

Opportunities and Challenges in Solid Waste Management of Hyderabad, a Case Study of Swatch Hyderabad Mission

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Abstract

Waste management in India has a long way to go. Sustainable waste management can be attained only through the establishment of appropriate channels for the collection, transportation, and disposal of waste. The aim of this study is to describe the sources of solid waste generation in Hyderabad and analyse the solid waste management infrastructure of GHMC and its ability to meet future growth and also to find out the sustainability scenario with respect to rising population in the city. The paper explores various opportunities and challenges by conducting survey on random basis among various stakeholders in solid waste management in the city. In our study, we brought out the various SWM measures taken up by the government of Telangana vis-à-vis SWM of Hyderabad such as a public-private partnership in SWM collection, new methods, techniques, and modernization of SWM infrastructure carried out to meet the SWM needs of Hyderabad.

Keywords: Solid waste management, self-sustenance, policymakers, segregation, community

Introduction

The massive rise in municipal solid waste (MSW) in the burgeoning cities of developing and emerging countries have led to rising public concerns with regard to the resultant health and environmental impacts. Today, the waste of about 3 billion people is still disposed of in an undisciplined manner. As per the World Bank, in 2016, the world's cities generated 2.01 billion tons of solid waste, amounting to 0.74 kilograms of waste generated per person per day. With population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tons by 2050. As increased levels of municipal solid waste have long posed threats to environmental quality and human health, citizens and the respective governments are becoming more sensitive to environmental pollution and its impact on the quality of life. This has made municipal solid waste management (MSWM) become significant in the local political objective. Managing waste properly is essential for building sustainable and liveable cities, but it remains a challenge for many developing countries and cities. Effective waste management has become all the more expensive. Managing this essential municipal service requires integrated systems that are efficient, enduring, effective, and socially supported.

Every economy in the world gives great importance to the markers of economic growth, the GDP, stock market, employment, etc. but we don't observe the same amount of scrutiny and evaluation of performance in solid waste management. The solid waste generated is very closely associated with economic growth and urbanization. For any economy to grow and sustain itself, it is imperative for it to handle the solid waste generated effectively not just to meet the present but future needs. Thankfully, the awareness and

attention given to solid waste management have increased and policymakers the world over are focusing on solving the issues of SWM.

Overview of Hyderabad City

Hyderabad is the capital of Telangana State and the sixth-largest city in India. According to the 2011 Census of India Hyderabad is the fourth most populous city in India and as per the latest estimates of UN World Population Prospects, the population of Hyderabad in 2022 is 10.4 million. The Greater Hyderabad Municipal Corporation (GHMC) is the civic body entrusted with the responsibility of solid waste disposal along with providing other civic amenities. When Greater Hyderabad Municipal Corporation (GHMC) has 650 km² (250 sq mi) resulting in an increase in population by 87%, in the 2001 census to 2011 census, 24% of which majority of them are migrants from different parts of India.

Areas that Come under GHMC: The Greater Hyderabad Municipal Corporation (GHMC) comprises the L. B. Nagar, Gaddi Annaram, Uppal Kalan, Malakjiri, Kapra, Alwal Qutubullapur, Kukatpally, Serilingampalle and Rajendranaga, Shamshabad, Satamarai, Jallapalli, Mamdipalli, Mankhal, Almasguda, Sardanagar and Ravirala, Ramachandrapuram and Patancheru. At present, Greater Hyderabad Municipal Corporation is spread across 4 districts- Hyderabad district, Medchal district, Ranga Reddy district, and Sangareddy district.

Solid Waste Generated Per Day: Hyderabad produces about 5,500 tonnes of solid waste daily which is transported to the dumpsite in Jawaharnagar Disposal is managed by the

Integrated Solid Waste Management project which was started by the GHMC in 2010

Zones Demarcated for Waste Collection: For the convenience of administration GHMC is divided into 6 zones (south, east, north, northeast, west and central zones), 30 circles and 150 wards. Each ward would cover about 37,000 people. The GHMC is headed by a commissioner belonging to IAS. A Zonal Commissioner will be there for each zone and an officer of the rank of Additional Commissioner with a Deputy Municipal Commissioners is heading every circle.

Municipal Zones of GHMC

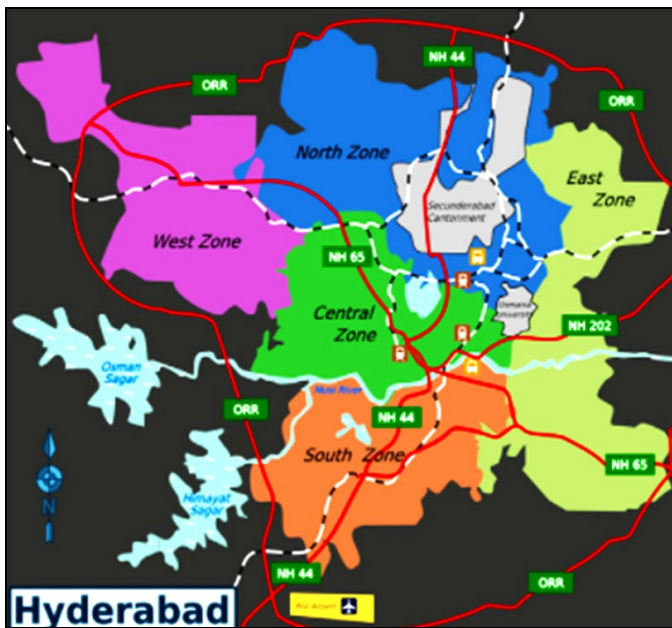


Fig 1: Municipal Zones of GHMC

Definition of Solid Waste

For the purpose of this study, we use the definition given by GHMC. Solid waste refers to a variety of litter-coming both from animal and human activities-that are disposed as unwanted and useless. Waste is generated throughout in every single way from our daily activities. Each activity will generate different types of waste which will requires its own separate or specialize treatment.

Methodology

Data is collected through primary and secondary research. Qualitative interviews are conducted for the stake-holders in municipal administration and the workers engaged in transportation of solid waste management in Hyderabad.

The Aims and Objectives of this Study

1. To describe the sources of solid waste generation in Hyderabad.
2. Analyzing the solid waste management infrastructure of GHMC and its ability to meet future growth.
 - What is the capacity of SWM of Hyderabad. Is it sufficient to meet future needs.
 - What is the projection of solid waste generation in future, what is the scope for capacity expansion
3. Describing the various innovative measures taken by GHMC to improve solid waste collection and disposal.
 - Highly decentralized waste collection system through 90 mini collection centers and many new secondary transfer centers.

4. Issues in solid waste management in Hyderabad.
 - Issues faced by the workers
 - Issues faced by the citizens of Jawaharnagar
5. Suggesting possible improvements in MSWM of GHMC

Limitations of the Study

This article offers the results of an analysis of part of the research. The Hyderabad metro region has a population of 10,534,000 in 2022. The data was provided from the responses of 368 participants (256 are residents from different localities, 112-municipal workers) who participated in the survey. Of the responses, 318 corresponded (223-residents and 106-municipal workers) to a 93 percent confidence level, which, as a consequence, meant the study had a high degree of validity. The questionnaire was distributed in an online environment and through personal interview conducted by the researcher. Respondents' Gender: male and female-ranging from the age: 18 years and above. The collected material was subjected to descriptive analysis. Areas of research conducted are Kukatpally, Banjara Hills, Lower Tank Bund, Boduppal, Dammaiguda, Balajinagar, Yusufguda, Dilsukhnagar. Data collection for entire Hyderabad was not possible due to scarce resources and limited time.

The Model of Solid Waste Collection in Hyderabad

Materials in MSW can be broadly categorized into three groups, Compostables, Recyclables and Inerts. Compostables or organic fraction comprises of food waste, vegetable market wastes and yard waste. Recyclables are comprised of paper, plastic, metal and glass. The fraction of MSW which can neither be composted nor recycled into secondary raw materials is called Inerts. Inerts comprise stones, ash and silt which enter the collection system due to littering on streets and at public places.

Sources of Solid waste in Hyderabad

1. **What are the Sources of Waste:** Solid waste is generated from a number of sources such as domestic, commercial, and industrial. The waste is also classified as hazardous and non-hazardous waste. The hazardous waste has to be segregated at source and treated for the disposal.

Per Capita Waste: Hyderabad residents generate the highest per capita waste in India-570gm per day. Bengaluru and Delhi follow closely the list with 440gm a day and 410gm a day respectively. The total volume of garbage generated daily in mega cities is-Hyderabad (4,200 tonnes), Ahmedabad (2,300 tonnes), Bengaluru (3,700 tonnes), Chennai (4,200 tonnes), Kolkata (3,670 tonnes), Delhi (5,800 tonnes) and Mumbai at a staggering 6,500 tonnes. It has been observed that the source of wastes for the Hyderabad Municipal Corporation (HMC) and the Urban Local Boards (ULBs) is mainly the domestic households (60 to 65%), generating the MSW of 1482 and 690 tons per day.

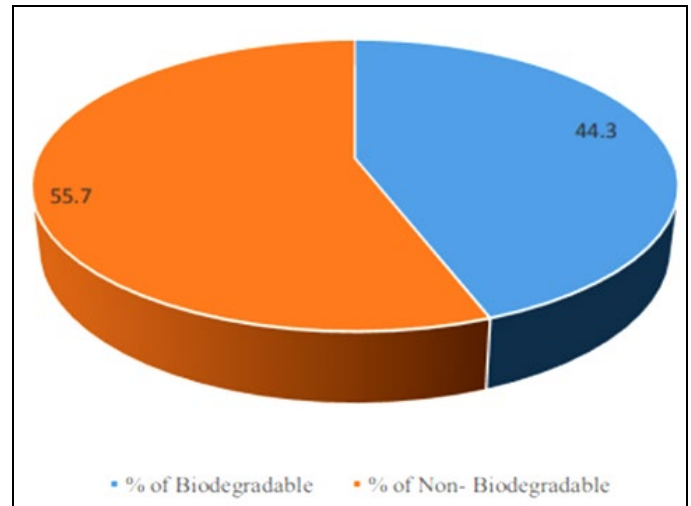
2. **Classification of SW in Hyderabad:** According to data collected from GHMC, municipal solid waste is of two types-Biodegradable and Non-Biodegradable.

Organic: Biodegradable waste consists of organic compounds, kitchen and garden waste, wooden components, Paper waste & Cloth material which are easily degradable. The wet waste constitutes two thirds of the overall waste generated. So far GHMC has installed around 3 small

composting units in its parks. Biodegradable wastes, without any disposable methods, can undergo decomposition naturally. The produce obtained after decomposition process is used as manure in agricultural fields to obtain more yield & available to farmers at cheaper cost. The generation & composition of bio degradable waste in dump yard is very high. The generation of easily degradable organic waste is high i.e., 44.3% compared to that of other types of wastes. Seven organic composter centres have been introduced by GHMC with its companies' partners being Google and Ramkey in many hotels and companies.

Inorganic and Recyclable

Non-Biodegradable waste consists of plastic material, metals, glass, batteries, leather & Hospital waste. These cannot be dissolved by a natural process and can be disposed by treatment or disposal methods. By depositing these materials large number of pollutants are released into the environment there by causing critical threat to the latter. The generation of plastics/bottles, are very high i.e., 22.0%, when compared to metals, glass etc.



Source: www.ijera.com ISSN: 2248-9622, Vol. 11, Issue 1, (Series-III) January 2021

Fig 2: % of biodegradable and non-biodegradable MSW of GHMC

Composition of Solid Waste of Hyderabad

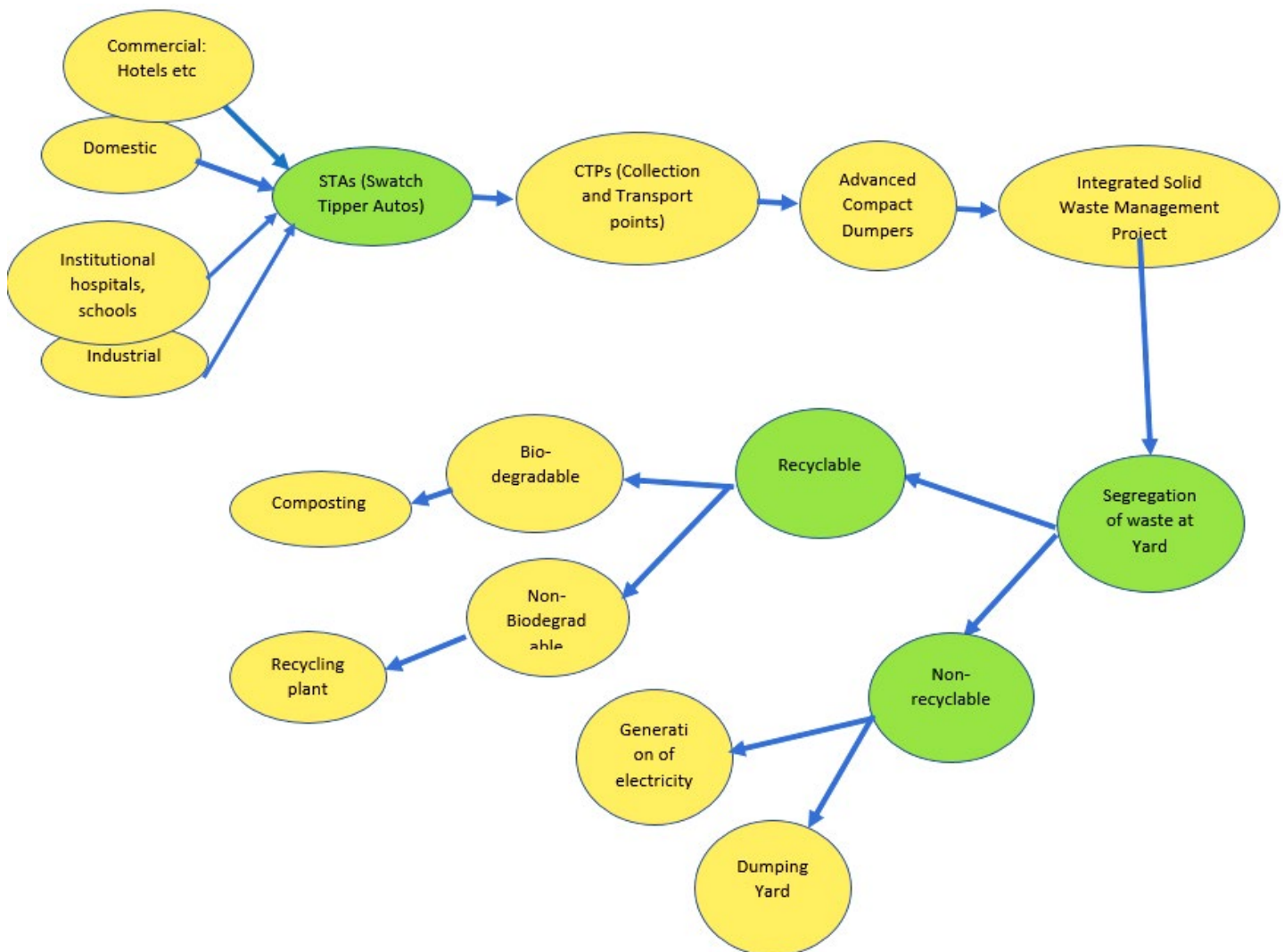


Fig 3: Schematic Diagram of solid waste management in Hyderabad

1. Collection, Storage and Transportation of MSW

2. Primary Collection

Collection of Municipal Solid Waste

- A total of 3515 “Swachh Auto Tippers” (SATs) are

entrusted with the waste collection from door-to-door with separate partition for wet and dry waste from individual households, shops and commercial establishments. Each SAT is made responsible for

collecting the garbage of about 400-450 households (HHs).

- Push carts and tricycle rickshaws are operating in the areas with narrow lanes.
- GHMC has employed (37) Refuse Compactor vehicles and (8) Big compactors to deal with the bulk waste generated from commercial establishments such as hotels and function halls.
- 315 Tippers with six tonnes capacity are engaged to collect waste from weekly market areas and collection points of garbage.

3. Secondary Collection

Transportation of Waste: The entire waste collected through SATs, Refuse compactors and Tippers will be transported to 32 Transfer stations scattered over different parts of the city. In order to avoid leachate generation at the transfer stations the waste is immediately transferred into bigger vehicles on the same day within 12 hours. The transfer stations are categorised into:

- Conventional Transfer Stations (8):** The waste from the primary/secondary collection vehicles is transferred into 160 25GVW capacity vehicles using 7 Rear end Refuse Compactor Vehicles (RCVs) of 8 Cum and (9) no of 14 Cum capacity.
- Modern Transfer Stations (24):** At these stations static compactors take in and compress the waste from autos and load the 24 cum capacity containers (round shaped). The hook mounted vehicle will take the container and transfer to Jawaharnagar. So far five modern stations have been built viz: Mallapur, Karmanghat, Sanjeevaiah Park, Amberpet and Kukatpally Metro mall. Works at Jaguda and Lower Tank bund are at Preliminary stage.
- Secondary Collection and Transport Points (SCTPs):** It replaces waste bins and garbage vulnerable points on roads. They help reduce the travel and waiting time of primary collection vehicles significantly. The direct transfer of waste from primary MSW collection vehicles into fully automated portable self-compactors (PSC) ensures minimal manual handling and stores the waste by compressing it. Once this container fills up, a specialised truck mounts the PSC upon itself and takes it to the designated dump yard. On a pilot basis one such SCTP has already been set up in LB Nagar.

4. Tertiary Stage

Treatment and Disposal: MSW transported from various transfer stations is received at the centralized treatment and disposal facility at Jawaharnagar.

Processing Facility at Jawaharnagar

The Integrated MSW Processing Facility located at Jawaharnagar is operated through the private operator namely M/s. Hyderabad Integrated Municipal Solid Waste Ltd., under Public Private Partnership in Built, Operate and Transfer (BOT) mode. It has a total processing capacity of 6000 TPD having the following processing facilities:

Table 1: Treatment capacity of each plant in the processing facility

S. No.	Description of the facility	Capacity
1.	RDF plant (2x1200 TPD)	2500 TPD
2.	Compost Plant (3x680 TPD)	2040 TPD
3.	Recycling complex (Plastic, Paper, Metal, Rubber, Glass etc.)	600 TPD
4.	Land fill with leachate collection and treatment system	735 TPD
5.	Waste to energy plant	19.8 MW

Source: NGT, Chennai

The table 1 explains about various processing facilities at Jawaharnagar in which the Refuse Derived Fuel (RDF) Plant at has a capacity to process 2400 tonnes per day (TPD) solid waste (including household waste and plastics) into valuable solid fuel. Similarly, the Compost Plant recycles 2040 TPD organic matter into a valuable fertilizer that can enrich soil. The Recycling Complex has the capacity to recycle 600 TPD and the Leachate Collection and Treatment System is preventing the accumulation of leachate of 735 TPD. Waste-to-energy plant has been installed with a capacity of transforming 1200 TPD into 19.8MW energy.

Presently, the facility is under operation utilising 1500 TPD of RDF. The facility provided sanitary Landfill and operated to accommodate inerts/rejects generated during process of treatment of MSW. Landfill constitutes of series of layers Lo viz., Clay liner, HDPE liner, drain media (for leachate collection), Geo-textile media to resist any contamination of leachate with ground water. The facility has provided H₂S & Methane gas collection, utilization/incineration system to minimize odour generation and mist spraying systems for spraying deodourising agents at the compost yards. The facility has installed MEE followed by ATFD to treat the RO rejects generated from the leachate treatment plant.

In addition to the above, the GHMC has also proposed to establish another Waste to Energy plant of capacity 14.5 MW at Dundigal, Medchal-Malkajigiri District to utilise the RDF generated from the integrated processing facility of Jawaharnagar. The Board issued CFE to the facility to utilise 1000 TPD of RDF.

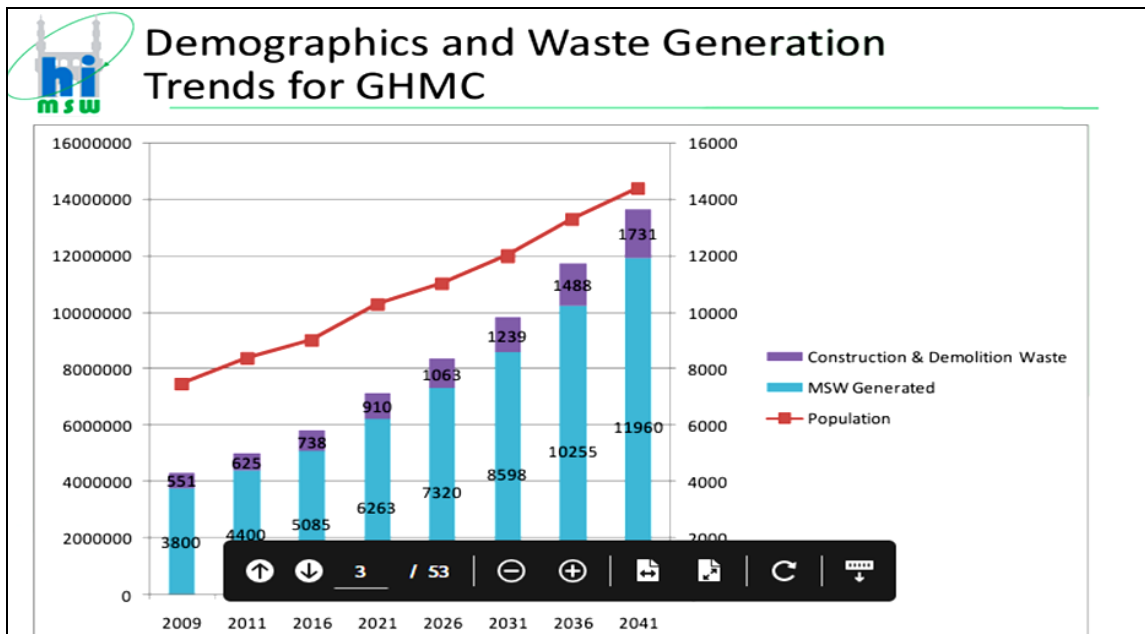


Fig 4: Demographics and Waste Generation Trends for GHMC

In the figure 4, the numbers on the lefthand side of the table are demarcating population of GHMC and on the right size waste generation tonnes per year. The figure depicts how increase in population year after year is leading to the quantum of waste generation (including construction and demolition waste and Municipal Waste)

Dry Waste Collection Centres Initiatives

The GHMC has also provided for Dry Waste Resource Centres at various locations across the twin cities as collection points for channelizing the Dry Waste for recycling. These DRCs are developed under CSR (Corporate Social Responsibility) initiative by ITC and Godrej and are maintained by Waste Pickers and SHG’s (Self Help Groups). T4.wo such centres have been operating at Rajendranagar and Ra5.manthapur. The Rajendranagar circle generates close to 45 to6.mnes of domestic waste of which 50 percent is wet waste. The SHG operating here managed to generate Rs. 5 lakhs revenue from selling dry waste of 98,000 kg containing recyclable material like plastic, papers, glass etc. With such a rewarding response GHMC has planned to take it to other parts of the city and intended to set up 50 such dry resource centres, one such centre for every 5000 households, where segregated dry municipal waste can be sold for recycling with the assistance of SHG’s.

Apart from generating income to SHG’s and rag pickers these centres are reducing amount of municipal solid waste being transported to the dump yard at Jawaharnagar and are providing employment to many individuals.

Similarly, workers at DRCC near Sanjeevaiah Park are segregating the waste collected from the trolleys to different items which are further bought by various private companies and recycling them according to their requirements. In this manner, DRCC here has collected a revenue of Rs. 11 lakhs only in a month.

Projection of Solid Waste Generated in Hyderabad Issues faced in SWM in Hyderabad

1. Segregation at source
2. Policy issues
3. Hazards for people handling solid waste

Segregation at Source

The twin city of Hyderabad and Secunderabad along with sub-urban territories under GHMC generates over 5,500 metric tonnes of waste daily. GHMC has heavily promoted the source segregation models through real and virtual campaigns. GHMC has introduced a door-to-door collection of garbage from households as a mega sanitation and cleanliness drive. GHMC has introduced the waste segregation model at the source by giving two bins to each household for dry and solid waste. Though the collection of garbage from door to door has been successful by hundred percent but segregation at source is only 39% as per the records of the GHMC. The researcher has found that on one side there is hardly any or no awareness on the segregation of waste among the slum dwellers such as B.R. Nagar Basti near Film Nagar and on the other side in colonies though awareness is there only few are segregating the waste.

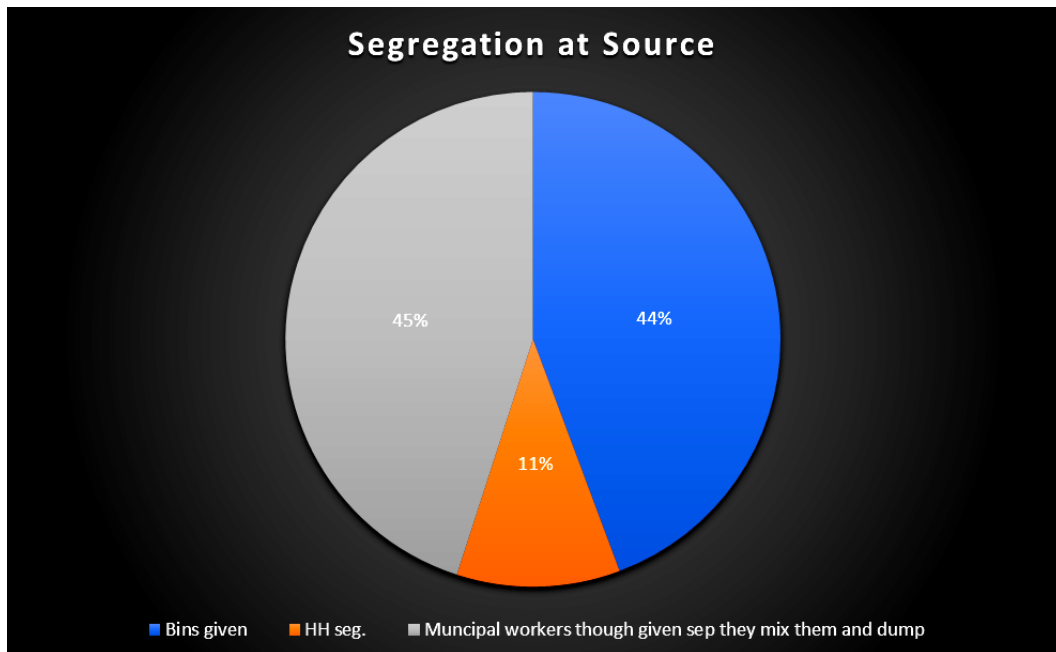


Fig 5: Segregation at source

The above figure describes that of 223 respondent's 44 percent have said that they have received two bins for segregating the waste and 45 percent said that though they (residents) gave waste in segregated form the municipal workers dumped it in their autos in the same bin only 11 percent have said they have segregated the waste and they are practicing this since 2015, the year when they were given the bins by GHMC.

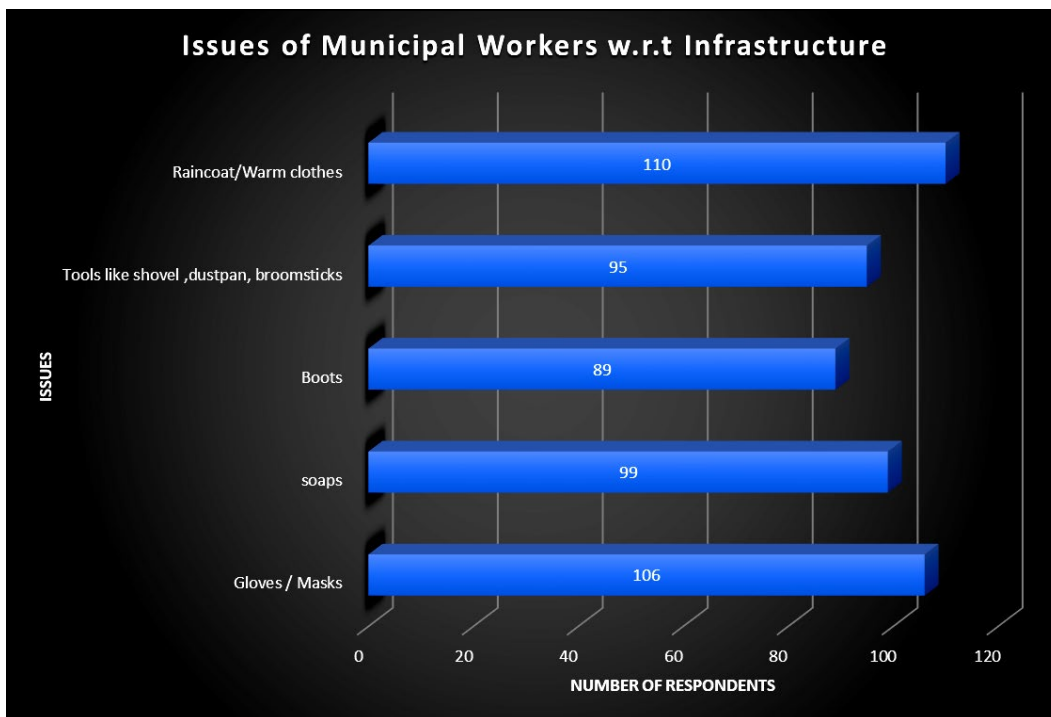
Policy Issues

Experiences in SWM in Hyderabad and another part of the country and world point to the need to incorporate several changes in the MSW rules to have a truly progressive policy. The rules must lay the onus on a range of actors-the producer, the consumer, the recycler, and the municipal authority-to reduce and manage waste (Gupta 2001). Extended producer responsibility should be incorporated in the MSW rules to ensure that producers remain responsible for their product till the end of its life cycle. The MSW rules must incorporate provisions that promote reuse practices. The policy must make provisions for community involvement in public-private partnerships in SWM. While the rules mention that manual handling of waste is to be prohibited, far more attention to the health hazards faced by conservancy workers (in all sectors-public, private and voluntary) and waste pickers is required.

Hazards for People Handling Solid Waste

The removal of municipal solid waste is associated with a variety of physical, chemical, and biological hazards. Municipal solid waste workers (MSWWs) have a risk of occupational injuries as fractures, ocular trauma, and bites, and diseases include skin and gastrointestinal disorders while picking up the garbage and shifting to the designated containers. Workers at municipal solid waste incinerators are exposed to a variety of concerning substances, such as heavy metals, respirable quartz dust, dioxins, furans, and mutagens. Workers can be safeguarded by applying safety measures. The grief due to occupational exposure to bioaerosols and carcinogens among MSWWs is unknown.

In the figure below researcher found that out of 112(43 female and 69) responders (municipal workers) have expressed their concern over insufficient tools and safety equipment's such as boots, gloves, mask, soaps, raincoats, warm clothing's during winters etc. It has also been observed that in some parts of the city though these necessities are provided only for one time which are supposed to be sanctioned a fresh every year. Without effective tools garbage collection not only becomes challenging task but becomes more vulnerable during rainy season.



Source: Self

Fig 6: Issues of municipal workers

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Soil, Water, and Air Pollution

Piling up of garbage months together not only releases a lot of air toxins including dioxins and furans but also it contaminates the surrounding water and soil. It is also an energy-intensive activity, with more electricity pumped in to burn the waste. Waste segregation is an inevitable activity and if it's not done qualitatively, the whole process is affected negatively.

Initiatives to Improve Solid Waste Collection and Disposal

The new mantra in the Public Health segment is Zero Landfill Future. GHMC has initiated some commendable steps in this regard.

Collaboration with Private Partners

GHMC has introduced the model of Dry Resource Centres (DRC) and eliminated almost 1,600 garbage vulnerable points across the community and residential areas. For this purpose, it has collaborated with private partners such as Rmky, ITC, Godrej for their technology.

Initiatives to Mobilize Community Participation

Resident Welfare Associations (RWAs) are engaged to mobilize support from every household towards waste. RWAs were made responsible for the maintenance and waste disposal at each apartment from which Swachh workers will take it further to transfer it to station level. Apart from this GHMC has also come up with MyGHMC mobile app to

promote and monitor the programme through the active participation of its stakeholders. In order to appraise the GHMC initiatives the United Federation of Resident Welfare Associations (UFERWAS) has been formed.

Waste composting at home is also being promoted in several RWAs. GHMC has also recruited community resource persons to educate those living along the nalas towards depositing trash with the garbage collectors, and through a CSR tie-up with ITC.

WOW, initiative (Wellbeing out of Waste) to inculcate the habit of source segregation of waste into wet and dry among the citizens of the twin cities. To this effect, a door-to-door campaign was conducted by Resource Persons (RPs)/Propagation Executives. Follow-up was done twice to ensure that the household practiced source segregation. Waste Collectors are also trained on systematic and segregated waste collection and bring to the Dry resource collection Centres (DRCC) and sell the dry recyclable waste, thereby earning additional income and ensuring source segregation among the households. The DRCCs are operated by Self Help Groups and also deploy rag pickers for handling the dry recyclables for value addition. The GHMC is the first civic body in the country to take up such an innovative scheme involving the corporate sectors under corporate social responsibility to ensure effective implementation of segregation of dry and wet waste.

Garbage Vulnerable Points are replaced with wall paintings, street beautifications, public festivals, and city plantations.

Modern Transport System

Tsunami model for waste management and Swachh Auto Tippers for inclusive development. GHMC is planning to add 18 state-of-the-art mechanical and vacuum cleaning sweeping machines for effective sweeping. GHMC introduced a mechanized transport wing with 37 refuse compactors with cutting-edge technologies.

Digitization and Technology used in SWM

To ensure efficiency and minimum manual operation, the

Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) monitoring system have been introduced which is automatically monitored and operated from a centralized control station. With the application of ICT, the complaints of citizens are handled with actual details.

Bins and vehicle movement can be tracked live and the route can be optimized for efficient collection and transportation of waste. Along with this ICT, helps in identifying gaps in the overall system by connecting to the central ERP system for smooth communication between the head office and collection vehicles or bins 'Swachh Dhooth' app to reward homemakers who post pictures of them segregating waste has been developed.

The Perspective of the IMSWM Facility

To address the ever-growing concerns of piling solid waste at Jawaharnagar, the GHMC has collaborated in a PPP model with the Ramky Enviro Engineers. With the commitment to a better environment and providing the best sanitation services, the Ramky has established a quality delivery system to the citizens of Hyderabad in the form of the Integrated Municipal Solid Waste Management. The project uses the most environmentally sound strategies for municipal solid waste with the scope of the door-to-door collection, secondary transportation up to transfer stations, transportation from transfer stations to processing and disposal facilities, reclamation, and alternative use of existing dumpsites. The project has adopted a combination of mechanical and biological treatment and thermal incineration technologies for the treatment of waste. Biodegradable or the compostable fraction of waste is transformed into city compost and the combustible fraction comprising largely of the non-biodegradable percentage of the waste is converted into Refuse Derived Fuel (RDF) which is used as an alternative fuel in cement plants. The projects generated during the process a land filled in a secured engineered landfill and leachate generated is treated with a high-performance P&T reverse osmosis system. To establish the treatment and disposal facility HRMSW has shifted the waste strewn at the Jawaharhagar site into an area of approximately 110 acres reclaiming over 200 acres of land. Due to this initiative to handle solid waste scientifically Hyderabad city has been ranked first in the country in terms of treatment of disposal in compliance with the Swachh Sarvekshan Survey in 2016 and 2017.

A dedicated Command & Control Centre remotely tracks and reports on the performance of this smart Waste Collection & Transport system on a 24×7 basis. Compared to other cities which have over 40 lakh population in the country, Hyderabad bagged 17th rank in Swachh Sarvekshan. One compactor truck will clear waste collected by 30 Swachh Auto tippers a day. These vehicles are being introduced in the city to do away with open waste trucks that cause inconvenience to other road users

As a part of Swachh Hyderabad Mission, more than 44 lakh bins were distributed to facilitate dry and wet waste segregation in different parts of the city.

Opportunities in SWM of Hyderabad

Waste to Energy (WtE) Plant

It refers to a set of technologies that treat waste to recover energy in the form of heat, electricity. GHMC in collaboration with Ramky has come up with the WtE plant here at Jawaharnagar to generate 63 MW of power, which is

considered to be South India's biggest WtE plant. Apart from this, a 15MW WtE power plant is coming up at Dundigul. The plant is going to use sophisticated air pollution control (APC) system for the treatment of flue gases. The air emission will be continuously monitored online. WtE will reduce the volume of waste up to 90% leaving only 10% of inert/ashes that need to be landfilled. Due care has been taken so that the combustion process will destroy all odor-emitting substances in the waste. The leftover bottom ashes will be converted into bricks or construction material and metals will be recovered from bottom ashes through magnetic separation. The entire process will be monitored from the control room with PLC controlled system.

Bio-mining Units

Biomining is a process by which garbage is treated with bio-organisms or natural elements like air and sunlight. The process of biomining the accumulated waste is exposed to bio-organisms and air and sun so that the biodegradable waste among the layers gets decomposed through the natural process. Auto Nagar was the dumping site with accumulated garbage of more than 25 lakhs tonnes under GHMC for over 25 years before the Jawaharnagar site came into being in Kapra seven years ago. A private firm, Bhavani Bio-organics, has dredged the waste by establishing a bio-mining unit and converted it into a bio-compost turning the place to be hot.

Anaerobic Digestion for Biogas Production

Anaerobic digestion (AD) is the decomposition of organic matter through microorganisms in the absence of free oxygen. The digestate can be used as organic fertilizer when the feedstock is source-separated and non-contaminated organic waste. Biogas is a mixture of different gases which can be converted into thermal and/or electrical energy. Due to its lower methane content, the heating value of biogas is about two-thirds that of natural gas (5.5 to 7.5 kWh/m³). The conversion of organic waste to biogas can be associated with several environmental benefits. Biogas usually replaces another form of energy.

The Policy of the Government W.R.T SWM

Rewards to citizens for taking a photograph of any open disposal of waste in the city and immediate action by the concerned authorities.

Swachh Sarvekshan, an annual survey of cleanliness, hygiene, and sanitation in villages, cities, and towns across India. It was launched as part of the Swachh Bharat Abhiyan. The surveys are carried out by the Quality Council of India, set up as a public-private partnership model on the model existing in the Netherlands.

Observations and Suggestions

1. The issues faced by Hyderabad in solid waste management vary from one area to another within the city. There are regions where solid waste collection and transport are seamless because of stakeholders' active participation and contribution, beginning from households to people involved directly in handling the waste. In other regions, there is a need to motivate and incentivize SWM for efficient collection, and transport.
2. Segregation at source remains an issue in Hyderabad barring a few pockets where it is followed. In order to overcome this, vigorous communication strategies are needed to be identified to bring about not only a behavioural change at a mass level but also to motivate

citizens to embrace segregation. This should be followed by strong monitoring system and enforcement through a series of by-laws and capacity building.

3. With regard to labour issues as such with workers safety and health a fair policy should be drafted. It is also observed that short-handled brooms are causing fatigue and back-ache among municipal workers, resulting in loss of sweeper's productivity. Inefficient infrastructure such as handcarts require constant bending leading to long term health consequences.
4. Economic security is one such serious concern of the municipal workers, especially contract and outsourcing workers. The vulnerability of these workers can be addressed by upgrading them from contract to permanent one. Researcher has found that majority of the interviewed workers are hoping for Pay revision and benefits such as ESI and PF from the government.
5. It is observed that though the GHMC in collaboration with its private partner is putting a lot of effort to address the issue of stinky smell emanating from dump yard, the residents dwelling in and around Jawaharnagar to a stretch of 8 to 10 kms radius are still complaining of it and especially situation worsens during rainy season. The residents within 3kms radius were the worst affected in terms of health by falling sick frequently.

Conclusion

Cities are considered as engines of growth. Ever growing population, here, making SWM in India a major problem. There are issues analogous with public participation in waste management and there is generally a lack of appropriate awareness and responsibility towards waste in the community. Many policies deemed to be failed due to lack of people's effective participation in it. There is a need to nurture community awareness and change the attitude of people towards waste to attain sustainable waste management systems. Sustainable and economically viable waste management must ensure optimum resource extraction from waste, combined with safe disposal of residual waste through the development of engineered landfills and waste-to-energy facilities. India faces challenges related to waste policy, waste technology selection, and appropriately trained people in the waste management sector. So long as these fundamental requirements are met, the state will continue to suffer from poor waste management and the related impacts on public health and the environment.

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