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## India's Swachh Bharat Mission: A Revolution In Waste Management And Hygiene

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### Abstract

Hyderabad has emerged as a leader in solid waste management, employing cutting-edge technologies to achieve "zero waste" status. With a population of over one crore and a floating population of 20 lakhs, the current garbage generation has climbed to 6,454.72 tons of solid waste each day. The current research examines the old garbage collection procedure previous to the establishment of Swachh Bharat Abhiyaan and the impact this mission had on Hyderabad Solid Waste Management (SMW). The Municipality, with the support of private players, adopted the covered SWaCH Auto Tippers in 2016, which completely eliminated the tricycle and garbage Bins concept, which created public nuisance because garbage lay everywhere on the roadways and the smell was unpleasant. Tippers could help with speedier door-to-door collection, which replaced the slow-moving tricycle garbage collection method, and source segregation, which never reached its full potential. In addition, the sophisticated Secondary transfer station was upgraded with advanced garbage compactors that delivered waste directly to the Dumpyard for scientific waste disposal. Hyderabad is the first city in the India to have a cutting-edge waste-to-energy facility, which can now convert waste into energy, resulting in zero waste in the city. Prior to implementation of SWaCH Bharat Abhiyaan (SBA) the Municipalities lacked data on rubbish generation since the existing SWM system does not track trash. The municipalities were unable to appropriately construct SWM-related infrastructure and resources since they had no idea how much waste they would eventually have to handle. Additionally, the traditional SWM system did not use offline surveys on a regular basis to gather valuable data on waste generation, nor did it use real-time waste data. This scarcity led to inadequate planning and services. But in 2016, Hyderabad's solid waste management underwent a significant transformation to fulfil the objectives of SWaCH Bharat Abhiyaan 2.0.

**Key Words:** SWaCH Bharat Abhiyaan, SWaCH Auto tippers, SWaCH Survekshan, Jan Andolan, to Energy

## Introduction

Hyderabad is the capital and largest city in Telangana state. It stretches about 650 kilometers along the Musi River's banks. By 2023, Hyderabad is predicted to have 14,151,724 citizens, making it a thriving metropolis. Hyderabad's population has expanded dramatically since 1950, when it was only 1,096,320 people. Based on the assumption that a middle-class family discards 350 grams of garbage per day, the Municipal Corporation of Hyderabad (MCH) estimated in 1993 that the total amount of waste generated by the population was between 1,300 and 1,500 metric tons every day. However, the Municipal Corporation of Hyderabad (MCH) was unable to dispose of all of its garbage due to several organizational and administrative challenges, as well as budgetary deficiencies (Reddy, 1994). Even though an official were assigned to pick up all the accumulated rubbish every alternate day during this time, there was still a daily backlog of waste that was believed to be between 500 and 100 metric tons. Trash was either burned in front of houses or given to scavengers to clean up in order to get rid of the clutter and remove this backlog. Nonetheless, some waste has been dumped on open space, usually next to or inside residential buildings, posing a long-term health risk to the general population. Municipal authorities reported that every year there is an increase in the average daily volume of waste processed and disposed of in tonnes. From 2,200 tonnes in 2012–13 to 5,900 tonnes in 2020–2021, trash disposal has tripled and is currently growing at a pace of 5% annually.

Now due to extreme poverty, high population density, and widespread urbanization, things have gotten harder in India. Insufficient funding from towns and vague property rights provides impoverished households with a convenient way to dispose of their unsorted waste in adjacent streets, drains, or open spaces (Shahab and Anjum, 2022).

Furthermore, illegal rubbish dumping occurs on purpose in unapproved government or personal-free zones on streets and curbside. The main motive for unlawful dumping is waste bin allocation at inconvenient places or no bin at all, most notably for personal convenience and saving money and time (Lu, W. 2019). We just discovered that India generates a large amount of waste on a daily basis, and that the rate of generation is also very high. This massive amount, combined with the high creation rate, gives rise to illegal dumping on streets and roadside. Illegal dumping is a major problem in India, and it may be found anywhere, from rural to metropolitan regions (Navarro, J. et al., 2016).

The aforementioned challenges stem from India's egregiously inadequate resources for trash collection and transportation, waste treatment facilities, and scientific disposal (Chand Malav, L. et al., 2020). Unmanaged Municipal solid waste (MSW) has also been linked as source to numerous diseases (Lestari, P. et al., 2019). Now, the increased rate of waste generation poses a management problem, particularly for city governments, because it places a significant financial load on municipal budgets. Another key factor contributing to the management crisis is a lack of expertise regarding long-term management across a range of SWM system responsibilities. (Zohoori, M. et al., 2017). To summarize, it was established via a thorough review of various research publications that India's municipalities are unable to handle such a large amount of MSW due to the financial crisis and weak institutional administration. Furthermore, municipalities lack the necessary resources, management techniques, and infrastructure to improve MSW services.

Among the other main issues facing municipalities are the following: a high percentage of door-to-door waste collection; a dearth of trash cans in residential and commercial areas; waste sorting at the source and disposal; a lack of waste treatment technologies; a shortage of disposal land; ineffective collection and scientific disposal techniques; and a fight for MSW disposal optimization (Mani, S. 2016). Furthermore, the municipalities lack waste generation data as a result of the present SWM system's failure to monitor rubbish. This is yet another severe flaw. As a result, communities are unable to predict the volume of waste that will be generated in the future. Municipalities will be unable to build the necessary infrastructure or resources for solid waste management (SWM) because they will be unable to predict future waste loads.

In addition to the previously identified issues, political influence directly affects how well local governments operate (Sharma, A. et. al., 2018).

When unlawful MSW dumping happens on the outskirts of cities, along highways, and along riverbanks, suburban communities become more economically, socially, and environmentally vulnerable (Sharma, A. et. al., 2018). Despite these problems, stumbling blocks, and constraints, municipalities have worked hard to improve the overall SWM service design (CPCB Report, 2020).

It is in the year 2014, under the direction of the Hon. Prime Minister Shri Narendra Modi, India has seen a revolution in waste management and sanitation. **Swachhata** has developed into a mascot and pillar of the public's way of life as well as all government programs. The Jan Bhagidari idea was first implemented on a broad scale through the Swachh Bharat Mission – Urban (SBM-U). A government initiative became a people's initiative thanks to the ownership and leadership of the people in this purpose. SBM-U attained **Jan Andolan** status. The women-led **Jan Andolan**, known as the "Rally for Garbage Free Cities," in which thousands of people took up the task of cleaning their streets, parks, and neighbourhoods. With the nationwide Swachh Bharat Abhiyan campaign, India discovered its way to a more sustainable and clean future. The government is committed to moving the Swachh Bharat Mission forward. "Now that one side of Swachhata has been transformed by the Swachh Bharat Mission, the newest technologies will bend to transform Waste to Energy and Wealth in a major mission."

As stated by India in the Paris Accord, the next step in this path is to go beyond waste and pollution management and turn these threats into opportunities for growth and energy production. Following the accomplishments of the '**Swachh Bharat Abhiyan**,' the Prime Minister's Science, Technology, and Innovation Advisory Council (**PM-STIAC**) intends to establish a '**Waste to Wealth Authority**,' which will employ cutting-edge technologies across states to address waste generation and create socioeconomic solutions for the nation. In order to help Urban Local Bodies solve their waste difficulties, the mission seeks to develop, test, validate, and implement solutions to treat trash in order to generate energy, recycle materials, and extract valuable resources. Additionally, the mission provides a technological library of national and worldwide innovations (**S.V. Gupta, 2022**). In order to streamline trash handling in the nation, the mission will support and enhance the Swachh Bharat and Smart Cities initiatives by utilizing science, technology, and innovation to develop circular economic models that are sustainable and profitable for waste management. This research investigates / paper examines the current policies and their long-term viability. Additionally, it offers some suggestions for program

enhancements that could be implemented as part of the SB goal to enhance SWM in India. The study will undoubtedly be helpful when it comes to routinely reviewing the plan to ensure that it keeps improving.

### **Methodology of review**

In order to investigate the multifaceted effects of SBM, the measures implemented were rigorously monitored in Hyderabad's Alwal municipality from May 2021 to February 2023. Relevant events that were covered by newspapers, websites, and other social media channels were closely watched in order to gain greater insight into the workings of the SBM in Hyderabad. Concurrently, interviews were conducted with municipal staff in regard to implementation of Swachh Bharat Mission 2.0 innovative with responsible for solid waste management and door-to-door rubbish collection. In parallel, careful observation was made of the job performed by the unofficial waste pickers, who are the true unsung heroes of SWM implementation on the ground. The present data was compared to the previously available SWM practices which were in place prior to the sources implementation of the Swachh Bharat Mission in 2014. Based on the information acquired, analysis was done to ascertain whether SBM was successful in delivering "Swachhata: to the intended area.

### **Results**

#### **Scenario of population growth and trash generation**

In 1991, Hyderabad's population reached 4.3 million. During this time, the daily municipal rubbish output in Hyderabad was between 1,300 and 1,500 metric tons. At present, Hyderabad's population continued to rise, reaching 10 million, with an additional 20 lakh people moving there each day. Concurrently, on November 15, 2020, 5,732.52 tons of garbage were generated every day; on November 5, 2021, that amount increased to 6,454.72 tons of solid waste per day.

#### **Waste disposal scheme and related issue**

The Municipal Corporation of Hyderabad (MCH) has been experimenting with garbage disposal plans in a number of Hyderabad localities since 1993, combining recycling activities with official municipal waste management services. In 1993, a local civic body in Hyderabad launched, with the help of NGOs and CBOs, one of India's first community-based voluntary waste disposal plans (Snel, 1999).

This newly developed voluntary garbage disposal system intends to educate the public about the importance and economic value of waste, to involve waste pickers in the program, and to help preserve clean neighbourhoods by accelerating rubbish removal with the assistance of community-based organizations. It was critical to connect informal waste pickers with the formal Municipal Waste Management (MWM) sector because they are not only capable of collecting waste from every household (where M.C.H. trucks cannot reach), but also play an important role in the informal sector's existing recycling programs (Shukla, 1992).

The social objectives include the rehabilitation of 10,000 to 20,000 of Hyderabad's approximately 35,000 garbage pickers. This was to be accomplished by providing them with work, free medical treatment, the ability to sleep in night shelters, and non-formal education and vocational training (Snel, M. 1997).

This plan included over 190,000 families inside the Municipal Corporation of Hyderabad (MCH) spread across 217 slums and 167 colonies. As part of the suggested arrangement, residents had to split their trash into two bins: one for non-biodegradable waste and another for biodegradable waste. Nonbiodegradable stuff was disposed of in the neighbourhood "garbage house." The biodegradable garbage (organic waste) was composted in a residential allotment, usually measuring half an acre.

However, of the total 1300–1500 tonnes of garbage generated daily, the Municipality could only collect 1,000–1,200 metric tons of waste per day during this time. This meant that every day, 200 to 500 metric tons of waste were piled up and disposed of in different ways, such as by open burning, waste pickers, or allowing it to break down organically.

Residents' welfare societies provided payment to the waste collectors, who were employed by the municipality on a contract basis and therefore relied on this monthly collection for their livelihood. Their tricycle cart enables them to go door-to-door in the areas they serve on numerous occasions. To gather and sort the waste produced, two to three workers who put in seven hours a day visited about 250–300 homes each day.

A single tricycle cart could move trash from about thirty residences. Each of the three separate living floors of a house produces trash every day. Nine cart journeys were needed to get to the next collection point from a colony of 300 homes. We do, however, overlook a great deal of routine tasks, such as the degree of waste segregation necessary, and the tricycle's work was a more time-consuming procedure. Furthermore, the garbage collectors' sole sources of income were the minimum monthly collection charge (Rs. 30 per residence) and sales of recyclables, as opposed to hard labour. The purpose of this tricycle was to transport waste to the adjacent open large trash cans, which were a kilometer apart.

### **Changes in garbage disposal following the implementation of the Swachh Bharat Abhiyan**

#### *a. Door-to-door Garbage Collection:*

Since 2016, there have been a total of 5250 SATs (Swachh Auto Tippers), of which 4500 are directly operated by Greater Hyderabad Municipal Corporation (GHMC) as primary garbage collectors from door-to-door, and an additional 750 are operated by private agencies, with separate partitions for wet and dry waste, known as "Swachh Auto Tippers" (SATs) from individual households, shops, and commercial establishments. The corporation purchased and distributed each Auto to selected garbage collectors (usually waste pickers), one driver, and one assistant, and assigned 400-450 households (HHs) to each SAT.

The GHMC proposed using (37 Nos; as on 2022) rubbish compactor vans and eight large compactors to gather waste from bulk waste sources such as restaurants, hotels, event centers, and commercial buildings. In addition to these (315) vehicles, there are 6Ton capacity tippers utilized for garbage collection from weekly market places, sweeping trash collection point. To promote sanitation in the city, the Greater Hyderabad Municipal Corporation (GHMC) has created 72 mobile Secondary Collection and Transfer Points (SC&TP) and 30 static SC&TP. All rubbish collected by Autos, refuse compactors, and Tippers will be carried to (30) transfer stations



situated across the city to be transferred into larger vehicles the same day within 12 hours, guaranteeing that no leachate is formed at the transfer stations. The SC&TP are constructed in such a way that Swachh Auto Tippers may dump rubbish into these containerised vehicles quickly.

*b. Conventional transfer stations:*

Using a number of rear-end refuse compactor vehicles (RCVs), the waste from the primary and secondary collecting trucks is moved into vehicles with a 25GVW capacity.

*c. Modern transfer stations with secondary collection and transfer points:*

The Primary collection vehicles unload their waste onto high-capacity automated static compactors, which compress the waste after transferring it into 24 cum hermetically sealed containers (cylindrical containers). Afterwards, containers are delivered to a treatment and disposal facility by being loaded onto 35 GVW hook loader trucks.

*d. Dry Waste Resource Centers:*

Designed to channel dry waste for recycling, dry waste resource centers, each with an average capacity of 1.5 TPD, were created at different places. Waste Pickers is responsible for maintaining these DRCs, which are developed under CSR initiatives.

*e. Treatment and Disposal of Waste*

MSW that has been moved from multiple transfer stations is received by the centralized treatment and disposal plant located in Jawaharnagar. It handles the material and gets rid of it according to the 2016 SWM requirements. After being unloaded from the trucks onto a tipping platform, MSW is left to dry for around seven days in order to collect the leachate that is pouring out. Trommel screens, which have sieves of 70 mm, are used to filter waste materials into two categories: wet and dry. The principal technique for processing material smaller than 70 mm is composting; the majority of trash is disposed of, and the remainder is typically supplied as Refused Derived-Fuel (RDF), a flammable fraction that is utilized as an alternative fuel in cement factories. However, the majority of the garbage is disposed of through the facility's 19.8 MW waste to electricity plant. The Municipal Administration department has set plans and targets for WTE plants at Dindigul (15 MW), which is expected to be completed by July 2023, and Jawaharnagar Phase 2 (24 MW), Pyranagar (15 MW), Yacharam (12 MW), and Bibinagar (11 MW), which are expected to be completed by December 2024. Every day, approximately 5,100 MT of RDF, equivalent to 15,000 MT of solid waste, will be used for WTE. This means that Hyderabad will process all of its solid garbage.

## Discussion

Prior to the implementation of the Swachh Bharat Abhiyan in Hyderabad from 1993 to 2016, solid rubbish was gathered and disposed of on a ward-by-ward basis based on findings and observations. Poor administration resulted in a strewn-about mass of garbage and insufficient door-to-door collection. Roaming animals posed a significant threat to this collection strategy, wreaking havoc at every dumpster and irrigating spot. Rag pickers were also evident in the areas between them, separating rubbish and dispersing the rest on the open roads, giving them a dirty appearance. When the Door-to-Door Collection System was first introduced as a Pilot Project, safety criteria were not followed since tricycles and tractors were used for transportation instead of close-body automobiles. In Ghana's urban and peri-urban areas, similar usage of tricycles for transporting municipal solid waste and open dumping of waste commonly led to the release of bioaerosols containing pathogens into the environment and into the bodies of the tricycle operators. The investigations' results showed that 12.9% of solid waste carriers who used open tricycles experienced respiratory illnesses. Their research revealed that cough, sore throat, and breathing difficulties were the most often reported symptoms by patients (Armoh S.Y., et al., 2023).

Similar symptoms have been discovered in other African investigations involving municipal solid waste workers (Emiru Z, et. al., 2017), solid trash collectors who go door-to-door and street sweepers (Eneyew B., et. al., 2017) and recyclers of landfill garbage (Tlotleng N, 2019). Trash pickers in Hyderabad, India, shown a lack of dedication to wearing personal protection equipment (PPE) when operating solid waste tricycles. However, this aspect is also not taken seriously under the Swachh Bharat Abhiyaan. Anyone directly involved in the collection, sorting, and transportation of solid waste should be obliged by law to wear personal protective equipment (PPE) kits in order to avoid infection and the spread of rare diseases, especially following the COVID-19 outbreak.

Alongside the Swachh Bharat Abhiyaan, the Internet of Things-enabled Swachh Auto Tippers were unveiled, strengthening the waste collection infrastructure. With the help of this new fleet of pick-up trucks, the Hyderabad twin cities made sure that waste is disposed of through covered vehicles, protecting public safety and preserving human dignity by reducing the need for manual labour.

The largest urban sanitation and cleanliness survey in the world, the Swachh Survekshan, was another flag that the SBA introduced. In an effort to provide better services to citizens and make cities cleaner, it has helped towns and cities establish a healthy rivalry. Encouraging widespread citizen participation and raising awareness among all societal segments about the need of cooperating to improve towns and cities as places to live are the main objectives of Swachh Survekshan. Under the direction of the Swachh Bharat Mission (Urban), the yearly survey has been able to rally people, resources, and authorities in an attempt to prove that their city is the cleanest in all of India and that sustainable practices are supported and encouraged.

Animals, rats, and flies are drawn to decomposing organic waste. Rodents can spread diseases like leptospirosis and salmonella, and they attract snakes to garbage dumps. Solid waste also serves as a breeding place for

mosquitoes (Monica, A.O. and Malyse, U. 2017). Therefore, one of the main issues with disease control that Swachh Bharat aims to address is the spread of disease caused by solid waste that is strewn on roads next to trash cans. Although there hasn't been a complete decrease as yet, open waste piles and locations where waste is thrown out in the open have been outlawed as part of the Swachh Bharat Mission. In Hyderabad, however, this illegal spread of garbage waste has been stopped in many locations, as can be observed.

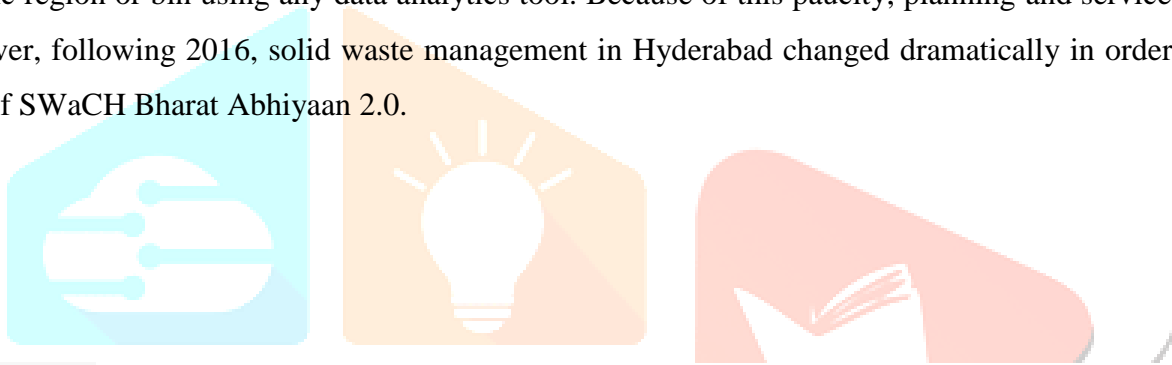
Moreover, the aim to have cities with zero waste can be achieved only when the collections of waste, segregation and transportation is done at a faster rate. Prior to Swachh Bharat mission implementation the door-to-door collection and the waste transportation was carried out slowly. However, with more Swachh Auto Tippers the door-to-door collections has become very efficient and also 100 % source segregation is achieved. Moreover, the advance compactor is been in use which have made the transportation of waste from secondary transfer station to main dumpyard for scientific disposal of waste. Hyderabad have become the leader in waste to energy which aims to make Hyderabad into zero waste city.

Additionally, faster rubbish collection, classification, and transportation are required to achieve the aim of zero waste cities. Prior to the inception of the Swachh Bharat initiative, waste transportation and door-to-door collection were done slowly. However, with more Swachh Auto Tippers, 100% source segregation has been achieved, and door-to-door collections are now fairly effective. Furthermore, the improved compactor currently in use has made it easier to transport waste from the secondary transfer station to the main dumpyard for scientific waste disposal, with no more waste spreading on highways and no more odour. Additionally, faster rubbish collection, classification, and transportation are required to achieve the aim of zero waste cities. Prior to the inception of the Swachh Bharat initiative, waste transportation and door-to-door collection were done slowly. However, with more Swachh Auto Tippers, 100% source segregation has been achieved, and door-to-door collections are now fairly effective. Furthermore, the improved compactor currently in use has made it easier to transport waste from the secondary transfer station to the main dumpyard for scientific waste disposal, with no more waste spreading on highways and no more odour that used to be an issue for the public.

Hyderabad has emerged as a leader in the waste to energy sector, with the objective of being a zero-waste city. Urbanization, industrialization, economic expansion, and population growth are some of the factors that could push the amount of MSW production to 2.6 billion tons per year by 2025. The waste-to-energy (WTE) process burns leftover, non-recyclable trash to create steam and power, which is how energy is produced. This method helps with the production of clean energy, the mitigation of gasses, and the effects of climate change because methane is not generated, unlike in landfills (Silva et al., 2017; Yang et al., 2017). Modern WTE plants are designed to recover clean energy from trash after it has been recycled and are equipped with air pollution control equipment to help limit emissions. The introduction of this innovative technology is the outcome of Swachh Bharat Abhiyan 2.0.



Therefore, with the introduction of the Swachh Bharat Abhiyaan, the paradigm for the development of solid waste management has entirely changed from traditional methodology to a smart and sustainable development approach—a common buzzword in modern development. It is important to note that the Swachh Bharat Abhiyaan was never intended to create jobs, but rather to integrate existing resources into the main stream of SWM in order to maintain cities clean. Prior to SWaCH Bharat Abhiyaan there was no forecast for future waste generation for SWM planning and Applications for Data Analytics were found in short supply. Municipalities lacked data on garbage generation since the traditional SWM system does not track trash. As a result, communities were unable to predict how much waste would be generated in the future. Because the municipalities did not know how much trash they would have to handle in the future, they were unable to properly develop SWM-related infrastructure and resources. Furthermore, the conventional SWM system did not employ real-time waste data and did not conduct regular offline surveys to collect useful waste generation data. As a result, governments lacked the data and were unable to examine garbage generation patterns in a specific region or bin using any data analytics tool. Because of this paucity, planning and services were poor. However, following 2016, solid waste management in Hyderabad changed dramatically in order to meet the aims of SWaCH Bharat Abhiyaan 2.0.



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