Full Length Research Paper

A Critical Evaluation of Solid Waste Management Practices with Special Reference to Allahabad City

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ARTICLE DETAILS	ABSTRACT
	In globalization era, our modern life style and economic development has been generated a new problem of solid waste in human life. Industrialization and Urbanization is a result of Economic boom that generates and provides more solid waste in our regular life. Due to this, absorption power of waste of environment has reduced. Environment has been degraded. Allahabad, holy city of three religious rivers, is also affected from this problem. Over-population, modern life-style, excess use of automobiles, urbanisation etc. is becoming dirty its culture and its environment. Allahabad Municipal Corporation spends on average 22% of its total budget on solid waste management respectively. Despite all, problem of solid waste has been still lying. Therefore, Solid waste Management is an important issue for the Allahabad city. Based on primary data and its testing, it can be said that *Solid waste management practices in Allahabad city are highly efficient in Allahabad City* but it is also need to improvement because on the basis of respondents' responses, researcher comes to this conclusion that there are some problems in demand and supply side of Solid waste Management practices in Allahabad city too.

1. Introduction

In globalization era, our modern life style and economic development has been generated a new problem of solid waste in human life. No one could escape from this problem. Solid waste was being absorbed by nature in ancient time because it was eco-friendly or natural. But now-a-days, it has become a problem due to over-population, greediness and economic boom. Industrialization and Urbanization is a result of Economic boom that generates and provides more solid waste in our regular life. Materials have been transformed from mud into steel or plastic. Everything has been packed in polyethylene or can or plastic bottles because packed materials demand has been raised due to modern life style or mobilization of labour. Due to these, absorption power of waste of environment has reduced. Environment has been degraded.

Allahabad, holy city of three religious rivers, is also affected. Over-population, modern life-style, excess use of automobiles, urbanisation etc. is becoming dirty its culture and its environment. Trees have been cutting and pollution has been increasing. Uttar Pradesh Government has been started a programme and scheme for making this city as 'Smart City' or 'Green and Clean City." The city is divided into 100 sanitary wards and the entire operation of solid waste management system is performed

under four heads, namely, cleaning, collection, transportation and disposal. In the city area of about 63 sq. km, the cleaning and collection operations are performed by the public health wing of AMC; while transportation and disposal of MSW are being performed by the transportation wing of AMC. It is dumped into depots (49 depots). MSW is then loaded into the transportation vehicles, which transport the waste to different disposal sites. Every year Allahabad Municipal corporation spends on average 22% of its total budget on solid waste management respectively.

Despite all, problem of solid waste has been still lying. Therefore, Solid waste Management is an important issue for the Allahabad city. Allahabad Municipal Corporation is responsible for the management of the MSW generated in the city. Therefore, measures and revolution has been must to become Allahabad city as Atmanibhar City.

2. **Waste and Waste Management**

Waste is useless material. Although waste is useless, it is necessarily created by human activities. We cannot escape by creating waste. Actually it is a part of human activities that can be economic, commercial, industrial or residential activities. Where there are human beings, waste is also unwillingly created. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. It is discarded after primary use, or is worthless, defective and of no use. It is a natural part of the life cycle. It occurs when any organism returns substances to the environment. Living things take in raw materials and excrete wastes that are recycled by other living organisms. However humans produce an additional flow of material residues that would overload the capacity of natural recycling processes, so these wastes must be managed in order to reduce their effect on our aesthetics, health or the environment.

Besides the classification based on their sources of origin, such as Solid waste, Liquid waste, and Gaseous waste also waste can be classified as biodegradable and non-biodegradable. In general, the waste might be ordered into the accompanying classes:

Solid Waste–

These are the undesirable substances that are disposed of by human culture. This includes metropolitan, rural, biomedical, and radioactive waste. Any kind of garbage coming households, factories or hospitals come under waste. Except solid wastes are only solids or semi-solids. These solids/semi-solids can be dry or wet.

Liquid Waste-

Wastes created from washing, flushing, or fabricating cycles of ventures are called fluid wastes.

Gaseous Waste –

These are the wastes delivered as gases from cars, plants, or consuming non-renewable energy sources like oil. They get blended in different gaseous climates and sporadically cause occasions like brown haze and corrosive downpour.

Wet Waste-

Any dissolved liquid based waste or sludge coming from wastewater plants, households, etc come under wet waste. Examples such as leftover curries, juices, rotten vegetables will come under wet waste

Dry Waste-

Waste which isn't dissolved in any form or in liquid form come under dry wastes. Examples such as plastics, bottles, etc will come under dry waste.

Biodegradable Waste

Any organic material that can be synthesized into carbon dioxide, water, methane or organic molecules by organisms in the soil come under biodegradable waste. Waste that consists of organic matter is referred to as biodegradable waste. Food and paper are perfect examples. Organic matter is broken down or decomposed into gases (methane, carbon dioxide) and liquids (water, others) via microorganisms of microorganisms. Major sources of biodegradable waste are households and some types of commercial establishments such as restaurants, hotels, food processing units etc. Some biodegradables can also come from industries, animal farms, and agricultural farms.

Non-Biodegradable Waste

Any material that cannot be synthesized into CO2, water or CH4 come under non-biodegradable waste. Non-biodegradable waste cannot be further decomposed via the action of the microorganisms. Such waste is the major source of toxins in the landfills. Chemicals, metals, plastics, paints, rubber, etc. are examples of non-biodegradable wastes. These materials can remain in landfills for thousands of years without any damage. Toxins from metals and plastics get soaked into the earth and pollute the soil and water sources.
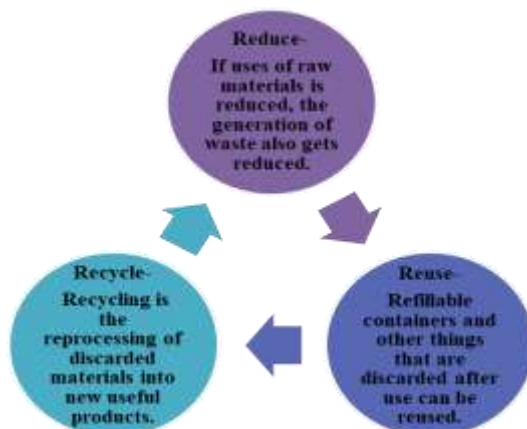
Chart-1: 3 R's Method for reduction Municipal Solid Waste

Indeed, Indians are old trash, but the quantity of junk and garbage that is thrown out of the houses all across the world is huge. Year after year, it can add up to millions of tons of waste materials that find their way into the landfills. Every industry contributes to environmental waste that gets added to the soils and landfills on the planet. Everyday human activities are also a major source of waste on our planet. This incorporates rubbish or trash from families, schools, workplaces, commercial centres, cafés and contains things like food trash, utilized plastic sacks, soft drink jars and plastic water bottles, broken furnishings, broken home apparatuses, clothing, and the industrial waste created from such sources.
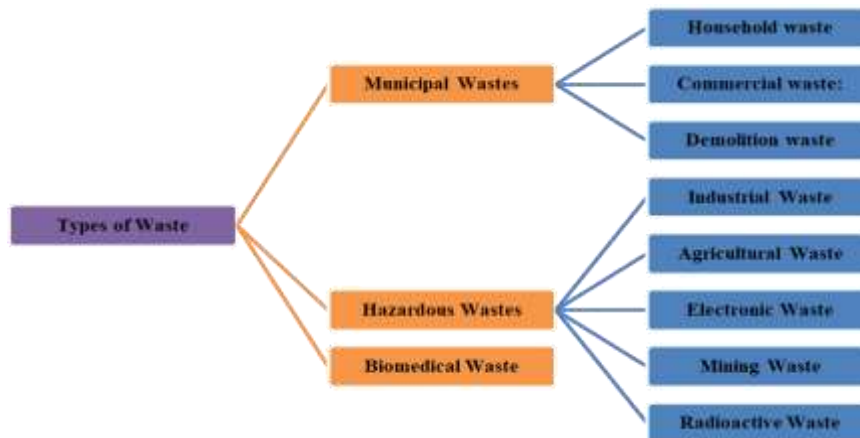
Status of waste generation per annum in India and Uttar Pradesh can be seen in Table-1.

Table 1 : Category wise Waste in India as well as Uttar Pradesh

S. No.	Category of Waste	Amount generated per Annum in India	Amount generated per Annum in Uttar Pradesh
		About Waste Generated	
1.	Solid Waste	6.2 crore tons	5.47 lakh tons
2.	Plastic Waste	56 crore tons	
3.	Bio-Medical Waste	1.7 lakh tons	
4.	Hazardous Waste	79 lakh tons	

5.	e-waste	15 lakh tons

About Waste Collected and Treated in India

1.	Waste collected by Agencies	4.3 crore tons
2.	Treated	1.19 crore tons
3.	Being dumped in low lying areas	3.10 crore tons
4.	Share of Urban local bodies in Collection of waste	75-80%
5.	Treated waste out of total collected by ULBs	22-28%

Time taken in decomposition of different Wastes

1.	Plastic Bags	20-1000 years
2.	Plastic Bottles	400 years
3.	Polysrene cup	50 years
4.	Plastic coated paper cup	30 years
5.	Glass Bottle	1000000 years
6.	Disposable Napkins	450 years
7.	Aluminium Cans	80-200 years
8.	Cigarette but	1-5 years
9.	Milk carton with wax coating	3 month
10.	Paper Towel	2-4 weeks

Source: Uttar Pradesh State Solid Waste management Policy, Urban Development Department, Government of Uttar Pradesh

On the above account, it can be said that the waste management has emerged as a huge challenge in the country. Not only the waste has increased in quantity, but the characteristics of waste have also changed tremendously over a period, with the introduction of so many new gadgets and equipment. The status of tonne per day waste has been compiling in the Table 2 from the various annual report of CPCB.

Table 2: Solid Waste in India and UP in TPD

	India				Uttar Pradesh			
Year	**Generated**	**Collected**	**Treated**	**Landfilled**	**Generated**	**Collected**	**Treated**	**Landfilled**
2013-14	142566	117645	22665	0	NA	NA	NA	NA
2014-15	141064	127531	34752	4515	NA	NA	NA	NA
2015-16	135198.27	111027.55	25572.25	47415.62	15192	11394	1857	0
2016-17	119140.9	116685.9	24045.05	49836.57	15500	12000	3115	0
2017-18	43298.385	45082.15	15386.81	22904.7	NA	NA	NA	NA
2018-19	152076.7	149748.6	55759.6	50161.33	17377.3	17329.4	4615	0
2019-20	150847.1	146053.8	70973.2	40863.2	14468	13955	5395	0
2020-21	160038.9	152749.5	79956.3	29429.2	14710	14292	5520	0

Sources: Various Reports of CPCB, New Delhi.

It shows the real picture of the problem that is generated from the waste in every year. Therefore storage, collection, transfers and disposing of waste is must in the country as well as Uttar Pradesh. In other words, waste management has become a need of the country as well as Uttar Pradesh. Waste management are the activities and actions required to manage waste from its inception to its final disposal. It is intended to reduce adverse effects on human health, the environment or aesthetics. So waste management is all about how solid waste can be changed and used as a valuable resource.

This paper is based on Municipal Solid Waste Management therefore Municipal solid waste management involves activities associated with six basic principles of solid waste generation, storage, collection, transfer and transport, processing and disposal. The collecting, treating and disposing off solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions and these conditions in turn can lead to pollution of the environment and to outbreaks of vector- borne disease that is diseases spread by rodents and insects. The Municipal Solid Wastes (Management and Handling) Rules 2000, prescribed under the Environment Protection Act 1986 by the Government of India define municipal waste as "includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes"

3. About the study Area
Allahabad District is one of the districts of Uttar Pradesh state of India, Allahabad, a holy city or City of God in Persian, also known as Prayag, is a city in the North Indian state of Uttar Pradesh. The city has a population of about 1,117,094 inhabitants (AMC, 2011). It has an area of 5482.10 sq.km. It has a population of 49.36 lakh and is densely populated with 911 persons per sq. km. There are eight tehsil namely Allahabad, Handia, Phulpur, Soraon, Karchhana, Meja, Koraon, Bara in Allahabd District. It has 20 blocks namely Pratapur, Phulpur, Meja, Mauaima, Manda, Koraon, Kaurihar-1, Kaurihar-2, Kaundhariya, Karchhana, Jasra, Holagarh, Handia, Chaka, Baharatiya, Dhanupur, Uruwa, Soraon, Shankargarh, Saidabad. 75% population lives in rural area. Highest population is found in Allahabad (M.Corp.+OG) area while lowest is found in Chak Imam Ali (CT) It can be concluded that higher population lives in rural area in Allahabad district & 68% literacy rate is found in this area. Government tries to make clean & green city of it. Therefore they implement a policy for it to convert this city as SMART CITY. In this study, researcher analyses it on the basis of some statistical tools.

4. Objectives, Hypothesis and Research Methodology of the Study
The main objectives of this study are as follows:-
1.To highlights the types and amount of solid waste generation.
2.To examine the efficiency of solid waste management practices in Allahabad City.

To fulfill the objectives following Hypothesis has been formulated-
H0: Solid waste management practices in Allahabad city are not statistically highly efficient.
H1: Solid waste management practices in Allahabad city are statistically highly efficient.

For testing the formulated hypothesis, following research methodology has been used-
• This study is based on Explanatory Research Method.
• The study is conducted on the basis of both Primary data that are collected from Allahabad City.
• Allahabad city of Uttar Pradesh is purposively selected as the study area.
• The primary data will be obtained from the 300 respondents in Allahabad city using simple random sampling method.

5. Critical Evaluation of Solid Waste Management Practice in Allahabad City
For testing the hypothesis of the study, nine indicators are used as efficiency of solid waste management practices in Allahabad City and then t-test has been applied on each indicator. These indicators are-
•Storing Solid Waste
•Storing household rubbish
•Segregation different type of waste
•Segregation of waste by telling collection service provider
•Having large bins in your area
•Having regular garbage collection in your area
•Using garbage collection services
•Satisfied with your current garbage provide service
•Dumping their waste alongside the garbage bins instead of putting it inside

On the basis of primary survey, responses of the respondents for these indicators are tabulated-
Table-3: Results of Primary Survey

S.N.	Particulars	Frequency in %	
		Yes	No
1	Storing Solid Waste	77.5	22.5
2	Storing household rubbish	79.6	20.4
3	Segregation different type of waste	10	90
4	Segregation of waste by telling collection service provider	15	85
5	Having large bins in your area	67	33
6	Having regular garbage collection in your area	72	28
7	Using garbage collection services	70	30
8	Satisfied with your current garbage provide service	58	42
9	Dumping their waste alongside the garbage bins instead of putting it inside	15	85

Sources: Collected from field by Researcher

All above indicators are used as a symbol of efficiency of solid waste management practices because if it will done regularly or will find regularly in Allahabad City, it will show the efficiency of solid waste management practice.

This hypothesis is tested on one sample t-test at 1.5 value because for apprising it, two point Likert scale is used in which 1 is assigned for No, 2 is for yes. Test value is equal to 1.5 means that respondents are always doing it regularly or every functions that are related to solid waste management has been doing regularly. In other words, universe mean is equal to 1.5 which will be equal to sample mean.

Table-4: One-Sample Statistics for efficiency of solid waste management practices in Allahabad City

Indicators	N	Mean	SD	SE(Mean)
Storing Solid Waste	275	1.77	.419	.025
Storing household rubbish	275	1.80	.403	.024
Segregation different type of waste	275	1.10	.303	.018
Segregation of waste by telling collection service provider	275	1.15	.357	.022
Having large bins in your area	275	1.67	.471	.028
Having regular garbage collection in your area	275	1.72	.450	.027
Using garbage collection services	275	1.70	.460	.028
Satisfied with your current garbage provide service	275	1.58	.495	.030
Dumping their waste alongside the garbage bins instead of putting it inside	275	1.15	.357	.022

Sources: Calculated by Researcher through SPSS

The mean value of six answers is more than 1.5 while mean value of three answers have less than 1.5 (Table-4). This difference is statistically significant at 274 degree of freedom and 5% level of significance. The p-value of all statistics is less than 0.05 (Table-5) which shows that Null Hypothesis will be rejected and alternative hypothesis will be accepted at two tail student test.

Table 5: One-Sample Test for efficiency of solid waste management practices in Allahabad City

Indicators	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Storing Solid Waste	10.875	274	.000	.275	.22	.32
Storing household rubbish	12.182	274	.000	.296	.25	.34
Segregation different type of waste	-21.795	274	.000	-.398	-.43	-.36
Segregation of waste by telling collection service provider	-16.308	274	.000	-.351	-.39	-.31
Having large bins in your area	5.948	274	.000	.169	.11	.23
Having regular garbage collection in your area	8.111	274	.000	.220	.17	.27
Using garbage collection services	7.146	274	.000	.198	.14	.25
Satisfied with your current garbage provide service	2.621	274	.009	.078	.02	.14
Dumping their waste alongside the garbage bins instead of putting it inside	-16.308	274	.000	-.351	-.39	-.31

Sources: Calculated by Researcher through SPSS

Results
Since mean of six answers out of nine are more than 1.5 therefore null hypothesis is rejected and alternative Hypothesis is accepted.

6. Conclusion
Based on testing, it can be said that ***Solid waste management practices in Allahabad city are highly efficient in Allahabad City*** but it is also need to improvement because on the basis of respondents' responses, researcher comes to this conclusion that there are some problems in demand and supply side of Solid waste Management practices in Allahabad city too.

Supply Side Problem –
- Door to door collection is only very low near about 61% in each wards.
- Only one collection motor is assigned in each mauhalla or area to collect door to door collection of waste by Nagar Nigam.
- Collectors charge Rs. 50-200/- for collecting waste to the citizen.
- They are not permanent staff of the AMC. Therefore the frequency of leaving jobs are high.
- There are no proper waste dustbins on the road side.
- The existing dump sites/trenching grounds namely, Buxi Band and Kareli, are located at an average distance of 10 km, from the city center. The transportation vehicles make three to four trips per day to transport the MSW to these dumping sites. It takes about 1.5 to 2.0 hours to make a trip depending on the traffic conditions.
- The waste is transported in open vehicles and this creates unhygienic conditions in the city.

Demand Side Problem –
The demand side problem is related to unawareness as well as the practice of throwing the wastes into the streets and drains. It is more prevalent in case of many households in the city as well as within the community of small restaurants and eateries; this unhygienic practice has resulted in clogging of drains. Excessive polythene has also emerged out to be one of the reasons for frequent clogging of drains.

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