

# Municipal Solid Waste Management In Visakhapatnam City, India



S. Kameswar Rao

**Abstract:** Management of solid waste is a major challenge for most of the urban local bodies in developing countries primarily due to the rising urban population and per capita waste generation rate. Improper management of municipal solid waste leads to repulsive condition of streets and spreading of diseases. The present study is an attempt to evaluate the user satisfaction on the performance of the Greater Visakhapatnam Municipal Corporation (GVMC) with regard to solid waste management. The findings of the study are going to be useful to the urban local bodies and GVMC in particular to identify the performance gaps and to initiate measures for further improvement.

**Keywords:** Municipal Solid Waste Management (MSWM), Greater Visakhapatnam Municipal Corporation (GVMC), Urban Local Body (ULB)

## I. INTRODUCTION

Waste is generated from households, markets, restaurants, hospitals, temples, street sweeping etc., and ineffective management of waste lead to ugly condition of streets and spreading of diseases. Waste can be defined as an unwanted or undesired material left over after the completion of a process. 'Waste' is a human concept: in natural processes there is no waste, only inert end products. Waste can exist in any phase of matter (solid, liquid, or gas). When released in the latter two states, gas especially, the wastes are referred to as emissions. It is usually strongly linked with pollution (Bohmer G, 1995). Solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes (Chobanoglous G. et al., 1993). Solid wastes have the potential to pollute all the essential components of living environment such as air, land and water. The problem of solid waste is more acute in developing nations than in the developed nations due to rapid economic growth and urbanization.

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Despite of huge expenditure the management of solid waste has become a major challenge to the urban local bodies. The present study was conducted in Visakhapatnam, India one among the developing smart cities. The study area has been divided into six geographical zones governed under Greater Visakhapatnam Municipal Corporation (GVMC). The main aim of the study is to evaluate the opinion of the customers on the performance of GVMC and to analyze the attempts made by GVMC with regard to solid waste management.

## II. LITERATURE REVIEW

Solid waste is generated from households, hotels, markets, temples, street sweeping etc., and ineffective management of waste leads to repulsive condition of streets and spreading of diseases. Solid waste is increasing with the high growth of population and the groundwater near landfill sites are contaminated (N. Victor 2013). Lacks of public awareness on the influence of unattended waste on the lives of citizens have made the communities uninterested towards the problem (Sunil Kumar 2010). Solid waste management is an important service and one cannot be included from these services even if they do not pay for the services because it is important for public health and environment (Sandra Cointreau-Levine 2012). The present society is consumption driven and is the reason for production of massive quantity of waste. The change of behavior and sustainable consumption, extended producer and consumer responsibility may give better results (Atiq UzZamanand Steffen Lehmann 2011). Increasing consumption of electronic products is the main cause for growing problems of e-waste and the main sources of e-waste are households, retailers, public and private sectors and illegally imported scrap. Estimation of future outflow if e-waste plays a significant role in solid waste management.

The important reason for the growth of municipal solid waste generation is urbanization and unempirical management of municipal solid waste that damage the health and environment. Installation of solid waste processing units and development of recycling industry can manage the municipal solid waste competently (Rajkumar Joshi and Sirajuddin Ahmed 2016). Segregation of waste at source, reuse of recycled material, use of scientific methods for waste disposal, public awareness and public private partnership can be suggested for efficient solid waste management (A. Khajuria et al. 2017).



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David C Wilson et al. (2011) have ascertained that improving the solid waste management system in all circumstances is not impossible. The authors have suggested that a reliable data on solid waste, transparent and sound institutional framework can improve the solid waste management system. S. Kameswar Rao (2018) has ascertained that GVMC has done a splendid job in providing civic services but the jurisdiction of GVMC and population has grown from time to time. Frankie R Edwards and Barbara J Steven (1978) argued that among the available schemes for waste collection, the contract system is the best scheme for collecting solid waste. Kurian Joseph et al. (2012) have suggested for capacity building and an integrated approach with the support of educational institutions for sustainable solid waste management. Peter M. Wiedemanna and Susanne Femers (1993) have examined the impact of public participation in the decision making process with regard to waste management. They have concluded that public participation in decision making process should be viewed as a means but not as a goal. Sepideh Taghizadeh et al. (2012) have attempted to determine the composition and amount of waste generated and developing the best strategy for waste management. They have suggested that proper assessment of the composition and amount of waste is essential for effective management of waste. The authors have observed that the best strategy for solid waste management is production of compost from the organic waste.

### III. OBJECTIVES OF THE STUDY

The major objectives of the study are:

- 1) To describe and assess the attempts made by GVMC with regard to solid waste management.
- 2) To study and evaluate the opinion of the residents on solid waste management by GVMC.
- 3) To identify the gaps in service delivery and suggest measures for further improvement.

### IV. RESEARCH HYPOTHESES

The following research hypotheses have been formulated for the purpose of the study, basing on the literature.

HO1: The consumers are not satisfied with the solid waste management system of GVMC.

HO2: There is no significant difference between consumers' opinion (zone wise) on solid waste management system.

### V. RESEARCH METHODOLOGY

The present study entails data and information from both primary and secondary sources

**Primary Data:** The primary data has been collected from a sample of 480 respondents and respondents have been chosen by using stratified random sample technique. A well structured questionnaire on solid waste management by GVMC is designed and implemented for the purpose. Further the respondents have been divided into four categories basing on the occupation such as businessmen, employees, professionals and others for a wider coverage of the universe **Secondary Data:** The secondary data was

collected from the official records of GVMC, website, reports and research articles.

ANOVA, Mean value, Percentages, Standard Deviation and Reliability tests have been used for the purpose of data analysis and interpretation. SPSS version 22.0 has been used as per the requirement. A one-way analysis of variance between groups is conducted to know the opinion of consumers in different zones on GVMC with regard to solid waste management. The reliability coefficient of the identified variables is tested using Cronbach's alpha analysis. The Cronbach's Alpha of the identified variables is .977 which is highly reliable.

### VI. STUDY AREA

Visakhapatnam is the largest city and financial capital of Andhra Pradesh. It is the 14th largest city in the country with a population of 2,035,922 as of 2011. Geographically the Visakhapatnam city is located at 17°42' North latitude and 82°02' East on the coast of Indian Ocean. The city has witnessed rapid industrialization and has been identified as one of the fastest growing cities in the world, economically and demographically. Large scale industrial establishments such as Hindustan Shipyard, Bharat Petroleum Corporation, Visakhapatnam Steel Plant, Bharat Heavy Plate and Vessels Limited, Hindustan Polymers, Hindustan Zinc Plant, Coromandel Fertilizers etc are located in and around the city and generating massive amounts of waste. The city is administered by the GVMC and the Public Health Department of GVMC is responsible for collection, transportation and disposal of solid waste. The present study is carried out in six geographical zones of Greater Visakhapatnam Municipal Corporation to assess the solid waste management scenario.

### VII. SOLID WASTE MANAGEMENT IN GVMC

The Public Health Department of GVMC is accountable for collection, transportation and disposal of solid waste generated in Visakhapatnam city. According to GVMC the quantity of waste generated per day is around 1150 metric ton. Table 1.1 shows that the main source of waste is domestic waste that covers 64.1 percent and around 15.32 percent waste is generated from shops and commercial establishments. Hospitals and clinics generate around 1.5 percent and markets generate around 3.9 percent of waste.

**Table 1.1: Details of solid waste generation in GVMC**

Sl. No.	Source of Generation	Quantity /day in tons	% to total
1	House Hold - Domestic	737.15	64.1
2	Shops, Commercial Establishments	176.18	15.32
3	Street Sweepings & Drain Cleanings	85.1	7.4
4	Hotels and Restaurants	39.79	3.46
5	Hospitals, Clinics	17.25	1.5
6	Markets	44.85	3.9
7	Industries & Others	49.68	4.32
	Total	1150	100

Source: Public Health Department, GVMC

The details of vehicles and staff engaged by GVMC for solid waste management are depicted in table 1.2. The municipal corporation has three levels of waste collection systems and the sanitation is being attended with 1030 regular workers and 5115 outsourced workers.



The first level is primary collection system that is door-to-door waste collection. The segregated waste at household level is collected and transported through Push Carts and Tri-Cycle to transit centres. The second level is secondary collection of wastes from household into containers and waste is collected through dumper and RCC bins. In addition roads sweeping is being attended every day and modern sweeping machines are also introduced for efficient sweeping. The third level refers to the transportation of waste to land fill sites from secondary sources.

**Table 1.2: Details of vehicles and staff for solid waste management in GVMC**

Sl. No.	Staff / Vehicles	Number
1	Sanitation Staff (Regular)	1030
2	Sanitation Staff (Outsourced)	5115
3	Push Carts	5115
4	Tri-Cycles	720
5	Tata Aces	171
6	Mini Tippers / Vans	54
7	Big Tippers	15
8	Compactor Vehicles	20
9	Mini Compactor Vehicles	50
10	Dumper Placers	02
11	Buldozers	02

Source: Public Health Department, GVMC

Around 171 no. of Tata Aces, 98 Dumper Placers, 54 Mini Tippers / Vans, 15 Big Tippers and 02 Buldozers are being used by GVMC. The bio-medical waste is collected by a private agency, Maridi Eco Industries Pvt Ltd., and the municipal corporation has faced challenges in getting additional landfill sites.

### VIII. RESPONDENTS' PERCEPTION ON GVMC WITH REGARD TO SOLID WASTE MANAGEMENT & RESULTS

The perception of respondents on GVMC with regard to solid waste management is assessed in the study. The study includes perception on “collection and transfer of solid waste is done regularly”, “municipal corporation use modern methods in solid waste management”, “the performance of public health workers is monitored effectively”, “public complaints are addressed effectively”, “the employees dealing with solid waste have required skills”, “employees dealing with solid waste are motivated” and “the performance of GVMC in solid waste management is satisfactory. Table 1.3 depicts the comparative analysis of the individual variables and this comparison is based on the Mean value and its standard deviation respectively.

**Table 1.3: Comparative chart of the Mean value and Standard Deviation**

Variables	Mean	Standard Deviation
Collection and transfer of waste is done regularly	3.60	.964
Municipal corporation use modern methods in solid waste management	3.60	.913
The performance of public health workers is monitored effectively	3.47	1.009
Public complaints are addressed effectively	3.53	.839
Employees dealing with solid waste have required skills	3.67	.792
Employees dealing with solid waste are motivated	3.64	.802
The performance of GVMC in solid waste management is satisfactory	3.50	1.005
Mean of mean	3.57	

**Table 1.4: Respondents perception on solid waste management by GVMC**

Variables	Mean Value						Total	F
	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Zone-6		
Collection and transfer of waste is done regularly	3.58	3.59	3.48	3.61	3.74	3.60	3.60	0.607**
Municipal corporation use modern methods in solid waste management	3.59	3.95	3.68	3.66	3.30	3.40	3.60	5.250**
The performance of public health workers is monitored effectively	3.56	3.64	3.50	3.45	3.28	3.40	3.47	1.274**
Public complaints are addressed effectively	3.81	3.61	3.69	3.58	3.14	3.36	3.53	7.141**
Employees dealing with solid waste have required skills	3.88	3.9	3.76	3.81	3.24	3.41	3.67	10.572**
Employees dealing with solid waste are motivated	3.84	3.81	3.71	3.84	3.26	3.40	3.64	8.388**
The performance of GVMC in solid waste management is satisfactory	3.56	3.59	3.48	3.60	3.35	3.40	3.50	0.863**

Table 1.4 represents the perception of respondents on GVMC with regard to solid waste management. The respondents rate the variable “collection and transfer of garbage is done regularly” as high as per their secured mean score of above 3.50 on a 5 point scale. Respondents from Zone 5 area are more satisfied (mean score 3.74) than other zones and respondents from Zone 3 are less satisfied (mean score 3.48) among the zones on the regularity of collection and transfer of garbage. A one-way analysis of variance between groups is conducted to know the respondents perception in different zones on the regularity in collection and transfer of solid waste. The actual difference in mean scores between groups is insignificant and there is no statistically significant difference in mean scores between GVMC Zones.

The descriptive statistics shows that total mean score of variable, “GVMC use modern methods in managing solid waste” is 3.60 which indicate that the consumers have positive opinion towards the municipal corporation with regard to use of modern methods in solid waste management. Among the zones, respondents from Zone 2 (mean score 3.95) are more satisfied than other zones and respondents from Zone 5 (mean score 3.30) are less satisfied with municipal corporation in use of modern methods for solid waste management. The actual difference in mean scores between groups is insignificant and there is no statistically significant difference in mean scores between GVMC Zones. Monitoring the employees performance play an essential role in determining the performance of employees and the total mean value of the variable, “the performance of public health workers is monitored effectively by GVMC” is 3.47 indicate that the respondents have positive opinion towards GVMC with regard to monitoring of employees performance. Among the zones, respondents from Zone 2 are more satisfied (mean score 3.64) than the other zones and respondents from Zone 5 are less satisfied (mean score 3.28) with GVMC in monitoring the performance of health workers.

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The total mean score of the variable, "the performance of GVMC is satisfactory solid waste management" is 3.50 which indicate that the respondents have positive opinion towards the municipal corporation. Among the zones, respondents from Zone 4 are more satisfied (mean score 3.60) than the other zones and respondents from Zone 5 (mean score 3.35) are less satisfied with the performance of municipal corporation with regard to solid waste management. A one-way analysis of variance between groups is conducted to know the opinion of residents on the performance of municipal corporation in solid waste management in different zones. The actual difference in mean scores between groups is insignificant and there is no statistically significant difference in mean scores between GVMC Zones. The perceptions of the respondents with regard to solid waste management are ascertained based on the seven variables as shown in table-4. The descriptive statistics shows that the total mean value of referred seven variables is 3.57 which indicate that the residents have positive opinion towards the municipal corporation with regard to solid waste management. Thus, the analysis results presented in the table provide a strong support for the rejection of the null hypothesis relating to the consumers are not satisfied with the solid waste management system of GVMC. The study further reveals that there is no significant difference among the zones in the respondents opinion on solid waste management. Thus, the results of the analysis presented in the table provide a strong support for the null hypothesis relating to that there is no significant difference between respondents opinion (zone wise) on solid waste management system.

### IX. CONCLUSION AND POLICY IMPLICATIONS

The present study focuses on the opinion of the residents and attempts made by GVMC with regard to solid waste management. The results of the study reveals that the total mean score of referred seven variables related to solid waste management is 3.57 on a 5 point scale. This indicates that the municipal corporation has been evaluated positively by the respondents with regard to solid waste management, whereas the residents are not fully satisfied.

Municipal corporations are recommended for continuous improvements to maintain a competitive edge. There is a need to consider human resources programs and make sure that employees are able to provide services professionally to the customers. Training and development of employees serve as a prime motivational tool and help organizations to be more flexible and proactive. Awareness programs on solid waste management should be arranged by the local bodies regularly with the involvement of NGOs and Residential Welfare Associations (RWAs). Workers and common people should be given some incentives such as best lane/street awards to manage waste properly. In addition there is a need for implementing penalty system to impose fine on the workforce as well as the community for changing attitude and behavior. Urban local bodies need to take public feedback and keep auditing at regular intervals with regard to solid waste management. In view of the health and environmental impacts, landfill sites need to be maintained properly and research efforts have to emphasize on biological methods of waste treatment. An integrated

approach ought to be adopted towards solid waste management with main aim to reduce, recycle and reuse the waste.

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