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Challenges and Opportunities in Solid Waste Management for Sustainability in District Hyderabad, Pakistan

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Abstract
Hyderabad, one of the most rapidly urbanizing districts in Pakistan, is confronting an escalating solid waste management (SWM) crisis, as municipal systems currently collect only about half of the 1,500–2,000 metric tons of waste generated each day. This study investigates the challenges and opportunities of SWM in the city through a mixed-methods design, combining household surveys (n = 385), statistical modeling, and comparative analysis of global best practices. The logistic regression analysis identifies education and awareness as the most significant predictors of waste segregation behavior: graduates are 2.86 times more likely to participate, and residents who are aware of recycling programs are 3.74 times more likely. Conversely, households with monthly incomes below PKR 20,000 exhibit a disproportionately high reliance on open dumping (38.1%), highlighting underlying structural inequities. Cross-tabulation reveals the uneven distribution of municipal services, whereas the waste composition analysis indicates that organic (43.3%) and plastic (22.8%) materials constitute the majority of household waste streams. Despite 73.5% of respondents recognizing health risks, only 23.9% express willingness to pay for improved services, underscoring a critical governance and trust deficit. Drawing on successful international models—such as Sweden's integrated recycling-energy systems, South Korea's volume-based fees, and Brazil's integration of informal waste pickers—the study proposes context-specific solutions for Hyderabad, including decentralized composting, incentivized waste reduction, and formalization of the informal recycling sector. The findings make a dual contribution: first, by offering one of the few empirical, regression-based assessments of SWM behavior in Pakistan; and second, by framing Hyderabad's challenges within a comparative global perspective that yields actionable, locally adaptable strategies. The study underscores the pivotal importance of education, social equity, and governance reforms in promoting sustainable waste management practices. These insights hold relevance not only for Hyderabad but also for other mid-sized cities in developing regions struggling with parallel waste management crises.

Keywords:
solid waste management; waste segregation; waste disposal methods; municipal service access; health risk awareness

1. Introduction

Solid waste management has emerged as one of the most critical urban challenges facing Hyderabad, Pakistan, where rapid population growth, unplanned urbanization, and inadequate infrastructure have overwhelmed the existing waste management systems. The city generates approximately 1500–2000 metric tons of solid waste daily, yet only about half is properly collected, with the remainder accumulating in streets, vacant plots, and water bodies [1]. This situation creates severe environmental and public health consequences, including groundwater contamination, increased vector-borne diseases, and greenhouse gas emissions from open burning of waste [2]. The problem is further exacerbated by limited public awareness, weak enforcement of regulations, and a lack of proper disposal facilities [3]. However, these challenges also present significant opportunities to implement sustainable waste management solutions that can transform Hyderabad into a cleaner, healthier, and more resource-efficient

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city. Examining successful models from developed nations reveals valuable lessons for Hyderabad. Sweden's integrated waste management system, which combines advanced recycling with waste-to-energy conversion, has enabled the country to divert over 99% of household waste from landfills [4]. Similarly, Germany's "Green Dot" system has achieved remarkable success by making producers financially responsible for the recycling of their packaging materials, resulting in recycling rates exceeding 70% for most materials [5]. Japan's meticulous waste segregation system, supported by strong community participation and strict enforcement, has made cities like Tokyo global leaders in waste management efficiency [6]. These international examples demonstrate that effective waste management requires a combination of technological solutions, policy frameworks, economic instruments, and public engagement—all areas where Hyderabad currently faces significant gaps.

Comparative international experiences indicate that no single waste management model is universally effective; instead, each presents distinct advantages and limitations[7]. Sweden's integrated system, which combines high recycling rates with waste-to-energy conversion, has nearly eliminated landfilling, but critics point out the potential environmental trade-offs of incineration and the heavy infrastructure costs required for implementation [8]. Germany's "Green Dot" program, which makes producers financially responsible for packaging waste, has successfully reduced landfilling and achieved recycling rates exceeding 70%, yet the system remains dependent on continuous regulatory enforcement and can be burdensome for smaller businesses [9]. Japan's approach, centered on meticulous waste segregation and strong community participation, has achieved global recognition for efficiency, though it requires intensive public compliance, strict enforcement, and a robust institutional framework that can be challenging to replicate in developing contexts [10]. Recent advances in sustainable waste management technologies have further expanded the options available: novel materials and processing methods now enable higher-value recovery and reduced environmental impact, though scalability and affordability remain critical challenges for cities in the Global South [11].

Despite these advances globally, empirical evidence from mid-sized cities in developing countries remains limited, particularly in Pakistan, where urban centers such as Hyderabad face rapid population growth, infrastructural strain, and governance challenges. Most existing studies in Pakistan focus on descriptive assessments of municipal inefficiencies [12]; however, few employ rigorous quantitative modeling to examine the behavioral determinants of waste management practices or to systematically compare local outcomes with global best practices [13]. This study aims to bridge this gap by presenting the first regression-based analysis of household waste management behaviors in Hyderabad, complemented by contextual comparisons with international models. In doing so, the study contributes both methodologically by employing binary logistic regression to identify key predictors of waste segregation, and substantively by situating Hyderabad's challenges within the broader discourse on sustainable urban transitions. The findings aim to inform policymakers, practitioners, and scholars by providing empirically grounded, context-specific insights that can guide both local reforms and comparative discussions of sustainable waste management in developing regions.

Solid waste management is not only a municipal challenge but also a core component of global sustainability agendas. The United Nations Sustainable Development Goals (UNSDGs) provide a guiding framework that directly relates to this study. Effective waste management advances SDG 11 (Sustainable Cities and Communities) by ensuring cleaner and healthier urban environments [14], supports SDG 12 (Responsible Consumption and Production) through waste reduction, recycling, and resource efficiency [15], and contributes to SDG 13 (Climate Action) by reducing methane emissions from landfills and curbing open burning [16]. In the context of Pakistan, where urban areas such as Hyderabad are expanding rapidly, aligning SWM strategies with the UNSDGs is essential for both environmental protection and human well-being. By explicitly framing SWM as a sustainability imperative, this study contributes to global discussions on how cities in developing countries can advance the UNSDGs while addressing local infrastructural and governance challenges.

1.1. Novelty of the Work

This study provides a novel contribution to solid waste management literature by integrating a robust mixed- methods approach with a unique comparative analytical framework, specifically applied to the under-researched urban context of Hyderabad, Pakistan. It advances beyond typical descriptive studies by employing binary logistic regression to quantitatively identify key behavioral determinants of waste segregation, while simultaneously contextualizing these local findings through a critical examination of adaptable international best practices. This dual-method approach bridges a critical gap between empirical local data and global policy frameworks, providing a transferable model for developing sustainable and equitable waste management systems in rapidly urbanizing cities. Furthermore, the research is explicitly framed within the United

2025, Vol. 1, Article ID. 2025.0010
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Nations Sustainable Development Goals, linking municipal challenges to broader sustainability targets and enhancing its practical relevance for policymakers and scholars focused on urban environmental transitions.

1.2. Research Contribution

Prior studies on solid waste management in Pakistan have largely provided descriptive overviews of municipal inefficiencies or focused narrowly on health and environmental impacts, without systematically analyzing the socioeconomic and behavioral drivers of household waste practices. Moreover, few attempts have been made to apply quantitative modeling methods, such as regression analysis, to identify the determinants of segregation behavior or to evaluate the equity dimensions of service provision in mid-sized cities. This study addresses that gap by conducting the first regression-based empirical analysis of household waste management in Hyderabad, while situating the results within a comparative global framework. Through this approach, the study contributes both to the academic understanding of the behavioral and structural dynamics of waste management in developing urban contexts, and to policy-oriented discussions on how mid-sized cities can adapt global best practices to local realities.

2. Methods

2.1. Research Design

This study employed a mixed-methods research design to evaluate solid waste management (SWM) practices in Hyderabad, Pakistan. The quantitative component utilized structured household surveys, whereas the qualitative component drew insights from government reports and international case studies. This dual methodology provided a comprehensive understanding of waste management challenges by combining empirical data with contextual analysis. The research was designed as a cross-sectional study to capture current waste disposal behaviors and public perceptions. Ethical considerations included ensuring respondent anonymity and obtaining informed consent before survey administration.

2.2. Study Area and Sampling

The research focused on Hyderabad, selected for its significant urbanization pressures and documented SWM inefficiencies. A stratified random sampling technique was used to ensure representation across different socioeconomic groups and geographic zones, including residential, commercial, and peri-urban areas. The sample size of 385 households was determined using Cochran's formula, with a 95% confidence level and 5% margin of error, reflecting Hyderabad's population of approximately 3.5 million. Surveys were conducted face-to-face over eight weeks (January–February 2023) by trained enumerators. Questionnaires were available in Urdu and Sindhi to accommodate linguistic diversity, and households were proportionally selected from all 16 union councils to ensure geographic coverage.

2.3. Regression Analysis

A binary logistic regression model was applied to assess factors influencing residents' willingness to segregate waste. The dependent variable was binary (1 = willing to segregate, 0 = not willing). Independent variables included:

- Age (categorized as $\geq$46 years or younger),
- Education (graduate-level or above vs. lower education),
- Income (monthly earnings > PKR 50,000 vs. lower income),
- Awareness of recycling programs (yes/no).

Model validity was assessed using the Hosmer– Lemeshow goodness-of-fit test ($p > 0.05$), while explanatory power was evaluated through the Nagelkerke R^2 statistic. Odds ratios (OR) with 95% confidence intervals (CI) quantified predictor effects, with statistical significance set at $p < 0.05$. Multicollinearity was assessed using variance inflation factors (VIF < 5), ensuring robust results.

2.4. Cross-Tabulation Analysis

Cross-tabulations examined relationships between income levels and waste disposal methods (municipal collection, open dumping, burning, recycling). Pearson's chi-square tests (χ^2) determined statistical significance ($p < 0.05$), with Cramer's V measuring effect sizes. Expected frequencies exceeded 5 in all cells to meet test assumptions. Post-hoc analyses with Bonferroni-adjusted p-values identified specific income-based disparities in disposal practices.

2.5. Data Analysis

Descriptive statistics summarized demographic profiles (Table 1), waste composition, and Likert-scale perceptions, reporting percentages, means, and standard deviations (SD). For Likert items (1 = Strongly Disagree to 5 = Strongly Agree), Cronbach's alpha ($\alpha = 0.78$) confirmed internal consistency. One-sample t-tests compared perception means to a neutral midpoint (3.0) to assess directional trends. Data were analyzed using SPSS v26, supplemented by visual aids (e.g., bar charts) to enhance clarity.

Table 1: Demographic characteristics of respondents (N = 385).

Variable	Category	Frequency	Percentage (%)
Gender	Male	238	61.8
	Female	147	38.2
Age	18–30 years	142	36.9
	31–45 years	168	43.6
	≥46 years	75	19.5
Education	No formal education	45	11.7
	Primary/Secondary	187	48.6
	Graduate or above	153	39.7
Income (Monthly)	<PKR 20,000	210	54.5
	PKR 20,000–50,000	132	34.3
	>PKR 50,000	43	11.2

3. Results

The survey collected responses from 385 residents across Hyderabad, revealing key socioeconomic patterns that influence waste management behaviors, as summarized in Table 1. Male respondents constituted 61.8% of participants, reflecting cultural norms in survey participation while potentially underrepresenting female perspectives on household waste practices. The age distribution indicated that 43.6% of respondents were between 31 and 45 years old, representing the primary decision-makers in household waste disposal. Educational attainment varied significantly, with 48.6% having primary or secondary education and 39.7% holding graduate degrees, indicating differing levels of environmental awareness across the population. Perhaps most notably, 54.5% of respondents reported monthly incomes below PKR 20,000, highlighting the economic constraints that shape waste management choices for the majority of Hyderabad's residents. These demographic characteristics are crucial for understanding how different population segments interact with waste systems and which groups may require targeted interventions.

3.1. Factors Influencing Waste Segregation Willingness

The logistic regression analysis identified several key determinants of residents' willingness to segregate waste. Educational attainment emerged as the strongest predictor, with graduates showing 2.86 times higher odds of being willing to segregate compared to less educated individuals. This finding highlights the pivotal role of education in promoting pro-environmental behavior. Awareness of recycling programs had an even stronger effect, increasing the likelihood of willingness to segregate waste by 3.74 times. Interestingly, although higher income was positively associated with willingness to segregate waste, its effect size (OR = 2.18) was smaller compared to that of education or awareness. The negative association with older age (≥46 years) suggests generational differences in environmental attitudes or resistance to changing established habits, as shown in Table 2. These results collectively indicate that behavioral change interventions should prioritize education and awareness campaigns while developing age-appropriate messaging to engage older residents.

The pronounced influence of education and awareness on willingness to segregate waste can be attributed to both cultural and institutional dynamics. In the Pakistani context, higher education not only increases environmental literacy but also fosters a sense of civic responsibility and exposure to global sustainability discourses. Educated individuals are more likely to engage with media and participate in civic discussions that highlight environmental issues, which helps explain their greater willingness to adopt waste segregation practices. Similarly, targeted awareness campaigns even when limited have a disproportionate impact because they provide actionable knowledge in a setting where official communication about waste practices is often scarce or fragmented. Cultural factors further reinforce this trend: educated households are typically more engaged in formal institutions and more trusting of structured processes, making them receptive to messages on proper waste management. By contrast, less educated or marginalized groups may rely on traditional practices such as open dumping, which are culturally normalized and reinforced by weak institutional enforcement. From an institutional perspective, the lack of consistent government-led awareness programs means that when such initiatives do reach citizens, they have a

2025, Vol. 1, Article ID. 2025.0010
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Table 2: Binary logistic regression analysis of factors influencing willingness to segregate waste.

Predictor Variable	B	SE	Odds Ratio (OR)	*p*-Value	95% CI for OR
Age (≥46 years)	−0.42	0.18	0.66	0.021 *	[0.46, 0.94]
Education (Graduate+)	1.05	0.22	2.86	<0.001 ***	[1.86, 4.40]
Income (>PKR 50,000)	0.78	0.25	2.18	0.002 **	[1.34, 3.55]
Awareness of Recycling	1.32	0.19	3.74	<0.001 ***	[2.58, 5.43]
Constant	−1.12	0.31	0.33	<0.001 ***	—

pronounced impact on behavior. This explains why awareness of recycling programs shows the strongest effect in the regression model—residents who are informed represent a small but influential group whose practices are directly shaped by rare exposure to formal environmental campaigns. These findings suggest that scaling up education-based interventions and sustained public awareness campaigns could generate significant behavioral change, particularly if they are adapted to local cultural norms and supported by visible institutional commitment.

Analysis of disposal methods by income level in Table 3 revealed significant socioeconomic inequalities in waste management practices. Low-income households (<PKR 20,000/month) reported open dumping at nearly double the rate (38.1%) of higher-income groups (20.9%), a statistically significant difference ($\chi^2 = 8.76$, $p = 0.013$). This disparity likely reflects both the limited coverage of municipal services in lower-income neighborhoods and the economic necessity of relying on informal waste disposal methods. While municipal collection rates showed a positive income gradient, the differences were not statistically significant, suggesting service gaps affect all income levels. Perhaps most concerning was the uniformly low recycling participation across income groups (3.3–7.6%), indicating systemic failures in recycling infrastructure that transcend economic divisions. These findings highlight the need for equitable service expansion and targeted interventions in low-income communities.

Residents expressed strong dissatisfaction with current waste management systems through Likert-scale ratings. Table 4 demonstrated that government enforcement received the lowest score (mean = 1.64), reflecting profound governance challenges in waste regulation. Service reliability scored only slightly higher (mean = 2.13), with 64.4% of respondents disagreeing that collection was timely. Paradoxically, although 73.5% of respondents acknowledged the health risks associated with improper waste disposal (mean = 3.83), only 23.9% expressed willingness to pay for improved services (mean = 2.41). This contradiction suggests a crisis of confidence in municipal authorities, where residents understand the problems but doubt the government's capacity to implement solutions. Such findings emphasize the need for transparent reforms and accountability mechanisms to rebuild public trust in waste management institutions.

The waste composition analysis in Table 5 revealed critical insights for intervention planning. Food waste constituted the largest portion of household discards (mean = 4.19), presenting both a disposal challenge and a substantial opportunity for composting initiatives. Plastic waste ranked second (mean = 3.78), confirming the urgent need for policies addressing Pakistan's plastic pollution crisis. The relatively low proportions of recyclables such as paper (mean = 2.96), metal (mean = 2.56), and glass (mean = 2.30) likely reflect both household consumption patterns and the effectiveness of informal recycling networks. These findings suggest that waste reduction strategies should prioritize organic waste treatment and plastic reduction while supporting existing informal recycling systems for other materials. The data provides a clear hierarchy for intervention priorities based on actual waste generation patterns.

4. Discussion

The findings of this study present a critical examination of solid waste management (SWM) challenges in Hyderabad, while drawing important lessons from successful international models. The logistic regression analysis identified education and awareness as key determinants of willingness to segregate waste, with graduates exhibiting 2.86 times higher odds of participation. This aligns with Japan's meticulous waste segregation system, where sustained public education campaigns and strict enforcement have achieved remarkable compliance rates [17]. However, Hyderabad's stark generational gap in environmental attitudes—with older residents less willing to segregate—contrasts sharply with Sweden's intergenerational approach that incorporates age-specific messaging in its national recycling program [18]. The socioeconomic disparities in waste disposal methods expose systemic inequities in service provision. Low-income households' reliance on open dumping (38.1%) mirrors chal-

Table 3: Cross-tabulation of waste disposal methods by income level (N = 385).

Disposal Method	<PKR 20,000	PKR 20,000–50,000	>PKR 50,000	Total	χ^2 (*p*-Value)
Municipal Collection	98 (46.7%)	62 (47.0%)	25 (58.1%)	185	4.21 (0.122)
Open Dumping	80 (38.1%)	38 (28.8%)	9 (20.9%)	127	8.76 (0.013 *)
Burning	25 (11.9%)	22 (16.7%)	6 (14.0%)	53	1.44 (0.487)
Recycling/Kabariwala	7 (3.3%)	10 (7.6%)	3 (7.0%)	20	3.89 (0.143)

Table 4: Public perception of waste management services (5-Point Likert Scale).

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean (SD)
1. Waste collection is timely and reliable.	28.3	36.1	15.6	14.8	5.2	2.13 (1.21)
2. Recycling facilities are accessible.	41.0	32.5	12.7	10.4	3.4	1.93 (1.15)
3. The government enforces waste management laws.	52.7	29.9	8.3	6.5	2.6	1.64 (1.07)
4. Open dumping/burning causes health problems.	5.2	9.9	11.4	43.6	29.9	3.83 (1.12)
5. I am willing to pay for improved services.	22.6	35.1	18.4	17.1	6.8	2.41 (1.24)

Table 5: Composition of household waste materials (self-reported).

Material	Never Present (%)	Rarely (%)	Sometimes (%)	Often (%)	Always Present (%)	Mean (SD)
1. Food waste	1.3	4.2	12.5	38.7	43.3	4.19 (0.89)
2. Plastic	2.6	8.1	21.0	45.5	22.8	3.78 (1.03)
3. Paper/Cardboard	9.9	23.4	34.5	24.7	7.5	2.96 (1.12)
4. Metal	18.4	32.7	28.3	15.6	5.0	2.56 (1.09)
5. Glass	25.7	36.9	22.1	11.4	3.9	2.30 (1.06)

lenges faced by Bangkok in the early 2000s, before Thailand implemented its "Polluter Pays" policy and expanded municipal collection to informal settlements[19]. The uniformly low recycling rates across income groups (3.3–7.6%) highlight infrastructure gaps similar to those Johannesburg addressed through its integrated waste picker incorporation program, which formalized 2000 informal recyclers into the city's SWM system [20]. The paradox between high health risk awareness (73.5%) and low willingness to pay for improvements (23.9%) reflects a governance crisis comparable to Delhi's pre-2010 situation [21]. India's capital addressed this challenge through transparent billing systems and visible service improvements, as documented in the Delhi Municipal Corporation's 2015 reform report [22]. Hyderabad's waste composition profile, dominated by organic (43.3%) and plastic waste (22.8%), presents opportunities to adapt proven solutions: Seoul's food waste reduction program cut organic waste by 30% through mandatory biodegradable bags [23], while Rwanda's plastic ban demonstrates the effectiveness of stringent material-specific policies [24].

Hyderabad's challenges are not unique but reflect shared challenges faced by rapidly urbanizing cities. The crucial differentiator lies in political will and adaptive policymaking—factors that enabled Curitiba to transform from a waste management crisis in the 1980s to a global model today [25]. For Hyderabad, the path forward requires context-sensitive adaptation of these proven strategies, coupled with strong monitoring systems to ensure equitable implementation across socioeconomic groups. Future research should examine the feasibility of implementing these international models in selected Hyderabad neighborhoods, with particular emphasis on cultural acceptability and institutional capacity. Longitudinal studies monitoring behavioral changes would further enhance our understanding of the effectiveness of interventions in the Pakistani context. It is evident that the technical solutions are available; the critical challenge lies in developing governance frameworks and public engagement strategies to implement them effectively. The reliance on open dumping and burning in Hyderabad has implications that extend beyond environmental degradation to severe pub-

2025, Vol. 1, Article ID. 2025.0010
https://doi.org/10.69709/SusProc.2025.102931

lic health consequences. Open dumping contaminates surface and groundwater sources, creating pathways for waterborne diseases such as cholera, diarrhea, and typhoid, which have historically caused outbreaks in Sindh's urban and peri-urban settlements. Similarly, stagnant waste sites provide breeding grounds for mosquitoes, increasing the risk of malaria and dengue transmission, while piles of organic waste attract rodents and flies that spread infectious diseases [26]. Open burning of plastics and mixed household waste releases toxic pollutants, including dioxins and fine particulate matter, which are linked to chronic respiratory illnesses, asthma, and even cardiovascular problems. Evidence from comparable contexts, such as Bangladesh, shows that unmanaged waste directly elevates hospital admissions during peak waste accumulation periods [27]. These health hazards highlight that SWM reform in Hyderabad is not solely an environmental or infrastructural concern but also a pressing public health necessity. Addressing waste mismanagement could therefore play a pivotal role in reducing the city's disease burden and healthcare costs while simultaneously improving quality of life.

5. Conclusions

This study reveals that solid waste management in Hyderabad is at a critical juncture, where systemic inefficiencies intersect with opportunities for reform. The empirical analysis indicates that education and awareness are the strongest drivers of waste segregation, with graduates and well-informed residents exhibiting significantly higher levels of participation. Income-based disparities remain acute, as low-income households disproportionately resort to open dumping, while municipal collection and recycling services remain unevenly accessible. The predominance of organic (43.3%) and plastic (22.8%) waste in household discards highlights priority areas for intervention; however, public willingness to fund improved services remains low, reflecting deep-seated mistrust in municipal governance.

The contribution of this study lies in combining robust statistical modeling with global comparative insights to illuminate the structural and behavioral dynamics of SWM in a mid-sized Pakistani city. By placing Hyderabad in the context of broader international experiences, the findings demonstrate that technical solutions such as community composting, formalization of the informal sector, and volume-based waste reduction already exist, but their effectiveness depends on context-sensitive adaptation. Policy responses must therefore address not only infrastructure gaps but also social equity and governance reforms to rebuild public confidence.

Moving forward, Hyderabad's path to sustainable waste management will require phased interventions. First, targeted education campaigns and awareness programs can foster behavioral change across generations. Second, equitable service expansion must prioritize low-income neighborhoods, while policy frameworks incentivize segregation and recycling at the household level. Third, integrating informal recyclers into formal systems will enhance efficiency while also providing dignified livelihood opportunities. Finally, transparent and accountable governance structures are essential for restoring trust and ensuring active citizen participation.

By synthesizing empirical evidence with global lessons, this research contributes to the academic discourse on urban sustainability and provides a practical roadmap for policymakers. The findings reaffirm that while Hyderabad's challenges are formidable, they also present opportunities for transformative change. With strategic, inclusive, and transparent reforms, the city can transition from a waste management crisis toward a resilient, sustainable urban future, offering a replicable model for other developing regions facing similar constraints.

5.1. Integrated Policy Implications

The survey results collectively depict a waste management system under strain, yet one with significant opportunities for improvement. Several important policy implications can be drawn: First, educational campaigns should target knowledge gaps across all demographics, with special attention to less educated and older residents. Second, service expansion must prioritize low-income neighborhoods where open dumping is most prevalent. Third, organic waste treatment and plastic reduction should form the cornerstone of waste diversion efforts. Fourth, governance reforms are urgently needed to rebuild public trust and enable effective policy implementation. Finally, interventions should build upon existing informal recycling networks rather than attempting to replace them. These evidence-based recommendations provide a roadmap for developing context-appropriate, equitable waste management solutions in Hyderabad.

6. List of Abbreviations

CI	Confidence Intervals
OR	Odds Ratios
SDG	Sustainable Development Goals
SWM	Solid waste management
UNSDGs	The United Nations Sustainable Development Goals
VIF	Variance Inflation Factors

Author Contributions

Conceptualization, methodology, software: A.R.K., W.S.; Validation: S.B.; Formal analysis: A.R.K., W.S.; Investigation, resources, data curation: S.B.; Writing original draft, writing-review and editing, graphical abstract: A.R.K., W.S., S.B.; Supervision: A.R.K.; Project administration: A.R.K., S.B. All Authors have read and agreed to the published version of the manuscript.

Availability of Data and Materials

All data supporting the findings are included in the manuscript.

Ethics Committee Approval and Consent to Participate

Approval for data collection was obtained from the School of Public Administration, Hohai University, Nanjing, China; Approval number: 20230103; approved on 3 January 2023. All participants were informed about the purpose of the study, assured of anonymity and confidentiality, and their informed consent was obtained before the administration of the survey.

Human Rights Statement

This study was conducted in accordance with ethical standards for research involving human participants.

Conflicts of Interest

The authors declare no conflicts of interest.

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