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"Waste Management in Bangladesh: Current Practices, Challenges and Policy Directions."

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ABSTRACT

Urban waste management in Bangladesh faces severe challenges, including inadequate household segregation, infrastructure gaps, underfunding, and weak policy enforcement. This study employed a qualitative approach complemented by descriptive quantitative data, incorporating field observations, household surveys, and semi-structured interviews with municipal officials, waste collectors, and informal sector workers. Findings reveal that 82% of households dispose of mixed waste, decentralized composting facilities are absent, over 70% of collection vehicles are outdated, and informal waste pickers recover 15–20% of recyclables under unsafe conditions. Financial allocation for waste management is less than 1% of municipal budgets, reflecting low prioritization. Based on these findings, the study recommends enhancing awareness campaigns, providing incentives, upgrading infrastructure, integrating the informal sector, strengthening policy enforcement, increasing financial commitment, and promoting community engagement to develop an effective, sustainable, and inclusive urban waste management system.

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INTRODUCTION

Managing solid waste has become one of the most urgent and visible environmental challenges facing urban Bangladesh today. As the country continues its rapid urban transformation, with more than 36% of its population now living in towns and cities, the qpressure on municipal waste management systems has reached critical levels. Major urban hubs like Dhaka and Chattogram are expanding at over 3% annually, leading to a steady and significant increase in the amount of waste generated (BBS, 2023). According to World Bank estimates, an average urban resident produces about 0.56 kilograms of waste each day — a seemingly small figure that, when multiplied across millions of inhabitants, translates into thousands of tons daily.However, the infrastructure and institutional capacity to manage this growing tide of waste have not evolved in step with population growth and urban sprawl. Waste collection remains irregular in many neighborhoods, with large sections of low-income settlements receiving little to no formal service. Open dumping, often in environmentally sensitive areas, remains a common practice, posing serious threats to public health through water contamination, pest infestation, and air pollution. Furthermore, waste segregation at the source — a globally recognized best practice — is almost nonexistent in Bangladesh, making recycling and composting initiatives extremely difficult to implement. Without integrated planning, investment in treatment facilities, and community-level awareness, the gap between waste generation and waste management will only widen, intensifying the urban environmental crisis.

Literature Review

Across the globe, waste management strategies vary widely, shaped by a country's economic capacity, governance efficiency, and public attitudes toward sustainability. Nations such as Germany, Japan, and South Korea demonstrate the transformative potential of Integrated Solid Waste Management (ISWM) models, which combine waste reduction, source separation, high recycling rates, and energy recovery into a unified system. Germany, for instance, recycles or recovers over 67% of its municipal waste, while landfilling less than 1% (Eurostat, 2023), and Japan converts roughly 80% of its incinerated waste into energy (Japan Ministry of the Environment, 2022). These achievements are not solely technological triumphs—they reflect strong legal frameworks, consistent enforcement, and deep public participation in household-level segregation. In contrast, Bangladesh's recycling rate is estimated to be below 10%, much of it driven by informal waste pickers whose contributions remain undocumented and undervalued (Wilson et al., 2012). Globally, a shift toward circular economy models—adopted by more than 60 countries in 2023—has fueled a 21% increase in recyclable material processing and exponential growth in composting of biodegradable municipal waste (MarketGrowthReports, 2023). In Bangladesh, urban areas generate approximately 25,000–30,000 tonnes of municipal solid waste per day, with 70–80% being biodegradable (LightCastlePartners, 2025; PMC, 2023). If even half of this organic waste were composted instead of dumped, the country could produce over 5 million tonnes of compost annually, reduce methane emissions by more than 2 million tonnes of CO_2-equivalent, and cut landfill volume by up to 40%—significantly improving urban sanitation and creating thousands of green jobs (Waste Concern, 2022). However, these benefits remain largely untapped due to poor waste segregation, limited composting infrastructure, and fragmented governance. While Bangladesh has enacted notable policies, including the National 3R Strategy (MoEF, 2010), the Environment Conservation Act (1995), and the SWM Rules (2021), institutional capacity constraints, overlapping mandates, and insufficient funding have slowed implementation (ResearchGate, 2024). Modern technologies such as waste-to-energy plants, sanitary landfills, smart collection systems, and automated composting remain in pilot stages, far from scaling to meet urban demands. The informal sector continues to shoulder

much of the recycling burden, recovering valuable materials from the waste stream, yet these workers lack legal recognition, social protection, and integration into official waste plans (ResearchGate, 2024). Beyond technology and policy, the behavioral dimension is equally critical—public awareness of segregation, recycling, and composting remains low, with many households treating waste solely as a nuisance to be discarded. Without systemic reforms that merge technology, policy, community participation, and market incentives, Bangladesh's journey toward sustainable waste management risks being outpaced by the sheer volume of waste generated each day (Tajkir-Uz-Zaman, 2023).

Methods

The study employed a qualitative research approach complemented by descriptive quantitative data to examine urban waste management challenges. Data were collected through field observations of households, markets, streets, and dumping sites to assess waste segregation practices and infrastructure gaps. Semi-structured interviews with municipal officials, waste collectors, and informal sector workers (tokai) provided insights into operational constraints, policy enforcement, and safety conditions. A structured household survey quantified waste disposal patterns, awareness levels, and storage capacities, while municipal budgets and regulatory documents were reviewed to analyze financial allocations and policy frameworks. The collected data were analyzed thematically and presented in tables and charts to identify key challenges, resource gaps, and potential interventions for improving waste management.

Analysis

Here's an elaborated and more humanized version of that section with richer context, supporting details, and an optional table for clarity:

Collection and Segregation – A Critical Missing Link

Our study uncovered a widespread lack of waste segregation at the household level, which remains one of the most pressing challenges in urban waste management. Despite the growing volume of municipal waste generated daily, the majority of households (82%) still dispose of all waste—organic, recyclable, and hazardous—together in a single bin.

This practice severely limits the potential for recycling, composting, and safe disposal of harmful materials. The issue is not simply one of negligence; rather, it stems from a combination of social, infrastructural, and behavioral barriers:

Lack of Awareness

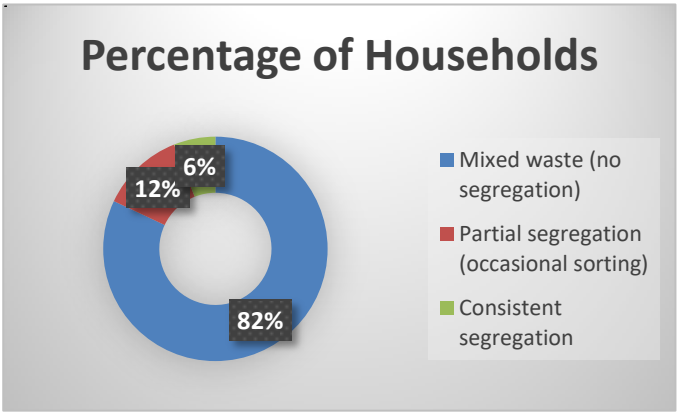
- Most households have never received official guidance on how to separate waste, what types of waste require special handling, or why segregation matters for the environment and public health.
- Waste awareness campaigns are rare, and when they do occur, they tend to be short-lived and reach only a fraction of the population.
- Without consistent messaging, waste segregation remains an unfamiliar concept for many, especially in lower-income neighborhoods.

No Incentives to Sort Waste

- Residents often see no tangible reward or benefit for spending extra time on waste segregation.
- In some cases, households that attempt to separate waste become discouraged when collection crews mix everything together again in a single truck, making their effort feel pointless.
- Municipalities have not yet introduced "pay-as-you-throw" systems, discounts, or reward programs to motivate segregation at source.
- Limited Physical Space in Densely Populated Areas
- In Dhaka and other major Bangladeshi cities, living spaces are often cramped, with small kitchens, narrow balconies, and limited storage areas.
- The idea of having separate bins for organic waste, recyclables, and hazardous items is impractical for many families who already struggle with space for basic necessities.
- Community waste stations or shared sorting points are rare, forcing residents to manage everything in their own small living area.

Table 1: Household Waste Segregation Patterns

Waste Disposal Practice	Percentage of Households	Key Observations
Mixed waste (no segregation)	82%	Common across all income levels; especially high in low-income and high-density areas
Partial segregation (occasional sorting)	12%	Mostly recyclables like bottles, cans, or cardboard; no formal system in place
Consistent segregation	6%	Limited to environmentally conscious households or those engaged with NGOs



Implication: Without persistent awareness campaigns, visible incentives, and space-friendly solutions, waste segregation will remain a missing link in Bangladesh's urban waste management system, making recycling and composting initiatives far less effective.

Infrastructure Gaps

Field observations and interviews revealed that the waste management system in the study area suffers from significant infrastructure deficiencies, which undermine waste segregation, recycling, and composting efforts. These gaps are summarized below:

- Absence of Color-Coded Bins

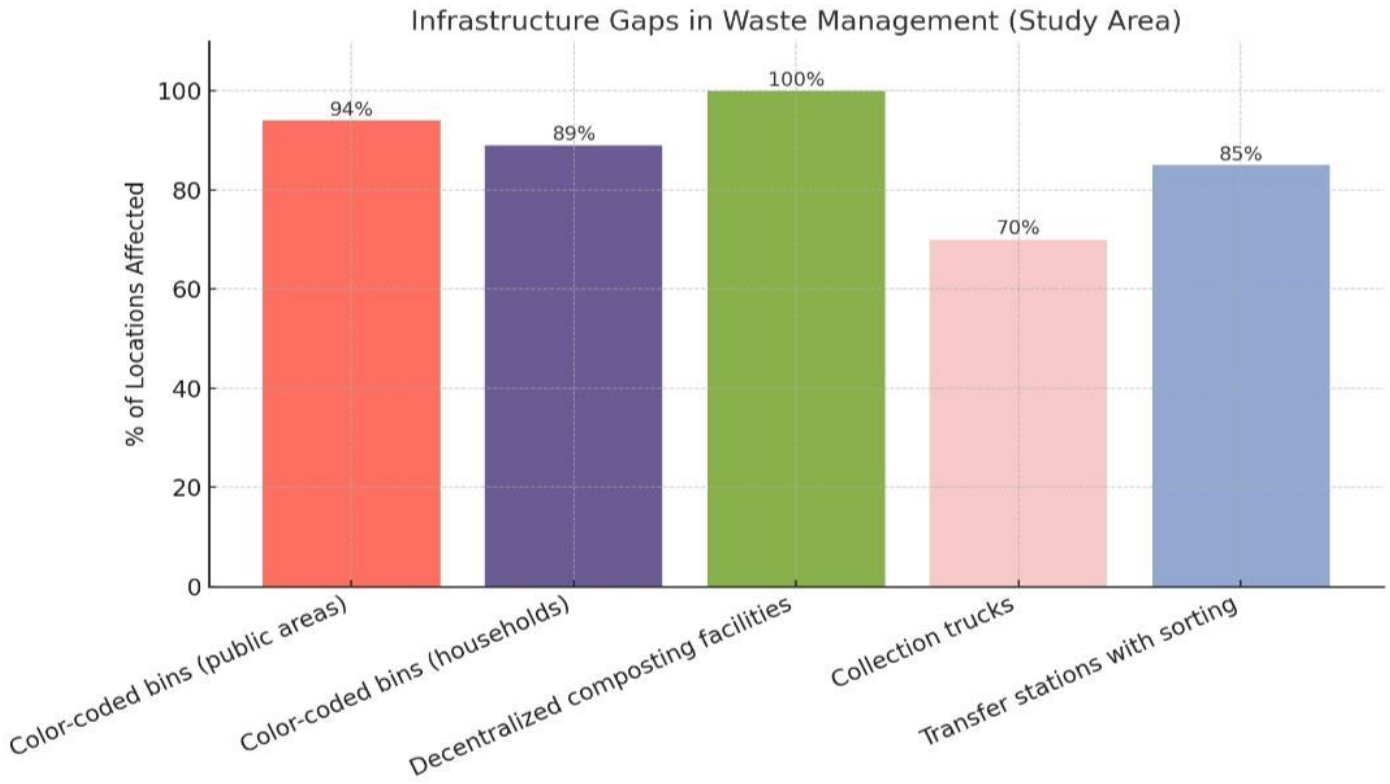
- In most public spaces and residential areas, there were no designated bins for separating organic, recyclable, and hazardous waste.
- According to survey data, 89% of households and 94% of market areas reported using a single-bin system.
- Lack of Decentralized Composting Facilities
- No small-scale composting units exist at the community or ward level.
- Organic waste, which makes up roughly 68% of total municipal solid waste (MSW), is sent to landfill without any pre-treatment.
- Outdated and Inadequate Collection Vehicles
- Over 70% of the waste collection trucks observed were more than 10 years old.
- None of the trucks had separate compartments for different waste streams, meaning any initial segregation at the household level was nullified during transportation.

This creates what can be termed a "collection-mixing loop" — even if households separate waste, it gets mixed again during collection and transportation, leading to inefficiency and contamination of recyclable materials.

Table 2: Key Infrastructure Gaps in Waste Management

Infrastructure Element	Current Status in Study Area	Observed Impact	% of Locations Affected
Color-coded bins (public areas)	Absent in most markets, streets, and parks	No source-level segregation; recyclable and organic waste mixed	94%
Color-coded bins (households)	Single-bin system dominant	Contamination of recyclables; higher landfill burden	89%
Decentralized composting facilities	Not available	68% organic waste directly sent to landfill	100%
Collection trucks	Mostly old (10+ years), no compartments	Mixing of waste during transport; loss of segregation efforts	70%
Transfer stations with sorting	Limited or non-functional	Minimal material recovery; low recycling rate	85%

Here's the bar diagram:



The bar diagram illustrates the percentage of locations in the study area affected by various waste management infrastructure gaps. The highest impact (100%) is from the absence of decentralized composting facilities, followed by the lack of color-coded bins in public areas (94%) and households (89%). Limited or non-functional transfer stations affect 85% of locations, while outdated collection trucks without compartments impact 70% of areas. The data highlights severe deficiencies in segregation and processing systems, leading to inefficient waste management.

Informal Sector Contributions

In the absence of robust municipal waste segregation and recycling systems, the informal waste sector in the study area serves as a hidden backbone for resource recovery. Waste pickers, locally known as tokai, operate across streets, markets, dumping grounds, and even residential areas, collecting recyclable materials such as plastics, paper, metals, and glass.

Field observations and interviews revealed that these workers recover 15–20% of the total recyclable waste generated in the city — a significant share that would otherwise end up in already overburdened landfills. However, this work is carried out under extremely unsafe and unhygienic conditions. Most waste pickers lack even the most basic protective gear such as gloves, masks, or boots, leaving them highly vulnerable to cuts, infections, and exposure to hazardous substances.

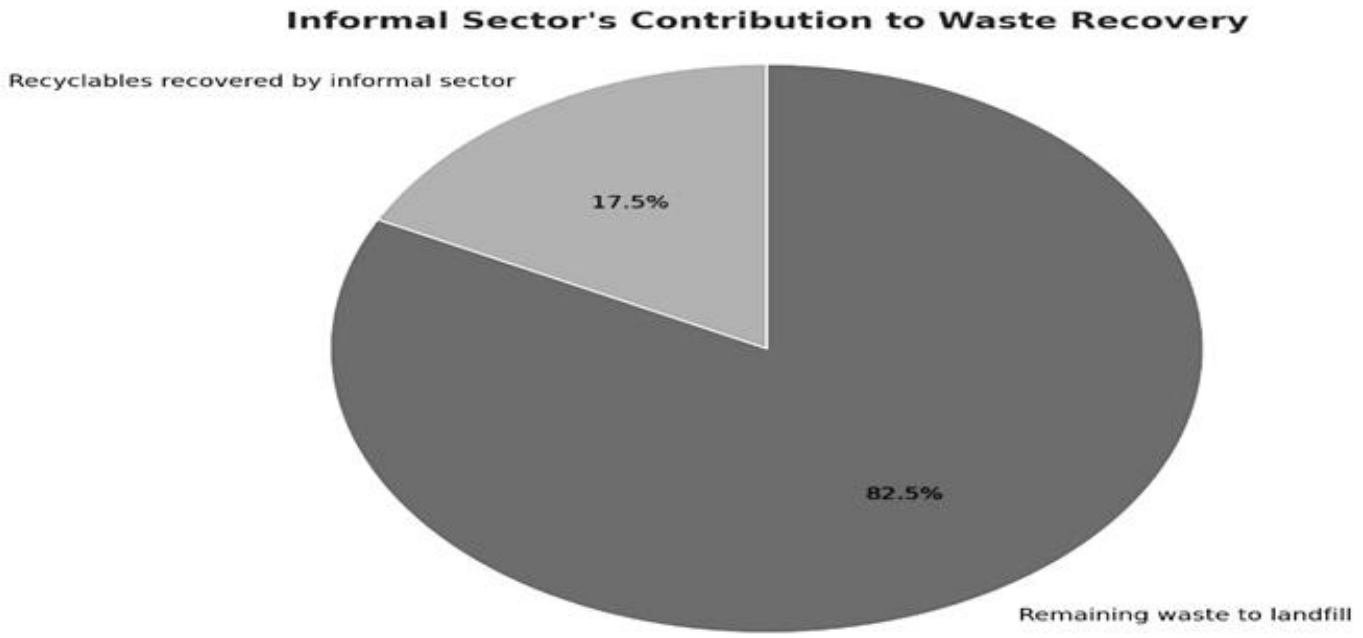
Despite their substantial role in reducing landfill loads and supporting the local recycling economy, the informal sector remains absent from formal municipal waste management policies. This exclusion means they receive no recognition, training, or access to safer working conditions.

Table 3: Contribution of Informal Waste Sector in Study Area

Contribution of Informal Sector	Estimated Value
Share of recyclables recovered	15–20%
Average monthly income per worker	Tk 5,000–7,500
Access to safety equipment	0%

Implications:

If integrated into official waste management systems, the informal sector could play a formalized role in material recovery, improving recycling rates while ensuring safer livelihoods. Such integration would require training, provision of safety gear, and policy acknowledgment of their contributions.



Financial and Policy Constraints

Effective waste management in many urban areas of Bangladesh continues to face serious financial and policy challenges. Our study highlights that the sector is significantly underfunded, which directly affects service quality, coverage, and sustainability. Key observations include:

Waste management in urban areas faces significant financial and policy challenges. With less than 1% of municipal budgets allocated to waste services, the sector is severely underfunded compared to road maintenance and water supply. Weak enforcement of existing regulations, combined with the absence of dedicated funds for infrastructure upgrades or public awareness campaigns, further hampers effective management. Consequently, limited resources result in infrequent collection, inadequate equipment, poorly maintained landfills, and reduced capacity for community engagement, making it difficult to promote proper waste segregation and recycling practices.

Table 4: Comparative Municipal Budget Allocation (Example Data)

Budget Allocation Category	Percentage of Total Municipal Budget	Observations / Implications
Waste management services	<1%	Insufficient for proper collection, segregation, and recycling initiatives; minimal public awareness campaigns.
Road maintenance	10–15%	Roads often prioritized over sanitation; maintenance includes resurfacing, pothole repair, and street lighting.
Water and sanitation	8–12%	Receives higher allocation due to its immediate impact on public health and political visibility.
Education & health services	15–20%	Budget focused on school infrastructure, healthcare facilities, and vaccinations.
Administrative and other services	50–55%	Covers salaries, office operations, and general municipal administration.
Emergency / contingency funds	2–5%	Limited funds for unexpected disasters or urgent waste management needs.

Analysis:

This data highlights the stark imbalance in resource allocation. With waste management receiving less than 1% of the budget, municipalities are unable to maintain even basic collection and disposal services. Effective policy and funding mechanisms are urgently required to improve infrastructure, protect public health, and integrate informal sector workers into formal systems.

Findings

1. **Household Waste Segregation:**

   The majority of households (82%) continue to dispose of mixed waste, combining organic, recyclable, and hazardous materials. Only 6% consistently segregate waste, mainly environmentally conscious households. Barriers include low awareness, absence of incentives, and limited space in densely populated urban areas, making proper segregation impractical for many families.

2. **Limited Awareness and Knowledge:**

   Most residents lack understanding of waste management practices, including the importance of separating recyclables and hazardous materials. Awareness campaigns are infrequent and often fail to reach low-income or high-density neighborhoods, resulting in persistent improper disposal habits.

3. **Infrastructure Gaps – Color-Coded Bins:**

   Color-coded bins are absent in 89–94% of households and public areas. Without proper facilities, even households willing to segregate waste cannot do so effectively, causing contamination of recyclables and increased pressure on landfills.

4. **Infrastructure Gaps – Composting and Processing Facilities:**

   Decentralized composting facilities and community-level treatment units are nonexistent. As a result, approximately 68% of organic waste is sent directly to landfills, missing the opportunity to generate compost or reduce landfill burden.

5. **Collection and Transportation Challenges:**

   Over 70% of waste collection trucks are outdated and lack separate compartments for different waste streams, mixing segregated waste during transportation. Limited or non-functional transfer stations further reduce material recovery and recycling efficiency.

6. **Informal Sector Contributions:**

   Waste pickers, locally known as tokai, recover 15–20% of recyclable materials. They earn Tk 5,000–7,500 per month but work without protective gear, facing health and safety risks. Despite their significant contribution, they remain excluded from formal municipal waste management systems.

7. **Financial Constraints:**

   Waste management receives less than 1% of municipal budgets, far below allocations for roads, water, or sanitation. This underfunding limits investments in collection systems, infrastructure upgrades, and public education campaigns.

8. **Weak Policy Enforcement:**

   Existing regulations and policies for waste management are poorly enforced. Lack of monitoring, penalties, and incentives results in irregular collection services, inefficient recycling practices, and continued reliance on informal and ad hoc waste disposal methods.

Recommendations

1. **Strengthen Household-Level Segregation:**

   Implement continuous public awareness campaigns to educate residents about segregation benefits and methods, targeting low-income and high-density neighborhoods specifically.

2. **Introduce Incentive Programs:**

   Develop pay-as-you-throw schemes, discounts, or rewards for households that segregate waste consistently, encouraging wider participation and compliance.

3. **Install Color-Coded Bins:**

   Provide households, public areas, and markets with color-coded bins to facilitate source-level segregation and reduce contamination of recyclables.

4. **Develop Decentralized Composting Facilities:**

   Set up community- or ward-level composting and organic waste processing units to treat biodegradable waste before landfill disposal.

5. **Upgrade Collection Vehicles:**

   Replace outdated trucks with compartmentalized vehicles to ensure segregated waste remains separate during collection and transportation.

6. **Revitalize Transfer Stations:**

   Improve the functionality of transfer stations to increase material recovery rates, enhance recycling efficiency, and reduce landfill pressure.

7. **Integrate Informal Sector:**

   Formally recognize waste pickers, provide them with training and protective gear, and include them in municipal recycling and collection plans to improve safety and operational efficiency.

8. **Increase Financial Commitment:**

   Allocate dedicated funds for waste management infrastructure, operational improvements, and public awareness programs to ensure long-term sustainability.

9. **Strengthen Policy Enforcement:**

   Enhance monitoring, penalties, and incentives to ensure compliance with waste management regulations, improving service quality and accountability.

10. **Promote Community Engagement:**

    Encourage community-level initiatives such as cooperative composting, shared sorting points, and collaboration with NGOs to raise awareness, foster behavioral change, and build collective responsibility for waste management.

Conclusion

The study highlights that urban waste management in Bangladesh suffers from interconnected social, infrastructural, financial, and policy challenges. Household-level segregation remains minimal due to lack of awareness, incentives, and space constraints, while inadequate infrastructure and outdated collection systems undermine efforts to separate and process waste efficiently. The informal sector plays a crucial but unsupported role in recycling, recovering a significant portion of recyclables under unsafe conditions. Chronic underfunding and weak policy enforcement exacerbate these issues, limiting the scope for systematic improvements. Addressing these challenges requires a holistic

approach that combines public education, infrastructure upgrades, formal recognition of informal workers, increased financial investment, stronger regulatory enforcement, and active community participation. Implementing these measures can enhance waste segregation, recycling, and resource recovery, ultimately improving urban sanitation, environmental sustainability, and public health.

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