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Domestic Solid Waste Management: A Case Study of Chandigarh (U.T.)

Dr. Inder Singh

Prof. of Geography,

Baba Mastnath University, Asthal Bohar-124021,

Rohtak (Haryana)

Vikram Singh

Research Scholar of Geography,

Baba Mastnath University, Asthal Bohar-124021,

Rohtak (Haryana)

Abstract

The present paper evaluates the domestic solid waste management: A case study in Chandigarh (U.T.). Rapid urbanization, population growth and changing consumption patterns have significantly increased the quantity and complexity of municipal solid waste (MSW), which is now major source of waste. Chandigarh is the first city in India developed in a planned manner which has helped in developing a comparatively better solid waste management in comparison to other Indian cities. This study is based on primary data, collected from Chandigarh through questionnaires. The study aims to investigate the management of domestic solid waste in Chandigarh. In conclusion, the study finds that food waste is primary waste component across area; conversely, the highest percentage of plastic and paper in rural areas. The garbage is primarily collected by mini tractor. Finally, 52 percent of respondents reported facing problems due to garbage disposal in open areas.

Keywords: - Consumption Pattern, Domestic Solid Waste, Garbage Disposal, Municipal Waste, Rapid Urbanization.

INTRODUCTION

Waste is defined as any material that is thrown away by a person because it is no longer needed and is no longer usable by that person at that time, despite the possibility of benefiting from those materials thrown away in another place and at another time (Hassan, 2022). The various types of waste can be categorized in too many different classifications, but they are all generally liquid, gaseous or solid (Nesbitt, 2025). Solid wastes are any discarded materials that can be solid, semi-solid material discarded by the human society. The

household waste and waste coming from the streets of a city are included as municipal solid waste. Liquid wastes can be defined as liquids/fluids that are generated from washing, flushing or manufacturing processes of the industries. They are also called sewage. The most common practice of disposing of liquid waste is to discharge it in ground or rivers and other water bodies without treatment. Gaseous wastes can be defined as waste products released in the form of gases from automobiles, factories, industries, burning of fossil fuels etc and get mixed in the atmosphere. These gases include carbon monoxide, carbon dioxide, sulphur dioxide, nitrogen dioxide, ozone and methane etc.

Solid waste is generated due to rapid urbanization, population growth, industrialization, business availability, economic prosperity and changing lifestyles of the people. Changing consumption patterns in India have magnified the challenge of solid waste management (Mainul, 2023). In India, most of the metropolitan and other cities, solid waste management is inefficient as systems adopted are primitive, tools and equipment outdated and inadequate and the man power productivity is also low. Processing and treatment of waste is limited and final disposal is in unscientific dumpsites, posing problems of soils and water contamination and air pollution. A significant portion of the population does not have access to primary waste collection service as the subject has been low priority and only 50 percent to 70 percent of waste is collected and transported for disposal (Hyderabad study) Today, urban and rural areas are facing different kinds of problems with solid waste. Solid waste generation is responsible for the deterioration of environment quality and the creation of serious health problems. Solid waste management in Indian cities has become a critical environment and socio-economic challenge, due to rapid urbanization, increasing waste generation and insufficient waste disposal infrastructure (Patil,2025).

The solid waste management (SWM) system refers to amalgamation of numerous functional elements associated with the management of solid waste. Waste management and waste disposal is the sum of all the activities and actions required to manage waste from its inception to its final disposal. This includes amongst other things that is Generation, Collection, Transportation, Treatment and Disposal of waste together with monitoring and regulation (Kulkarni and Ganpati, 2018).

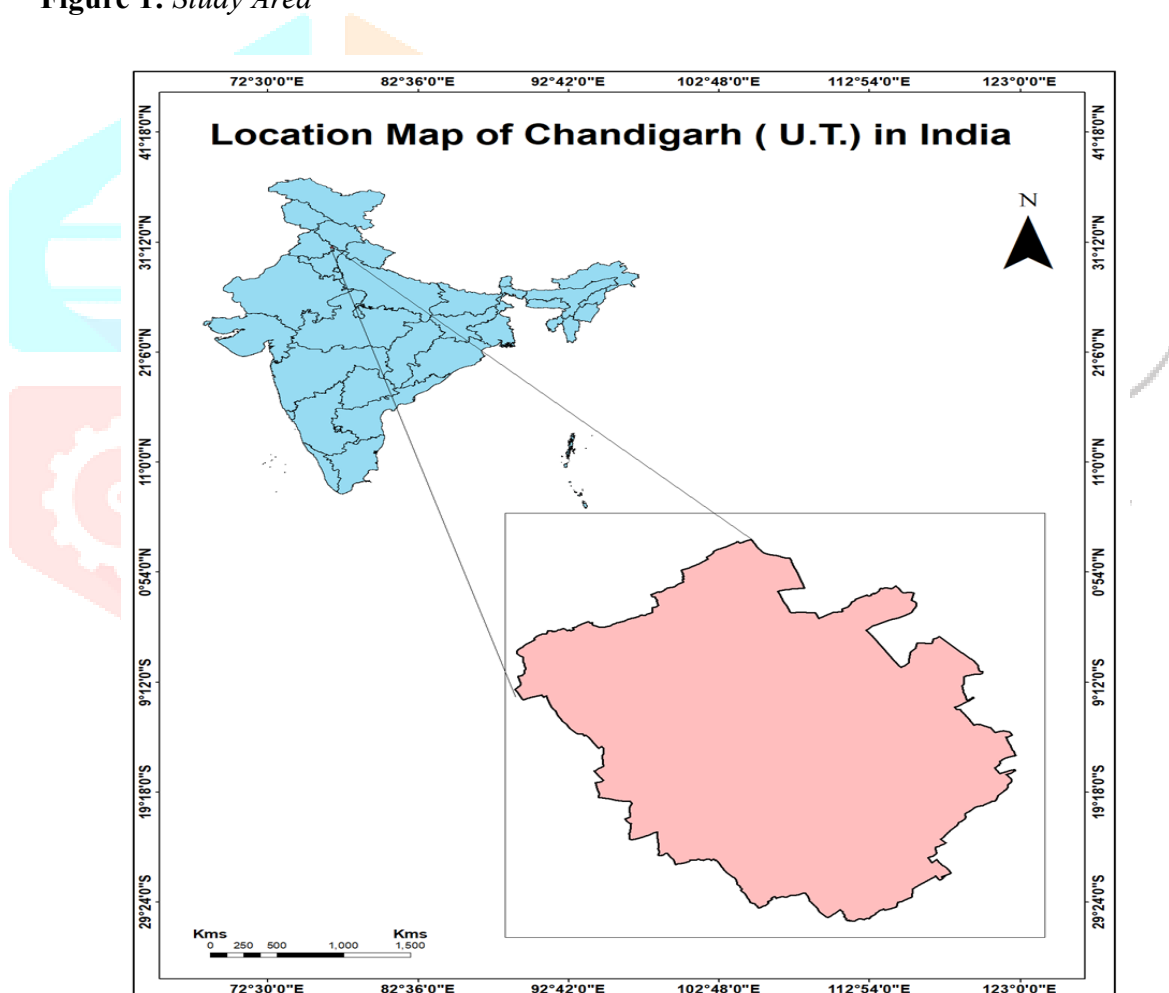
As the world population and economies have grown, the global production of materials such as paper, plastic and aluminium has increased significantly. Without a proper waste management system, the growth in consumption leads to a significant increase in mismanaged waste (Ritchie, 2023). India generates approximately 58,406,486.5 tons of municipal solid waste annually with per capita 119.09 gm/day solid waste generation, driven by rapid urbanization and changing consumption patterns. The vast quantity of waste poses significant challenges for waste management infrastructure and systems across the country (Mainul, 2023). This population increase has led to problems with unmanaged solid waste in Haryana's urban centres. Eighty-four urban local bodies, including 37 classified as class-I and II, are responsible for implementing the Municipal Solid Waste rules, 2000 with updated 2016. These 84 ULB's collectively generated 4635.79 tons of Solid waste daily. In the case of Chandigarh, as it is a first planned city in India, it is also the Capital of Haryana and Punjab states. Because Chandigarh being a developed city, tends to produce more solid waste compared to the developing cities. It is a well - known fact that the quantity of waste generated is governed

majorly by the two factors: the rate of population increases and per capita waste generation. Due to the climate factors of Chandigarh such as high temperature and humidity, and also due to high organic composition in the solid waste, collection is done regularly as the waste decomposes rapidly (Rana, 2015).

STUDY AREA

The proposed study focuses on the Chandigarh (U.T.), which is an administrative region of Haryana, as shown in figure 1. Chandigarh, a beautiful city, is Union Territory and state capital of Haryana and Punjab. Its geographical location is $76^{\circ} 47'$ E longitude and $30^{\circ} 44'$ N latitude. These coordinates place it in the Northern part of India. Its Mean Sea level height is 304-365 meters. It means it is in low lying areas. Its drainage gradient is 1 % which will result in slow surface runoff. It can also result in waterlogging if drainage is not managed properly. The total area of Chandigarh is 114 Sq. kms. It has an additional 25.42 sq.km. hilly catchment area which has been declared as Wildlife Sanctuary.

Figure 1: Study Area



Source: Prepared by the Research Scholar using ArcMap 10.8

OBJECTIVE

- To evaluate management of domestic solid waste in Chandigarh (U.T.)

RESEARCH METHODOLOGY

This study is based on primary data. For the data collection, a survey was conducted to obtain first-hand information regarding household waste generation, type of waste produced, and the prevailing management systems. The sample size is set at 428 households of Chandigarh (U.T.). Out of total 428 sample, 220 are from urban areas and 208 are from rural areas of Chandigarh (U.T.). To determine the sample size, the Cochran formula is used. The Cochran formula is:

$$\text{Cochran formula is } n = \frac{z^2 pq}{e^2}$$

- e is the desired level of precision (i.e., the margin of error).
- p is the proportion of the population which has the attribute in question.
- q is 1-p.
- z – value is found in a Z table.

$$N = ((1.96)^2 (0.5) (0.5)) / (0.05)^2 = 385$$

RESULTS AND DECISION

The distribution of waste by their type from house in Chandigarh city has been represented in the table 1. The waste has been classified into two categories that is solid and liquid waste. The solid waste is referring to any garbage, refuse or discarded materials that are not in liquids or gasses form. The liquid is waste that includes fluid form, oils waster and chemical runoff. Out of total samples, approximately 78 percent waste are solid and liquid each comes from houses. Around 18 percent waste belonging to solid category and around 5 percent waste lies in liquid category.

Table 1: *Distribution of Waste According to their Type in Chandigarh (U.T), 2025*

Type of waste	Number	Percentage
Solid	77	17.99
Liquid	20	4.67
Both	331	77.33
Total	428	100.00

Source: Field Survey, 2025

Table 2: *Composition of Household Solid Waste Chandigarh (U.T.), 2025*

Type of Waste	Urban	Rural
Only Food	28.18	26.44
Paper	4.54	8.17
Plastic	6.36	14.42
Glass	2.27	1.44
Food and Paper	9.54	4.80
Food and Plastic	6.36	3.84
Food, Paper and Plastic	20.45	15.71
Food, paper, Plastic and Glass	18.63	13.94
Paper and Plastic	3.18	1.44
All	0.45	4.32
Total	100.00	100.00

Source: Field Survey, 2025

Table 2 illustrates the household waste composition in urban and rural areas in Chandigarh (U.T.). According to the data, food waste is the most significant component in urban areas. This is like due to higher population density and food demand in these regions. The waste composition in urban areas is approximately 28 percent. The next highest category are food, paper and plastic waste at 20.45 percent, followed by other waste 18.83 percent. Conversely, glass waste represents the smallest proportion in urban areas, at only 0.45 percent. In rural areas, food waste also accounts for highest percentage at 26.44 percent, following a similar pattern to urban waste composition. The plastic waste follows at combined categories of food, paper, plastic and glass waste also account for about 14 percent. The smallest waste category in rural areas is 1.44 percent. If we concluded the table that food waste is higher waste composition in both urban and rural areas, while the lowest percentage are attributed to glass in urban areas and the combined paper and plastic category in rural areas.

Table 3: Distribution of Solid Waste Composition According to their Percentage in Chandigarh (U.T.), 2025

Percentage/ composition	Food	Plastic	Paper	Glass	Other
0-10	160 (37.38)	152 (35.51)	172 (40.18)	316 (74.29)	231 (53.97)
10 – 20	57 (13.31)	130 (30.37)	124 (28.97)	59 (13.78)	68 (15.88)
20 – 30	96 (22.42)	78 (18.22)	74 (17.28)	31 (7.24)	50 (11.68)
30 – 40	72 (16.82)	48 (11.21)	37 (8.64)	14 (3.27)	59 (13.78)
40 - 50	21 (4.76)	9 (2.10)	8 (1.86)	4 (0.93)	7 (1.63)
Above 50	22 (4.90)	11 (2.57)	13 (3.03)	4 (0.93)	13 (3.03)
Total	428 (100.00)	428 (100.00)	428 (100.00)	428 (100.00)	428 (100.00)

Source: Field Survey, 2025

Table 3 illustrates the distribution of solid waste composition by percentage. The data has been classified into 6 categories: 0-10, 10-20, 20-30, 30-40, 40-50 and above 50 percent of solid waste. Out of total samples, 37.38 percent food waste, 37.38 percent falls within the 0-10 percent category. This is followed by 22.42 percent of food waste in the 30-40 percent category, which represents the second highest distribution. The lowest recorded percentage is 4.76 percent occurring in the 40-50 percent category. Further, more than 30 percent plastic waste falls into the 0-10 and 10-20 percent categories. Except for the 20-30 percent categories, where plastic waste is less than percentage less than 15 percent in all the remaining categories, the category that is 20-30 percent, the plastic waste is 18.22 percent. Similarly, paper waste follows then same distribution pattern as plastic waste. In case of glass waste, the highest concentration is belonging to the 0-10 percent category, where the percentage exceeds 75 percent. In all the categories of glass waste, the percentage is less than 15 percent. The other category also followed the pattern of glass waste. The table reveals that the glass waste is higher in the category of 0-10 percent waste category; this is because glass waste is reuse more often than

food, plastic and paper waste. Additionally, food waste is higher in the 30-40 percent category because it is not as other such as paper or plastic.

Table 4: *Source of Information about Solid Waste Management in Chandigarh (U.T.), 2025*

Source of Information	Number	Percentage
T.V.	123	31.29
Radio	38	9.66
In public meeting	39	9.92
In school and college	182	46.31
Internet and mobile	10	2.54
Other	1	0.25
Total	393	100.00

Source: Based on Field Survey

Table 4 show the sources of the information for solid waste management in Chandigarh U.T. In the study area, collected 393 sample are collected. Regarding information on solid waste management, 58 respondents stated that they are unaware of the solid waste management. The community awareness plays an important role in promoting sustainable solid waste management practise. Out of remanning samples, 182 respondents stated that they receive their information regarding solid waste management through school and college. It is clear from the table that, 123 respondents received information regarding solid waste management via T.V. followed by 39 and 38 respondents who says that the information regarding solid waste management by in public meeting and radio respectively. Only 10 respondents says that they collected information regarding solid waste management through the internet and mobile. Information regarding solid waste management is important because, due to increasing generation of waste, environment concerns and the need for sustainable practise. Because the urbanization and industrialization have led to a surge in waste generation making solid waste management a critical issue. If we are aware about solid waste management, we are addressing the challenges and promoting environment protection and public health.

Table 5: Garbage Collection According to their Garbage Collection Frequency in community of Chandigarh (U.T.), 2025

Garbage collection	Number	Percentage
Daily	255	59.57
Once in two days	77	17.99
Once in three days	36	8.41
Weekly	39	9.11
Other	21	4.90
Total	428	100.00

Source: Field Survey, 2025

Table 5 display the distribution of garbage collection according to its frequency in Chandigarh. It is clear from the table that around 60 percent of the garbage is collected daily which is highest percentage. This is followed by approximately 18 percent garbage collection is once in two days, it means the garbage is collected from community bins or door-to-door collection in time every two days. Similarly, approximately 9 percent of garbage collection is once every three days, which is third highest percentage. According to weekly category, around 10 percent of garbage is collected in a week, which is a very low frequency for garbage collection in the community area. In other category, only 4.90 percent is belonging to this category.

Table 6: Distribution of Household According their Rupees for Garbage Collection in Community in Chandigarh (U.T.), 2025

Rupees for collection	Number	Percentage
Below – 100	49	11.44
100 – 250	204	47.66
250 – 500	47	10.98
Above – 500	17	3.97
Not pay	111	25.93
Total	428	100.00

Source: Field Survey, 2025

The responsibility for garbage collection lies primary with local municipal bodies, such as municipal corporation. In many cases, these bodies outsource the work, or in gated communities, management works with resident welfare associations. This necessities payment for garbage collection services. Table 6 displays

the distribution of households according to the amount paid in rupees per month for garbage collection. The total sample has been classified into five categories: below 100, 100-250, 250-500, above-500 and not pay category. It is clear from the table that the highest percentage of respondents that is 47.66 percent pay 100-250 rupees is per month for garbage collection. Around, 26 percent respondents are not pay for the garbage collection, followed by approximately, 12 percent respondents are paying below-100 rupees for garbage collection and 10.98 percent respondents pay 250-500 rupees per month for garbage collection. Statistical tabulation, of the table shows that around 4 percent respondents pay above 500 rupees for garbage collection, and this is a high amount for garbage collection.

Table 7: *Facing any Type Problem Due to Waste Disposal in Chandigarh (U.T.), 2025*

Problem for disposal	Number	Percentage
Public Health Risk	287	67.05
Aesthetic Disturbance	49	11.44
Odour Disturbance	55	12.85
Nuisance for Flies	19	4.43
Other	18	4.20
Total	428	100.00

Source: Field Survey, 2025

Table 7 illustrates the numerous problems caused by waste disposal. The primary concern is the public health risk which affects 67.05 percent of the total sample the highest share among all issues. Additionally, 12.85 percent of respondents reported odour disturbances. The statistics also indicate that approximately 11 percent of the people face aesthetic disturbances, making it the third most significant problem related to waste disposal. Furthermore, 4.43 percent of individuals experience a nuisance from flies in the waste disposal area. In the total sample, 4.20 percent reported facing various other problem due to waste disposal.

Table 8: *Types of Transportation for garbage collection in Chandigarh (U.T.), 2025*

Type of transport	Number	Percentage
Big tractors	104	24.29
Cycle carts	68	15.88
Garbage truck	4	0.93
Loaders	90	21.02
Mini tractor	151	35.28

Other	11	2.57
Total	428	100.00

Source: Field Survey, 2025

Table 8 provided a picture of the transportation used for garbage collection in Chandigarh. The sample is classified into six categories: big tractors, cycle carts, garbage truck, loaders, mini tractors and other vehicles. For the garbage collection, mini tractor is used the most according for 35.28 percent of the total. This is followed by big tractor, which collected 24.29 percent of the garbage and loaders, which collected 21.02 percent. Cycle carts are responsible for collecting 15.88 percent of the garbage. Only 0.93 percent of the garbage is collected by garbage trucks.

Table 9 gives the picture of source of solid waste management in Chandigarh City. The data related to source of solid waste management has been classified five categories that is Government agencies, private agencies, Municipal cooperation Chandigarh, government and private agencies and other. The table reveals that around 80 percent solid waste is managed by Government agencies. This is because, for affective solid waste management, government provide national and state-level policies and regulation. According to the Solid Waste Management Rules, 2016 enacted under the Environment (protection) act, 1986. These rules provide a comprehensive framework for waste management practices (mainul andqumar and sethy, 2023) and this accounts for the highest percentage. Around 13 percent solid waste is managed by private agencies and the municipal cooperation of Chandigarh has only 1.16 percent solid waste been managed.

Table 9: *Source of solid Waste Management in Chandigarh (U.T.),2025*

Management source	Number	Percentage
Government	344	80.37
Private agencies	57	13.31
Municipal cooperation Chandigarh	5	1.16
Govt and private	14	3.27
Other	8	1.86
Total	428	100.00

Source: Field Survey, 2025

CONCLUSION

To summaries this study has examined the different ways, in which waste is generated and how it is best handling by people in Chandigarh city. The results show that the solid and liquid both waste is come out from the household level. If we compared to solid or liquid waste, most of the waste is food waste followed by food, paper and plastic waste. There is a large variation in composition of solid waste. The study reveals that according to the percentage of waste composition all the composition lies in 0-10 percent category, that is highest percentage. Besides, it is concluded that around 70 percent heads of household are pay for the garbage collection and the amount is 100-250 rupees.

It has been found that most of the respondents is effect by the bins near area. The main problem faced by bins that is odour. The study also reveals that the many types of transport has been used for garbage collection, but mini tractor used more than other transport, because mini tractor is easy to going to community. If we concluded the problem facing by waste disposal near community, out of total sample, around 48 percent respondents have not faced any problem for disposal of garbage near community but 52 percent respondents facing many problems for the garbage disposal near community, the most popular problem for garbage disposal is public health risk.

The study concluded that the source of information regarding to solid waste management, around 46 percent respondents reply they have collected the information regarding solid waste management form school and college. Most of the respondents' states that the solid waste is manage by government.

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