

# People's Perception and the Current Policy Gap for Solid Waste Handling in Delhi

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**Abstract:** MSW management directly impacts public health and quality of life in cities. Unfortunately, solid waste management is generally considered the exclusive domain of government. However, since residents are the primary generators of municipal solid waste, there is virtually worldwide consensus among all major stakeholders that citizens must actively participate in this process. The need for more awareness among citizens and better communication between the government and citizens severely hampers this. Therefore, specific government initiatives are needed to bridge this communication gap. With this in mind, this study presents a structure for developing a waste management transmission process that recognises the public's leading issues and the best strategies for raising public awareness. The results indicate that people's attitudes toward solid waste could be more satisfactory. The government should also involve the public in managing regional and local waste problems.

**Key words:** Delhi, municipal solid waste management, questionnaire survey, people's perception.

## Introduction

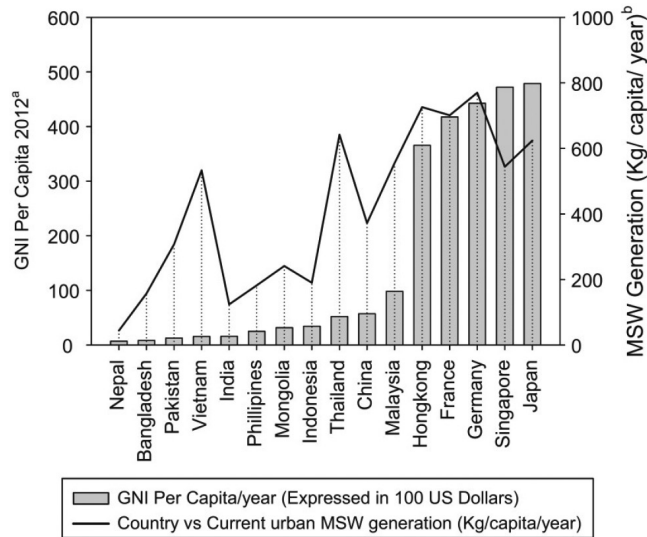
### Generation of the Municipal Solid Waste Global Scenario

Considerable research (Beede and Bloom, 1995; Gour and Singh, 2022; Hoornweg, 2012; Kaushal et al., 2012; Sahu and Mishra, 2023; Sridhar, 2016) conducted to look into the worldwide trend of solid waste management (SWM) reveals that the amount of garbage produced increases as low-income to high-income nations' economies develop. A statistically significant association between solid waste generation was found between rural and urban regions as well as the overall population after data analysis from a World Bank study of 192 countries (Hoornweg, 2012). It was discovered that the statistical relationship between the

amount of waste produced and the total population was 0.6390, whereas it was 0.8421 for the urban population. According to this, the correlation among urban residents is statistically around 1.5 times larger than the correlation with the general population. The statistics mentioned above show an intriguing trend in SWG that increases along with the wealth of the nations. However, the improvements made to the SWM do not yet meet the criteria needed to dispose of the surplus SWG properly.

The generation of MSW in developing countries (Figure 1) has significantly grown due to the fast pace of urbanisation and the expanding economy (Idris et al., 2004; Minghua et al., 2009; Singh and Agrawal, 2010). The amount of garbage produced by urban centres worldwide is now estimated to be 1,300 million metric

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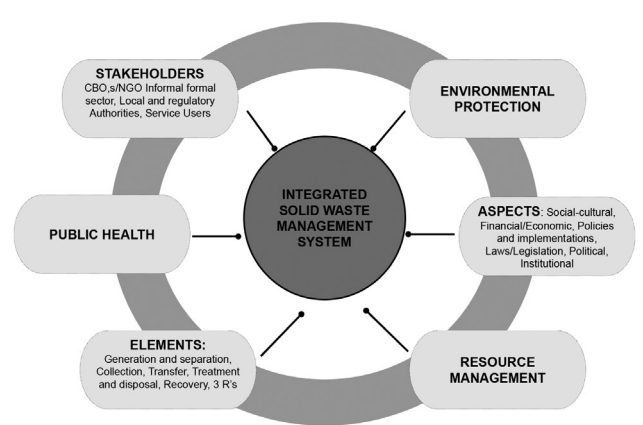
**Figure 1: Municipal Solid Waste (MSW) generation rate and Gross National Income (GNI) per capita.**

Source: World development indicator database, World Bank (2013) and Hoornweg and Bhada-Tada (2012).

tonnes per year which is about 1.2 kg per person per day, but from 2025, the number is likely to increase to 2,200 million metric tonnes per year (Hoornweg, 2012). Thirty-three percent of the world's total rubbish is created in East and South Asia (Hoornweg, 1999). By 2025, Asia's MSW creation rate is anticipated to increase to 1.8 million metric tonnes daily (Hoornweg, 1999). With 70% of the region's total trash production, China is the most significant producer in East Asia and the Pacific. The correlation between MSW production rate and GNI per capita is seen in Figure 1.

### Solid Waste Management Outline

The Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCB) are responsible for environmental policy, monitoring and reporting at the national and state levels. The municipal authorities/cantonal offices execute the strategies and plans in the areas according to their jurisdiction at the municipal scale. Strict attention is also paid to ensure that roads are not contaminated and waste is transported through the distribution route specified by the local authorities (CPCB, 2016). The SWM paradigm used in India was rudimentary and simplified. However, with the introduction of concepts that include reducing, reusing and recycling (3Rs) and energy and material recuperation, the concept has evolved substantially, as seen in advanced nations (Figure 2).

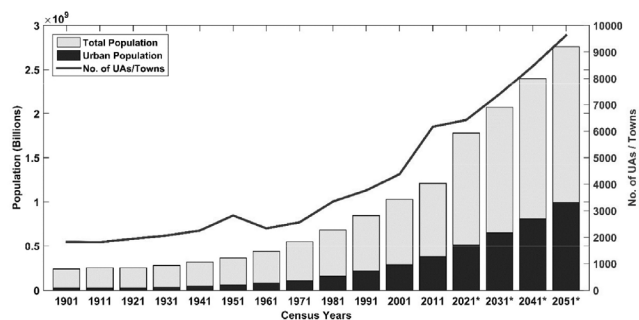


**Figure 2: A comprehensive solid refuse management technique (van de Klundert and Anschütz, 2001).**

### General Rules and Laws Prevailing in India

SWG in India is now 0.34 kilogramme per capita per day, projected to grow to 0.7 kg per day by 2025 (Hoornweg and Bhada-Tata, 2012). Nevertheless, the SWG rate is substantially lower than in around 90% of nations worldwide (Kaza et al., 2018). However, because of its enormous population, India ranks seventh in the world regarding SWG, with a total waste generation rate of more than 168,403.24 TPD (Figure 3). Nevertheless, it is estimated that by 2025, India might become a more crucial waste producer than Germany, Japan, and Brazil, now ranked 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup>, respectively (Hoornweg and Bhada-Tata, 2012).

India is a rapidly developing country with over 1.3 billion people. With such a vast population, the government will inevitably generate significant waste, especially municipal solid waste (MSW). Households, commercial establishments, and institutions generate Municipal Solid Waste. This essay will explore the MSW regulations and schemes in India.



**Figure 3: Urbanisation trends in India during the census years 1901 to 2011 and urban population trends with a linear projection till 2051 (Census of India, 2011).**

### Rules and Regulations on MSW in India

The 2016 Solid Waste Management Rules are essential for urban local bodies in India to establish a solid waste management strategy and regulate garbage segregation, transportation, and disposal methods. They also control the processes for garbage segregation, transportation, and disposal.

According to the Solid Waste Management Rules (2016), every waste producer must separate waste into three categories: wet, dry and hazardous. The rules also prescribe that the waste generator shall store the waste in three separate bins or containers. The waste generator shall also hand over the segregated waste to the authorised waste collector. The rules mandate that the waste collector collect garbage from every household or commercial establishment daily. The waste collector shall transport the waste to a waste processing facility. The waste processing facility shall process and dispose of the waste per the rules (Dave, 2022).

Another effective regulation is the Plastic Waste Management Rules, 2016. These rules prescribe plastic waste collection, segregation, and disposal process. The rules also mandate using plastic carry bags above a certain thickness. The rules also specify the process for the disposal of multi-layered plastic. The regulations require every waste generator to segregate plastic waste into non-recyclable and recyclable. The generator

waste shall store the plastic waste in separate bins or containers. The rules also mandate the waste collector collect the plastic waste separately from other waste (Taron et al., 2022).

### SWM in Delhi

An estimated 11144 TPD of solid waste is generated in Delhi, wherein 11144 TPD is gathered, 5259 TPD is processed, and 5885 TPD is disposed off. The local authorities documented 100% of the collection, including from house-to-house pickups or transports in enclosed trucks. The National Disaster Management Committee (NDMC) reported that 90% of the buildings in the area segregate waste at the source; the DCB reported that 90% of the buildings in the civil sector and 60% of the buildings in the army sector do the same; the SDMC said the fact that 80-100% of the buildings in the areas they serve segregate garbage at the origin; and the EDMC disclosed that 30% of the buildings in the respective regions do the same thing (Table 1). According to North DMC, 80% of the buildings within the three model zones do the same thing (CPCB, 2021) M/s. Delhi MSW Solutions Ltd. manages the Bawana Integrated Solid Waste Management Facility. South Delhi Municipal Corporation (SDMC) proposes building one Engineered Sanitary Landfill in Tehkhand, while East Delhi Municipal Corporation proposes to

**Table 1: Current Situation of MSW Generation, Processing, and Disposal in the NCT of Delhi, including Legacy Waste (CPCB, 2021)**

S.No.	Particulars	North DMC	SDMC	EDMC	NDMC	DCB	Total
1.	Total Municipal Solid Waste (MSW) Generation (in TPD)	4500	3600	2700	272	72	11144
2.	Lifting/Collection of MSW (in %)	100%	100%	100%	100%	100%	NA
3.	No. of Wards	104	104	64	14	8	.....
4.	Segregation of MSW at Source (in %)	80% (in 3 Model Wards)	About 80% in 13 Wards (Including 03 Model Wards)	100% (in 3 Model Wards) 75% (in 6 Wards) 30% (in 55 Wards)	90% (All Circles)	90% (Civil Area) 60% (Army Area)	NA
5.	Processing of Waste in TPD (in %)	2400* (53%)	1850 (51%)	700 (26%)	272 (100%)	37 (51%)	5259 (47%)
6.	Disposal of MWS in Landfill Sites	2100 (47%)	1750 (49%)	2000 (74%)	Nil	35 (49%)	5885 (53%)

build a combined Solid Waste Management Plant for 2000 TPD at Ghonda Gujran in a joint venture with NTPC. Okhla also has a 200 TPD Centralised Compost Plant (CPCB, 2021). In light of this, the present research examined public's perceptions on solid waste, their knowledge of waste management and its practices, and the current state of waste management in Delhi. The research also aimed to unravel the gap between government strategies and their accurate execution, which had yet to be investigated before, particularly in this domain.

### Material and Method

The primary data source for the study and analysis is the survey done in the areas mentioned. For information on the collection procedure, we conducted a household

survey on a sample of households. This would help us know how and where they dispose off the refuse from their residence. We then compare the results across various locations and see if there is a significant difference between them.

The data collection procedure was founded on a social survey research methodology to address the accumulation and disposal of solid refuse and the public's perception (Choon et al., 2017; Sahu and Mishra, 2023). It comprises multistage sampling procedures such as the participatory urban appraisal (PRA) technique, household survey, field observation, market survey, focus group discussion (FGD), and interview with a key informant (KII), respectively.

New Delhi, North Delhi, South Delhi and East Delhi were the four areas that made up the whole of Delhi (Figure 4). For all four sites in Delhi, a total of 35256

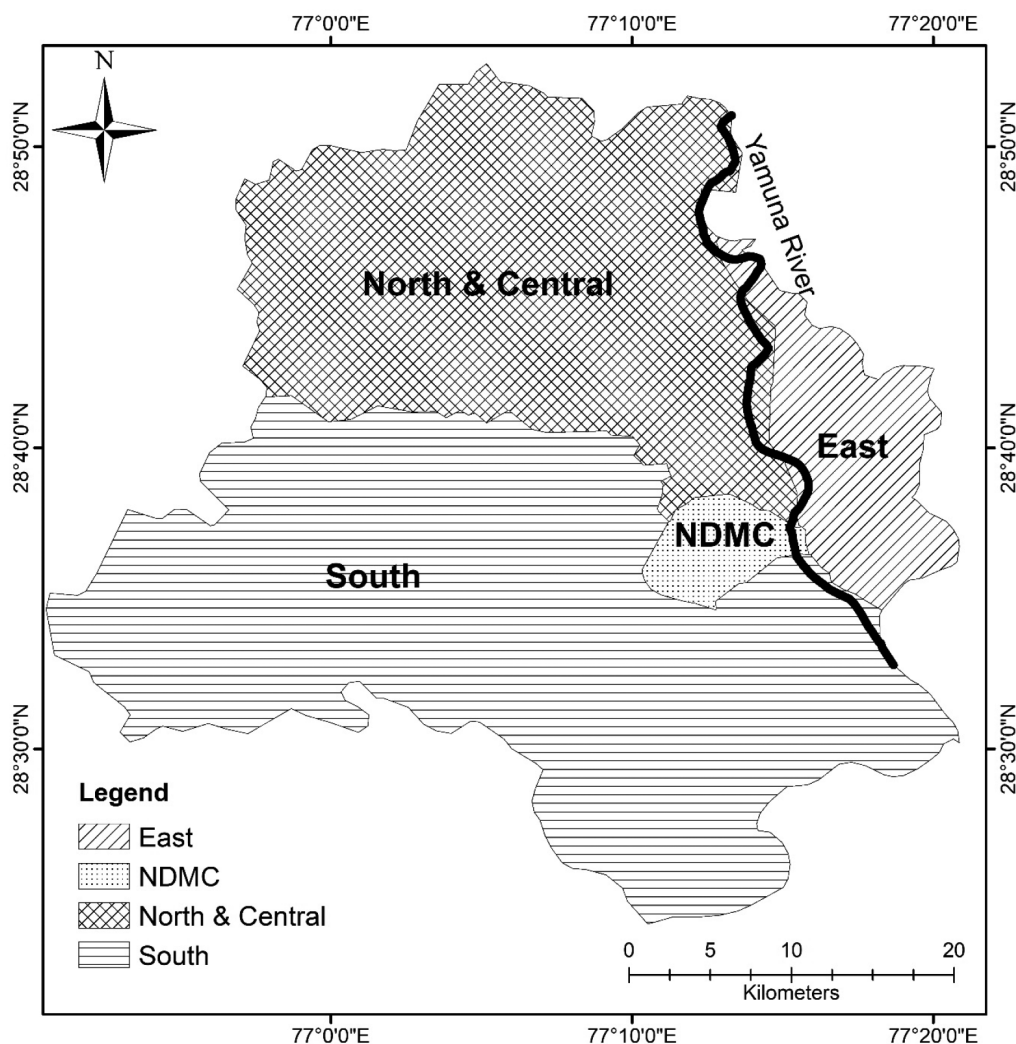


Figure 4: Represents the sampling location of the study area.



samples were gathered based on the original household survey. Each sample home was categorised according to income levels: high, medium, and poor. To comprehend it better, the data were integrated and analysed using the Statistical Package for Social Sciences (SPSS) version 21 and Microsoft Excel 2019.

### Questionnaire for the Study

Following are the questions that have been decided upon for the perception studies under each aspect:

- |    |   |
|----|---|
| 1  | Do you know about Solid Waste Management Act 2016?  |
| 2  | Do you segregate different types of waste at the source/home?   |
| 3  | Where do you dispose of your household waste?<br>Transfer to an authorised garbage collector<br>Disposed of in an open area |
| 4  | Do you have regular garbage collection in your area?  |
| 5  | Which type of collection service do you use?<br>Private<br>MCD Van  |
| 6  | Do you find the current waste collection service satisfactory?  |
| 7  | Do you know how your service provider disposed off your collected waste?  |
| 8  | Do individuals throw their trash out in the open or beside trash containers instead of putting it in the bin?               |
| 9  | Do you or your family members participate in the cleaning campaign?   |
| 10 | Do you believe that the degradation of the environment is having an adverse effect on your family?                          |

### Study Area

The MCD serves many citizens, from wealthy neighbourhoods and commercial centres to workers' colonies. With 388 permitted settlements, 111 unauthorised settlements, 252 regular unauthorised settlements, 81 urban villages, 86 rural settlements, and 32 JJ resettlement communities, it has the most land in Delhi. The SDMC has five zones under its control, and the SDMC has 1,068,572 households, according to the 2011 census. Defence Colony, Greater Kailash 2, Katwariya Sarai, Ber Sarai, Malviya Nagar, and Munirka were all included in the study.

## Results and Discussion

Poor solid waste management has severe adverse health implications. The trash workers are those who experience these effects the greatest. However, the research is focussed on how families' health, particularly that of young children under 5 years, is affected. The management and citizens' health metrics deteriorate as we progress down the category. A straightforward inquiry is posed on the frequency of fever, cough, and cold. Focus is also placed on the qualitative aspects of health issues, such as the government's provision of free services, the amount of money spent on healthcare, and how families see illnesses brought on by solid waste. Finally, facts are gathered using a solid waste survey form with a structured and semi-structured questionnaire. Officials from the MCD pre-tested the solid waste survey form before the ground truth survey began, and they chastised it for being unreliable. For this research, municipal trash includes processed bio-medical waste, home garbage, and near-constitutional waste collected from businesses such as offices and retail stores. Based on the abovementioned six factors, two colonies were chosen from MCD's twelve administrative zones (Kapoor, 2015; Pandey and Sahu, 2019).

The first question in the questionnaire survey was essential, arguing that most people in Delhi were aware of the Solid Waste Management Act, 2016. The most significant proportion of views was recorded in NDMC (88.5%), followed by North DMC (80.3%) and EDMC (74.8), while the lowest was reported for SDMC (72.1%) (Pandey and Sahu, 2019). The middle-income category of persons likewise showed a very excellent response in NDMC (83.2%), followed by North DMC (58%), SDMC (54.5%), and EDMC (34.7%). The more significant rate of reflection may be because NDMC is highly developed, and the residents are a little better educated as compared to other districts of Delhi (Figure 5).

The second question in the questionnaire survey was: Do you segregate different types of waste at the source/home? The result shows that 89.1% of people in NDMC agree and reiterate that they separate the refuse at home, while in SDMC, it was 73%, less than 17% compared to NDMC. The responses for North DMC and SDMC were 67.5 and 66.4, respectively (Bleck and Wettberg, 2012; Choon et al., 2017). The idea was obvious, as in the NDMC, the waste collection vehicle accepted only

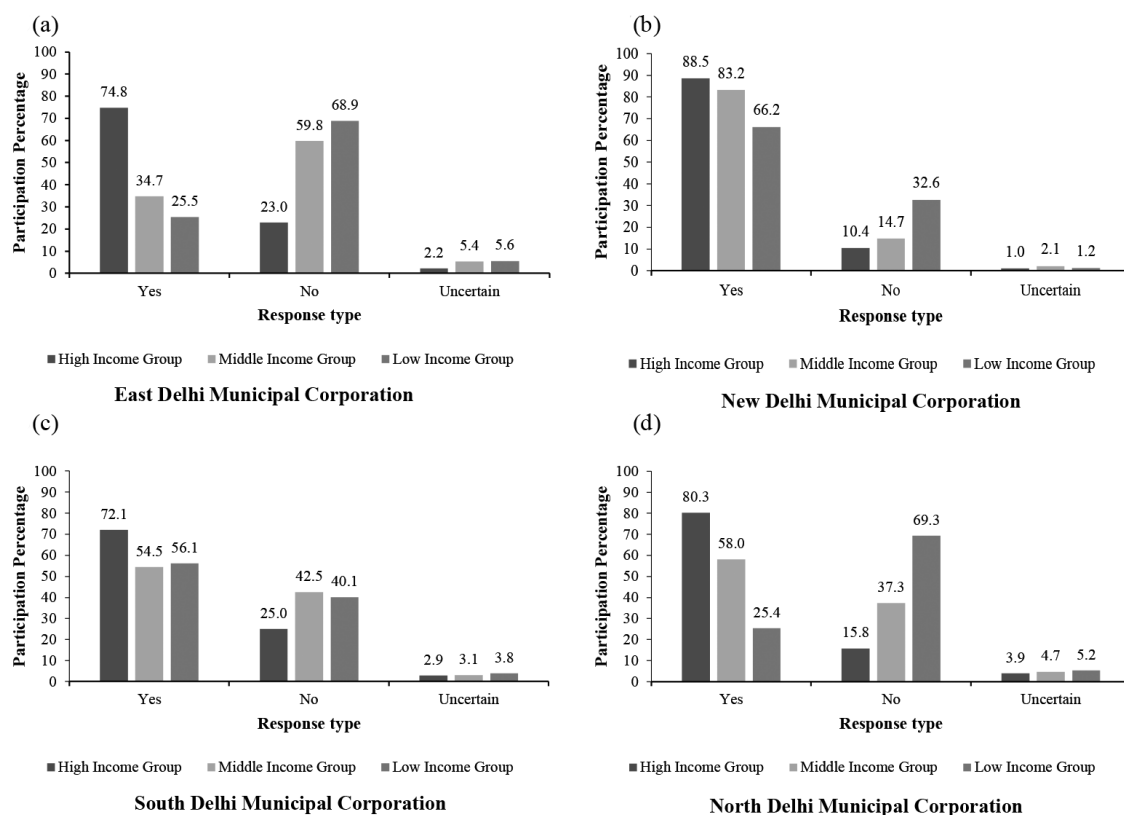


Figure 5: Represents the result of the 1<sup>st</sup> questionnaire survey. Do you know about Solid Waste Management Act 2016?

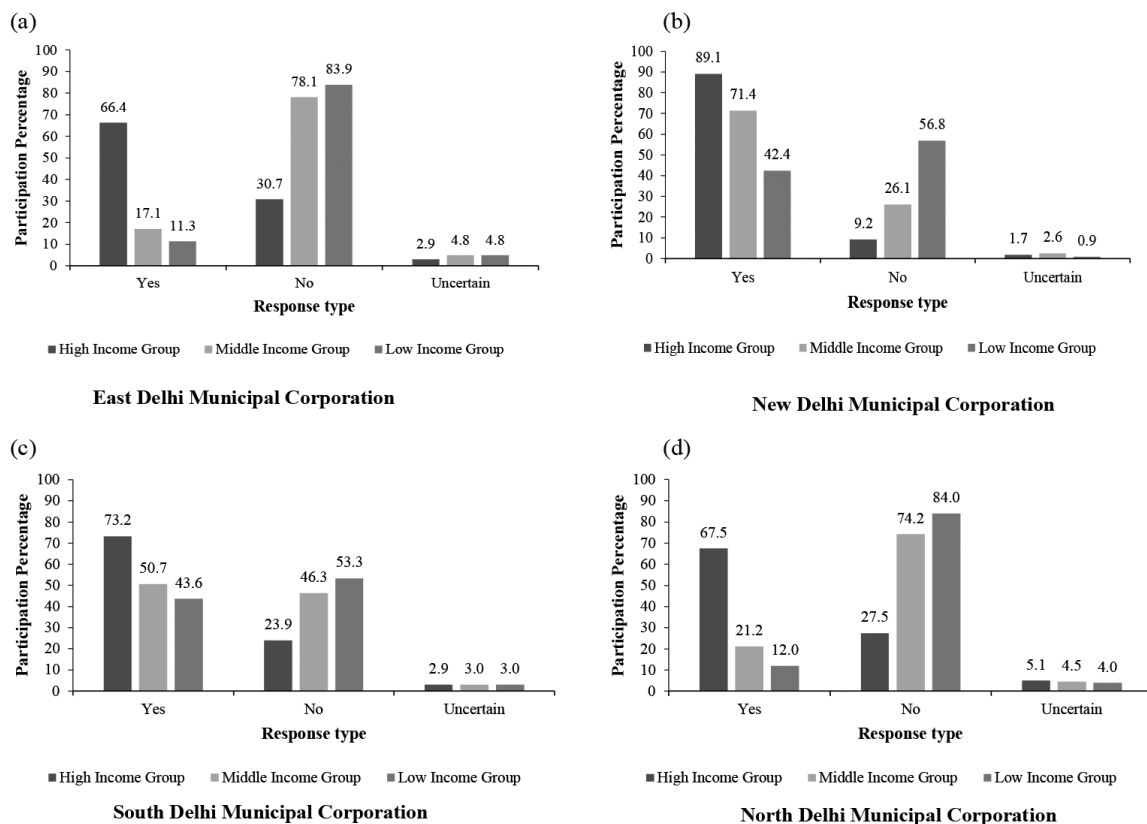


Figure 6: Represent the result of the 2<sup>nd</sup> questionnaire survey, Do you segregate different type of waste at source/home?

the separated refuse, but it was not the same in other parts of Delhi (Figure 6).

The third query in the questionnaire was, where do you dispose off your household waste? a) Transfer to the authorised refuse collector; b) Dispose off in an open area. The result was obvious, stating that most people—around 80%, or in the case of NDMC, 99.3%—replied that they don't dispose off the refuse but instead transfer it to the authorised garbage collector. Because Delhi is a metropolis with limited open space for refuse disposal, the results were virtually identical for individuals of all income levels (Sahu and Mishra, 2023). There is also a system of penalties for anyone noticed disposing off their garbage in an open space (Figure 7).

The fourth question in the questionnaire was, “Do you have regular garbage collection in your area?” The result revealed that DMC residents have a well-organised collection system, and the waste collectors visit frequently. However, the median income category in SDMC has voted for 30.1 per cent, which is a

significant number. This may be due to the inadequate management system in SDMC, as the high-income people have already addressed this in all the zones where the frequency of refuse collectors is excellent (Gour and Singh, 2022). The cause for 31.1% of the middle-income group in SDMC maybe people's awareness regarding refuse collectors (Figure 8).

The fifth question in the questionnaire was about which form of collection service household use. Most people (91.8%) in the NDMC use MCD vans to collect garbage for all income categories, while North DMC, EDMC and SDMC use mostly private collectors to dispose off their waste. In the case of the low-income group individuals, North DMC, EDMC, and SDMC vehicle is persistent in collecting garbage, which is very high in the case of EDMC (91.9%) (Singh, 2015). This data also revealed that the private parties are the primary collector of the refuse generated in Delhi, which is very high compared to MCD (Figure 9).

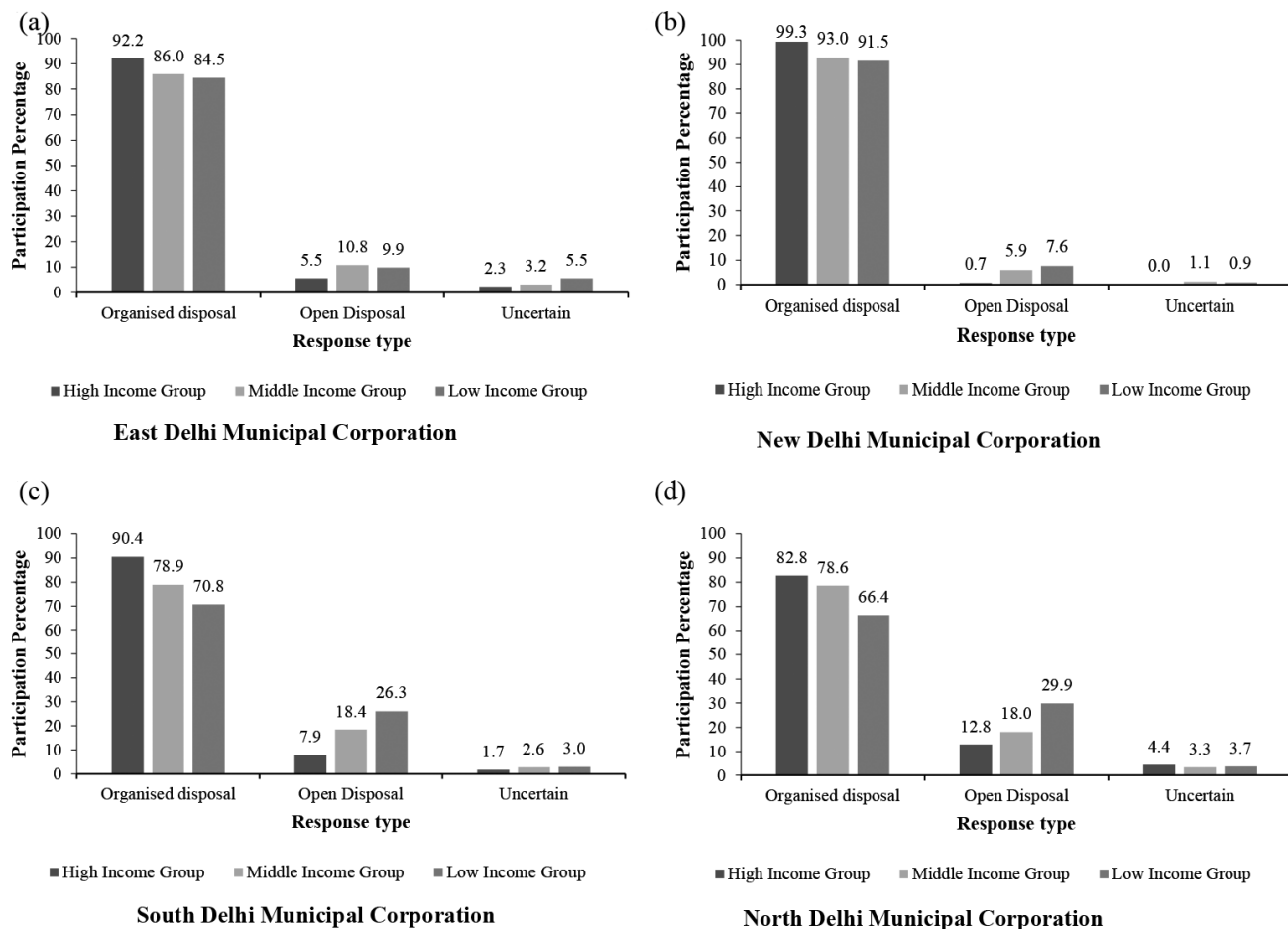


Figure 7: Represent the result of the 3<sup>rd</sup> questionnaire survey; where do you dispose off your household waste? (a) Transfer to authorised garbage collector, (b) Disposed-off in an open area.

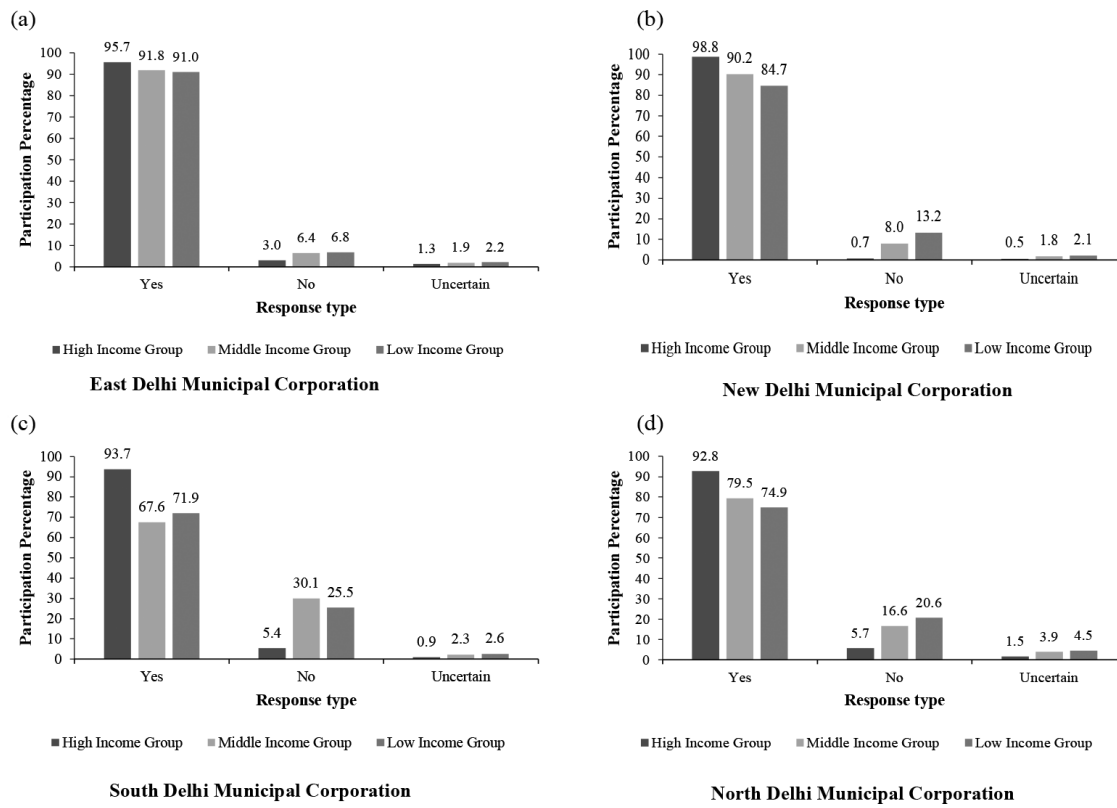


Figure 8: Represent the result of the 4<sup>th</sup> questionnaire survey. Do you have regular garbage collection in your area?

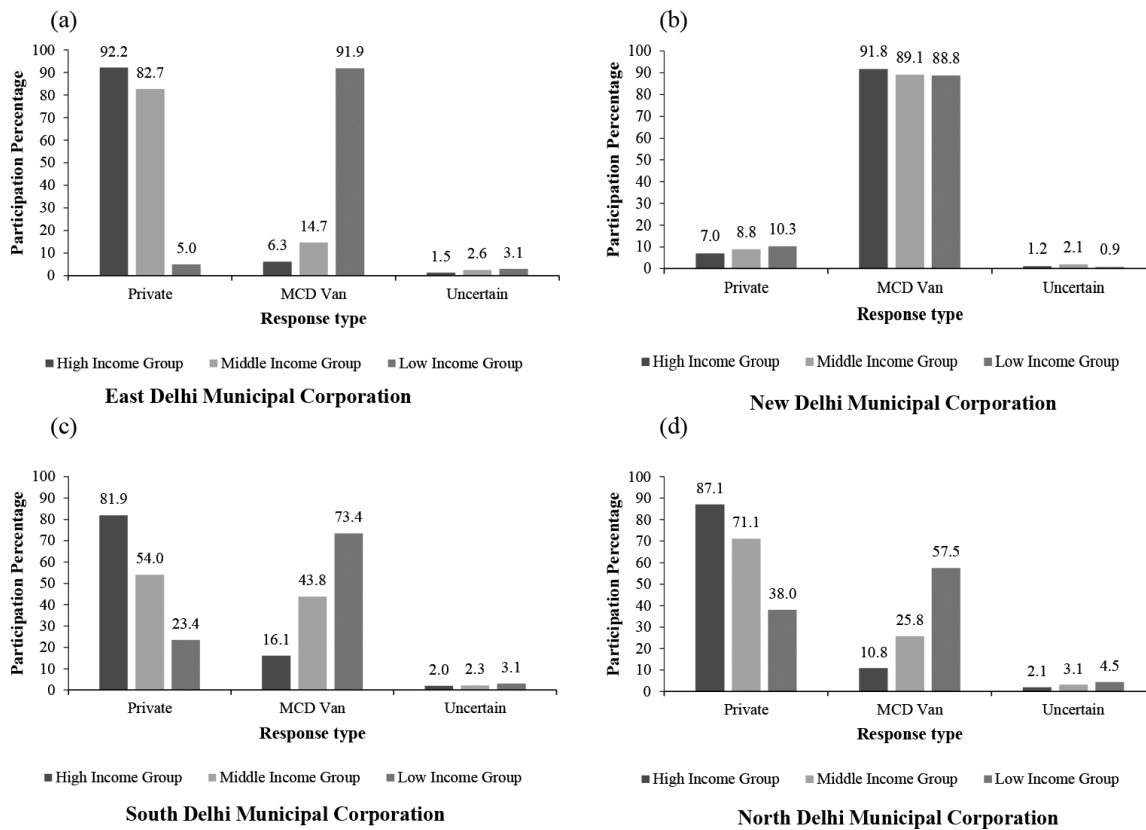


Figure 9: Represent the result of the 5<sup>th</sup> questionnaire survey; which type of collection service do you use? (a) Private (b) MCD Van.



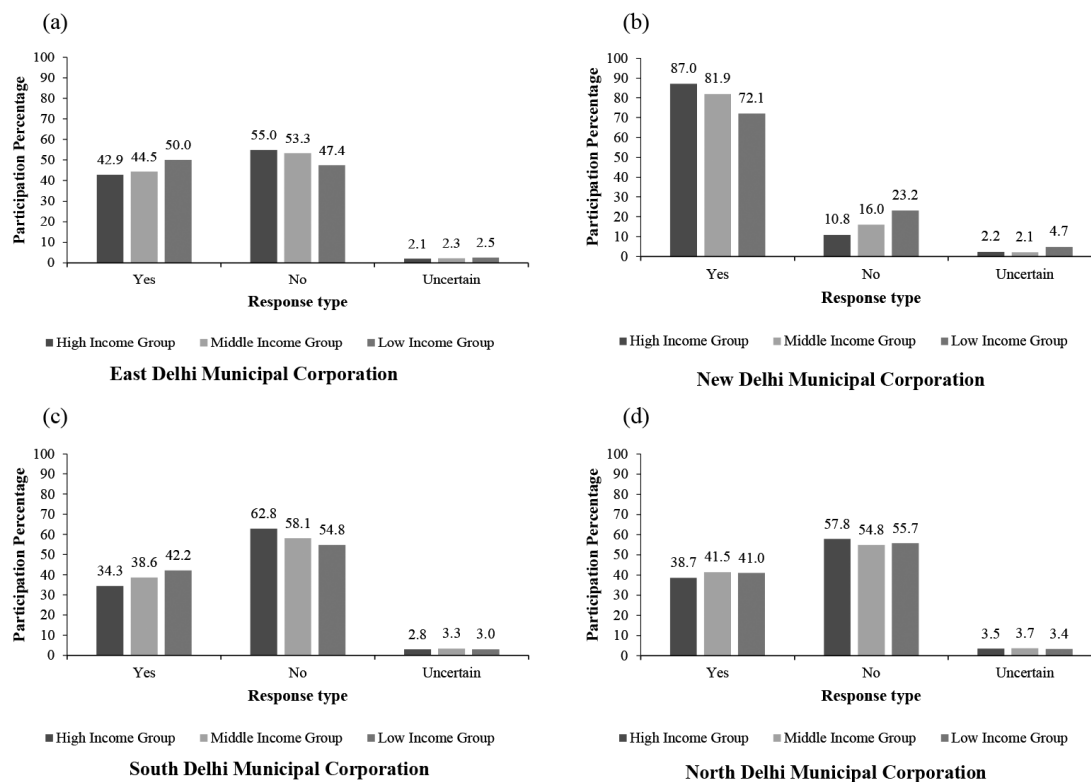


Figure 10: Represents the result of the 6<sup>th</sup>. Do you find the current waste collection service satisfactory?

Respondents were asked the sixth question if they were satisfied with the existing garbage collection service. The findings revealed that while most NDMC households and income groups were happy with the MCD's services, North MCD, EDMC, and SDMC residents were less pleased due to their dependency on a third-party garbage collector (Pandey and Sahu, 2019; Sahu and Mishra, 2023). People want the government to get involved in garbage collection so that it would be on time and they won't have to rely on any private parties (Figure 10).

Most families across all income levels concurred that they understood where their collected garbage was being disposed off, which is the most crucial information in this text. However, less than 50% of homes in the North MCD and SDMC were aware of this (CPCB, 2021). This could be because most residents of the NDMC are settled and have lived there for over a decade (Bhan, 2009) whereas in other regions of the MCD, most residents are new and don't need to know where their garbage is going (Figure 11).

The outcome reveals that over 90% of families, or practically all of them, confirm that they throw their trash inside the bin rather than next to it. For all the income levels, the statistics for NDMC are relatively

straightforward. However, the proportion was slightly lower in North MCD, where it was agreed that they would spend some time sorting their trash close to the bins for all income levels (Mishra and Singh, 2022). In low-income households, the percentage was higher (51.4%) (Figure 12).

The findings indicate that most persons from high-income categories in the whole MCD affirm that they participate in the clean-up programme. The outcome was more significant than 85% in NMCDs, demonstrating how the public feels about a clean Delhi. The outcome differed significantly for lower-middle-class individuals, as fewer than 50% participated in EDMC, SDMC and North DMC (Kapoor, 2015). This can result from the ongoing battle to maintain a healthy lifestyle. Due to their showoff and the Swachh Bharat Mission, the involvement of NDMC people in all income categories is good (Figure 13).

Most people, and about 90% in NDMC, are concerned about the environment and aware of environmental damage. This held for the higher-income segment of persons across the entire MCD. However, this is not true for those with low and intermediate incomes (Figure 14).

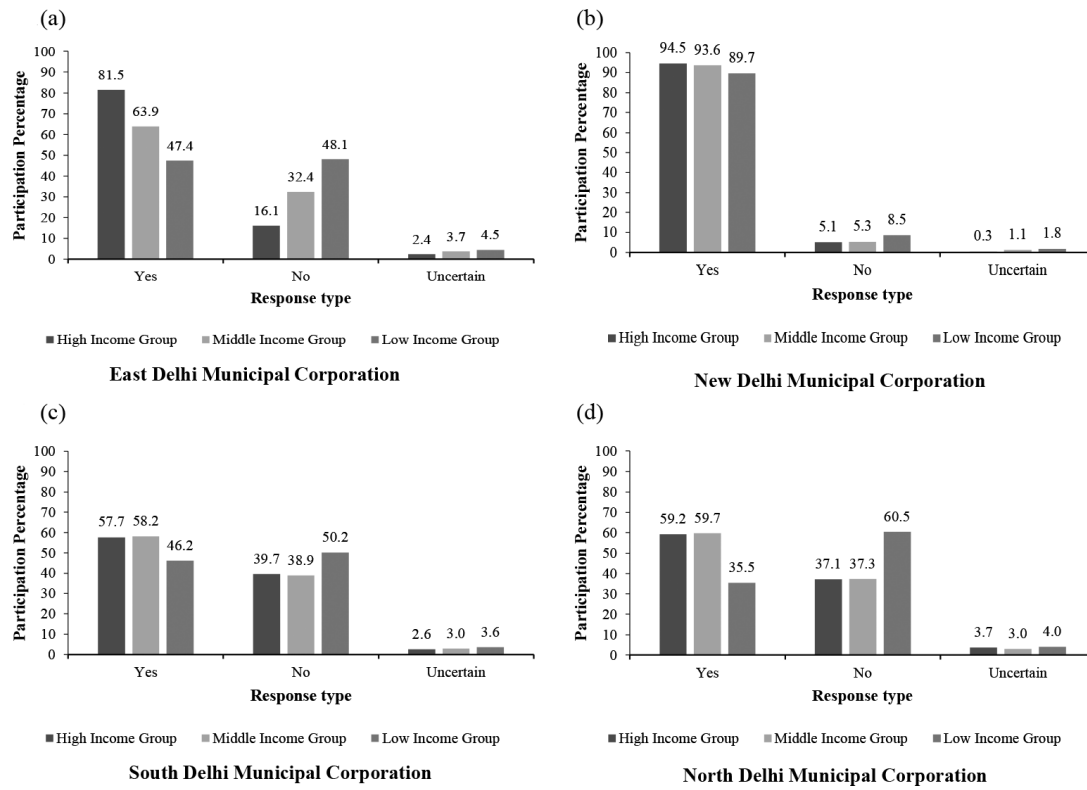


Figure 11: Represents the result of the 7<sup>th</sup>. Do you know how your service provider disposed off your collected waste?

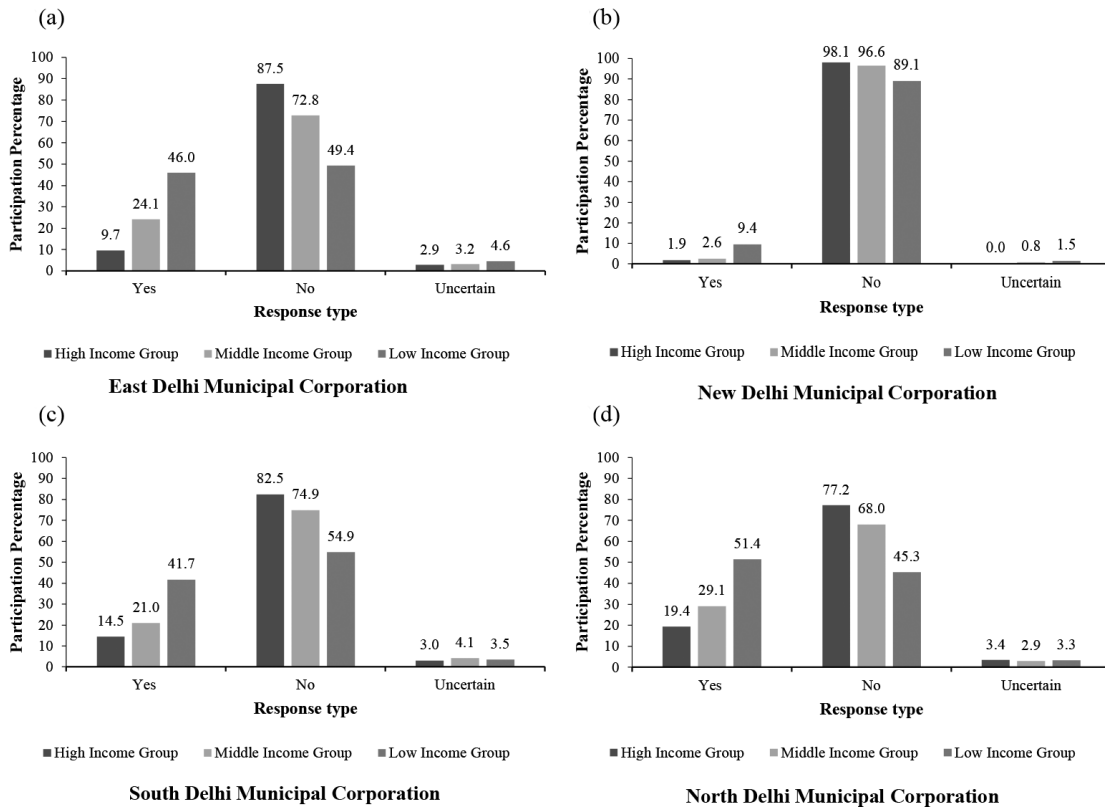


Figure 12: Represents the result of the 8<sup>th</sup>. Do individuals throw their trash out in the open or beside trash containers instead of putting it in the bin?

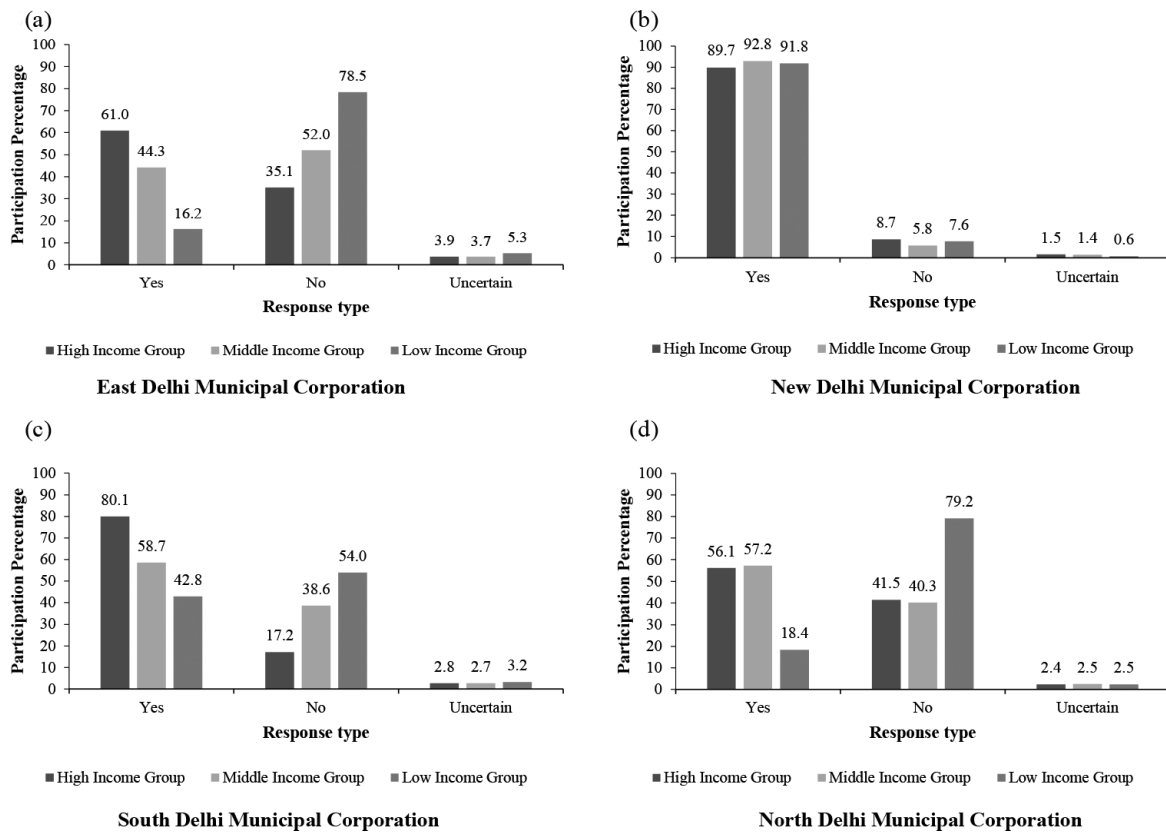


Figure 13: Represents the result of the 9th. Do you or your family members participate in the cleaning campaign?

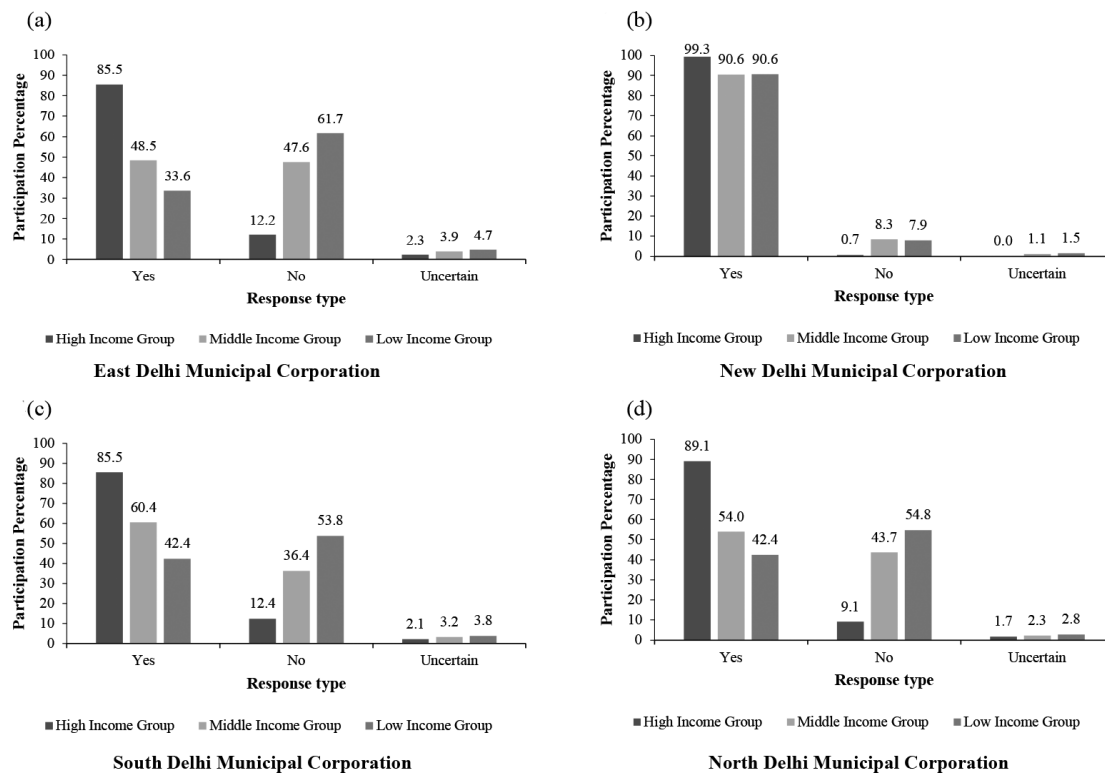


Figure 14: Represents the result of the 10<sup>th</sup>. Do you believe that the degradation of the environment is having an adverse effect on your family?

The lack of suitable and adequate areas for sanitary landfilling is the fundamental issue with municipal solid waste management in India. To address this, the government has begun charging a 0.5% tax upon selling every product or service as part of the “Swaccha Bharat Abhiyan” (Clean India Mission) (CPCB, 2021; CPHEEO, 2016). However, rather than incurring costs for its treatment or charging users a fee, government planning should focus on making money from the trash. More people are expected to become involved in government initiatives to incentivise rag pickers and the less fortunate to collect solid garbage or relieve taxation on taxpayers. Internal and external variables directly impact SWM, including age, lifestyle, and socioeconomic and psychological issues.

### Conclusion

The current study found that the location where people live, a person's gender, and their level of education are key factors that affect how they manage their solid waste. The consistency test's positive outcome confirmed that the public understands effective waste management, but the procedures for managing solid waste are only mediocally effective. The research also highlighted the gap between public engagement and current government initiatives and the need to design revenue-based SWM policies to encourage public engagement. The study adds to the body of scientific knowledge of waste management by assessing public views of awareness, behaviour, and desire to participate in the fight against SWM. Policy frameworks emphasising on economic gain and social advantages are recommended to help persuade residents to cooperate with the government in addressing a regional-level problem like SWM. These studies should be carried out before, during, and after adopting policies to reinforce, amend, and improve the current SWM policies. It will enhance the quality of life of the people in urban settlements, and we will be closer to SGD 11. Focussing on sustainable cities and communities brings us much closer to SGD 11.6, which focusses special attention on municipal and other waste management by 2030.

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