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Comparing The Gaps Between Policy Making and Implementation in Solid Waste Management: Cases of Germany, Japan, India, Usa, Kenya and Singapore

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Abstract

Solid waste management is essentially one of the most pressing problems in today's world; It increases its importance every day as both an environmental and social issue. Rapid population growth, urban accumulation, and unbridled consumption habits not only increase the amount of waste but also create a multi-layered crisis ranging from pollution to public health and from there to economic losses. This is exactly why governments are under serious pressure to produce ambitious and solution-oriented policies. But the point is, the gap between those theoretical goals on paper and the hard realities on the ground never closes. While this state of disconnection reduces the efficiency of policies, it also, unfortunately, disrupts dreams of sustainable development. The main axis of this article is the wide gaps between policy design and implementation practices. Why are there these gaps? What are the consequences? While pursuing these questions, we examine the practices of countries with very different administrative and economic structures, from Germany to Japan, from India to Kenya and Singapore, through comparative case studies. At the centre of our discussion is the heavy burden of these disruptions on social justice and economic efficiency. The point we have reached is clear: Failure in waste management is not just a technical deficiency; on the contrary, it is a phenomenon that is linked to the quality of governance, political determination, and institutional flexibility. Therefore, to improve the processes, not only a technical solution but also a more holistic perspective is required. Methodologically, this study employs a multi-layered qualitative comparative case analysis (QCA), utilizing thematic analysis and data triangulation to systematically decipher the structural policy-implementation gaps across six diverse national contexts.

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1. Introduction

Since the Industrial Revolution, the relentless wheels of production and consumption have generated an unprecedented and enormous waste problem. World Bank data from 2018 clearly reveals the severity of the situation; it is predicted that the more than 2 billion tons of solid waste produced annually will increase by 70% by 2050 (Silpa et al., 2018). Today, solid waste management is no longer just a local municipal service; it is a multi-layered global policy issue extending from the climate crisis to biodiversity loss, from ocean pollution to public health (Priti and Mandal, 2019). At this point, the circular economy models and recycling strategies that states have devised on paper serve as a vital bridge for a sustainable future. However, a deep chasm often forms between the ideal world of strategic plans and the harsh realities on the ground. Ambitious goals that set out with the "zero waste" vision; Obstacles such as insufficient funding, weak political will, or the inability to involve the public in the process are the most concrete examples of this "policy gap." These shortcomings in implementation not only render environmental efforts futile but also undermine trust in public administration and call into question the legitimacy of governments (Zhu et al., 2025).

This study examines policy gaps on a global scale in depth through six countries that are diametrically opposed in terms of their administrative traditions and socio-economic structures. Each case examined presents its own unique challenge to the universal crisis of waste management: In this context, the research offers a broad perspective, ranging from Germany, considered a pioneer of the circular economy with its high recycling discipline, to the Japanese model, which is trying to overcome its narrow geographical boundaries with advanced technology; from India, a giant struggling with the irregular waste piles brought about by rapid urbanization, to the US example, which differs with its administrative fragmentation and consumer culture brought about by its federal structure. This analysis includes Singapore, an island nation reflecting technology-focused strict regulations, and Kenya, which continues to seek dynamic solutions in Africa despite infrastructural bottlenecks, in this comparative matrix, opening up a multi-dimensional discussion of the gap between policy and practice.

This study traces the following fundamental questions to decipher the chronic "policy gap" in the world of solid waste management:

1. Policy-Practice Disconnect: What exactly does the gap between strategies on paper and practical realities on the ground represent, and in what dimensions does it manifest itself?

2. Effects of Transformation: How have historical processes, political, legal, and cultural changes in the countries under examination shaped these management gaps in the background?
3. The Role of Management Models: What is the exact impact of different administrative structures on the nature of these shortcomings in waste management and the proposed solutions?
4. Costs and Consequences: What lasting impacts do these disconnects in current policies leave on public health, ecological balance, and social justice?
5. Methodological Benefit: How can a comparative perspective, spanning from the past to the present, open up new avenues for us to develop much more sustainable policies?

In conclusion, these comprehensive studies show that these gaps in waste management vary significantly depending on each country's political structure, economic strength, and administrative capacity. However, we are not merely conducting a theoretical discussion here. Our main goal is to demonstrate how decisive local factors are, thereby developing concrete, practical, and forward-looking recommendations for policymakers and academics.

2. Literature Review

Solid Waste Management and Policy Making Concept

The phenomenon of solid waste management is fundamentally a complex chain of operations, starting from the initial production of waste and continuing until its final disposal (Guerrero et al., 2013; Nanda and Berruti, 2021). This operational process must be based on a strict hierarchy of priorities, ranging from preventing waste generation at its source (prevention), reusing existing products, recycling materials, recovering energy or raw materials, and finally, safe disposal (Hoornweg and Bhada-Tata, 2012). In recent years, visionary approaches such as "Zero Waste" or "Circular Economy," which have resonated globally, are cantered on the goal of transforming waste from an environmental burden into an economic value by making the upper levels of this hierarchical structure functional (Khan et al., 2022; Okot-Okumu, 2012). In this regard, legal regulations, financial incentive mechanisms, and large-scale infrastructure investments implemented by governments form the main pillars of national waste policies (Hoornweg and Thomas, 1999; Sakai et al., 1996).

However, the real problematic area becomes apparent at the points of resistance that this theoretically rational framework encounters in practice. This phenomenon, characterized in academic literature as the "solid waste management policy gap," refers to the uncontrolled widening of the gap between the goals on paper and the real-world outcomes. This disconnect can manifest itself at different levels of systemic operation (Arı and Telsaç, 2025; Liu et al., 2021; Nzeadibe and

Ejike-Alieji, 2020; Oduro-Appiah and Afful, 2021; Teshome, 2021). For example, failure to achieve targeted recycling rates or inability to curb the increase in waste volume is a direct "Target Deviation," while channelling limited budgets or qualified personnel into inefficient areas manifests as "Resource Misdirection." Furthermore, disruptions in service continuity, low community participation, or public resistance to local-level infrastructure development further deepen this structural gap. Viewing the issue solely as a lack of technical coordination is also misleading; the inadequacy of waste management services in disadvantaged neighbourhoods clearly reveals that the issue also has a socio-political dimension of "Injustice and Inequality." To properly analyse these administrative bottlenecks, it is necessary to understand the characteristics of the models being implemented. A hierarchical structure where the central authority sets the norms and expects complete compliance from local units is defined as the "Top-Down Approach" (Dye, 2001; Imperial, 2021). In contrast, the "Bottom-Up Approach," where local administrations, civil society organizations, and citizens themselves are involved in decision-making processes, allows solutions to be shaped much more flexibly according to local realities and needs (Crescenzi and Rodríguez-Pose, 2011; Sabatier, 1986). Perhaps the most sustainable method lies in "Hybrid Approaches," which synthesize central strategic guidance with local energy. Because such flexible and participatory models offer the most pragmatic solutions today for overcoming the unpredictable barriers that arise during the implementation phase and minimizing those infamous policy gaps (Kolagar et al., 2020).

Figure 1. Zero Waste Hierarchy

Source: The figure was created by the authors of the study using artificial intelligence.

Key Determinants of the Policy Gap in Solid Waste Management

The gap observed between the theoretical success of solid waste management strategies and their concrete outputs in practice actually has a multi-dimensional and intricate background that cannot be reduced to a single cause (Asnani, 2006; Imam et al., 2008; Telsaç and Arı, 2025; Wilson et al., 2012). The primary factors triggering this "policy gap" are formulation errors made during the

initial stages of strategy development (Kokkinos et al., 2019; Triguero et al., 2016). In particular, ambiguities such as vague implementation procedures and unclear financing models lead local actors to interpret the process differently and deviate from the target. Furthermore, the multi-stakeholder and highly complex nature of waste management, when combined with utopian "zero waste" targets conceived without considering local capacity and existing resources, causes the system's operation to become bogged down at the very beginning. At this point, institutional and bureaucratic obstacles also come into play; The lack of qualified human resources, inadequate technological infrastructure, and weak coordination between different levels of management make it impossible to implement plans on paper (Haregu et al., 2016; McAllister, 2015). Corruption practices, particularly in critical areas such as bureaucratic resistance and waste management tenders, further deepen this structural gap by leading to inefficiency in public resources and the dysfunction of control mechanisms. In addition to the technical and administrative dimensions of the issue, political will and societal dynamics are also central to this disconnect in implementation (dos Muchangos et al., 2015; Wang et al., 2022). The marginalization of waste management on the political priority list, or the sacrifice of sustainable investments for short-term populist interests, causes interruptions in reforms. Frequent government changes and accompanying ideological debates create instability, especially in long-term projects such as the establishment of disposal facilities. Socio-economic and cultural factors added to this political landscape are undermining the social aspect of the process (Deus et al., 2022; Raghu and Rodrigues, 2020). Public indifference to recycling programs or the reflex of not wanting facilities near their living areas (NIMBY) can render even the most rational policies ineffective. Ultimately, these factors, combined with external influences such as global economic crises and fluctuations in raw material markets, create a complex spiral of failure that causes local governments to deviate from their policy objectives and focus on short-term solutions.

Ethical and Governance Dilemmas of the Solid Waste Management Gap

Operational gaps in waste collection or disposal mechanisms are not only a technical inadequacy but also an "environmental injustice" crisis that disproportionately targets impoverished residential areas and low-income social groups (Laurent, 2011). The selection of socioeconomically disadvantaged neighbourhoods as primary locations for waste facilities that pose environmental risks further exacerbates this systemic inequality (Coolsaet, 2020; Telsaç and Arı, 2026a). On the other hand, this complex structure inherent in waste management also makes the accountability levels of public authorities and private enterprises regarding their performance a serious subject of debate. In particular, the lack of transparency in service tenders and contract processes provides fertile ground for the abuse of resources and corrupt practices. These failures in policy implementation (when manifested in tangible indicators such as dirty streets or urban odor pollution) profoundly undermine citizens' institutional trust in local governments and general state mechanisms. This resulting crisis of trust creates a wave of resistance that further hinders public involvement in newly developed

projects or participatory programs. The attitude of political leaders also constitutes a decisive barrier; decision-makers tend to gravitate towards short-term solutions that can quickly garner support at the ballot box and be visually displayed (e.g., purchasing a new fleet of garbage trucks) rather than long-term, costly systemic reforms (e.g., building a comprehensive recycling infrastructure) (Mohai et al., 2009; Telsaç and Arı, 2026b).

3. Methodology

This study, structured under the title "Comparison of Gaps Between Policy Making and Implementation in Solid Waste Management," aims to make sense of the distance that has solidified over time between strategic designs and practical implementations in the field in selected country examples, by maintaining a historical projection. The main axis of the research is based on examining the multi-layered dynamics, operational methods, and structural bottlenecks encountered behind this disconnect in policy processes within a qualitative comparative research discipline. Given the intricate nature of the issue, ranging from policy design processes to resource allocation, from institutional capacity deficiencies to political manoeuvring areas and from socio-cultural fabric to external shocks, the qualitative comparative case analysis (QCA) method offers a rich and flexible analytical ground for the in-depth deciphering of different national ecosystems and the understanding of unique contexts. This is because the methodological roadmap adopted here does not limit its focus to a descriptive question such as "what" has been implemented; on the contrary, it adopts a holistic perspective that aims to analyse the social motivations, "how," "why," and "under exactly what specific conditions" the application processes evolved into their present form.

Research Design

This study is based on a multi-layered research design consisting of a strategic synthesis of conceptual analysis, systematic literature review, and thematic comparative case analysis. This design offers a flexible yet exploratory analytical framework for identifying implementation gaps in solid waste policies and understanding the current implications of these processes. This holistic perspective aims to blend theoretical depth with empirical richness. The fundamental categories forming the conceptual pillars of the research, such as "policy gap" (target deviations, mismanagement of resources), "implementation models" (up-down, down-up, and hybrid frameworks), and "determinants" (institutional capacity, political will, socio-cultural dynamics), have been developed by drawing from a wide range of literature. At this point; Pressman and Wildavsky's emphasis on the complexity of processes (Alexander, 1989; Bowen, 1982), Lipsky's thesis of "street-level bureaucrats" (Lipsky, 2010; Weatherley and Lipsky, 1977), and modern public administration theories reinforce the theoretical backbone of this study. This stage represents the construction of a systematic analytical framework that goes beyond merely defining concepts and grounds the empirical indicators of

these concepts and their dynamic relationships with each other. To support this developed conceptual structure and to provide in-depth insights into waste management practices in six selected countries (Germany, Japan, India, the USA, Kenya, and Singapore), a comprehensive systematic literature review was conducted. This review, ranging from policy analysis to environmental sciences, sociology to development studies, encompasses a wide data pool, from peer-reviewed articles to doctoral dissertations and strategic policy reports. In particular, it examines in which specific areas the gaps in these countries are concentrated, such as recycling, e-waste, or plastic waste; the unique factors underlying the policy gaps and the ethical dilemmas that arise in this process have been examined. This review activity provides both a historical panorama for each case and blends current discussions with empirical findings. In the final stage of the study, a thematic comparative case analysis method was adopted to reveal the concrete functioning of deviations in waste management policies and the axes of similarities/differences between countries. This approach clearly demonstrates how political systems ranging from federalism to unitary structures, levels of local autonomy, and historical legacies shape the volume of policy gaps. How variables such as resource allocation and political commitment change in each case and the structural reasons for this differentiation are meticulously compared. This methodological choice not only appreciated contextual specificities but also allowed for the drawing of lessons that can be generalized on a global scale. The combination of different sources such as academic publications, government reports, and international organization data (data triangulation) has been a key element in reinforcing the scientific credibility and robustness of the findings.

Data Analysis Methodology

In the classification and analysis phase of the data filtered from the research universe, thematic analysis technique was adopted as a guide to take advantage of the flexible and layered analytical possibilities offered by qualitative methodology to the researcher (Braun & Clarke, 2006). This method is actually a highly adept instrument for bringing to light the invisible patterns, recurring conceptual patterns, and implicit meaning structures within the massive volumes of raw data through a systematic reporting discipline. Each output of the analysis process was reconstructed in a logical pattern under predetermined thematic headings, establishing an organic link with the theoretical framework (conceptual framework) of the study. Thanks to this analytical lens, the experience of the policy vacuum in each case study's unique socio-political ecosystem was taken beyond a mere descriptive narrative; it was examined in depth, along with all its structural layers, on a comparative and critical level with other country experiences.

Validity and Reliability

When designing a qualitative study, it is essential to overcome a series of methodological hurdles to ensure that the findings go beyond mere observation and gain scientific credibility and transferability. In this research, in order to prevent the

principles of dependability and confirmability from remaining merely theoretical concepts, defence mechanisms have been built that extend to every stage of the analysis process. The fundamental question here is what kind of analytical leverage a historical and comparative lens offers in understanding policy gaps; because we aimed not only to capture a snapshot of the present but also to decipher why and how these gaps have become entrenched. The main strength reinforcing the credibility of the research undoubtedly lies in the data triangulation strategy. Instead of being confined to a single type of data source, data from quite different avenues such as comprehensive academic literature, national/international official reports, civil society field projections, and reputable media analyses have been blended into a single analytical framework. This heterogeneous structure allowed the findings to be validated not just from a single perspective, but through a multi-layered support mechanism. On the other hand, the presentation of the examined national contexts and policy deviations using a "thick description" method allows the reader to grasp the analysis processes with the depth of a field observer; this directly contributes to the transferability of the study. In terms of ethical neutrality and verifiability, the researchers were constantly grappling with their own intellectual presuppositions and potential biases throughout the process. This self-regulation process, which we can define as "reflectiveness," ensures that data is filtered from an unbiased perspective while maintaining the logical consistency of all findings within the conceptual framework. Ultimately, each argument was sealed with reliable academic references, leaving a clear "audit trail." This provides the transparency needed for an outside observer to track the entire journey of the data and verify the inferences.

Case Studies

Germany

Described as the flagship of circular economy literature, Germany maintains its position as a global point of reference in this field, particularly with its "Green Point" (Der Grüne Punkt) framework for packaging waste management (Jones, 2015). The main backbone defining the country's waste regime was shaped by the Packaging Waste Regulation (Verpackungsverordnung), enacted in 1991, and the Circular Economy Act (Kreislaufwirtschaftsgesetz), which gained legal status in 1996; thus, the principle of "producer responsibility" evolved from a theoretical ideal to a legal obligation (Kitagawa, 2021; Kranert, 2017). However, the "policy gap" between this highly ambitious legal framework, which aims to dry waste at the source and maximize recycling efficiency, and the real outputs on the ground constitutes the most fragile aspect of the system (Mohajan, 2021; Allen-Taylor, 2022).

Perhaps the most painful manifestation of this disconnect is clearly evident in the process of managing plastic waste. Despite the glittering recycling quotas on paper, a considerable portion of the collected plastics—unfortunately due to the allure of low raw material costs and technical barriers—is sacrificed to incineration plants under the guise of energy recovery instead of being reintroduced into the

economy (Frankenbach et al., 2025). Despite the high level of discipline that German society displays regarding its recycling culture, unrestrained consumption habits and out-of-control packaging use continue to push legal limits and dangerously increase the total volume of waste. Moreover, the efficiency of the system; due to chronic coordination deficiencies between local governments, private sector actors, and civil society components, the desired level of efficiency cannot be achieved (Luzarraga, 2024).

From an economic perspective, the low prices of primary raw materials in the market undermine the competitiveness of recycled materials and directly jeopardize the financial future of the sector. This situation is a structural and economic resistance that delays the full realization of Germany's "circular economy" claim (Kitagawa, 2021). Indeed, although the federal government, with the new Packaging Act (Verpackungsgesetz) enacted in 2019, expanded the deposit system and raised targets, creating a new area of intervention to force producers towards ecological design, how much of this gap will be closed is still a matter of debate (Simoens and Leipold, 2021; Theobald et al., 2024).

Japan

With its limited geographical area and suffocating population density, Japan is perhaps one of the countries facing the most unique challenges in solid waste management in the world (Hotta and Aoki-Suzuki, 2014). Recognized globally as a flagbearer of the "3R" (Reduce, Reuse, Recycle) philosophy and a hub for high-tech waste incineration plants, this island nation has meticulously crafted its waste regime since the 1970s (O'Neal, 2023). In particular, the "Basic Law Promoting the Formation of a Circular Society," which came into effect in 2000, placed the 3R principle at the heart of national policy; while the almost genetically ingrained discipline of the public regarding waste sorting became the main driving force of the system (Takiguchi and Takemoto, 2008; Yoshida, 2007).

However, behind this technological superiority and social discipline lies a formidable "policy vacuum." Even Japan's most modern incineration plants face the chronic "never in my neighbourhood" (NIMBY) resistance, fuelled by local health and environmental concerns (Sakai et al., 2011). This sociological barrier poses a significant obstacle to new infrastructure investments; the greatest irony within the system itself lies in its cultural roots (Dvornik Perhavec and Kamnik, 2025; Margulies, 1992). The "Omotenashi" culture, a symbol of Japanese hospitality, ironically fuels excessive packaging use, creating a situation diametrically opposed to the government's waste reduction goals (Suarez et al., 2020). At this point, policymakers are hitting a wall of ingrained consumption habits; legal goals are insufficient in the face of the cultural codes of daily life. The issue is not merely a cultural conflict; the enormous energy costs and financial burden of waste incineration operations compared to recycling place a heavy burden on local governments (Yabar et al., 2009). This situation not only prevents Japan from fully achieving its 3R targets but also creates a policy vacuum that prevents waste

volumes from reaching desired levels (Hezri, 2010). Although the government strives to perfect emission technologies, the fact that the real struggle is to gain public trust and establish a transparent governance process remains the most fragile link in the system (Aoki-Suzuki et al., 2023; Hotta, 2013).

India

India, caught in a spiral of dizzying population growth and uncontrolled urbanization, is grappling with a massive logistical and humanitarian crisis in the field of solid waste management (Joshi and Ahmed, 2016). A considerable portion of the existing waste volume is either haphazardly burned or added to uncontrolled heaps on the outskirts of cities without ever being included in an official collection network (Ao and Ngullie, 2024; Gupta et al., 1998). Essentially, India attempted to forge a modern legal framework at the national level with the Solid Waste Management Regulations enacted in 2016; setting many idealistic goals, from source separation to recycling standards (Nandan et al., 2017; Dave, 2022). However, these elegant policy sets devised by the central government remain nothing more than "wishful thinking on paper" in the face of the financial helplessness and lack of technical infrastructure of local governments (municipalities) (Sharma and Jain, 2019).

The most crucial and perhaps the most tragic "policy gap" in the system is evident in the case of informal waste collectors, known as "rag-pickers," who operate entirely outside the official system (Chandramohan et al., 2010). This invisible army, the true drivers of recycling in India, not only fails to find its rightful place in policy designs but is also pushed to the margins, endangering their lives and undermining overall productivity (Shekar, 2015; Priti and Mandal, 2019). When chronic corruption infiltrating tender processes and a dramatic decline in service quality are added to this structural neglect, the evaporation of resources becomes even clearer. The fact that waste management often ranks low in politicians' priorities, coupled with widespread public awareness, transforms this governance gap into a chronic public health crisis; waste accumulating on the streets acts as a breeding ground for infectious diseases (Jagadale and Santos, 2022). Although some weak steps have been taken in recent years to integrate informal communities into the system and increase their capacity, pressured by civil society, these gaps persist due to the deep socio-economic turbulence the country is experiencing (Venkatesh, 2023).

USA

Waste management in the United States is a complex field of interaction created by the interconnected, yet often conflicting, jurisdictions of federal, state, and local authorities. This multi-layered administrative architecture creates systematic gaps between strategic goals on paper and actual practices that are difficult to bridge (Milbrandt et al., 2024). While the Environmental Protection Agency (EPA) provides a general framework at the federal level through regulations such as the Resource Conservation and Recovery Act (RCRA), the

extensive autonomy of states and municipalities in policy-making transforms the country into a veritable "mosaic of practices." As a result, waste collection standards exhibit a lack of uniformity, showing dramatic differences from state to state, and even from city to city (Tulve et al., 2024).

Federally focused visions often remain as "guiding principles" due to the local political agendas of local governments, chronic budget constraints, and infrastructural heterogeneity. The most concrete reflection of this situation is seen in recycling practices: while some progressive states have strict regulations on recycling programs, in other regions this process is left entirely to individual choice or has been abandoned due to lack of infrastructure (Adjei and Afriyie, 2025). Moreover, the insatiable appetite for consumption in the US keeps the volume of waste constantly on an upward trajectory; while current policies are insufficient to transform individual consumer responsibility into a social norm (Aiguobarueghian et al., 2024).

Deep inequalities in financing virtually divide the quality of services between municipalities. While some wealthy municipalities can invest in advanced recycling technologies, many local governments struggle even to cover the costs (Saragih et al., 2024). The fact that national politics codes waste management as a secondary issue and that the topic remains off the agenda even in local elections reveals this policy gap as a chronic state of systemic dysfunction. Consequently, the US is condemned to lower recycling rates compared to other developed economies and continues to confine its waste on a large scale in landfills (Kakadellis et al., 2025). Although promising micro-initiatives such as regional composting and private sector collaborations are emerging, a transition to a holistic waste doctrine at the federal level still seems a distant possibility within this fragmented structure (Adjei and Afriyie, 2025).

Kenya

Kenya, the rapidly urbanizing face of East Africa, faces a massive waste crisis, particularly centered around the capital Nairobi, that has long exceeded the existing infrastructure capacity (Amugsi et al., 2022). Although the Environmental Management and Coordination Act (EMCA), which defines the country's waste regime, outlines a framework that glorifies environmental protection and systematic disposal on paper, these policies are caught between the high-profile goals of the central government and the chronic impossibilities of local governments (Juma, 2002; Muigua, 2019). The lack of budget for municipalities to finance these processes causes the basic infrastructure chain, from collection vehicles to modern disposal facilities, to break at the very first link (Haregu et al., 2017).

The most vital artery in Kenya's waste ecosystem, paralleling the example of India, is the enormous informal sector that fills the gaps in the official system but remains "invisible" at the legal level (Baud et al., 2006). The inability to integrate this sector into official policies undermines the system's efficiency and jeopardizes

the safety of thousands of waste collectors (Haregu et al., 2016). Moreover, tender corruption and coordination failures within bureaucratic mechanisms prevent limited resources from reaching the right targets (Otundo Richard, 2024).

At the societal level, practices such as the illegal burning or abandonment of waste in open areas stem not only from a lack of awareness but also from the inability to offer a systemic disposal alternative. The location of massive waste sites like Dandora, particularly near impoverished neighborhoods, has transformed the issue from a technical problem into a deep "environmental justice" crisis (Malii et al., 2025). Although Kenya has taken radical and ambitious steps that have resonated globally, such as the plastic bag ban in 2017; such successes are insufficient to bridge the deep policy vacuum created by the fundamental funding and infrastructure deficiencies that permeate the country (Nwanege, 2024; Otundo Richard, 2024).

Singapore

Deeply feeling the crisis of spatial constraint brought about by being a small island nation, Singapore has built a unique model for waste management based on technology and extremely strict regulations (Vuk et al., 2025). The "waste management hierarchy" that the country has meticulously followed since the 1990s is based on a holistic framework aimed at minimizing waste volume and ultimately disposing of what remains at Semakau, the world's first offshore landfill (Chan, 2016). However, despite this clockwork system, Singapore's high-income level and established consumer culture create a difficult psychological barrier to overcome in achieving its waste reduction goals. Singapore's most significant "policy gap" perhaps lies in the asymmetrical relationship between the institutional success of the state and individual participation. Despite the massive awareness campaigns conducted by the government, the active participation of the public in recycling processes has not yet reached the desired level of "social reflex". The low motivation of consumers to separate waste at the source casts a social shadow over the technical success of the system (Khoo et al., 2012). Moreover, the fragility of recycled materials in economic markets and fluctuations in the global recycling market constantly expose the country's efforts to external shocks (Soudachanh et al., 2024).

Although the system generally performs above world standards, existing policy gaps make it difficult to achieve the "Zero Waste" ideal and push the capacity of waste incineration plants to their limits (Min and Cho, 2024). Indeed, the "Zero Waste Masterplan" implemented in 2019 aimed to overcome these bottlenecks by introducing mandatory "producer responsibility" (EPR) systems for e-waste and plastics, opening up a more aggressive intervention area aimed at spreading responsibility from the state to industry and the individual (Hossain, 2025).

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Table 1. Comparative Illustration of the Differences Between Policy Making and Implementation in Solid Waste Management.

Comparative Aspects ↓	Germany	Japan	India	USA	Kenya	Singapore
Main Focus	Circular Economy	Tech-Based Disposal	Informal Sector	Local Autonomy	Urbanization Trend	Innovation / Space
Governance Model	Federal, Strong Regulation	Unitary, Techno-bureaucratic	Federal, Weak Enforcement	Federal, Fragmented	Centralized, Weak Capacity	Unitary, Technocratic
Policy Area	Recycling & Circularity	Waste Reduction & Waste-to-Energy	Basic Disposal & Collection	State-level Diversity	Rapid Urban Management	Land Constraints & Incineration
Key Determinant	Consumption Standards	Excessive Packaging & Land Scarcity	Capacity Gaps & Informality	Policy Inconsistency	Infrastructure & Funding Gaps	Consumption Culture & Logistics
Design Quality	High, Legal Mandates	Ambitious, High-Tech	Exists on Paper, Weak Practice	Fragmented & Variable	General/Draft Framework	Comprehensive & Detailed
Implementation Capacity	High (Finance/R&D)	High (Automation)	Very Weak	Variable (State-by-State)	Very Weak	Very High
Political Will	Very Strong	Strong	Moderate (Increasing)	Variable (Polarized)	Weak	Very Strong & Stable
Corruption Impact	Very Low	Very Low	Very High	Low (Lobby-Oriented)	High	Very Low
Public Participation	High (Responsibility)	High (Disciplined)	Low Awareness	Moderate (Regional)	Low Awareness	High (Compliance)
Critical Outcome	Hidden Incineration Increase	Efficient Disposal / Space Savings	Pollution / Open Dumping	Low National Recycling Rates	Public Health Risks	Maximum Land Efficiency

Source: Table created by the authors of the study.

The table above summarizes the extent of gaps between policy-making and implementation in solid waste management in the six countries studied, their key determinants, and the governance approaches they have adopted. The existence and nature of these gaps are deeply intertwined with each country's specific context, and political decisions, ethical sensitivities, cultural norms, and governance models play a key role in understanding these dynamics.

4. Findings

The findings show that gaps between policy-making and implementation in solid waste management follow different trajectories depending on the management

models, political systems, cultural norms, and historical experiences adopted by countries, but also give rise to significant and complex ethical, social, and operational challenges. Solid waste policy gaps are more than just a technical or administrative problem; they are a force that profoundly affects the quality of public administration, political legitimacy, and social justice.

Financial Systemic Gaps in Solid Waste Policies: Universal Themes and Structural Dilemmas

Regardless of the heterogeneous management models of the case groups examined, the dynamics underlying implementation gaps in solid waste policies are universal in nature from the perspective of the public administration discipline. Below, the fundamental problems fueling ineffectiveness in this policy area are examined from an analytical perspective:

- Strategic Design Error and Implementation Reality: In all the examples examined, conceptual ambiguities in the policy design phase and "ultra-idealistic" expectations detached from the contextual realities of the field are the main source of frustration in the implementation phase. India's waste regulations, which appear flawless on paper but disregard local capacity, or the US's inability to establish a national doctrine due to federal fragmentation, are prime examples of this. This situation necessitates that policymakers move beyond the "legal text equals implementation" fallacy and prioritize capacity analysis and contextual conditions at the design stage.
- Capacity Crisis and Resource Constraints: Insufficient financial, technical, and human capital reduces even the most ambitious policies to mere "statements of intent." While this crisis manifests as chronic deprivation in Kenya and India, even in developed ecosystems like Germany, the need for additional investment required by technological transformation is pushing the system to its limits. Any policy initiative lacking qualified personnel and modern infrastructure support is doomed from the outset to be nothing more than a fabricated concept.
- Political Will (From Invisibility to Prioritization): Because waste management is inherently an "out of sight" (out of mind) field, it is often relegated to lower priority in political priorities. The true driving force behind Singapore's technological success is the unwavering political will that overcomes bureaucratic resistance; in India, the entrenched problems are directly linked to a lack of leadership. Strong political motivation ensures both financial flow and acts as the driving force for inter-institutional coordination.
- Lack of Coordination and Stakeholder Distribution: Solid waste management is an extremely complex and multi-stakeholder governance area involving numerous disciplines such as economics, health, and industry. The coordination struggles between actors in Germany and the confusion of authority in the US demonstrate how challenging it is to establish a holistic strategy. The inability to establish an inter-sectoral

approach leads to each unit remaining in its own isolated sphere, thus deepening policy gaps.

- Socio-Cultural Resistance and Stakeholder Participation: When policies clash with the established cultural fabric or economic interests of society, it inevitably triggers public resistance. The "NIMBY" (not my neighborhood) syndrome in Japan, or low public awareness, reminds us that the public should be seen not merely as a "service recipient," but as an active "part" of the system. Any design that excludes stakeholder participation is destined to fail due to social barriers.
- Accountability and the Destruction of Corruption: Especially in developing countries, corruption is the most destructive factor rendering all legal and institutional efforts ineffective. The non-transparent tendering processes and weak oversight seen in Kenya and India lead to the waste of public resources and drag the quality of services down to rock bottom. Without transparency and strong oversight mechanisms, closing policy gaps seems impossible.

It should be noted that the success of waste management policies lies not only in technical excellence, but also in striking the right balance between realistic design, strong institutional capacity, and unwavering political will.

Analytical Trajectories and Policy Gaps Between Different Governance Models

The managerial asymmetry among the case groups examined is the key variable determining both the nature and severity of policy gaps. Actors spread across a wide geographical area and struggling with the fragmentation of authority brought about by a federal structure (India, USA) and countries constrained by limited institutional capacity (Kenya, India) represent the grounds where policy gaps are most chronic. In these ecosystems, structural elements such as resource scarcity, corruption spirals, and weaknesses in central-local coordination can paralyze even the most ambitious reform initiatives at the very beginning of the implementation phase. While the gaps seen in the US example are largely fueled by "managerial fragmentation" (federal-local disconnect), in developing countries the gap is entrenched by the inability of institutional capacity to keep pace with the targets. On the other hand, even in countries like Germany, which have institutional maturity and economic strength, policy gaps have not been completely eliminated; however, these gaps manifest in more "niche" areas, such as subtle deviations in recycling quality or technical glitches at the micro-application level. In the case of Japan, it is noteworthy that well-intentioned and technology-focused incineration policies hit a sociological wall (public resistance), while in Singapore, the gap stems directly from structural-cultural dynamics such as deeply ingrained consumer culture. These sophisticated contexts require governance interventions that are far more delicate and require "fine-tuning" rather than a crude approach to reform.

Ultimately, the size and character of policy gaps vary sharply depending on the relevant sub-policy area. In cases like Kenya and India, waste collection and basic disposal services are directly hampered by funding and infrastructure bottlenecks; while in developed examples like Germany and Japan, recycling and circular economy goals are shaped by market factors and consumer habits. This confirms that there is no "one-size-fits-all" prescription for combating policy gaps, and that each country must develop a set of solutions appropriate to its own governance trajectory.

The Transformative Role of Historical and Comparative Perspectives on Policy Gaps

In the discipline of solid waste management, reading the infamous "gap" between policy design and implementation through historical evolution and case-based contextual dynamics offers researchers a transformative analytical lens beyond mere description. This perspective allows us to define policy gaps not as simple operational malfunctions, but as a complex "governance crisis" tightly interwoven with the country's political, administrative, legal, and socio-economic genetic makeup. Such an understanding frees policy analyses from mere technical functionality, making them more sensitive to political realities and grounded in reality. The historical and comparative filter fundamentally shakes the dangerous "one-size-fits-all" fallacy in the literature. For example, this contextual difference explains why Singapore's technologically advanced solutions fail to find a counterpart or create the desired effect in Kenya's infrastructural reality. This situation highlights the vital importance of strategic adaptation for policymakers, while also warning that each country must deeply understand its own specific ecosystem. On the other hand, assessing the environmental pollution and public health risks triggered by policy gaps from a holistic perspective reveals not only short-term firefighting efforts but also long-term, systemic improvements and opportunities for institutional adaptation. The efforts of the informal sector to integrate into the system in India or the dynamics of social resistance in Japan are not merely "success-failure" stories for other actors, but enriched models of "policy learning." This depth offered by the historical perspective reopens the discussion on solid waste management through the transparency, accountability, and democratic legitimacy of public institutions. How policy gaps erode public trust or transform bureaucratic processes can only be revealed through an analysis of past implementation dynamics. Ultimately, this historical awareness; it functions as an early warning system that allows us to proactively predict how public policies might resist emerging environmental threats such as the climate crisis or global pandemics.

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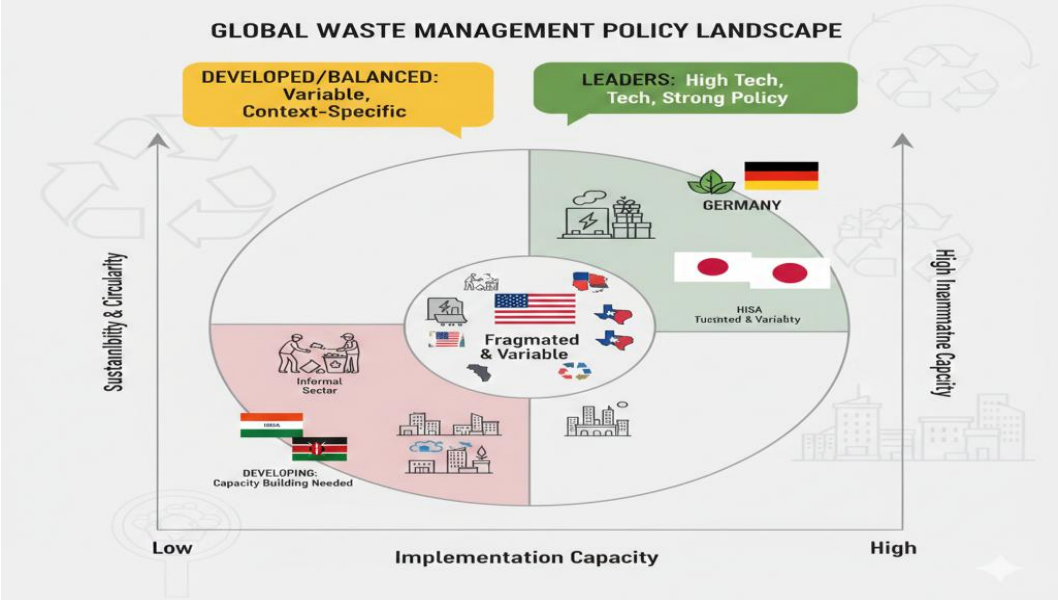
Figure 2. A visual summary of solid waste policy for Germany, Japan, India, the USA, Kenya, and Singapore.



Source: The figure was created by the authors of the study using artificial intelligence.

This comparative matrix clearly demonstrates that an effective waste management strategy is not merely a matter of "national wealth," but rather a complex intersection of political commitment, technological capabilities, and societal synchronization. Countries like Germany and Singapore, which have pioneered this discipline, have established a global "gold standard" with their high-tech circular economy frameworks and uncompromising legal structures. In contrast, the experience of developing actors such as India and Kenya reveals how an uncontrolled wave of urbanization, pushing the limits of institutional capacity, can paralyze even the most idealistic policies. On the other hand, the US's "fragmented governance model" serves as a laboratory proving that high resource availability alone is insufficient; the disconnects in the federal distribution of authority create an inconsistent and fragmented performance landscape at the national level. Ultimately, evolving from a "Linear Waste Management" approach that views waste merely as a disposal object to a "Circular Economy" perspective that prioritizes resource efficiency requires not only the construction of new facilities but also a new social contract in which behavioural codes and systemic functioning will undergo a radical transformation.

Strategic Projections and Policy Recommendations for the Future

The global examples and the anatomy of policy gaps examined throughout this study point to the need for a transformation beyond the status quo to overcome current bottlenecks. Strategic recommendations developed to ensure efficiency in solid waste management and minimize implementation weaknesses are presented below:

- Realism and Stakeholder Focus in Design: The first step is to eliminate "sterile" targets detached from the socio-economic realities of the field from policy texts. Recycling metrics and disposal targets should be synchronized with existing implementation capacity; phased transition models tested with pilot projects should be preferred instead of complex reform packages. Including actors such as the "informal sector," which has gained vitality in examples such as India and Kenya, in the design process not only prevents the policy from remaining only on paper but also reinforces social legitimacy and implementation success.
- Strengthening Institutional Capacity and Coordination: The most concrete remedy for policy gaps is strengthening institutional capacity with financial and human capital. However, the issue is not simply about investing in waste collection vehicles or recycling facilities; the real issue is the construction of horizontal and vertical coordination mechanisms (information sharing platforms, joint boards) that will overcome the chronic "coordination paralysis" between the central government and local units. Performance incentive systems should be considered a systemic necessity for the bureaucratic culture to evolve into an innovative and citizen-oriented structure.
- Political Commitment and the Fight Against Corruption: It is essential to move waste management from an "invisible" area on the list of political priorities to a strategic national security issue. The fight against corruption is possible not only with legal texts but also with a strong political will supported by judicial independence and transparent tendering processes. This "stable leadership," which underlies the success seen in the Singapore example, is the most important reference point for other developing countries in breaking down bureaucratic resistance.
- Transparency, Accountability, and Social Trust: Models where the citizen is seen not as part of the system but only as a "service recipient" are doomed to fail. An ecosystem should be created where the waste journey can be transparently tracked through open data platforms, and accountability is ensured through internal and external audit mechanisms. Cases like the public resistance movement (NIMBY) in Japan prove that public trust can only be established through correct communication strategies and participatory management mechanisms.
- Technological Leap and Digital Integration: Establishing a forward-looking waste regime isn't just about adding tech; it's about a fundamental digital 'interweaving' where IoT networks, big data, and smart containers become the backbone of urban metabolism. These tools do more than just streamline—they act as the ultimate lever for pulling back the curtain on operational transparency. That said, we can’t afford to ignore the looming 'digital divide.' The real mission is to pivot technology so it functions as a gateway for inclusivity, rather than a tool that solidifies social rifts.

Ultimately, looking at the road ahead, waste management must transcend its reputation as a dry, technical obligation. It needs to be reimagined as a cornerstone

of strategic statecraft—one that seamlessly fuses grassroots societal engagement and radical transparency with a bold, tech-driven metamorphosis.

5. Conclusions

This study examines the profound discrepancy between the theoretical framework of solid waste policies and their real-world repercussions across a wide geographical and administrative spectrum, from Germany to Kenya, and from Singapore to the USA. The findings confirm that policy gaps constitute a universal governance crisis, while clearly demonstrating how heterogeneous the genetic makeup of these gaps is, intertwined with each country's political understanding, administrative legacy, and socio-cultural fabric. We now know that these gaps are not merely a technical design flaw, but a composite of a "causes" ranging from resource constraints and institutional capacity paralysis to political will weakness and a spiral of corruption.

Our case analyses have strikingly confirmed the power of contextual reality: the informal sector reality in India, Germany's legal discipline, or Singapore's spatial constraints serve as landmarks proving why a global prescription is impossible. Policy gaps not only create operational inefficiency; at the same time, it erodes the trust that citizens have in the state and institutional mechanisms, making the foundation of democratic legitimacy fragile. The solution here lies not in the mechanical coldness of purely administrative reforms, but in a holistic, human-centered governance philosophy interwoven with transparency, accountability, and socio-cultural sensitivity. The real test for the modern state in the face of the complexities of the digital age and global ecological crises lies in the extent to which it can narrow these gaps. Learning from past administrative mistakes and transforming the "failure stories" of different countries into learning laboratories will move future policy-making processes to a much more realistic and sustainable foundation. This analytical integration of historical and comparative perspectives whispers to us that policy gaps are not merely "faults," but a fundamental "governance force" that transforms public administration and redefines social relations. Ultimately, this study aims to offer not just a technical analysis, but a proactive roadmap towards building more just, transparent, and dignified public administrations worldwide.

Building upon this proactive roadmap, it is evident that future comparative research must pivot towards the complex intersection of climate adaptation, digital governance, and emerging waste streams. As the global economy rapidly digitizes, the exponential growth of electronic waste (e-waste) and the unprecedented material footprint of artificial intelligence (AI) infrastructure demand new analytical frameworks. Subsequent cross-national studies should investigate how algorithmic policy-making and smart city technologies can be leveraged to manage these novel, highly hazardous waste flows without generating new implementation gaps. Furthermore, exploring the structural integration of solid waste systems into broader urban climate resilience and adaptation strategies remains a vital frontier. Ultimately, deciphering these next-generation policy gaps will be essential to

ensure that rapid technological advancement does not outpace sustainable, equitable, and climate-resilient environmental governance.

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