

Socio-Economic Determinants of Household Solid Waste Management Practices: An Empirical Study of a Selected Ward in Gorakhpur City

Seema Mishra¹, Senior Prof. Sandeep Kumar², Dr. Amit Kumar Sharma³

¹Research Scholar, Department of Economics, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur Uttar Pradesh

²Senior Professor, Department of Economics, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur Uttar Pradesh

³Assistant Professor, Department of Economics, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur Uttar Pradesh

Abstract

Solid waste management is a growing concern in urban areas because of improper disposal, poor segregation, and problems in waste collection. This study examines the socio-economic determinants of household solid waste management practices in a selected ward Gorakhpur City. It mainly considers the role of education and household income in household waste-related practices. The results show that education is significantly related to waste segregation, while household income also affects waste management practices. Open dumping, lack of dustbins, irregular waste collection, and limited awareness are the main problems reported by households. The paper suggests better waste collection facilities, awareness about waste segregation, more dustbins, and greater community participation to improve household solid waste management.

Keywords: Household Solid Waste Management, Socio-Economic Factors, Waste Segregation, Household Income, Educational Status, Waste Disposal, Urban Waste Management.

1. Introduction

Solid waste refers to any unwanted, discarded or abandoned solid, semi-solid, or contained liquid material generated by domestic commercial, industrial, agricultural and institutional activities. Waste management has involved from simple disposal in ancient civilizations to complex, global systems focussed on recycling and sustainability. Solid waste management (SWM) involves the collection, storage, segregation, transportation, treatment, recycling, and final disposal of solid waste. The growth of cities, population increase, changing lifestyles, and higher consumption have increased the amount and variety of waste generated in urban areas. According to the World Bank, around 2.56 billion tonnes of municipal solid waste were generated worldwide in 2022, and this amount could reach about 3.86 billion tonnes by 2050 if present trends continue (World Bank, 2026). The growing amount of waste has made its proper collection, segregation, treatment, recycling, and disposal have important concern for urban areas.

The problem of solid waste is not limited to the amount of waste generated. How waste is handled at the household level is also important. Waste is first stored and managed within households before it enters the municipal waste collection system. Households may separate wet and dry waste, reuse materials, and handover waste to collection workers. In other cases, different types of waste may be mixed or waste may be disposed off in open or vacant places. These everyday practices can affect the further collection, recycling, treatment, and disposal of waste.

Source segregation is an important part of household waste management. Separating biodegradable and recyclable waste at the place where waste is generated makes further handling and processing easier. However, the availability of waste collection services does not necessarily ensure that households will follow proper segregation practices. Household behaviour may vary according to their awareness, daily habits, convenience, access to facilities, and socio-economic conditions. Therefore, understanding household practices is important for improving waste management at the local level.

Among the socio-economic characteristics of households, income and educational status are particularly relevant to waste-related practices. Income may influence household consumption and the type and quantity of waste generated. It may also affect the use of available waste management facilities. Education may improve awareness about cleanliness, environmental problems, and the importance of separating waste. However, income and education alone may not determine household practices, as other household and local factors can also influence these practices.

India is facing increasing pressure on its urban waste management systems due to population growth, urbanisation, and changes in consumption. The Central Pollution Control Board reported municipal solid waste generation of about 1,70,339 tonnes per day in India during 2021–22, while about 1,56,449 tonnes per day was collected, giving a reported collection efficiency of about 92 percent (CPCB, 2022). Although collection is an important part of waste management, proper segregation, processing, recycling, and safe disposal are also required to manage the increasing quantity of waste.

Uttar Pradesh is also experiencing the challenges associated with growing urban waste. The Uttar Pradesh State Solid Waste Management Policy gives importance to door-to-door collection, segregation at source, recycling, recovery, and proper disposal of municipal solid waste. The effectiveness of these measures depends partly on household participation and the way where households handle waste before and during collection. Better household participation can help in reduction of mixed waste and improve the use of available collection and processing facilities.

Household waste management is therefore closely connected with everyday decisions made within homes. Even where basic collection services are available, differences in household practices may continue to exist. Examining these practices can help to identify the areas that require greater attention at the local level. It can also provide useful information for planning measures that are suitable for the conditions of a particular locality.

The issue is relevant in the context of Gorakhpur City which is an important urban centre of eastern Uttar Pradesh. Municipal waste collection services are available in residential areas, but waste-related problems can still be observed at the local level. During field observation in the selected area, waste was found at some vacant or unused places despite the availability of door-to-door collection services. This situation indicates the need to understand household waste management practices along with the availability of municipal services.

The present study focuses on Ward No. 56, officially known as Raghupati Sahay Firaq Nagar, in Gorakhpur City. Households in the selected ward may differ in their income and educational status, and

these differences may be associated with their waste segregation practices. A ward-level study can provide a closer understanding of household behaviour in a specific local setting without assuming that the findings represent all households in Gorakhpur City.

Against this background, the present study examines the association of household income and educational status with household waste segregation practices in Ward No. 56 (Raghupati Sahay Firaq Nagar) of Gorakhpur City. The paper also suggests appropriate policy measures for improving household solid waste management practices in the selected ward based on the basis of findings.

2. Literature Review

Abhiharshan and Samudyatha (2025) focused on household solid waste management among 318 households in urban Kolar, Karnataka. Waste segregation was relatively common, but proper management of sanitary waste remained a concern.

Sangeetha and Manasi (2025) considered income, education, awareness, segregation and disposal behaviour among 247 households in Bengaluru. Their work indicates that education and awareness have an important role in improving household waste management.

Joseph et al. (2025) covered 75 households in Girdharpur, Greater Noida, Uttar Pradesh, with emphasis on segregation, composting and recycling. Regular segregation was limited, while many households were willing to participate in community waste-management programmes.

Saran et al. (2024) focused on household solid waste management in Mainpuri, Uttar Pradesh, across different income groups. Differences in waste generation and disposal practices were reported between income groups.

Deshpande, Ramanathan and Babu (2024) considered socio-economic factors in relation to household waste generation and recycling behaviour in Chennai. The study provides evidence that household socio-economic conditions are relevant to waste-related behaviour.

Kaur, Kaur and Aggarwal (2023) focused on waste segregation in a North Delhi locality where education, income and awareness were among the factors considered in relation to household segregation practices.

Teferi (2022) provided evidence from 236 residents of Fiche Town, Ethiopia, which shows that knowledge of waste-management rules and access to door-to-door collection were associated with better household waste-management practices.

Rai and Umashankar (2021) covered 300 households in selected areas of Bangalore. Education and income were among the household characteristics associated with waste segregation practices.

Kumar and Agrawal (2020) reviewed solid waste management in Indian cities, with attention to source segregation, collection and disposal. Public awareness and participation were identified as important areas for improvement.

Khan, Kumar and Samadder (2016) related household waste generation to socio-economic characteristics such as income, education, occupation and family size. The study provides a useful basis for considering household characteristics while studying waste-related behaviour.

2.1 Research Gap

Many previous studies have looked at solid waste management at the city, town or wider local level, but fewer studies have focused on waste management at the level of a particular ward. In Gorakhpur City, there is limited information about how household income and education are related to waste segregation practices. Ward No. 56, Raghupati Sahay Firaq Nagar, provides an opportunity to study these issues at the

household level. During field visits, waste was observed at some vacant and unused places even though door-to-door waste collection is available in the ward. Therefore, the present study focuses on households in Ward No. 56 and looks at the relationship among household income, educational status and waste segregation practices. The study also provides practical suggestions for improving household solid waste management in the selected ward.

3. Objectives

1. To examine the relationship between socio-economic characteristics and household solid waste management practices.
2. To recommend policy measures for improving household solid waste management practices.

4. Research Methodology

4.1 Research Design

The present study adopts a descriptive and analytical research design to examine household solid waste management practices and their association with selected socio-economic factors. The descriptive approach focuses on existing waste management practices, while the analytical approach examines the association between socio-economic characteristics and household solid waste management practices.

4.2 Study Area

The study was conducted in Ward No. 56 of Gorakhpur City, Uttar Pradesh, India. Gorakhpur is a major urban center in eastern Uttar Pradesh experiencing increasing urbanization and household waste generation. Ward No. 56 was selected as the study area considering its suitability and accessibility for conducting a household-level survey on solid waste management practices.

4.3 Data Sources

The study is primarily based on primary data collected from households in the selected study area through a structured questionnaire. The questionnaire covers socio-economic characteristics and household solid waste management practices in specific ward no. 56 of Gorakhpur City. Relevant secondary data were also obtained from government reports, official publications, research articles, and other reliable sources to provide contextual information for the study.

4.4 Population and Sample Size

The exact number of households in the selected ward was not available; therefore, the population was considered unknown for determining the sample size. The sample size was calculated using Cochran's formula at a 95% confidence level and 7% margin of error, with an assumed population proportion of 50%. The calculated sample size was approximately 196 households. For convenience in field data collection and to maintain a manageable sample size, the study considered a final sample of 200 households.

Cochran's Formula:

$$n_0 = \frac{(Z^2 \times p \times q)}{e^2}$$

Where,

n_0 = Required sample size

$Z = 1.96$ (Standard normal deviation at 95% confidence level)

p = Estimated proportion of the population = 0.50

$q = (1-p) = 0.50$

e = Margin of error = 0.07

Calculation:

$$n_0 = \frac{[(1.96)^2 \times (0.50) \times (0.50)]}{(0.07)^2}$$

$$n_0 = \frac{(3.8416 \times 0.25)}{0.0049}$$

$$n_0 \approx 196$$

Thus, the calculated sample size is approximately 196 households. For convenience in field data collection and to maintain a manageable sample size, the final sample size was rounded to 200 households.

4.5 Sampling Technique

The study used convenience sampling to select household respondents. Primary data were collected using a structured questionnaire through Google Forms. Respondents were selected based on their availability and willingness to participate in the study. In addition to the questionnaire survey, field observation was also carried out in the selected ward to understand the local waste management situation. The observation included waste disposal practices and the presence of waste at open or vacant places.

4.6 Variables of the Study

The variables considered in the present study are broadly classified into two major categories: socio-economic variables and household solid waste management variables. These variables are used to examine the association between the socio-economic characteristics of households and their solid waste management practices.

Type of Variables	Variables
Independent Variables	1. Educational status, 2. Monthly household income
Dependent Variables	1. Waste segregation, 2. Waste disposal method, 3. Door-to-door collection availability, 4. Frequency of waste collection, 5. Composting of biodegradable/wet waste, 6. Plastic waste management, 7. Environmental and health awareness, 8. Household waste storage facility.

4.7 Data Processing and Analysis

The collected data were checked for completeness and consistency before analysis. The responses were coded, classified, and entered into Microsoft Excel for data management. Frequencies and percentages were used to summarize the responses. The Chi-Square Test of Independence was used to examine the association between selected socio-economic variables and household solid waste management practices. The Chi-Square value was calculated using the standard formula, and the results were interpreted at the 5% level of significance.

4.8 Chi-Square Test of Independence (χ^2)

The Chi-Square Test of Independence (χ^2) was employed to examine whether a statistically significant association exists between selected socio-economic factors and household solid waste management practices. The test was applied to categorical variables using a 5% level of significance. A p-value less than 0.05 was considered statistically significant, indicating a significant association between the variables, while a p-value greater than 0.05 indicated no statistically significant association. This formula is denoted by:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where,

χ^2 = Chi-Square statistic

O = Observed frequency

E = Expected frequency

Σ = Summation over all cells/categories

Example:

To illustrate the calculation of the Chi-Square test, the association between Educational Status and Waste Segregation is considered as an example from the primary survey data of 200 households.

1. Observed Frequency (O)

The observed frequencies obtained from the survey are presented below:

Educational Status	Always	Sometimes	Never	Row Total
Up to Primary	2	2	10	14
Secondary/Higher Secondary	11	25	15	51
Graduate	22	30	20	72
Postgraduate & above	36	24	3	63
Column Total	71	81	48	N = 200

Here, the values represent the Observed Frequencies (O) obtained from the respondents.

2. Calculation of Expected Frequency (E)

The expected frequency for each cell of the contingency table was calculated using the following formula:

$$E_{ij} = \frac{R_i \times C_j}{N}$$

Where,

E_{ij} = Expected frequency for the cell

R_i = Row total

C_j = Column total

N = Grand total

For example, for the cell **Up to Primary** × **Always**, the row total is 14, the column total is 71, and the grand total is 200.

$$E = \frac{14 \times 71}{200} = 4.970$$

Similarly, for **Up to Primary** × **Sometimes**:

$$E = \frac{14 \times 81}{200} = 5.670$$

and for **Up to Primary** × **Never**:

$$E = \frac{14 \times 48}{200} = 3.360$$

The same procedure was followed to obtain the expected frequency for each cell of the contingency table.

3. Calculation of Chi-Square Statistic

The Chi-Square statistic was calculated using the following formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where,

O = Observed frequency

E = Expected frequency

For illustration, consider the cell **Up to Primary × Always**:

$$O = 2,$$

$$E = 4.970$$

Therefore,

$$\begin{aligned} \frac{(O - E)^2}{E} &= \frac{(2 - 4.970)^2}{4.970} \\ &= \frac{(-2.970)^2}{4.970} \\ &= \frac{8.8209}{4.970} = 1.775 \end{aligned}$$

Thus, this cell contributes **1.775** to the overall Chi-Square statistic.

The same procedure was applied to all 12 cells of the contingency table. The individual cell contributions were then summed to obtain the calculated Chi-Square statistic:

$$\chi^2 = 40.66$$

4. Degree of Freedom

The degree of freedom is calculated as:

$$d.f. = (r - 1) \times (c - 1)$$

Where,

r = 4 rows

c = 3 columns

$$\begin{aligned} d.f.. &= (4 - 1) \times (3 - 1) \\ df &= 3 \times 2 \\ df &= 6 \end{aligned}$$

For the calculated Chi-Square value of 40.663 with 6 degrees of freedom, the corresponding p-value obtained from the Chi-Square distribution is less than 0.001 ($p < 0.001$). Thus, the calculated result is:

$$\begin{aligned} \chi^2 &= 40.663 \\ d.f. &= 6 \end{aligned}$$

and, $p < 0.001$

5. Results and Discussion

5.1 Socio-Economic Profile of the Respondents

The socio-economic profile of the respondents provides a brief overview of the educational status and

monthly household income of the 200 households included in the study. In terms of educational status, 14 respondents (7.0%) had education up to the primary level, 51 respondents (25.5%) had secondary or higher secondary education, 72 respondents (36.0%) were graduates, and 63 respondents (31.5%) had postgraduate and above education. Thus, a majority of the respondents (67.5%) were graduates or postgraduates. Regarding monthly household income, 66 households (33.0%) reported a monthly income below ₹15,000, 63 households (31.5%) reported an income between ₹15,000 and ₹35,000, while 71 households (35.5%) reported an income above ₹35,000. The distribution indicates that the respondents belonged to different educational and income groups, providing a suitable basis for examining their association with household solid waste management practices.

Table- 1

Association between Educational Status and Household Solid Waste Management Practices

S. No.	Variable Tested	χ^2 Value	D. f.	p-value	Result
1	Waste Segregation	40.663	6	< 0.001	Significant
2	Waste Disposal Method	39.081	12	< 0.001	Significant
3	Door-to-Door Collection Availability	22.623	6	< 0.001	Significant
4	Frequency of Waste Collection	15.713	6	0.015	Significant
5	Composting of Biodegradable/Wet Waste	4.080	3	0.253	Not Significant
6	Plastic Waste Management	49.663	12	< 0.001	Significant
7	Environmental and Health Awareness	42.870	6	< 0.001	Significant
8	Household Waste Storage Facility	37.270	6	< 0.001	Significant

Source: Primary Survey Compiled by Researchers

Interpretation

Table-1 presents the results of the Chi-Square test examining the association between educational status and selected household solid waste management practices. The findings indicate that educational status has a statistically significant association with waste segregation ($\chi^2 = 40.663$, $p < 0.001$), waste disposal method ($\chi^2 = 39.081$, $p < 0.001$), door-to-door collection availability ($\chi^2 = 22.623$, $p < 0.001$), frequency of waste collection ($\chi^2 = 15.713$, $p = 0.015$), plastic waste management ($\chi^2 = 49.663$, $p < 0.001$), environmental and health awareness ($\chi^2 = 42.870$, $p < 0.001$), and household waste storage facilities ($\chi^2 = 37.270$, $p < 0.001$). However, composting of biodegradable/wet waste was not significantly associated with education ($\chi^2 = 4.080$, $p = 0.253$). Overall, educational status is significantly related to 7 of the 8 selected waste management practices.

Table- 2
Association between Monthly Household Income and Household Solid Waste Management Practices

S. No.	Variable Tested	χ^2 Value	D. f.	p-value	Result
1	Waste Segregation	35.455	4	< 0.001	Significant
2	Waste Disposal Method	28.732	8	< 0.001	Significant
3	Door-to-Door Collection Availability	19.210	4	0.001	Significant
4	Frequency of Waste Collection	16.845	6	0.010	Significant
5	Composting of Biodegradable/Wet Waste	3.920	2	0.141	Not Significant
6	Plastic Waste Management	31.670	8	< 0.001	Significant
7	Environmental and Health Awareness	27.540	4	< 0.001	Significant
8	Household Waste Storage Facility	22.890	4	< 0.001	Significant

Source: Primary Survey Compiled by Researchers

Interpretation

Table-2 presents the results of the Chi-Square test examining the association between monthly household income and selected household solid waste management practices. The findings indicate that monthly household income has a statistically significant association with waste segregation ($\chi^2 = 35.455$, $p < 0.001$), waste disposal method ($\chi^2 = 28.732$, $p < 0.001$), door-to-door collection availability ($\chi^2 = 19.210$, $p = 0.001$), frequency of waste collection ($\chi^2 = 16.845$, $p = 0.010$), plastic waste management ($\chi^2 = 31.670$, $p < 0.001$), environmental and health awareness ($\chi^2 = 27.540$, $p < 0.001$), and household waste storage facilities ($\chi^2 = 22.890$, $p < 0.001$). However, composting of biodegradable/wet waste was not significantly associated with household income ($\chi^2 = 3.920$, $p = 0.141$). Overall, monthly household income is significantly related to 7 of the 8 selected waste management practices.

Table-3
Major Problems Identified by Respondents

S. No.	Major Problems / Issues	Frequency	Percentage (%)
1	Open dumping	48	24.0
2	Lack of dustbins	39	19.5
3	Lack of public awareness	34	17.0
4	Lack of waste segregation	31	15.5

5	Irregular waste collection	24	12.0
6	Other problems	24	12.0
Total		200	100.0

Source: Primary Survey Compiled by Researchers

Interpretation

The findings indicate that open dumping was the most commonly reported problem, mentioned by 48 respondents (24.0%). This was followed by lack of dustbins (19.5%) and lack of public awareness (17.0%). Further, 15.5% of respondents identified lack of waste segregation as a major problem, while 12.0% reported irregular waste collection. The findings suggest that inadequate waste disposal infrastructure, limited public awareness, and insufficient segregation practices are important issues affecting household solid waste management in the selected ward in city.

Field Photograph as a Visual Evidence of Open Dumping: The field photograph below provides visual evidence of open dumping observed in the selected ward.

Picture-1
Open Dumping of Solid Waste in Ward No. 56, Gorakhpur City



Source: Field Photograph taken by the Researchers

6. Major Findings of the Study

The study found that socio-economic factors, particularly educational status and monthly household income, are significantly associated with most household solid waste management practices in Ward No. 56 (Raghupati Sahay Firaq Nagar) of Gorakhpur City. Based on the survey of 200 households, educational status was significantly associated with seven out of eight selected waste management practices, including waste segregation, waste disposal method, door-to-door collection availability, frequency of waste collection, plastic waste management, environmental and health awareness, and household waste storage facilities. However, no statistically significant association was found between educational status and composting of biodegradable/wet waste ($p = 0.253$). Similarly, monthly household income was significantly associated with seven out of eight waste management practices, namely waste segregation, waste disposal method, door-to-door collection availability, frequency of waste collection, plastic waste management, environmental and health awareness, and household waste storage facilities. Composting of biodegradable/wet waste was again found to have no statistically significant association with household income ($p = 0.141$). The study also identified open dumping as the most commonly reported waste management problem, accounting for 24.0% of responses, followed by lack of dustbins (19.5%), lack of public awareness (17.0%), lack of waste segregation (15.5%), and irregular waste collection (12.0%). Overall, the findings indicate that household socio-economic characteristics are closely associated with several waste management practices, while inadequate disposal infrastructure, limited awareness, and insufficient waste segregation remain important challenges in the selected ward. These findings highlight the need for improved waste collection and disposal facilities, adequate dustbins and collection points, greater public awareness, and improved household participation in waste segregation and other sustainable waste management practices.

6.1 Key Findings of the Study

- 1. Socio-economic profile:** The study covered 200 households. Graduates and postgraduates constituted 67.5% of respondents. In terms of income, 33.0% had income below ₹15,000, 31.5% had ₹15,000–₹35,000, and 35.5% had above ₹35,000.
- 2. Educational status:** Education was significantly associated with 7 of 8 waste-management practices ($p < 0.05$). The highest association was observed with plastic waste management ($\chi^2 = 49.663$, $p < 0.001$). Composting was not significant ($p = 0.253$).
- 3. Household income:** Income was significantly associated with 7 of 8 waste-management practices ($p < 0.05$). The strongest association was with waste segregation ($\chi^2 = 35.455$, $p < 0.001$). Composting was not significant ($p = 0.141$).
- 4. Major problems:** Open dumping was the most reported problem (24.0%), followed by lack of dustbins (19.5%), lack of awareness (17.0%), lack of segregation (15.5%), and irregular collection (12.0%).
- 5. Overall finding:** Both education and income showed significant associations with most waste-management practices, while composting was the only practice not significantly associated with either factor.

7. Conclusion

The present study concludes that socio-economic factors, particularly educational status and household income, play an important role in shaping household solid waste management practices in Ward No. 56 of Gorakhpur City. The study, based on 200 households, found that both education and income were

significantly associated with 7 out of 8 selected waste management practices at the 5% level of significance. Educational status showed significant associations with waste segregation, disposal methods, door-to-door collection, collection frequency, plastic waste management, environmental and health awareness, and household waste storage facilities. Similarly, household income was significantly associated with the same seven practices. However, composting of biodegradable waste did not show a statistically significant association with either education or income, indicating that this practice may require specific interventions beyond socio-economic improvement.

The findings also reveal several practical challenges in household waste management practices. Open dumping was the most commonly reported problem (24.0%), followed by lack of dustbins (19.5%), lack of public awareness (17.0%), inadequate waste segregation (15.5%), and irregular waste collection (12.0%). These findings indicate the need for improved waste collection infrastructure, greater public awareness, and stronger household participation. Overall, effective solid waste management in the study area requires a coordinated approach involving households, local authorities, regular collection services, adequate disposal facilities, segregation at source, and promotion of sustainable practices such as recycling and composting.

8. Policy Suggestions

The findings of the study highlight the need for a comprehensive and participatory approach to improve household solid waste management in the study area. Since educational status and household income were significantly associated with most waste management practices, policies should focus on awareness, infrastructure, and household participation. The major problems reported by respondents, particularly open dumping, lack of dustbins, inadequate awareness, poor segregation, and irregular collection, require targeted interventions. Based on the empirical findings of the study, the following policy suggestions are proposed:

- **Improve Door-to-Door Collection:** Regular and reliable door-to-door waste collection should be ensured in all households to reduce open dumping and improve proper disposal practices.
- **Increase Dustbins and Collection Points:** Adequate and strategically located dustbins and community collection points should be provided, particularly in those areas where their shortage is frequently reported.
- **Promote Waste Segregation at Source Level:** Households should be encouraged to separate biodegradable, recyclable, and other waste at the household level through awareness programmes and suitable waste containers.
- **Strengthen Public Awareness:** Regular awareness campaigns should be organised through schools, community groups, local bodies, and social organisations to promote responsible waste management practices.
- **Strengthen Community and Local-body Participation:** Effective waste management requires cooperation between households and municipal authorities. Local monitoring committees, grievance mechanisms, and community participation should be encouraged to improve collection, segregation, disposal, recycling, and overall waste management.

9. Limitations of the Study

- **Limited Study Area:** The study was restricted to Ward No. 56 of Gorakhpur City. Therefore, its findings may not fully represent household waste management practices across the entire city or other

geographical areas.

- **Limited Sample Size:** The study included only 200 households. Although the sample provides useful insights into the selected ward, the relatively small sample size may limit the generalisation of findings to a larger population.
- **Sampling Method:** The study employed convenience sampling for household selection. This method may involve selection bias and may not completely represent the socio-economic diversity and waste management practices of all households.
- **Self-reported Data:** The study primarily relied on questionnaire-based responses collected from households through Google Form. Such information may be influenced by respondents' recall, personal perceptions, level of awareness, or tendency to provide socially desirable responses.
- **Limited Variables:** The study examined selected socio-economic factors and household waste management practices. Other factors, such as institutional capacity, municipal resources, environmental conditions, and behavioural aspects, were not examined in detail.

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