged sword.” Poorly designed policies or programs may generate consequences that undermine rather than promote sustainability. Achieving sustainable development is therefore a collective responsibility, shared not only among individuals but also across generations (Meredith & MacDonald, 2017). Governments play a central role in regulating and supervising the use of natural resources, ensuring that they are managed responsibly and equitably (Aguja, 2016). Effective institutional arrangements—

whether in the form of sound policies, strong collaboration with private actors, or active public participation—are vital mechanisms through which sustainability goals can be realized (Aguja, 2016; Purnomo, Ramdani, & Tomaro, 2019).

One of the unintended costs of development is the generation of solid waste. Solid waste management (SWM) remains one of the most persistent and complex challenges facing governments in many developing countries. The responsibility for addressing this problem rests on both individuals and communities, as waste is produced at every level of society. Yet quantifying the losses associated with ineffective waste management is particularly difficult for governments, as the impacts span health, environmental, and economic domains (Das et al., 2019). Moreover, solid waste management intersects with nearly every aspect of governance, involving national policy frameworks, institutional capacity, and local-level implementation.

2. Solid Waste Management as a Governance Issue

The study revealed that governance plays a decisive role in shaping how solid waste is managed in Batam. Governance, both formal and informal, encompasses the frameworks, institutional arrangements, and relationships that guide interactions among citizens, communities, and authorities. In Batam, these elements are evident but unevenly developed. While municipal regulations and policies establish a clear framework for solid waste management (SWM), their implementation often falls short, largely due to limited institutional capacity and fragmented

coordination among actors. Respondents frequently described governance as “the backbone” of waste management, yet also pointed to significant gaps between policy design and practice.

Five interconnected governance objectives—policy framework, quality of service, efficiency, citizen participation, and institutional arrangement—emerged in Batam’s case but were not equally prioritized. Policy frameworks were in place, most notably through local regulations that mirror national mandates on 3R practices. However, the enhancement of public services and the creation of cost-effective, efficient systems were constrained by financial limitations and weak enforcement. Citizen engagement, a cornerstone of sustainable governance, was inconsistent, with some neighborhoods actively participating in waste banks and recycling programs while others remained disengaged. Administrative structures existed, but respondents noted overlaps of authority between municipal departments and contractors that complicated effective service delivery.

The findings underscore that waste in Batam is generated across households, industries, and the commercial sector, confirming its status as a collective responsibility. Nevertheless, the burden of managing this waste is unevenly distributed. The government, as the primary provider of public services, retains decision-making authority, but resource limitations hinder its ability to deliver consistently. This has created a situation in which local communities often take on responsibilities that exceed their

capacities. Participants from community-based organizations described a sense of frustration, noting that “the government tells us to segregate, but without support or consistent collection, people lose motivation.” This illustrates a governance gap where public expectations are not matched by municipal support, eroding trust in government institutions.

Policy was identified as both a strength and a vulnerability within Batam’s waste governance. On one hand, formal regulations provided legitimacy for community-based initiatives and encouraged citizen involvement. On the other, weak enforcement and limited follow-through undermined credibility. Many residents reported that their reliance on neighborhood organizations was greater than their trust in municipal authorities. This declining trust mirrors trends in other Indonesian cities where ineffective enforcement reduces public confidence in local governments. In Batam, landfill management practices reinforced this perception. The placement of the Telaga Punggur landfill at the city’s periphery served to minimize public visibility of waste, but also contributed to a perception that waste issues were being “pushed out of sight,” rather than transparently addressed.

3. Social Capital in Participatory Approach

The analysis of Batam’s solid waste management (SWM) reveals that governance remains the central determinant of how waste policies and practices evolve in the city. Governance, in this context, extends beyond formal institutions to include the informal norms and arrangements that regulate the relationships

between government, private actors, and communities. In Batam, municipal authorities have established a set of regulations and initiatives aimed at promoting the 3R principle—reduce, reuse, and recycle—but implementation has not been consistent. Field evidence indicates that while policy frameworks exist, their effectiveness is weakened by institutional fragmentation, limited resources, and uneven citizen participation.

The study found that waste generation in Batam, which exceeds 700 tonnes per day, is driven not only by household activities but also by the expanding industrial and commercial sectors. This reflects the city's identity as a free trade zone and industrial hub, where development has accelerated at a faster pace than institutional capacity. Respondents emphasized that the government, while positioned as the primary service provider, struggles to balance rapid population growth with the demand for efficient waste services. Communities frequently described this imbalance as a “disconnect” between expectations and municipal performance.

Citizen engagement emerged as a critical but inconsistent factor. In neighborhoods where social capital was relatively strong, waste banks and community-based recycling programs gained traction, supported by networks of trust, reciprocity, and mutual monitoring. In other areas, however, participation was minimal, often due to perceptions that municipal services failed to provide consistent support. Several participants explained that residents “lose motivation” when

segregated waste is later mixed by collection crews, illustrating how weak governance undermines community trust. This erosion of trust has led some residents to rely more on neighborhood leaders or informal arrangements than on official services, reinforcing the notion that governance deficits reduce institutional legitimacy.

The study also highlighted the complex role of the informal sector. Informal waste pickers and small-scale recyclers make a significant contribution to reducing landfill-bound waste, yet they remain excluded from policy discussions and formal recognition. Officials often viewed these actors as unregulated and problematic, despite acknowledging their role in sustaining recycling flows. This ambivalence reflects deeper governance challenges, where entrenched perceptions prevent the integration of informal actors into formal waste systems. The exclusion of the informal sector represents a missed opportunity for collaborative governance, particularly in a city like Batam where landfill dependence remains high.

Social capital was identified as an important enabling factor that shapes the effectiveness of both governance and participation. In communities with stronger networks of cooperation, informal monitoring and social sanctions proved effective in reinforcing compliance with waste practices. For example, some neighborhoods used peer pressure and digital platforms to discourage littering, strategies that participants described as more effective than municipal enforcement. These findings align with

broader scholarship on environmental governance, which emphasizes that social capital can substitute for weak formal institutions by fostering accountability and cooperation at the community level.

Nevertheless, systemic challenges persist. The Telaga Punggur landfill continues to absorb the majority of Batam's waste, despite its limited capacity and environmental risks. Recycling rates remain low relative to national targets, and segregation at source is still not widespread. Many respondents attributed these shortcomings to poor coordination among municipal departments, limited technical knowledge among staff, and insufficient financial resources. Policies designed to improve SWM often remain aspirational because they are implemented in conventional ways that do not address the complexities of Batam's rapidly urbanizing and socially diverse context.

Overall, the findings suggest that Batam's SWM is best understood as a governance problem rather than solely a technical issue. While infrastructure and regulations are necessary, they are insufficient without inclusive governance mechanisms that integrate informal actors, strengthen social capital, and foster citizen trust. The study demonstrates that sustainability in Batam's waste system depends on aligning institutional arrangements with community practices and perceptions. Without this alignment, participation remains fragmented and sustainability elusive. The evidence from Batam therefore reinforces the need to reconceptualize waste management as a collaborative governance challenge, where social capital serves as a bridge between community action and policy implementation.

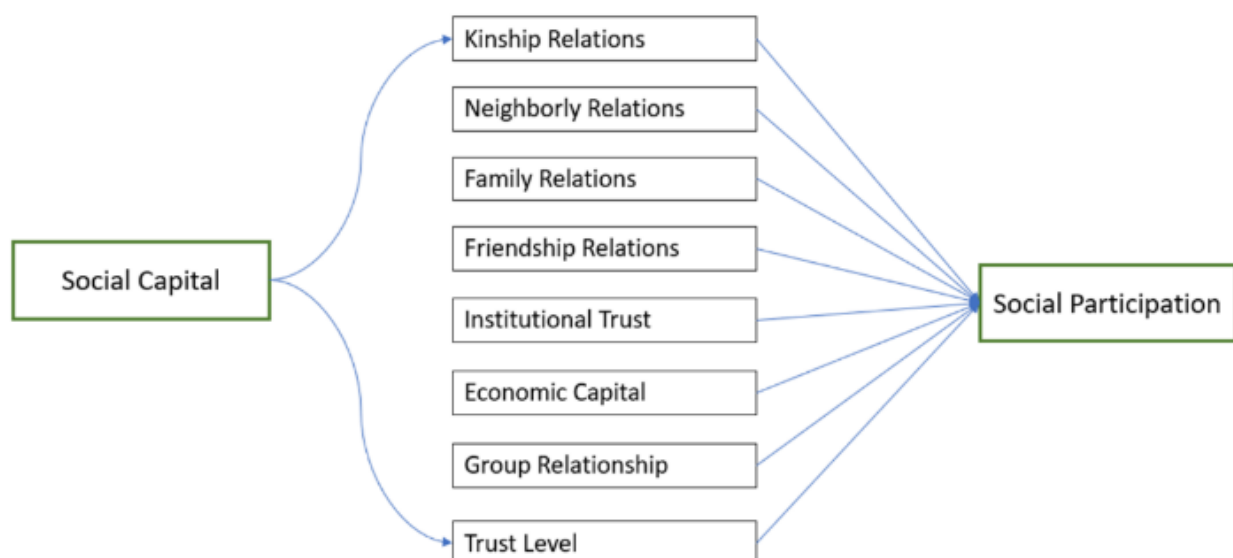


Figure 1. Conceptualization on Social Capital in Influencing Social Participation, Source: Khalili et.al (2013)

4. Policy Implementation and Citizen Trust

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5. Role of Informal Sector

The informal sector emerged as a critical yet marginalized actor in Batam's SWM system. Informal waste pickers, itinerant collectors, and small-scale recyclers contribute substantially to waste recovery by diverting materials away from the landfill. However, their contributions remain largely unacknowledged in municipal policies. Decision makers often perceive the informal sector as disorganized or disruptive, echoing patterns observed in other Indonesian cities. This perception limits opportunities for integration, despite evidence from the field

that informal actors play an indispensable role in sustaining recycling flows. Several municipal officials admitted that the sector is "important but difficult to regulate," indicating ambivalence toward more formalized collaboration. This exclusion reflects governance challenges rooted in perceptions and institutional inertia rather than in empirical performance.

6. Toward a Governance-Based Approach to Sustainability

The findings position Batam's SWM as fundamentally a governance issue rather than solely a technical challenge. Policies, institutions, and community engagement must be aligned if sustainability goals are to be achieved. Effective governance requires integrating informal actors, strengthening social capital, and creating monitoring systems that combine formal enforcement with community-based oversight. Without such integration, Batam risks repeating cycles of ineffective waste management, where policy innovations remain on paper but fail in practice. This reinforces the argument that sustainable solid waste management depends not only on infrastructure and technology but also on governance arrangements that are inclusive, transparent, and rooted in community engagement.

C. CONCLUSION

This study demonstrates that solid waste management in Batam is not merely a technical or infrastructural challenge but fundamentally a governance issue in which social capital plays a pivotal role in transforming participation into sustainability. While municipal authorities have introduced regulations and 3R initiatives, implementation gaps, limited institutional capacity, and low public trust have hindered progress. The findings reveal that communities with stronger networks of trust and reciprocity are more successful in sustaining waste segregation and recycling, whereas weak social cohesion leads to fragmented participation. The exclusion of informal actors further limits the effectiveness of current policies despite their significant contributions to waste recovery. To achieve long-term sustainability, Batam's waste governance must integrate formal regulations with inclusive approaches that strengthen social capital, foster citizen engagement, and recognize the role of both formal and informal stakeholders. In doing so, Batam can move closer to aligning development with the principles of sustainable governance and the broader objectives of the Sustainable Development Goals.

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