

Sustainability at Mahakumbh 2025: Lessons on local waste management from the world's largest mass gathering in India

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Abstract

After the 2018 ban by China on the import of foreign waste, the responsibility of waste processing has fallen back on governments and companies, leading to a shift from global outsourcing of waste to managing waste locally. The waste management approaches adopted at Mahakumbh 2025, the world's largest spiritual fair held for forty-five days in India, can offer lessons on how domestic waste can be managed locally. The fair witnessed an unprecedented congregation of people, presenting critical challenges for sustainable waste management. It reportedly witnessed over 663 million people worldwide participate in the events, celebrations and meditations held on the banks of the Ganga River. For this purpose, a temporary "city" was set up on the riverbanks for nearly one and a half months, with housing facilities, hospitals, restaurants, eateries, transportation, business activities and hundreds of events. One of the biggest tasks in this unique gathering was to maintain the cleanliness and hygiene in the fairgrounds where millions of devotees and tourists arrived, stayed, lived and celebrated. Field visits, attendee reports, wide media coverage and news reports show that the area was mostly very clean despite the gatherings and events happening daily on such a large scale, from morning till night. This is a pioneer study that explores the waste management strategies and practices for managing the huge amount of solid waste generated at the Mahakumbh. Using an exploratory and inductive approach, the findings suggest that adopting a decentralized approach, providing more dignity and better wages for waste management work, hiring manpower, use of technology and multistakeholder collaboration helped manage the gigantic amount of domestic waste locally. The model of Mahakumbh 2025 can also offer valuable guidance to address waste management issues in large scale gatherings worldwide, from the Rio Carnival in Brazil to The Glastonbury Festival in the UK.

Introduction

With increasing economic development and rising consumption, waste management is one of the key sustainability challenges faced globally (World Economic Forum, 2025). Because waste management that is effective and sustainable in the long term often entails higher costs for companies and governments, many developed countries in the past exported their waste to developing countries such as China, where less stringent frameworks and laws were in place. It is estimated that profits from the illegal waste trade amount to US\$ 10–12 billion annually (Basel Institute on Governance, 2021; Tan et al., 2018). Around 2018, China which was a major importer of solid waste from developed countries, imposed a ban on foreign waste imports. This led to major changes in global waste flows with many developed countries searching for other developing countries in which to dispose of their solid waste. A better response to such bans and disruptions can be to find strategies and realistic ways to manage the domestically generated waste locally.

The recently concluded Mahakumbh 2025 fair in India witnessed waste generation on a humungous scale. But as per multiple independent sources and attendees, the sprawling area was very clean and the solid waste was managed quite well. Therefore, a study could offer interesting insights about local waste management that actually works. Given the sensitivity of the Ganga ecosystem and increasing global focus on sustainable development, Mahakumbh 2025 was positioned by the Indian government as a model for green event management. This paper analyzes the waste management strategies and practices employed during the event.

Mahakumbh 2025

The “Mahakumbh 2025” was the largest public gathering on spirituality and faith held at the city of Prayagraj, India between 3-Jan-2025 to 26-Feb-2025. This unique fair and festival is commonly called “mela” in Hindi language. It occurs once every 144 years in Prayagraj at the “Triveni Sangam” - the meeting point where the Ganga, Yamuna, and the mythical Saraswati rivers converge. The timing of this festival is determined by the astrological positions of the Sun, Moon, and Jupiter, believed to signal an auspicious period for spiritual cleansing and self-enlightenment (Government of India Research Unit, 2025). Unlike traditional religious gatherings, here people visited for both spirituality and celebration. UNESCO recognized Kumbh Mela as a “Cultural heritage of humanity” and the world’s largest peaceful gathering of pilgrims (Central Pollution Control Board, 2019). Devotees, pilgrims and spiritual seekers from nooks and corners of India and worldwide gathered to participate in various spiritual and cultural celebrations. On each day of the Mahakumbh festival, thousands of devotees gather at the “Sangam”, the confluence of the Ganga, Yamuna, and Saraswati rivers, to take a holy dip in the sacred river. The Mahakumbh 2025 edition reportedly witnessed over 663 million devotees take a holy dip in the period from 1 January 2025 to 6 February 2025 (Biswajeet Banerjee, 2025).

A temporary ‘tent’ city spanning 4,000 hectares, housing 150,000 tents, was set up for nearly one and a half months. It included stay facilities, hospitals, restaurants, eateries, transportation, markets, business activities, daily public talks, events, and celebrations. The event attracted approximately 660 million visitors, and witnessed a notable rise in international tourists from the United States, United Kingdom, Canada, Australia, Russia, and Japan (AG Horizon, 2025; Behal, 2025). Figure 1 below shows the tent city at night. Figure 2 provides a glimpse of the gathering on one of the bathing days at the Mahakumbh 2025.



Figure 1. Gatherings at one of the bathing days at Mahakumbh 2025 (Source: Department of Revenue, 2025).

The Mahakumbh was held after 144 years based on celestial and spiritual factors. Due to the high spiritual significance of the event, nearly 15 million devotees congregated daily (Vinod Rai, 2025). In nearly 45 days, a temporary city was set up to provide stay facilities for pilgrims along with electricity, water and sanitation facilities, hospitals, restaurants, eateries and transportation. The temporary city featured daily

markets, numerous business activities, public talks, cultural and spiritual events and celebrations. Unlike other mass gatherings around the world, where people usually stay for only a few days, tourists and spiritual seekers at the Mahakumbh often stayed for nearly a month. Around 50,000 security personnel were deployed to ensure safety and management at the gathering.



Figure 2. Partial view of the tent city at night (Source: Ministry of Information and Broadcasting, 2025).

When a temporary “city” comes up on the riverbanks, with stay houses, hospitals, restaurants, cafes, transportation, markets and business activities and events, it creates large-scale logistical and management complexities. One of the biggest tasks for the authorities was to maintain cleanliness and hygiene in the area where millions of devotees and tourists traveled, stayed, lived, and celebrated within the limited mela grounds for nearly 45 days. The challenge was not only the waste generated on the riverbanks but also the flowers, offerings, plastics, and other non-biodegradable items thrown into the river during religious practices. It is reported that the actual number of visitors surpassed the government’s expected figures. If we compare the event with other mass gatherings in the world, such as concerts and pilgrimages, the Mahakumbh 2025 was much larger in scale, lasted longer in duration, and involved multiple events per day. For example, the Hajj in Saudi Arabia lasts five days, and on peak days nearly 2–3 million pilgrims attend. Other major events, such as large concerts and celebrations, usually last only a single day or a few days and attract a few million people (Wikipedia, 2025).

Previous edition of Mahakumbh

News headlines highlighted how some of the previous editions of the Kumbh and Ardhkumbh melas (in 2013 and 2019) had left behind heaps of waste and an even more polluted river, drawing strong criticism from the National Green Tribunal (NGT). Latest detailed case study by (Dubey et al., 2025) evaluates the current procedures for managing municipal solid waste (MSW) in Prayagraj city and finds that a

considerable amount of waste continues to go uncollected or improperly disposed of. Given this setting, the broad research questions are as below:

1. What were the waste management strategies and practices adopted at the largest mass gathering in the world, held for nearly one and half months?
2. How was domestic waste managed locally, especially how waste management strategies were effectively implemented in such an unprecedented large scale gathering?

The broad objective of this study is to explore the waste management strategies and practices at the Mahakumbh 2025, held in Prayagraj. This was the largest mass gathering in the world that was not just for a day or a few days but forty-five days.

Methodology

An exploratory, inductive, and interpretive approach was adopted using secondary data such as government reports, media coverage, environmental monitoring reports, social media (videos and vlogs by attendees). Additionally, the author visited the Mahakumbh and carried out field observations during February 2025.

Waste generated

Based on multiple reports, approximately 400–600 MT of solid waste was generated daily, consisting of religious offerings such as flowers, garlands, coconuts, cloth, and food items – especially at the bathing steps along the riverbanks. The waste also included large amounts of paper, plastic wrappers, food packaging from stalls and pilgrims, and other plastic materials (Hindustan Times, 2025). As reported by the Urban Development Department, approximately 400 metric tonnes (MT) of solid waste was collected and disposed of daily (Hindustan Times, 2025).

A field study by R. Singh et al. (2025) found that the massive amount of solid waste at the mela was generated as a result of the daily attendance of approximately 1.5 million visitors. On days considered holy to take a dip in the river, known as ‘Maha Snan’ days, there was a surge in pilgrims and visitors. For example, on the peak dates of January 13 and 14, 2025, the Sangam area experienced an extraordinary influx of around 50 million devotees from across the globe. Consequently, nearly 16 million litres of faecal sludge and 240 million litres of greywater were generated daily (Vinod Rai, 2025).

Despite such an unprecedented amount of waste generated, the author's field visits on five separate days of the fair and attendee reports from the grounds suggest that waste management was executed quite effectively, with most of the fair ground area appearing clean and hygienic, even during peak days. Table 1 below demonstrates the indicators and targets on waste management at Mahakumbh 2025.

Indicator	Target	Achieved	Remarks
Waste Segregation at Source	60%	65%	Target exceeded
Landfill Waste Reduction (vs. 2019)	20%	22%	Target exceeded
Vendor Compliance (eco-friendly norms)	85%	90%	Strong enforcement and awareness campaigns worked
Resolution Time for Sanitation Complaints	<2 hours	~1.3 hours	Real-time monitoring system proved effective
Ganga River Water Quality Improvement	15%	18%	Improvement above target

Table 1: Key Performance Indicators (KPIs) for Waste Management at Mahakumbh 2025. *Source:* Author compiled data from multiple sources (Government of India Research Unit, 2025; Kapoor, 2025; Ministry of Tourism, 2024; Vinod Rai, 2025)

Strategies and initiatives adopted

Decentralized Waste Management

To handle massive waste volumes efficiently across the sprawling Mahakumbh area, it was divided into 25 sectors spread over the 4,000-hectare of the river banks and each sector was managed semi-independently (Diwan, 2023). Each sector was designed to accommodate pilgrims with housing, roads, electricity, water supply, and communication towers (S. Singh, 2025). A total of 25,000 dustbins, along with 3.7–3.8 million garbage liners, were installed at nearly 25-meter intervals, ensuring ample coverage and localized waste drop-off points. One waste transfer station was set up in each sector and supported by two waste compactors. Every sector had two circle in-charges, 11 supervisors, and mates, with each mate overseeing multiple groups of 12 street-cleaning workers (Kapoor, 2025).

Temporary units of Material Recovery Facilities (MRFs) were established for waste sorting and recycling, and sector-level composting units were built for biodegradable waste management. Three temporary sewage treatment plants were also set up. A study by (IFC, 2024) states that temporary infrastructure, such as modular sewage treatment plants (STPs) and fixed sewage treatment plants (FSTPs) were planned to be dismantled and reused in rural areas post-event. Such temporary STPs & FSTPs reduce land use by 70% and eliminate the need for chemical treatment.

Source Segregation and Collection

Waste segregation at the source was another important strategy adopted to prevent waste from piling up in the area. According to officials, 25,000 color-coded bins were installed – green for biodegradable waste, blue for recyclables, and black for non-recyclables – to facilitate segregation. Dustbins with liner bags were placed systematically and in ample quantities across different sectors. A total of 3.775 million liner bags were provided to the cleanliness and sanitation teams for segregation, collection, and disposal (ChangeStarted, 2025; Press Information Bureau, 2025). Authorities also installed bio-toilets throughout the mela area, while waste bins were placed inside tents and public spaces to encourage proper disposal (Department Of Revenue, 2025). Special sanitation teams were deployed for rapid waste clearance, particularly after major bathing rituals (Press Information Bureau, 2025). To manage bio-waste and maintain hygiene standards, bio-vans were deployed to collect bio-waste from the entire area every 10–15 days (Department Of Revenue, 2025). Reverse Vending Machines (RVMs) were also placed at different locations to effectively manage plastic waste (KnowESG, 2025).

The Mahakumbh 2025 also introduced a campaign discouraging the use of plastics and thermocol in the mela area. A large-scale initiative involving thousands of volunteers raised awareness about using biodegradable cutlery – plates, bowls, and cups – commonly known in Hindi as *pattals*, *dona*, and *kulhads* (The Financial Express, 2025). These biodegradable materials have been traditionally used in India since ancient times. Strict regulations on single-use plastics were also enforced to prevent commercial outlets from generating such waste. Special awareness drives on waste segregation and disposal into bins were conducted through multimedia campaigns using hoardings, radio, and mobile alerts, which were further translated into several languages such as Hindi, English, and various regional languages.

As per government statistics, on major bathing days such as February 14 and February 24, 2025, over 20 million tourists participated in the mela. Quick Response Teams (QRTs) were deployed to ensure swift removal of waste, particularly on such days. There were also overnight cleaning drives to restore the riverbanks and fairgrounds. Cleaning vehicles included 120 hopper and GPS enabled tipper trucks and 40 compactors for efficient garbage collection, along with 94 suction machines for liquid waste management (Vinod Rai, 2025). The trucks collected waste three to four times daily, with additional trips on peak event days. A large team of cleanliness workers known as *Swachhata Mitras* were deployed to monitor sanitation hotspots, ensuring that garbage bins were used properly, and that waste was segregated at the source. Two trash skimmers were also used to remove 10-15 tonnes of waste from the river daily.

Redefining the status, Utilizing manpower

Cleanliness workers are often looked down upon in India. They are paid some of the lowest wages and historically, socio-cultural factors have led to notion that waste collection and cleaning are not respectable

forms of work. As a result, even many economically disadvantaged people hesitate to take up such jobs. To address this bias during the Mahakumbh preparations and execution, cleanliness workers were referred to as *Swachhata Mitras* and *Ganga Sewa Doots* (Gupta, 2025). The term *Ganga Sewa Doots* translates to 'Ambassadors of the Ganga' in English. This helped shift perceptions among workers themselves, officials, and the public regarding the dignity of their work. Reports indicate that around 2500 *Ganga Sewa Doots* were hired to keep the river banks clean. A study by Kapoor (2025) notes that nearly 15000 street cleaners were hired (5000 by private sector and 10000 by the government) and organized into 800 groups with nearly 12 cleaners per group for faster waste removal in different sectors of the fairground. They played an instrumental role in ensuring the success of the multiple waste management initiatives adopted. *Swachhata Mitras* were deployed to monitor sanitation hotspots, ensuring that garbage bins were used properly, and that waste was segregated at the source. They were trained to handle waste management processes efficiently, using special gloves, masks, and other safety equipment to maintain hygiene. Figure 3 below shows the cleaning workers collecting garbage from the riverbanks.



Figure 3. *Swachhata Mitras* cleaning the river banks during the bathing days at Mahakumbh 2025 (Source: Parvez Sultan, 2025)

Coca Cola India, under the "Maidaan Saaf" campaign distributed 21,500 jackets made from recycled plastics (Anjali Singh, 2025). *Maidaan Saaf* campaign was inspired by the opportunity to promote effective waste management at large-scale gatherings across the country. These jackets were given to sanitation workers, boatmen, and volunteers working round the clock to ensure the safety and well-being of visitors.

The *Ganga Sewa Doots* focused on educating the pilgrims about the importance of keeping the Ganga River clean. They conducted awareness campaigns, distributed biodegradable bags, and encouraged people to avoid littering, especially in and around the sacred river. These volunteers also facilitated the distribution of eco-friendly alternatives to single-use plastics, thereby promoting sustainable practices. Serving as role models and change agents, their grassroots engagement played a vital role in the implementation.

Due to socio-cultural factors, the well-being of sanitation and cleanliness workers in India is often neglected, which commonly leads to inefficiencies in waste management. But this time, the state government prioritized the well-being of sanitation workers and designated them as "*Safai Mitras*" (translates into English as 'friends who help clean'), recognizing their crucial role in maintaining cleanliness

at Maha Kumbh and making the “Swachh Maha Kumbh Abhiyan” a huge success. New measures were adopted such as building sanitation colonies to provide proper housing and amenities, admission to primary schools for their children, ensuring access to education, uniforms and mid-day meals, through the “Vidya Kumbh” initiative. Fair management authorities in each sector were responsible for providing adequate food, accommodation, and timely salary payments for all sanitation workers. The government also supplied food rations to each worker (Kapoor, 2025). These efforts highlight the administration’s commitment not only to maintaining sanitation but also to supporting the workers responsible for it (Press Information Bureau, 2025).

Technological Integration

Waste disposal is a monumental task in such gigantic-scale gatherings and was managed through an integrated IT system that monitored and controlled the waste disposal rate in each sector of the mela. The use of advanced information and communication technologies (ICTs) by the government and local administrative agencies enabled real-time monitoring of the fair for forty-five days. Geographic Information Systems (GIS) were employed to create detailed maps of the festival grounds. GIS-enabled dashboards tracked waste collection frequency, dustbin fill levels, and disposal routes (Tourism, 2025).

A new app called the “Swachh Kumbh” app enabled pilgrims to report sanitation issues and locate nearby toilets or waste bins simply through their smartphones. The app was usable in multiple local Indian languages, considering the diverse backgrounds of tourists.

Artificial intelligence (AI) equipped special vans designed to detect uncleared trash piles on the roadsides and peak gathering spots in the fairgrounds (TNN, 2024). Upon detecting a waste pile, the AI van would generate an event ticket for the control room and send alerts to sanitation workers assigned to the concerned mela sector.

Trash skimmer machines were deployed to remove 10 to 15 tons of garbage from the Ganga-Yamuna daily (India, 2025). The trash skimmers collect floating waste from the water’s surface and have been increasingly used worldwide for cleaning rivers, ports, and seas. These machines can remove plastic, bottles, religious offerings, clothes, metal objects, puja waste, and even dead animals or birds. The machines are also effective in removing water hyacinth and aquatic weeds, ensuring clean and navigable waterways. The machines used in the Mahakumbh fair had a capacity of 13 cubic meters and covered a 4 km stretch of the river. A typical trash skimmer features gates on both sides, with a conveyor belt positioned inside. These gates close hydraulically to trap floating debris. Once collected, the waste gets transferred to the conveyor belt. The debris is then moved to an unloading conveyor belt, where it is extracted and processed for disposal (India, 2025; YouTube, 2025). Innovative wastewater treatment technologies such as the Hybrid Granular Sequencing Batch Reactor (HGSBR) - an advanced biological treatment method, developed by ISRO and BARC - were used to process faecal sludge and greywater effectively. Geotube Technology, a cost-effective and efficient method for dewatering sludge, played a significant role in managing liquid waste.

Waste to Resource Approach

While large scale waste collection and awareness drives were necessary, a bigger concern was where to finally dispose of the massive amount of waste that had been collected. Several techniques and methods were used to convert the collected waste into a resource. The first method was composting, in which organic waste generated on-site was processed and later used for landscaping. Religious offerings were treated separately through vermicomposting.

Another method was recycling and the collected plastic, metals, and paper were sold to authorized recyclers. The authorities implemented a comprehensive waste management system capable of processing 650 metric tonnes of garbage per day at the Baswar waste processing plant, located on the outskirts of Prayagraj (Vinod Rai, 2025). Evidently, 21,500 jackets made from recycled plastic were distributed to sanitation workers and volunteers, in collaboration with Coca-Cola India. Also, 1,000 changing rooms from recycled plastic were installed along a 12 km stretch of the Ganges (AG Horizon, 2025).

Multi-stakeholder Collaboration

Government allocated Rs. 152.37 crore (~US\$ 17 million) for special cleanliness management measures (Gupta, 2025). Sanitation workers worked around the clock to ensure the entire region remains clean for devotees, coming to Prayagraj to attend the Maha Kumbh. (India, 2025). As per a January 2025 article (The Financial Express, 2025), nearly 10,000 cleaning staff, respectfully addressed as “Safai Karamcharis”, were deployed. These were further divided into 850 teams. Over 15,000 sanitation workers, were mobilized, trained in best practices by NGOs and PMC trainers and equipped with personal protective equipment. Special sanitation teams were deployed for rapid waste clearance, particularly after major bathing rituals.

Volunteers led important initiatives that improved large-scale waste management. One such initiative was called the “One bag one thali drive” (The Financial Express, 2025) to make the gathering a low-waste generator. Under this initiative, 1.5 million steel plates (reusable) and 2 million cloth bags were distributed among devotees. Over 50,000 volunteers participated in multiple waste management efforts. Unlike normal days, a higher level of community participation was observed. Workshops were conducted for school children in the city to sensitize them regarding the non-use of plastic. NGOs conducted awareness and behavioural change programs during the initial few days in the fairgrounds.

Private sector initiatives to manage waste were launched by the Tata group, Reliance Industries, Coca-Cola, Unilever, PepsiCo. as studied by Gupta (2025). For example, FMCG brand Reckitt, through its flagship hygiene brand Dettol supported nearly 15,000 sanitation workers by providing training programs and making washing soaps accessible to them at Kumbh. UltraTech Cement Limited specifically processed 400 MT of plastic waste as an alternative fuel (UltraTech, 2025). It can be understood that the government and corporations aligned with SDG 12 of responsible production and consumption in the context of waste management.

Discussion and Conclusion

In the post China ban era, when solid waste is no longer freely tradable, localized waste management has become even more important for governments and corporations. In this respect, the waste management strategies and practices at the Mahakumbh 2025 event offer valuable insights into how large-scale domestic waste can be managed locally, responsibly, and efficiently.

Globally, numerous waste management strategies and practices have been adopted over the years, to handle solid waste. Many developed countries often chose to export the solid waste to developing countries where the costs of waste management were lower. Both developing and developed countries have been trying circular economy models, corporate social responsibility (CSR) measures, regulations such as penalties for not segregating waste and stressed the use of biodegradable materials. However, it is evident that despite such measures, many countries still grapple with improper waste disposal, waste heaps and landfills. Particularly, after large scale mass gatherings such as concerts, sports events, rallies, religious festivals etc., the local authorities have to deal with mounting waste and litter. One recent example reported by (Shirreff, 2024) is from the Glastonbury festival - the world’s largest music festival in the UK where despite environment-friendly messaging, the area was strewn with litter and overflowing litter bins.

While there have been previous editions of spiritual fairs in India that saw similar waste management challenges for authorities, the Mahakumbh 2025 which was way larger on scale, stands out with its unique combination of strategies and approaches that successfully addressed the challenges of large scale domestic solid waste. The study highlights how the decentralization of waste management by dividing the entire fairgrounds into multiple sectors and then managing them semi-independently played a crucial role in more effective waste collection and disposal. Independent teams for waste collection and disposal in each sector allowed for timely execution of responsibilities and quicker waste removal.

An important step taken up by the government was redefining the way cleanliness and sanitation workers were supported and perceived. By providing better facilities, timely and improved wages to workers, and redefining their status as friends of cleanliness and ambassadors of the holy river, a new dignity was brought into this line of work that many in India previously refused to take up. This not only led to a lot of new job creation but also improved the societal perceptions of such work. Technology tools further improved the efficiencies of tracking and collection and added more dignity to the job. This indicates that sustainable waste management strategies can be successfully implemented in developing countries if

the workforce is allowed better pay, proper tools and more dignity. The waste management sector has a huge potential for new job creation.

The role of multinational corporations such as Unilever, Coca-Cola, and Reckitt Benckiser contributed significantly to waste management through manpower, donations and recycling support. The participation of such corporations represents how CSR helps address cross-border local sustainability challenges. The Mahakumbh festival highlights the evolving role of global businesses in addressing waste management concerns through localized action.

Lastly, a multi-stakeholder collaboration worked well to solve multifaceted issues of waste management in a fair that was of both spiritual and tourism significance. A UN study by (Henrique Pacini, 2021) stressed that for successful circular economy, stakeholders from global to local levels must work cohesively to translate plans into action. This was illustrated in the Mahakumbh where the central and local government agencies, corporations, NGOs, independent volunteers and technology came together to achieve a seemingly impossible goal of clean and environment-friendly Maha Kumbh festival.

This study throws light on how large scale waste was managed effectively and locally at the Mahakumbh 2025. If this model can be adapted in other cities, countries or large scale gatherings worldwide, it can not only help manage the domestic waste but also create new jobs, foster corporate social responsibility and reduce the dependencies of exporting waste.

Limitations and Directions for Future research

While this study explores the waste management strategies and practices at the world's largest gathering, there is a need to conduct more in-depth studies how waste was managed by different sector level teams. Such studies can further strengthen our understanding of what actually worked that led to successful implementation of the local waste management strategies. Further research could also examine the recycling of collected waste and how individual corporations benefitted from such recycling initiatives. In addition, future studies could conduct detailed surveys with foreign nationals regarding their experiences of waste management and cleanliness at the fair, to gather more realistic and comprehensive data about the event.

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