

*Original Research*

# **Orientations Towards Urban Domestic Waste: Messages for Urban Environmental Integrity**

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## **Abstract**

Developing countries are struggling with urban waste management. Focusing on Islamabad, Pakistan, cross-sectional data determines how contextual variants impact domestic waste management. The study deployed a multifaceted approach to assessments. Hence, waste-bin density is a reliable proxy variable for situational analysis. It emerged that the waste-bin density in Islamabad is asymmetrical. It formulates that some localities in Islamabad receive preferential treatment, which contradicts the principles of “parity” and “environmental justice.” The analysis entails synchronizing efforts based on the principle “Polluters pay the price”. Likewise, it emerged that solid waste management in Islamabad inherently relies on landfills. This “Low-hanging fruit” option is not sustainable. Hence, technological-based solutions through market-driven measures seem more dependable. Messages in monetary terms are persuasive and automatically prioritize waste disposal options. Therefore, the study analysis analyzed the feedback from 305 respondents. The female representation was 36.4%, much lower than their due. A greater focus on capacity-building and female empowerment is required to reverse this trend. (96.4%) demanded integrated waste management, (41%) remain dissatisfied with the current arrangements, and (88.5%) believe that bad waste management depreciates property value. The assessments based on (Age, Gender, Education, Nature of employment, and Duration of stay) render that the respondents’ views significantly modified ( $p \leq 0.05\%$ ) with Age and Duration of stay. Resilient domestic waste management requires resource recovery mechanisms such as a “circular economy framework”. It seems a plausible option in countries like Pakistan, as it generates revenue. Urban residents prefer whatever is productive and cost-effective. It demands a paradigm shift in strategies through public participation and context-based assessments. The assessments affirm that GIS-based spatial analysis techniques are dependable for improvising measures to manage urban domestic waste.

**Keywords:** domestic waste, circular economy, environmental sustainability, waste management

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## Introduction

Production and consumption are two integral aspects of natural and human systems. Both aspects have their peculiar imprints on resource consumption and waste generation. Yet, the natural and human systems interpret waste differently. Nature perceives every component of the environment as valuable; thus, it considers it a resource. Hence, “waste” is not a feature of nature’s dictionary. On the other hand, humans are more obsessed with the linear use of environmental assets [1, 2]. In this context, [3] and [4] recommended policy coherence, which is currently lacking in developing countries like Pakistan. Even a scarce commodity that is not of immediate use is discarded as waste. This discarded stuff piles and converts human settlements into waste dumps [5]. Managing the problem in urban areas is more complex and cumbersome than in rural surroundings. Consequential urban environmental and resultant exacerbations demand diagnostic and integrated responses.

Urban domestic waste is a subset of municipal waste. It originates from homes within a local administrative jurisdiction [6, 7]. Population pressures, unregulated urbanization, technological advancements, rampant consumerism, and lack of awareness complicate its disposal [8-10]. The repercussions are damaging the environment and society. [11, 12], and [13] tried to highlight the damaging impacts of urban solid waste. They formulated that developing countries like Pakistan are more vulnerable to the consequences due to capacity constraints. Hence, this scenario needs immediate redressal as a primary environmental concern. It requires scrutiny from diverse perspectives for urban environmental resilience in developing regions.

The reported studies infer that domestic solid waste strains Islamabad’s ecology, economy, and environment [12]. This, once, “Green City” is Pakistan’s capital and is facing rapid migration and consequential urbanization. This is a drastic scenario that is accentuating domestic waste disposal in Islamabad. Resultant stresses require collaborative efforts to manage household waste effectively. For this purpose, researchers such as [5] and [14] explored the prospects of market-based solutions to manage solid waste in Islamabad. In this context, two other studies are equally relevant. One assessed composting as a potential solution [15], while the other focused on the waste dumping sites in the city [5]. Likewise, the scholars weighed the impacts of waste dumping on human health [16], soil [17], and vegetation [18]. The researchers also explored the prospects of geospatial data for improving domestic waste disposal in Islamabad [19].

However, such studies mainly focused on the physical, chemical, and biological characteristics of domestic waste. There is a realization that humans cause destruction and should be part of the solution [20]. Therefore, context-driven measures that involve

stakeholders are getting recognition. The focus enhances the social acceptability, economic viability, and durability of the initiatives taken [13]. Thus, the present study evaluates the imprints of socioeconomic determinants on domestic waste generation in Islamabad. The study hypothesizes that socioeconomic determinants have palpable imprints on the orientations regarding domestic waste management in developing countries. Accordingly, the study provides a situation analysis of solid waste management in Islamabad. The following are the principal objectives of this study:

- I. To provide a situational analysis of solid waste disposal and management in Islamabad.
- II. To assess the impacts of socioeconomic determinants on urban domestic solid waste in transforming economies like Pakistan.

The subsequent section explains the methodology of this study. Section 3 focuses on significant findings and assessments. Section 4 discusses the observations’ possible causes and impacts. The final section summarizes the conclusions. The study anticipates that the findings will support the efforts towards sustainable management of urban domestic waste in similar contextual settings.

## Material and Methods

### Study Area

The research examines how urban residents view and manage their household waste. For this purpose, investigations were conducted in Islamabad, Pakistan (Fig. 1). This urban settlement stretches about 917.79 square kilometers (Annexure 1). Around 1.01 million people live in this city, and its population is surging (World Population Review – date of accessed August 18, 2022; <https://worldpopulationreview.com>). This undulating urban settlement in the foothills of the Himalayas experiences marked weather and seasonal fluctuations (The World Bank. (n.d.). Climate Change Knowledge Portal. – date of accessed August 18, 2022; <https://climateknowledgeportal.worldbank.org>).

### Data Acquisition and Collection

The study relies on a multifaceted assessment approach. This technique combines quantitative and qualitative data sets for evaluations. The empirical data was retrieved through field observations for assessments. The CDA collects, transports, and manages domestic solid waste in Islamabad. Therefore, the researchers obtained secondary household waste collection and disposal information from the CDA. For this purpose, the field assessments were made through the Global Positioning System (GPS) (Fig. 2).

The opinions of the residents were obtained through a cross-sectional survey. These respondents were, primarily, located in Zone 1, Zone 2, and Zone 4

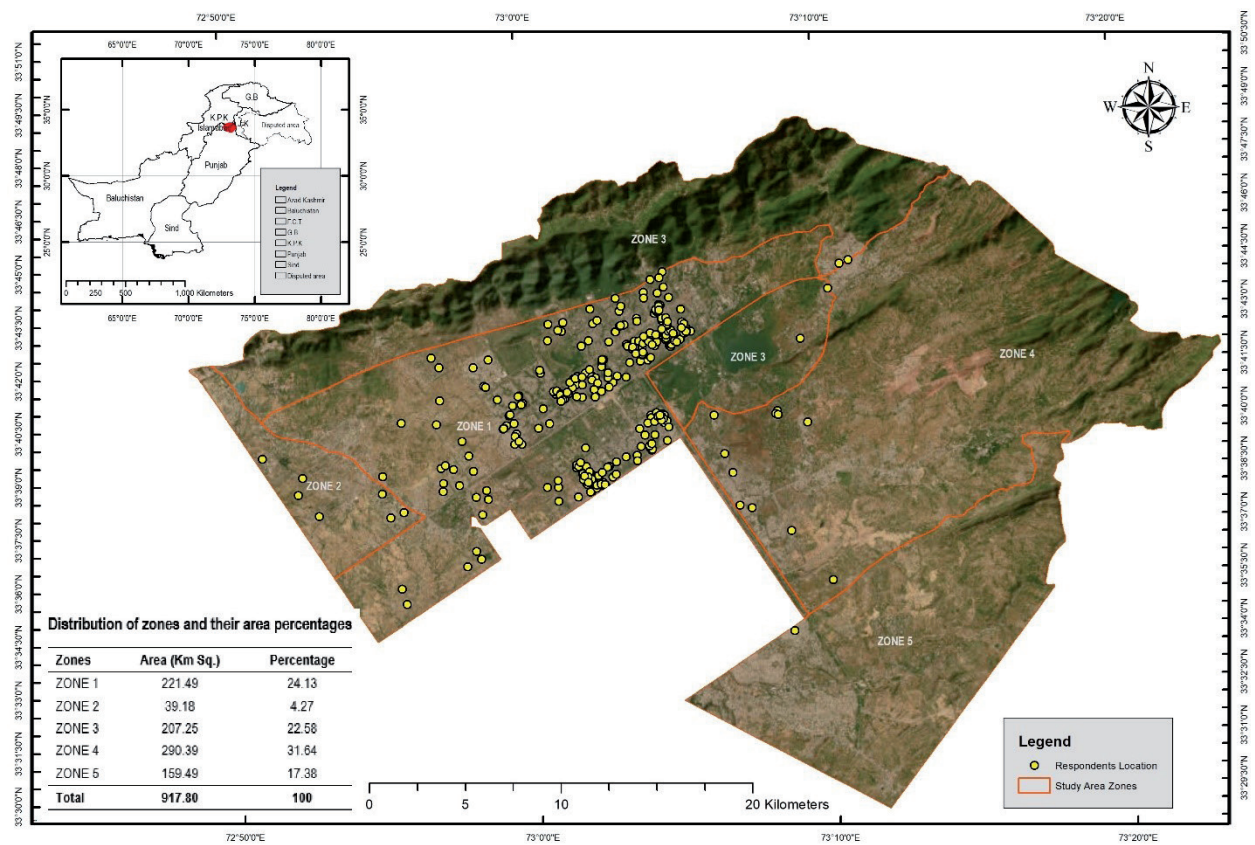


Fig. 1. The study area and geographic distribution of respondents.

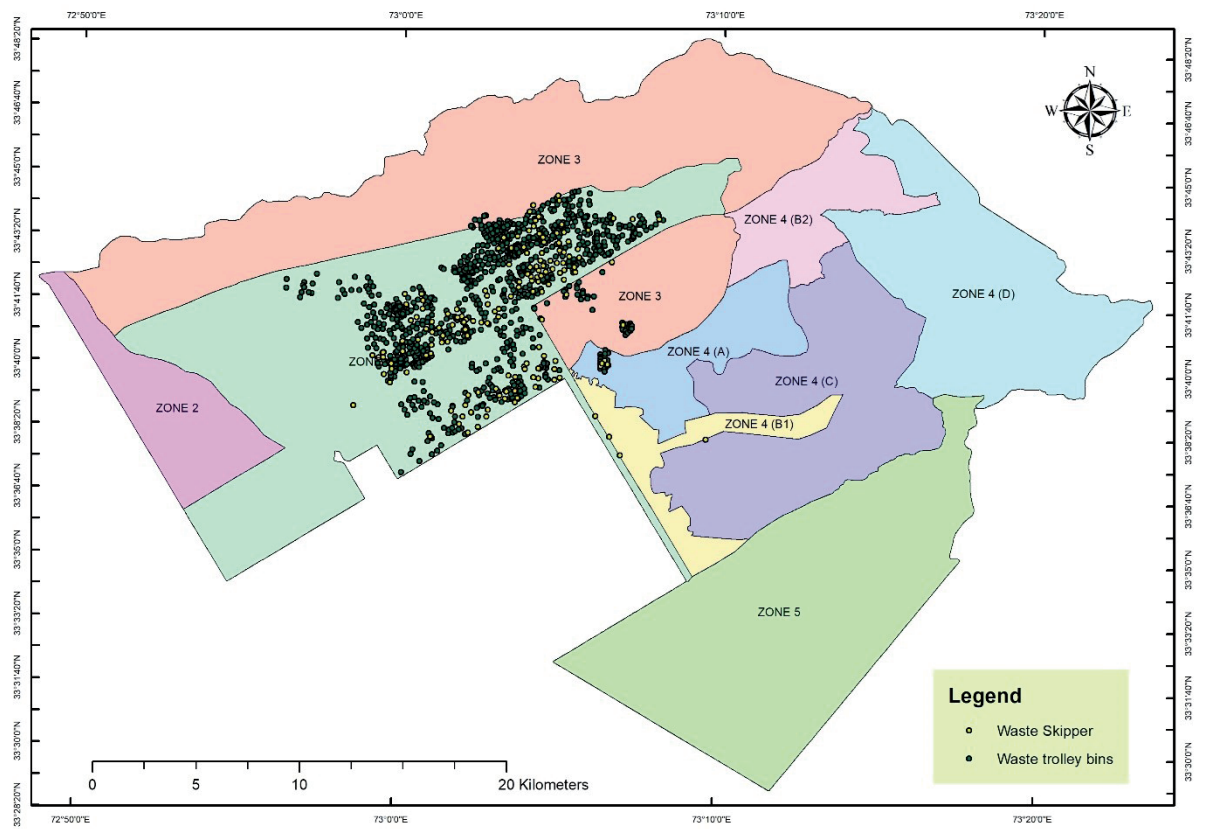


Fig. 2. The deployment of waste collection skippers and trolleys in the study area.

of the city (Fig. 1). The responses were retrieved through a questionnaire (Annexure 2). Its robustness was validated through a pilot survey. The researchers adopted a convenience sampling technique for data collection.

#### *Data Arrangement and Processing*

GPS-based reading (Model eTREX 10) empowered to illustrate (Fig. 3) the deployment of waste collection trolleys ( $n = 942$ ) and skippers ( $n = 155$ ). ArcGIS-based spatial analysis was deployed to interpret the spatial patterns of waste collection and transportation. Likewise, the waste dumping sites were identified and examined. The potential respondents were approached through social media platforms like WhatsApp and Facebook. The questionnaires were hand-delivered to respondents, explained, and collected between October 2021 and March 2022. Hence, we retrieved a total of 353 responses. In the next stage, 305 responses were sieved/selected through data cleaning and tabulated.

#### *Data Analysis and Assessments*

Following this, the authors performed data analysis and statistical tests through R-software (version R-4.2.1). Subsequently, the significant findings were mapped through GIS (ArcGIS version 10.3). For this purpose, the comparison based on demographic changes helped

comprehend the trajectory of domestic waste generation in the city.

## **Results**

The study evaluates the perceptions regarding domestic solid waste in Islamabad. The critical findings have been condensed and categorized into the following subsections.

### **Institutional Arrangements and Domestic Solid Waste**

Statutory policy and institutional arrangements significantly influence perceptions, actions, and domestic waste management. For this purpose, the existing framework in Islamabad was focused.

#### *Waste Collection*

The dedicated staff collects domestic waste in Islamabad from doorsteps and piles it in a cerb (waste collection dump). For this purpose, the management deploys 939 trollies and 155 skippers (Fig. 2). Here, scavengers segregate waste and sell the collected items. Meanwhile, the waste dumpers/lorries transport the remaining waste (Annexure 3).

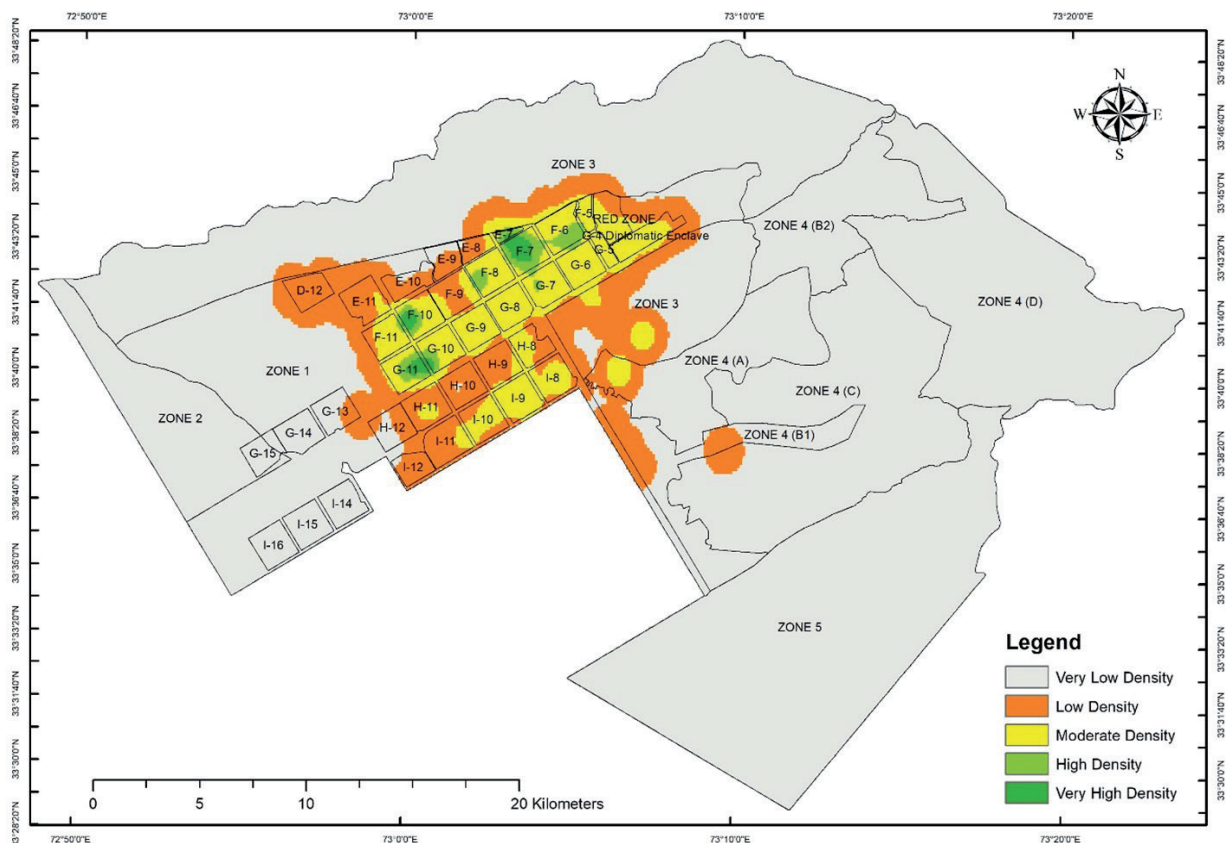


Fig. 3. Domestic waste hotspot visualization through waste-bin density in Islamabad.



Table 1. The variations in waste-bin density in the study area.

Density	Area (Km Sq.)	Percentage
Very Low	813.3377114	88.630687
Low	38.594944	4.2057516
Moderate	31.996271	3.4866839
High	25.847965	2.8166933
Very High	7.893657	0.8601842
Grand Total	917.6705484	100

The assessments show that the distribution of waste bins in the city is not uniform (Table 1). (Fig. 3) illustrates the spatial concentration of waste bins in the study area. Waste-bin availability ranges from “Very Low” to “Very High” categories – this density served as a proxy for evaluating municipal waste services. The “Very Low” density category covered 88.63% of the study area. Here, the concentration of waste bins is minimal. The “Low,” “Moderate,” and “High” categories cover 4.21%, 3.49%, and 2.82%, respectively, of the study area and point to more organized waste management (Table 1). Interestingly, the “Very High” density category accounts for only 0.86% of the total area but indicates an organized focus on municipal services.

### Waste Disposal

It emerged that the collected domestic waste goes to the Losar landfill site (Figure 4). Landfill mechanism is the preferred choice for household waste disposal in Islamabad. However, urban sprawl, local pressures, and capacity exhaustion forced these “Landfills” to relocate. (Fig. 4) comprehensively illustrates the spatial-temporal trajectory of such intermittent relocations in Islamabad.

### Socio-Demographic Profile of Respondents

The human population density and growth have tangible impacts on domestic solid waste. Therefore, the assessments of population growth in Islamabad for the year 2017 were relied upon as benchmarks for approximations regarding 2022 (Annexure 4). The assessments reflect the spatial-temporal variations in the demographic density of Islamabad.

The findings affirm that a heterogeneous population participated in the study (Fig. 5). The participation of male respondents (63.6%) is significantly higher than that of females (36.4%). Likewise, middle-aged people (63.9%) more actively participated in the survey (Fig. 5).

The assessments indicate that most respondents are educated and engaged in the services sector. However, a significant proportion of respondents (24.3%) belong to miscellaneous occupations. Therefore, the socio-demographic factors that symptomatically influence

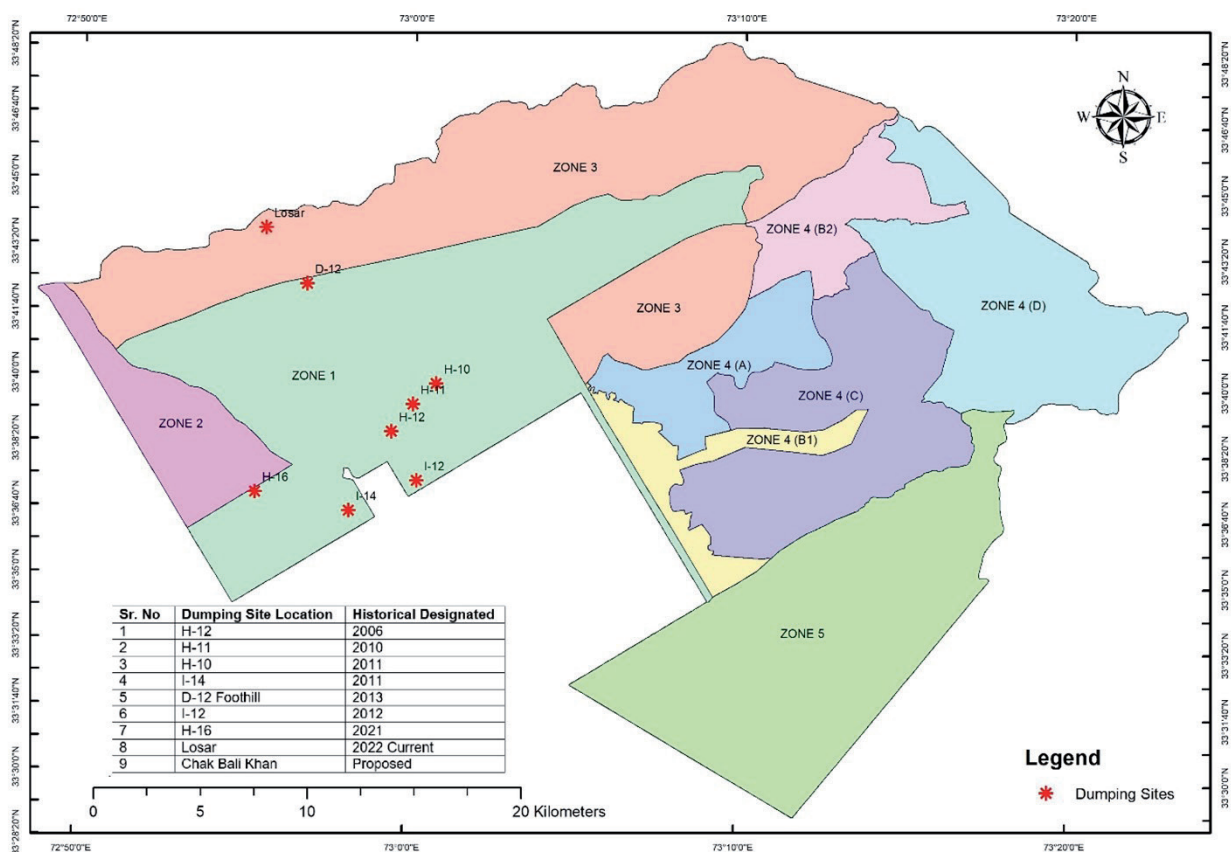


Fig. 4. The spatial-temporal evolution of waste dumping sites in Islamabad city.

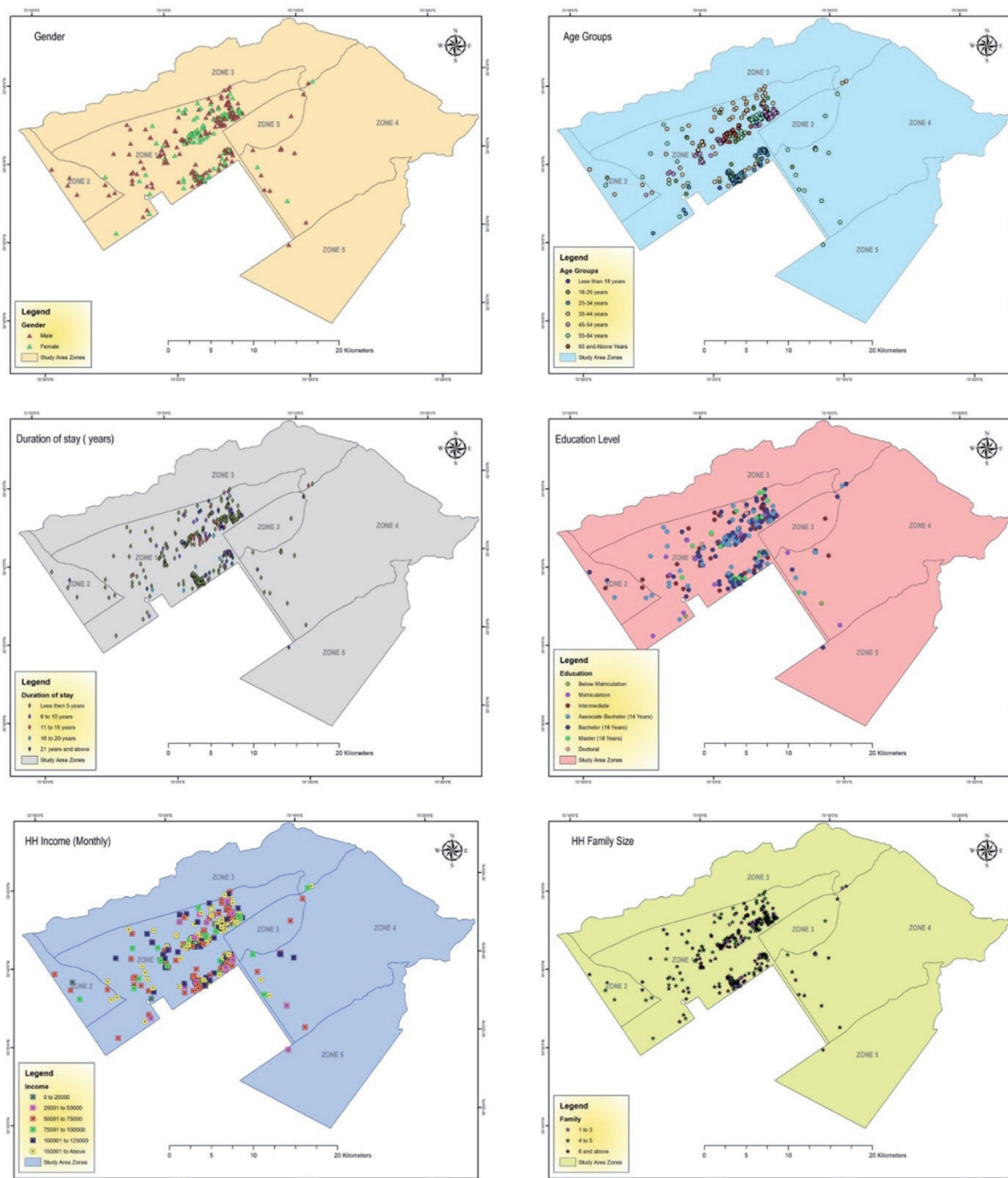


Fig. 5. Spatial distribution of respondents based on the predictor variables in the study area.

domestic waste generation and management are relied upon as proxy variables for assessments and inferences (Fig. 5).

### Perception Regarding Domestic Solid Waste

The study inherently assessed the views regarding domestic waste management in Islamabad. For this purpose, it weighed the opinions regarding the hazardousness of household waste. Most respondents (28.5%) view domestic solid waste as dangerous. While

(26.6%) consider industrial waste dangerous, another (21%) view mixed waste as harmful to the environment (Fig.6).

However, an overwhelming majority (96.4%) believe that integrated waste management ensures socioeconomic and environmental resilience in urban areas (Fig. 6). So, the study evaluates the views regarding Islamabad's existing waste collection and disposal arrangements. A sizeable proportion (41%) is unsatisfied with the current arrangements. Thus, they either opted for Disagree (28.9%) or Strongly Disagree



Fig. 6. The orientations of respondents regarding domestic solid waste.

(12.1%). Meanwhile, a significant proportion showed neutrality (12.5%) or was partially satisfied (46.5%) with the existing domestic waste management arrangements in Islamabad (Fig. 6).

Subsequently, the impacts of socioeconomic determinants (Age, Gender, Education, Nature of employment, and Duration of stay) on the inclinations of respondents were examined (Table 2). It emerged that views regarding domestic waste collection significantly modify ( $p \leq 0.05\%$ ) with the Age and Duration of stay. Meanwhile, the linkages among the remaining options emerged as insignificant ( $p \geq 0.05\%$ ). Consequently, the variables having significant associations ( $p \leq 0.05\%$ ) were further scrutinized.

#### Domestic Waste Management and Urban Property

Domestic waste management characteristically influences the worth of urban property. Accordingly, the responses were weighed to ascertain the impacts of household waste management on the rental and real

estate values in Islamabad. The majority (88.5%) opined that those compromises over waste management caused depreciation in the worth of property in Islamabad (Fig. 6). Subsequent scrutiny helped to identify that gender and age have noticeable imprints on the respondents' views (Table 2).

#### Payment for Domestic Waste Disposal

Monetary considerations, meaningfully, influence domestic waste management. However, the residents of Islamabad do not pay any charges for waste collection or disposal. Hence, the study also inquired about the inclination toward payments for waste collection services (Fig. 6). Subsequently, the responses were statistically examined (Table 2). The summary statistics reflect that the willingness to pay for waste disposal significantly changes ( $p < 0.05\%$ ) with the Age and Duration of stay.

Table 2. The Predictor variables and their association with response options ( $p < 0.05$ ).

Parameters	Predictor Variables ( <i>Chi-square Association</i> )				
	Age	Gender	Education	Nature of Employment	Duration of stay
Which type of solid waste is most dangerous?	0.15	0.073	0.355	0.259	0.67
What is the significance of DSW collection for human and environmental health?	0.001	0.202	0.165	0.506	0.036
Do the existing waste management practices are satisfactory?	0.633	0.266	0.556	0.167	0.611
Does the management of DSW influence the value of property?	.000	.049	.147	.178	.182
Willingness to pay for waste collection/management services	.000	.802	.348	.340	.001

## Discussion

Domestic waste is straining the urban environments in developing countries. Consequently, many unregulated domestic waste streams are sprouting, culminating in cities being reduced to massive trash heaps [5]. Repercussions are multiplying due to contextual compromises and constraints. The aftermaths are insidious and have long-lasting effects. The outcomes exhaust urban areas' social, economic, and ecological integrity [13, 21]. The resultant degradations strangle the resilience of both natural and human environments [13]. Moreover, the trickle-down impacts of unregulated domestic waste stimulate global warming and trigger climate change [22]. Thus, the present study uses empirical data to support context-driven measures.

It is required to curtail resource depletion and waste generation. Therefore, a paradigm shift regarding domestic waste production and disposal is needed. The looming scenario demands assessments of socioeconomic dynamics for improvising robust measures. Hence, context-based evaluations and interpretations are gaining recognition [23, 24]. Despite such dividends, estimations based on socioeconomic parameters from developing regions are scarce [25, 26]. Thus, the present study uses empirical data to support context-driven measures.

The assessment formulated that Islamabad is a heterogeneous blend of urban populations. The demographic pressures (Annexure 4) and socioeconomic transformations trigger domestic waste generation. The waste includes large amounts of discarded stuff from homes, industries, and construction sites. Consequently, the volume and complexities of household waste are damaging the environment in Islamabad (Fig. 5). The studies by [5, 21, 27], and [19] also highlighted such damaging impacts on the socioeconomic and ecological resilience of this city. Hence, the present study examined the orientations regarding urban domestic waste in Islamabad for improving preventive and curative measures.

For this purpose, the authors collected empirical data for holistic appraisals (Table 2). It is essential for pluralistic reviews. The findings infer that most respondents belong to the middle-aged category. These observations align with the statistics about the age structure of Islamabad and Pakistan [28]. It authenticates the representativeness of selected samples. Trusting in high-quality data is the first step to making impactful decisions. Likewise, the more significant proportion of younger strata in the sampling renders that the outcomes will have long-term relevance and significance for decision-making.

However, the representation of females in this study is only 36.4%, which is lower than their proportion in the urban population of Islamabad. This discrepancy is a long-standing issue in Pakistan, rooted in the country's cultural landscape. As a result, females are often discouraged and excluded from participating in matters of common interest. A focus on capacity-building and female empowerment is required to reverse this trend. It entails the greater engagement of females in economic and social activities. As signatories, Pakistan must ensure environmental protection and social equity. Hence, reversing this trend is crucial to achieving sustainable development objectives.

The study deployed spatial analysis techniques through GIS for assessments. This mechanism is a dependable strategy for spotting spatial-temporal fluctuations in phenomena [29, 30]. Thus, the spatial data sets and socio-demographic information combined for conclusive assessments. This amalgamation contributed to highlighting the spatial and temporal aspects of waste management. Besides this, the illustrations helped to magnify the contextual variations in the trends and responses regarding domestic waste in Islamabad (Figs 5 and 6). The insights will supplement the administrative measures for integrated domestic waste management in this city.

The study found a notable bias in the availability of waste disposal facilities in Islamabad. There are enough waste collection bins in some sectors like F-10, F-6, and G-11. Still, residential areas such as E-11, F-9,



H-8, and H-9 need more waste disposal facilities. This trend suggests that some localities in Islamabad receive preferential treatment, which contradicts the principle of “polluters pay the price.” Hence, enforcing this principle fairly and equitably on all localities and citizens is obligatory. Regardless of our resources, reducing waste and caring for our planet is imperative. These insights are relevant for those interested in promoting urban environmental sustainability in Islamabad and beyond.

The statistics (Table 2) authenticate that respondents’ age and duration of stay in a neighborhood significantly influence their views regarding domestic waste. These determinants characteristically shape the perceptions concerning the environment. Moreover, urban residents favor, prefer, and promote whatever is productive and cost-effective. Likewise, the age and gender of respondents significantly influence their opinions regarding the impacts of waste management on the worth of urban property. The resultant inclinations influence the willingness to pay for domestic waste disposal. It implies that urban residents make objective decisions based on experience and exposure.

Therefore, market-driven diagnostics are gaining recognition in urban environmental studies. The messages in monetary terms are more precise and, thus, readily acceptable. Hence, the scenario entails synchronizing efforts based on the principles of “Economy.” The monetary-based estimates automatically prioritize waste management, making them more persuasive. Scholars such as [12] drew similar diagnostics for urban environmental integrity in Islamabad.

Accordingly, the study assessed the orientations regarding domestic waste disposal in monetary terms. For this purpose, the Contingent Valuation Method (CVM) is used for estimations. It assessed respondents’ willingness to pay for household waste disposal. The majority was unwilling to contribute for this purpose (Table 2). The plausible explanation is that financial constraints in the wake of COVID-19 are hitting the financial liberties of urban residents in developing countries. Moreover, the lack of realization prevents the residents from paying for the services. Both factors ultimately compromise the environmental and social resilience of urban residents. Thus, socioeconomic capacity buildings are the prerequisite for global ecological sustainability.

The assessments validate (Fig. 5) that Islamabad’s landfill-driven urban waste management system is unsustainable. This “Low-hanging fruit” option has failed to serve its purpose [12]. Domestic waste’s growing volume and complexity require improvisations in techniques and approaches for sustainable solutions. It formulates that technology is the cause of the problem. Hence, it must be part of the solution.

It is evident from the findings that a sustainable urban waste management system is only possible by addressing demographic pressures. Hence, population control through awareness and policy interventions

is incumbent. Moreover, a curtailment of rural-to-urban area migration in Pakistan is also needed. It requires a focus on infrastructural development in the less developed regions. Orientation is obligatory for social harmony, balanced economic growth, and social progression. It will alleviate urban environmental stresses in Pakistan. Hence, the study formulates that the policy measures should focus on turning the challenges of domestic waste into opportunities through eco-friendly strategies and practices.

## Conclusions

The distinction between waste and resource, symptomatically, rests on human cognition, predispositions, awareness, and exposure. Thus, holistic appraisals are obligatory for transforming views regarding the waste-resource dichotomy. The resilience of urban areas in Pakistan rests on synchronized efforts founded on the premises of a “circular economy.” There is a critical need to reassess the traditional linkages among industrialization, urbanization, and progress. The current study highlights the significant social, economic, and institutional challenges for solid waste disposal in Islamabad, namely that the city’s waste disposal framework is inequitable and relies on landfills. At the same time, the pressures are multiplying due to emerging stresses—concerns regarding the impact of waste disposal on real estate values further complicate the situation. Despite public hesitance towards active participation in waste management, the study suggests that implementing resource recovery-based waste collection mechanisms could provide a practical solution, yielding revenue and prolonging landfill lifespans. A comprehensive approach is vital to reshape perspectives on the waste-resource relationship, emphasizing coordinated efforts to promote resource conservation and waste reduction. Hence, the study advocates targeted waste management strategies, enhanced awareness, context-specific diagnostics, and societal inclusiveness in decision-making processes to address this looming challenge. For this purpose, it stresses adopting a resource-conservative “circular economy” model. The proposed transition to a “circular economy” framework is mandatory for enhancing urban environmental, social, and economic resilience in countries like Pakistan. Hence, the study underscores the urgency of collective action in implementing these transformative measures. The transformation is incumbent for sustainable waste management, resource conservation, and stimulating environmental consciousness.

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## Conflict of Interest

The authors declare no conflict of interest.

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## Supplementary Materials

### Annexure. 1. Distribution of Zones and Their Area Percentages.

Zones	Area (Km Sq.)	Percentage
ZONE 1	221.493	24.13316
ZONE 2	39.1762	4.268513
ZONE 3	207.2486	22.58114
ZONE 4 (A)	35.0162	3.815252
ZONE 4 (B1)	25.004	2.724355
ZONE 4 (B2)	34.3647	3.744267
ZONE 4 (C)	98.0554	10.6838
ZONE 4 (D)	97.951	10.67243
ZONE 5	159.486	17.37708
Grand Total	917.7951	100

### Annexure 2. Questionnaire.

#### Section-1: Socio-economic and demographic parameters

Q.1. What is the Homestead location of the respondent?

Q.2. Year of birth or age of the respondent?

Q.3. Gender of the respondent?

☐ Male ☐ Female

Q.4. The highest academic qualification of the respondent?

☐ Below Matriculation ☐ Matriculation ☐ Intermediate ☐ Associate Bachelor (14 Years) ☐ Bachelor (16 Years) ☐ Master (18 Years) ☐ Doctoral

Q.5. What is the average monthly income of the family?

Q.6: How many of your family members reside in this dwelling?

☐ 1 to 3 ☐ 4 to 5 ☐ 6 and above

Q.7: How long has your family been residing in this house?

☐ Less than five year ☐ 6 to 10 years ☐ 11 to 15 years ☐ 16 to 20 years ☐ 21 years and above

#### Section-2: Perception about domestic solid waste

Q.1: Which type of solid waste is most dangerous?

☐ Household waste ☐ Industrial Waste ☐ Construction waste ☐ Mixed waste ☐ Hospital Waste

Q.2: What is the significance of MSW collection for human and environmental health?

☐ Yes ☐ No

Q.3: Does the management of HSW influence the value of property?

☐ Yes ☐ No

Q.4: Do the existing waste management practices are satisfactory?

☐ Yes ☐ No

Willingness to pay for waste collection/management services?

☐ Yes ☐ No

Annexure 3. Collection Management and Sector-Wise Distribution of Equipment Vehicles: An Operational Analysis.

Sector	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
D-12	SET_01	SET_02	SET_03	SET_04	SET_05	SET_06	SET_07
E-7	SET_06	SET_05	SET_03	SET_01	SET_04	SET_02	SET_07
F-11	SET_01	SET_03	SET_05	SET_07	SET_02	SET_04	SET_06
F-5	SET_01	SET_03	SET_05	SET_07	SET_02	SET_04	SET_06
F-6	SET_06	SET_05	SET_03	SET_01	SET_04	SET_02	SET_07
F-7	SET_05	SET_01	SET_06	SET_02	SET_07	SET_04	SET_03
F-8	SET_07	SET_06	SET_05	SET_04	SET_03	SET_02	SET_01
G-10	SET_09	SET_11	SET_13	SET_08	SET_10	SET_12	SET_14
G-11	SET_14	SET_13	SET_12	SET_11	SET_10	SET_09	SET_08
G-4	SET_07	SET_05	SET_03	SET_04	SET_02	SET_06	SET_01
G-5	SET_01	SET_02	SET_03	SET_04	SET_05	SET_06	SET_07
G-7	SET_08	SET_09	SET_10	SET_11	SET_12	SET_13	SET_14
G-8	SET_14	SET_13	SET_12	SET_11	SET_10	SET_09	SET_08
G-9	SET_08	SET_10	SET_12	SET_14	SET_09	SET_11	SET_13
H-11	SET_02	SET_04	SET_06	SET_07	SET_03	SET_01	SET_05
H-8	SET_05	SET_01	SET_06	SET_02	SET_07	SET_04	SET_03
H-9	SET_07	SET_06	SET_05	SET_04	SET_03	SET_02	SET_01
I-10	SET_08	SET_10	SET_12	SET_14	SET_09	SET_11	SET_13
I-10	SET_08	SET_09	SET_10	SET_11	SET_12	SET_13	SET_14
I-11	SET_07	SET_06	SET_05	SET_04	SET_03	SET_02	SET_01
I-8	SET_01	SET_03	SET_05	SET_07	SET_02	SET_04	SET_06
I-9	SET_01	SET_02	SET_03	SET_04	SET_05	SET_06	SET_07
NS <sup>1</sup>	SET_06	SET_05	SET_03	SET_01	SET_04	SET_02	SET_07
NS <sup>2</sup>	SET_09	SET_11	SET_13	SET_08	SET_10	SET_12	SET_14

NS<sup>1</sup> = Rawal town, Margala Twon, and Chak Shahzad; NS<sup>2</sup> = Trammrudi and Tahtrar Road Surrounding Area



Annexure 4. Intra-urban variations in household size and population (2017 and 2022).

S.N.	Sector	Population 2017		Estimated Population 2022	
		Households	Population	Household Size	Population
1	D-12	408	2296	441	2636
2	E-7	288	1393	312	1599
3	E-8	1373	9333	1486	10715
4	E-9	3417	19155	3697	21991
5	E-10	131	1122	142	1288
6	E-11	6412	32977	6938	37860
7	F-5	545	2355	590	2704
8	F-6	3166	17903	3426	20554
9	F-7	2074	12066	2244	13853
10	F-8	1653	7313	1789	8396
11	F-9	5	47	5	54
12	F-10	2619	12408	2834	14245
13	F-11	3995	18604	4323	21359
14	G-5	308	975	333	1119
15	G-6	6120	36520	6622	41927
16	G-7	10107	64548	10936	74105
17	G-8	6943	38752	7513	44490
18	G-9	9299	51637	10062	59283
19	G-10	7562	40354	8183	46329
20	G-11	7985	39608	8640	45472
21	G-13	3629	18139	3927	20825
22	G-14	2624	17758	2839	20387
23	G-15	1877	11620	2031	13340
24	H-8	864	5439	935	6244
25	H-9	765	4728	828	5428
26	H-10	189	5959	205	6841
27	H-11	301	1946	326	2234
28	H-12	211	1817	228	2086
29	I-8	5601	31854	6061	36570
30	I-9	3928	22117	4250	25392
31	I-10	9981	56127	10800	64437
32	I-11	1799	11805	1947	13553
33	I-14	286	1815	309	2084
34	I-16	784	5115	848	5872
	Total	107249	605605	116050	695272