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# Quantification & Management of Solid Waste Generated in Municipal Area Lucknow

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**Abstract:** *In India's cities and towns, managing solid waste is one of the most difficult issues. In Indian cities, the production of municipal solid waste (MSW) is accelerated by rising population levels, brisk economic expansion, and rising community living standards. Solid Waste Management (SWM) at the community level presents a number of challenging issues that must be understood and addressed, and the Center's survey for the characterization and quantification of solid waste in Lucknow's Gram Panchayats is an important undertaking. Solid waste management (SWM) is an organized process that addresses solid waste storage, collecting, transportation, processing, and disposal. Each of these steps is essential for reducing the negative effects of solid waste on human health, the environment, and aesthetics. By stratifying Gram Panchayats according to population size, the survey took a logical approach to the task, displaying a careful, data-driven strategy. To gain a thorough understanding of solid waste generation and disposal procedures in Gram Panchayats with more than 10,000 residents, a comprehensive survey of 300 families was carried out. In order to ensure that the study adequately reflected the different demographics of the area, a proportional number of households were polled in Gram Panchayats with populations of less than 2,000, 2,000 to 5,000, and 5,000 or more. Information regarding the types and subcategories of garbage created was learned from the data gathered over a 7-day period from each studied household. Block-Bakshi ka Talab, Block-Chinhat, Gram-Dig, Block-Sahjanwa, Gram-Budhat, and Gram-Juggaur*

**Keyword:** *Groundwater contamination, sanitary dumps, Panchayatraj, and Lucknow, Uttar Pradesh*

## I. INTRODUCTION

In the current study, the state of municipal solid waste management (MSWM) in Lucknow City is evaluated. Rapid economic expansion and an increase in community living standards will greatly speed up the generation of MSW in Indian cities. With 0.6 million floating residents, Lucknow City has a total population of roughly 4.5 million. With a geographical area that accounts for 9.0% of the nation's total, Uttar Pradesh is the fourth-largest state in terms of size. It is also the most populous state in India, with 19.98 crore (199.8 million) residents, of which 15.53 crore live in rural regions and 4.44 crore in urban areas, according to the 2011 Census. With an 828 person per square kilometer population density, it is one of the highest highest population density states in the nation. The state's annual growth rate from 2001 to 2011 (including Utrtrakhand) was 20.09%. According to the 2011 Census, the State's rural population makes up 77.72 percent of the total population, down from 79.22 percent in 2001. In 2011, there were 912 women for every 1000 men, which was less than the national average of 943. However, the State's level of urbanization (22.28%) is quite low when compared to India as a whole, where the rate is 31.16%. Agra, Aligarh, Azamgarh, Allahabad, Kanpur, Gorakhpur, Chitrakoot Dham, Jhansi, Devi Patan, Faizabad, Bareilly, Basti, Vindhyachal (Mirzapur), Moradabad, Meerut, Lucknow, Varanasi, and Saharanpur are the 18 divisions that make up Uttar Pradesh's administrative split into 75 districts. An evaluation of the current state of Lucknow's municipal solid waste management (MSWM) is done in the current study. The type and source of waste generated determine the best SWM procedure to use. Many different places produce solid waste, including homes (kitchens and yards), commercial locations (stores, hotels, and restaurants), industry (raw materials and packaging), and institutions (schools, hospitals, and offices), building and demolition sites, domestic and wild animals (dead animals' carcasses, manure), parks (fallen branches, leaves from trees), and roadways (sand, silt, clay, concrete, bricks, asphalt, air deposition residues, and dust). If handled, stored, transported, disposed of, or managed poorly, the waste poses a major threat to both human health and the environment. Small amounts of leachate can seriously endanger human health by contaminating huge amounts of groundwater. as a result of drinking water that was thus tainted (Bakare et al., 2007). It has been noted in various earlier studies that all Indian cities dispose of their waste in open dumps a few kilometers outside of the city without understanding scientific landfilling processes or the effects on human health. Municipalities struggle greatly with MSWM. An evaluation of the current state of Lucknow's municipal solid waste management (MSWM) is done in the current study.

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- 1) Gram Panchayat with more than 10000 population 300 households were surveyed.
- 2) Gram Panchayat with 5000-10000 population 150 households were surveyed.
- 3) Gram Panchayat with 2000-5000 population 100 households were surveyed.
- 4) Gram Panchayat with less than 2000 population 50 households were surveyed.

## II. METHODOLOGY

The first stage of the study examined state level legislation as well as the guiding principles for the solid waste management approach in Uttar Pradesh. The second phase of the study involved gathering information from the Panchayat Raj Department Lucknow Government of Uttar Pradesh on the origin of MSW trash, quantity, daily disposal, processing, availability of containers, collection frequency, and other factors. The original map of the wards in Lucknow city was examined in the third stage of the investigation

## III. DISCUSSION

### A. Guidelines For Uttar Pradesh's Solid Waste Management Strategy

The negative effects of trash on the environment are minimized through scientific disposal of solid waste through segregation, collection, treatment, and disposal in an environmentally sound manner. The construction of the infrastructure for the collection, storage, segregation, transportation, processing, and disposal of solid waste is the responsibility of the Gram Panchayats, Blocks, and District. The following concepts serve as the foundation for the Uttar Pradesh Rural Solid Waste Management Policy.:

### B. Reuse and Trash Reduction at the Source

The Gram Panchayats will encourage reuse and waste reduction solutions. It will be beneficial in lowering the expenses associated with handling, treatment, and disposal, as well as lowering a number of adverse environmental effects such leachate, air pollutants, and the production of greenhouse gases.

- 1) *Composting of Garbage:* As much as is practical, the organic component of waste should be turned into a humus and used to boost agricultural productivity.
- 2) *Waste Recycling:* The next preferable option is to recover recyclable material resources through a process of sorting, collecting, and reprocessing to produce new products.
- 3) *Waste-to-Energy Recovery:* Energy recovery from waste through the creation of heat, electricity, or fuel may be preferable where material recovery from waste is not practicable. Bio-methanation, waste incineration, waste pelletization, waste to oil conversion, and Co-processing of the sorted dry rejects from solid waste and the generation of Refuse Derived Fuel (RDF) may be used.
- 4) *Conclusion of the Unofficial Sector:* The rag pickers should be given identification cards by the Gram Panchyat, who should also integrate them.

### C. Roles & Responsibilities of Waste Generator

- 1) Each waste generator is required to: •Segregate and store their waste into two separate streams, namely biodegradable and non-biodegradable wastes and domestic hazardous wastes; and •Hand over the segregated wastes to authorized waste pickers or waste collectors as directed by the local authorities from time to time. For this reason, the Gram Panchayat must announce three color schemes for the trash cans.

- 2) No waste generator may deposit the solid trash they produce in drains, open public areas outside of their properties, or in bodies of water. Instead, they must burn, bury, or toss it away.
- 3) .As outlined in the Gram Panchayat's bylaws, all waste generators are required to pay the user fee for solid waste management.

*D. Roles & Responsibilities of District Magistrate*

- 1) Land should be secured for the processing of solid waste (composting and MRF centers) at each Gram Panchayat and for the disposal of solid waste (inert and hazardous waste) in each District.
- 2) In conjunction with the Commissioner or Director of Panchayati Raj and Secretary-in-charge of the State Panchayati Raj Department, evaluate the performance of Gram Panchayats in terms of waste segregation, processing, treatment, and disposal at least once every three months and take corrective action.

*E. Roles & Responsibilities of Gram Panchayats*

- 1) Gram Panchayats ought to draft a bylaw that imposes fines on anyone who litter or burn trash. The minimum fine for littering should be Rs. 1000, and the maximum fine should be Rs. 50,000 for the production, sale, and use of illegal polythene bags (thickness less than 50 micron).
- 2) Gram Panchayats should develop a bylaw for waste collection and segregation that outlines user fees.
- 3) For garbage collection and processing, the Gram Panchayats may also contract with private companies, who may then bargain user fees with property owners or businesses.

*a) Primary Collection*

- Will make sure that trash is separated at the source and will be directed toward wealth creation through recovery, reuse, and recycling. It is required to use a two-bin system for hazardous, dry, and green waste.
- Category-A Gram Panchayats, as previously said, should set up door-to-door collection of segregated solid waste from all households, including slums and informal settlements, commercial, institutional, and other non-residential locations.
- Create a system to identify organizations of waste collectors or garbage pickers, and encourage and set up a system to integrate these informal waste-pickers and waste collectors to make it easier for them to participate in solid waste management, including waste door-to-door collection.

*b) Secondary Collection*

- Will guarantee that each Secondary Collection Point has two bins. which ought to be the maximum for 50 houses with two bin sets.
- Establish material recovery facilities or secondary storage facilities at every Gram Panchayat with enough room for sorting recyclable items, enabling unlicensed waste collectors and pickers to separate recyclables from the rubbish. Give garbage collectors and recyclers simple access so they can collect segregated recyclable waste including paper, plastic, metal, glass, and textile from the point of generation or from facilities for material recovery.
- Create facilities for the disposal of residential hazardous waste and provide guidance to waste producers on where to dispose of these materials safely. Such a facility shall be built in a Gram Panchayat in such a way that one center is established for the neighborhood, and such centers shall be informed of the times for receiving household hazardous waste.

*c) Transportation of Waste*

- Deliver separated biodegradable trash to processing facilities such a composting facility, a biomethanation facility, or another facility of this nature. On-site processing of such trash should be preferred.
- Deliver nonbiodegradable garbage to the appropriate processing facility, material recovery facility, or secondary storage facility.

*F. Role & Responsibilities of Zilla Panchayat*

- 1) Shall prepare a budget for the Gram Panchayats' solid waste management needs.
- 2) Will make sure that a separate area is designated in the development plan for group housing or commercial, institutional, or any other non-residential complex with more than 200 dwellings or a plot area larger than 5,000 square meters; particularly in Category-A Gram Panchayats.

With the assistance of the District Authority, Gram Panchayats were chosen. 7-day data (Solid Waste) was gathered from each household in the Gram Panchayats and analyzed as shown below. The Center carried out a survey to characterize and quantify solid waste in Uttar Pradesh's gram panchayats. In the table below, the category of garbage is shown.

Table 1  
Shows type of waste

S.no	Waste Type	Sub category & Type
1	Bio degradable waste	Mostly green waste from the kitchen and animal
2	Recycle Waste	Thermocol , glass , tin, metal
3	Hazardous Waste	Diaper sanitary Napkin small batteries
4	Inert Waste	Mud & dust

Table-2  
Per Capita Waste Generation for 600 families in Lucknow

S.NO	Category of Waste	Lucknow-600 families In gms- per day per capita
1	Inert waste	10.32
2	Bio degradable waste	43.57
3	Hazardous waste	0.34
4	Recyclable waste	15.41
	Total	69.52

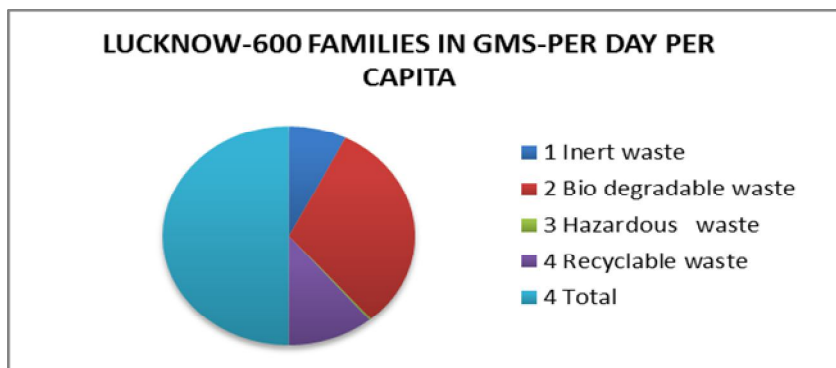


Fig.1: Shows pie representation waste generation of 600 families

Table 2 clearly demonstrates that the amount of garbage produced per person per day in Lucknow was only 10.29 grams, but the amount of recyclable waste generated there was 15.41 grams per day. It is important to keep in mind that the weather during the survey days also had an impact.

Table-3 Category Wise Recyclable Waste

S.No	Recyclable waste per day in gms	Lucknow-600 families per capita per day
1	Card Board	0.57
2	Metal	0.13
3	Thermocol	0.16
4	Paper	3.16
5	Plastic	3.98
6	Wood	1.89
7	Glass	0.68
8	Other	2.69

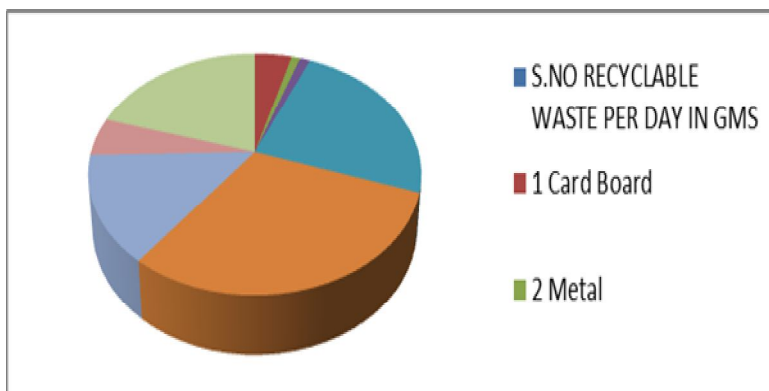


Fig.2: Shows pie representation of recycle waste generation

Analyses of the different types of recyclable waste generated per person per day are shown in Table -3. It was discovered that although plastic trash was only 0.13gm per inhabitant per day in Lucknow, it was 3.44gm in Lucknow.

Analyze the data with Gram Panchayat population size, including Gram Panchayats with less than 2000 inhabitants, Gram Panchayats with 2000–5000 inhabitants, Gram Panchayats with 5000–10,000 inhabitants, and Gram Panchayats with more than 10,000 inhabitants, in the tables below.

Table-4

Category Wise Per Capita Waste Generation For Gram Panchayats Less Than 2000 Population

S.No	Waste Generation	Lucknow-50 per capita Block-Bakshi ka Talab, Gram-Digoi
1	Inert Waste	0.68
2	Bio degradable waste	52.80
3	Hazardous Waste	0.00
4	Recycle Waste	12.90
	Total	66.38
	Total Family Member	337

We can see in Table 4 above that in Lucknow, biodegradable trash ranges from 52.80gms per day per capita, while hazardous waste is 0 gms. This data is for Gram Panchayats with less than 2000 inhabitants.

Table-4 Category Wise Per Capita Waste Generation For Gram Panchayats Population 2000-5000

Table 5

S.No	Waste Generation	Lucknow-100 families percapita per day block-chinhat gram-papnamau lucknow
1	Inert Waste	7.21
2	Bio degradable waste	45.54
3	Hazardous Waste	0.37
4	Recycle Waste	23.74
	Total	76.86

Above data for Gram Panchayats with population 2000-5000

We can see that inert waste 7.21gms per day per capita at Lucknow recyclable waste range between 23.74gms at Lucknow hazardous waste is 0.37.

Table 6

- Category Wise Per Capita Waste Generation For Gram Panchayats Population 5000-10000 Districts.

S.No.	Category of Waste	Per capita Block-Piprauli, Gram Piprauli,Lucknow
1	Inert Waste	21.71
2	Bio degradable Waste	52.77
3	Hazardous Waste	0.06
4	Recyclable Waste	19.76
	Total	94.30

Above data for Gram Panchayats with population 5000-10000 we can see that inert waste 21.71 gms per day per capita at Lucknow recyclable waste range between 19.76gms at Lucknow hazardous waste is 0.06

Table 7

S. No.	Category of Waste	per capita Block-Piprauli, Gram-Jangal Suhas Rani Kuwari ,Lucknow
1.	Inert Waste	11.57
2.	Bio degradable Waste	22.79
3.	Hazardous Waste	0.95
4.	Recyclable Waste	5.24
	Total	40.55

We can observe that inert waste 11.57gms in Table 7 above data for Gram Panchayats with population greater than 10,000. Lucknow, while biodegradable waste is between 22.79 grams per person per day. Recyclable garbage in Lucknow starts at 5.24 grams.

Table 8

Weekly Market Data- Number & Type of Shops/Stalls

S.NO	In Juggaur-Lucknow Nature or Type/category of Stall	Total No. of Stall
1	Vegetables, Flowers and Fruits	8
2	Meat/Chikan/Fish Stalls	1
3	Food Stalls	5
4	Grains Stalls	2
5	Handlooms & clothes	4
6	Kitchen Utility Stalls	1
7	Farm Utility Stalls	4
8	Footwear Stall	1
9	Plastic Households/Plastic wares	2
10	Decorative items stalls	0
11	Cosmetics Stalls	4
12	Others-clay pot etc	6
	Total	38

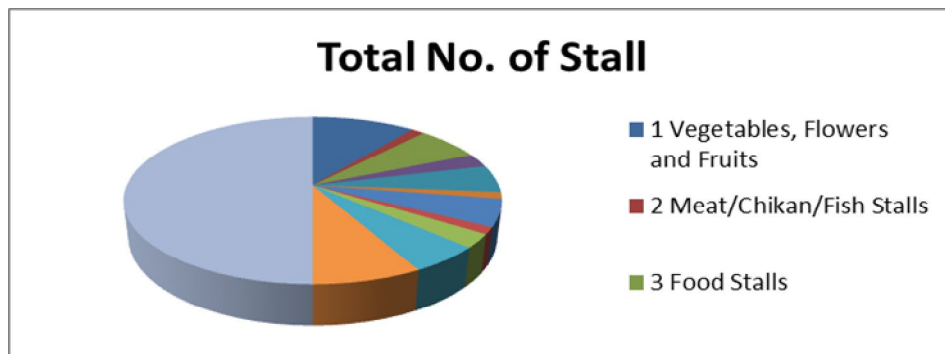
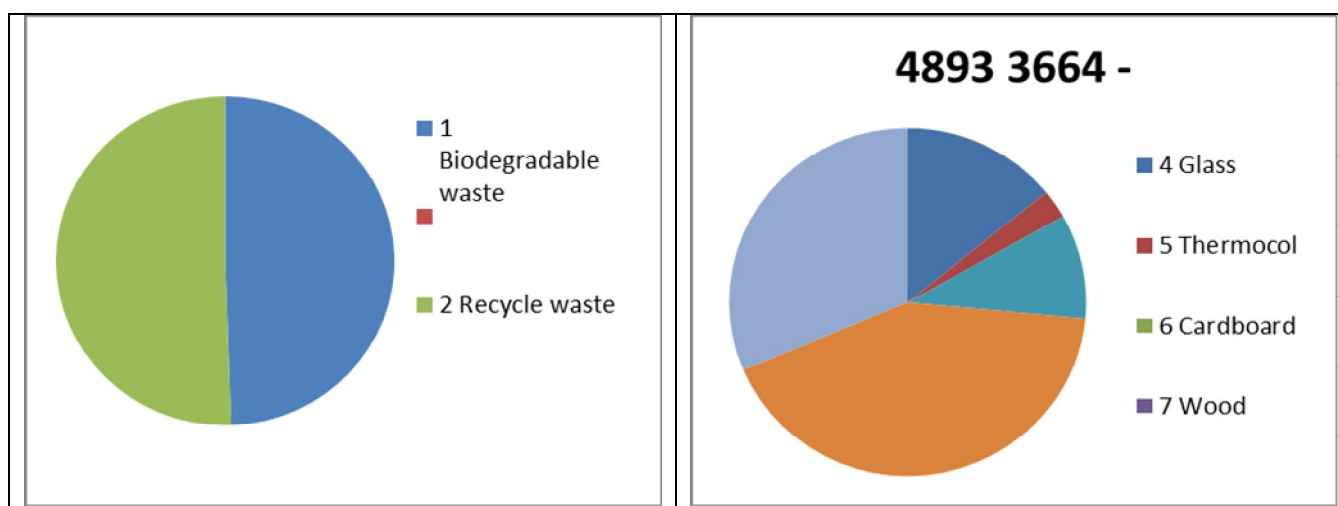


Fig.3 A survey of one weekly market was conducted to gather information on the amount and type of waste produced there. Lucknow- Juggaur was chosen because there were daily markets there while there were no weekly markets at any of the other gram panchayats that were studied.

Table 9  
weekly Market Data- Categorization of Waste. (In Gms)

	Biodegradable waste	13200
	Recycle waste	13500
1	Paper	4893
2	Plastic	3664
3	Metal	-
4	Glass	2640
5	Thermocol	498
6	Cardboard	0
7	Wood	0
8	Other	1805
9	Inert waste	7850
10	Hazardous waste	5843



### III. CONCLUSION

To sum up, the research project carried out by the Centre for the Characterization and Quantification of Solid Waste in Gram Panchayats Last but not least, the study carried out by the Centre for the Characterization and Quantification of Solid Waste in Gram Panchayats in Uttar Pradesh has given important insights into the waste creation patterns in various demographic categories.



The information gathered from several Gram Panchayats in Lucknow provides insight into the per capita garbage generation rates and the nature of the region's solid waste. The survey's main finding is that Lucknow creates 69.52 grams of solid trash per person per day on average. This garbage is divided into recyclable, toxic, biodegradable, and inert categories. Notably, the research shows that waste content differs considerably between various population groups. Biodegradable garbage, with an average per capita generation of 52.80 grams per day for Gram Panchayats with less than 2000 inhabitants, makes up the majority of waste. In comparison, this category hardly ever includes hazardous garbage. With average per capita generation rates of 7.21 grams and 23.74 grams per day, respectively, in Gram Panchayats with a population between 2000 and 5000, inert waste and recyclable garbage are more prevalent.

While recyclable garbage generation has increased significantly as well, biodegradable waste still makes up a sizeable share of the waste stream in locations with a population of between 5000 and 10,000. In Gram Panchayats with a population exceeding 10,000, the waste composition shifts towards lower biodegradable waste and higher recyclable waste. The survey also includes weekly markets in its analysis, demonstrating the different stall kinds there as well as the waste they produce. Implementing waste management strategies in these market sectors may require the use of this knowledge. Overall, the results from the survey provide a thorough insight of the solid waste landscape in various Gram Panchayats of Uttar Pradesh, enabling policymakers and waste management authorities to customize their approaches to efficiently manage and minimize trash in the area. It emphasizes the value of specialized waste management approaches that take into account the distinctive waste generating patterns in different demographic segments.

#### IV. ACKNOWLEDGEMENT

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