

# **The Hidden Backbone: Rethinking Waste Management Systems**

## Why the Informal outperforms the Formal sector

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Thank you, Melissa, for bearing with my disappearances and still having confidence in me when I didn't. To my site buddies, Dainty and Trisha, who were always willing to go to the site no matter the occasion. To Nuzha, Dainty, Dhruv, and Adi, thank you for bearing with my highs and lows. And lastly, my sister and mom for always being there, and Nyla for constantly distracting me.

Thank you, everyone, we finally made it through.

## Undertaking

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I, Batul Sethwala, the author of the DRP report titled “**The Hidden Backbone: Rethinking Waste Management Systems, Why the Informal outperforms the Formal sector**”, hereby declare that this is an independent work of mine, carried out towards partial fulfilment of the requirements for the award of Bachelors Degree at Faculty of Planning, CEPT University, Ahmedabad. This work has not been submitted to any other institution for the award of any Degree/Diploma.

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## Abbreviations

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1. AMC- Ahmedabad Municipal Corporation
2. BBMP- Bruhat Bengaluru Mahanagara Palike
3. DWCC- Dry Waste Collection Centre
4. EPR- Extended Producer Responsibility
5. GHG- Green House Gases
6. MLP- Multi Layered Packaging
7. MRF- Material Recovery Facilities
8. MSW- Municipal Solid Waste
9. PWM- Plastic Waste Management
10. RDF- Refuse Derived Fuel
11. SEWA- Self Employed Womens' Association
12. TPD- Tonnes per day
13. ULB- Urban Local Bodies



## **Abstract**

The informal waste sector is fundamental to India's waste management ecosystem, playing a vital role in its resource recovery and recycling. Unlike the formal waste management system, which follows a linear approach - collecting waste and transporting it to landfills/dumpsites - the informal sector operates more circularly. In cities like Ahmedabad, where municipal solid waste generation is rapidly increasing, the contribution of the informal sectors is crucial not only for maintaining high recycling rates but also for reducing landfill dependency. Interviews with stakeholders in Ahmedabad reveal that the informal sector is the backbone of the city's waste collection and recycling value chain, despite the inefficiencies and leakages that take place. Drawing on primary data collected through interviews with various stakeholders, this study examines Ahmedabad's existing waste management systems and understands why the informal waste management system works better. Through this study, I hope to highlight the need for the formal system to depend on and learn from the informal system for better and improved waste management practices.



## Chapter 1

- 1.1. Global Scenario
- 1.2. Indian Scenario
- 1.3. Ahmedabad Scenario
- 1.4. Methodology

## 1.1 Global Scenario

---

With rapid urbanisation, growing populations, and changing consumption patterns, waste management has become a huge issue globally. Every year, approximately **2.01 billion tonnes** of municipal solid waste are generated globally, and this is only expected to increase to **3.40 billion tonnes** in the next 30 years (Filipenco, 2024). Currently, India produces over **62 million tonnes** of waste annually (CPCB, 2021), which equals nearly **24800** Olympic swimming pools. This amount of waste often winds up in landfills and dumpsites, which have long surpassed their capacity. This ever-growing gap between the amount of waste generated and the country's waste management infrastructure highlights several limitations of the formal waste management system, which is struggling to keep up with the increasing amounts of waste. Many cities lack adequate collection and disposal facilities, while irregular collections and insufficient landfill space only aggravate the problem further (Yajnik, 2024).

But what is waste? The definition of this varies across countries, reflecting the differences in legal frameworks, cultural perceptions, and regulatory priorities. For example, Egypt defines it as a byproduct of any activities or processes that exhibit hazardous characteristics (Basel Convention, 2011). In contrast to this, Sri Lanka defines waste as any substance—whether liquid, solid, gaseous, or radioactive, that is discharged, emitted, or deposited into the environment in significant quantities, thereby having the potential to impact the environment (Basel Convention, 2011).

These definitions are not simply distinctions but help in the framing of rules and regulations that look at the handling, treatment, and disposal of said waste.

In the case of India, there is no specific, universally applicable definition of waste for the purpose of transboundary movement, which has led to a lack of clarity in regulatory practice and enforcement (Basel Convention, 2011).



Fig 1. What the world thinks of waste

Countries in the Global North tend to generate more waste per capita, as seen in Fig. 2, with plastics, metals, and paper constituting a higher proportion of waste. Countries from the global south tend to generate more organic waste. High income countries like the United States, Switzerland, Canada, Australia etc, are expected to see an increase of 19% in their daily per capita waste (Filipenco, 2024), while low-income countries such as Afghanistan and several African nations will see an alarming 40% or higher increase in the waste being generated (Filipenco, 2024). Much of the waste generated in the Global North is shipped off or dumped in the Global South countries like Malaysia and Indonesia (Break Free From Plastic, 2024). Ever since China banned waste imports in 2018, many countries in Southeast Asia have become the destination for waste shipments from mainly the EU countries and the US (Patrick, 2022). These disparities highlight the unequal burden of waste generation and its management across the globe. Malaysia has become a major recipient of plastic waste exports (Patrick, 2022).

# A World of Waste

Municipal solid waste generated per year  
(in kilograms per capita)

■ Less than 200 kg ■ 200-499 kg ■ 500-799 kg ■ 800-1,100 kg

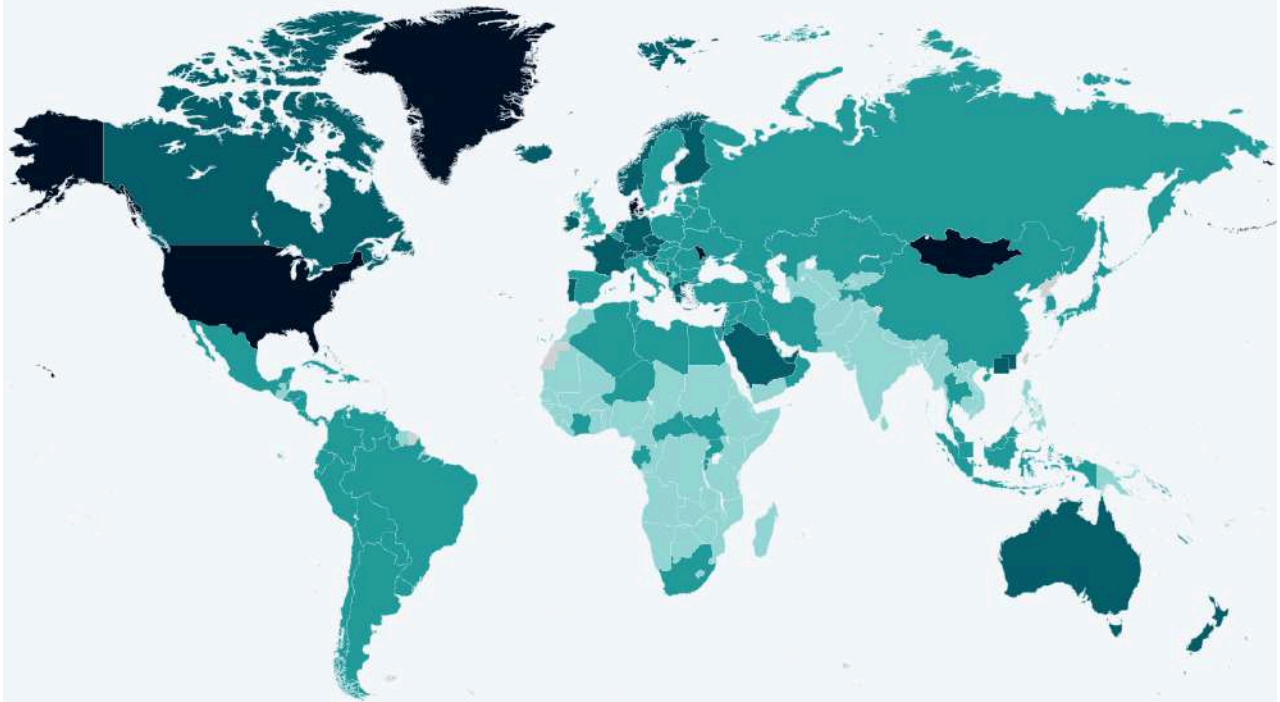


Fig 2. The amount of waste generated per year around the world

India is another significant player in the global waste trade dynamics. Despite producing approximately **188,500 tonnes** of MSW daily, Indian firms import plastic scraps, specifically PET bottles, from countries like China, Italy, Japan, and Malawi (PrintWeek Team, 2022). These imports increased from **12,000 tonnes** in 2016-2017 to **48,000 tonnes** in 2018 (PrintWeek Team, 2022). This dependence on imported recyclables arises not from the shortage but from the inefficiencies in waste segregation and collection systems. India consumes 14 lakh tonnes of PET plastics annually, yet much of its recyclable potential remains untapped due to the inadequate infrastructure and the poor integration between formal and informal waste sectors.

The waste management system in India can be broadly divided into two sectors: the informal sector, comprising the ragpickers, kabadiwalas, pastiwalas, sorters, and wholesalers, and the formal sector, led by the municipal corporations and private firms (Vidhi Center for Legal Policy, 2021). The informal sector plays a vital role in recycling activities—handling nearly 50-80% of plastic waste, 30-60% of paper/cardboards, and almost 100% of glass bottles—yet it operates without formal recognition or support (CSE India). This lack of integration results in inefficiencies and missed opportunities for scaling up recycling efforts. Government initiatives like the Swachh Bharat Mission 2.0 have acknowledged the need to integrate informal workers into the formal systems. However, implementation remains inadequate due to policy gaps and insufficient infrastructure. For example, while laws against single-use plastics have been enacted, India still lacks enough treatment plants or systems to process its growing waste volumes effectively.

## 1.2 Indian Scenario

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India generates approximately 62 million tonnes of MSW annually, with projections showing that there would be a rise to 165 million tonnes by 2030 due to rapid urbanisation and economic growth (*Waste Management in India: Facts, Challenges & Solutions*, 2024). The per capita waste generated in urban areas is expected to reach 0.7kg per person per day by 2050, which is 4-5 times higher than in 1999 (*Waste Management in India: Facts, Challenges & Solutions*, 2024).

The formal waste management sector in India operates under a regulatory framework that is led by the Union Ministry of Environment, Forest and Climate Change (MoEF&CC) and implemented through Urban Local Bodies (ULBs) such as the municipal corporations. The Mayor and City Commissioner oversee municipal operations with departments like public health and sanitation for the management of waste collection and disposal. The public health department typically handles street cleaning, waste collection, and epidemic control,

while the transportation department manages waste transported to landfills/dumpsites or processing facilities. Cities are divided into zones and wards for operational efficiency, with contracted workers or private agencies often tasked with door-to-door collection. Despite this structure, ULBs face several challenges, particularly in smaller towns and rural areas, where waste is more often than not dumped in open fields or burned due to inadequate infrastructure.

Governed by the Solid Waste Management Rules 2016, this sector is responsible for systematic waste collection, transportation, treatment, and disposal. While the SWM Rules (2016) mandate source segregation, composting, and decentralized processing, compliance remains weak. Municipalities often lack the financial resources to upgrade infrastructure, relying instead on limited government grants and user fees. Corruption and bureaucratic inefficiencies further hinder the enforcement, with penalties for non-compliance rarely imposed. For example, a National Sample Survey Office (NSSO) study found that only 43% of urban households segregate waste at source, reflecting poor public awareness and institutional failure. Additionally, the formal sector struggles to integrate Extended Producer Responsibility (EPR) frameworks, which hold manufacturers accountable for post-consumer waste.

In India, most of the garbage that is received by the municipality is a mixed heap of organic waste, scraps, and recyclable items. Before waste is disposed of in a landfill, scraps and recyclable items are scavenged for by the informal workers. There are two distinct waste disposal methods, one through the informal sector and the other through the formal sector (Vidhi Center for Legal Policy, 2021). In the informal sector, rag pickers scavenge through waste to collect paper and plastics, while kabadiwalas go door to door to collect these recyclable materials. This “sector operates in the shadows, often bypassing the formal waste management system due to lack of infrastructure and systemic support” (Green Planet Solutions, 2024). They are important to the waste management system as they process about 60-90% of the recyclables (Green Planet Solutions, 2024). They do the collection, sorting, segregation, hypersegregation, and recycling. These workers work without any fixed salary or dignity and are more often than not exposed to several health-related issues due to cuts, infections, etc (India Spend, 2017). Despite there being

efforts to integrate the informal sector within the waste value chain, nothing really moved forward (Vidhi Center for Legal Policy, 2021)

### 1.3 Ahmedabad Scenario

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Ahmedabad is India's 7th largest metropolis, with a population of more than 63 lakh people (Ahmedabad Municipal Corporation Solid Waste Management, n.d.). 3800-5200 tonnes per day of municipal solid waste is generated daily, with an average of 600 g- 700 g being generated per person per day (Iyer & Mahato, n.d., 1). The Ahmedabad Municipal Corporation (AMC) collects almost 50% of the waste from municipal bins and from sweeping the streets (Ahmedabad Municipal Corporation Solid Waste Management, n.d.). AMC processes 10,000 MT of MSW monthly (about 9% of total waste generated) (Ahmedabad Municipal Corporation & United Nations Centre for Regional Development, n.d.). The waste is then taken to dumpsites, landfills, or treatment facilities. The dumpsites are unregulated sites for waste disposal, while landfills are regulated sites for waste disposal.

### 1.4 Methodology

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This research is qualitative and exploratory in nature and aims primarily to understand how the informal waste value chain functions and the role of the different stakeholders in it. For this, I rely on primary data collected through interviews as well as secondary data collected through news articles, journal articles, videos, and documentaries on waste management, and the thesis written by former CEPT University students.

This study is based on two informal settlements that are currently working with an NGO called SAATH. The two sites studied were Behrampura and Vanjaravas in Ahmedabad. These sites were selected because SAATH has their urban resource centres here, which enabled me to further connect and interact with other stakeholders like ragpickers, kabadiwalas, and wholesalers who reside or frequent this site.

In addition to interviews being conducted with ragpickers, kabadiwalas, sorters, wholesalers, and recyclers, interviews were also conducted with one staff member from the following NGOs: Manav Sadhana, NEPRA, Recyclink, and Paryavaran Mitra. These semi-structured interviews were analysed to understand and map out the routes that waste flows through from the point of generation to its endpoint. It also helped me understand the spatial organization and day-to-day activities and challenges that different stakeholders faced, and in identifying and contrasting the problems in the formal and informal sectors.

This research hence aims to map out the waste value chains and supply chains within both the formal and informal sectors. By identifying stakeholders across these sectors and analysing their roles within the value chain – from collection to dumpsite – I hope to highlight why the formal sector must rely on and what it can learn from the informal sector for a more efficient waste management system. In doing so, I hope to also bring recognition to the contributions of the informal workers who form the backbone of India's circular economy.

## Chapter 2

2.1. Formal system in India

2.2. Policies

2.3. Implementation in Ahmedabad

2.4. Informal system in India

## 2.1 Existing System in India

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In Ahmedabad, the contrast between the formal and informal sectors is particularly stark. The formal waste management system collects and transports waste directly to the dumpsites and landfills with minimal processing, with mainly wet waste being processed into compost. Meanwhile, the informal sector actively recovers materials like plastic, paper, and cardboard thrown on the streets and dumpsites.

In Ahmedabad, these are Pirana and Ajmeri dumpsites, and Gyaspur Sanitary Landfill. From these sites, waste pickers rummage through the mixed waste to collect more recyclables. Once collected, it is sold to kabadiwalas who further segregate the waste. It is then sent to recyclers or re-processors, which are facilities that convert the waste into usable raw materials.

## 2.2 Policies in India

In India, several policies since the 1990s have been implemented to regulate waste management. Policies have been implemented to formalise the informal waste sector, but despite having put out so many regulations, very seldom cities have followed them. Below are listed the policies that have been implemented for all the different types of waste.

### Hazardous Waste (Management & Handling) Rules, 1989

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The Hazardous Waste (Management and Handling) Rules, 1989, authorised under the Environment Protection Act, 1986, marked one of India's earliest regulation efforts to manage industrial pollution.

Some of the key provisions were:

1. Mandatory record keeping by waste-generating industries to ensure traceability and accountability (*Hazardous Wastes (Management and Handling) Rules, 1989*, n.d.)
2. Enforcement by the State Pollution Control Boards to authorize and monitor the facilities (*Hazardous Wastes (Management and Handling) Rules, 1989*, n.d.)
3. Prohibition of hazardous waste imports for dumping, with limited exceptions for regulated recycling (*Hazardous Wastes (Management and Handling) Rules, 1989*, n.d.)
4. Certain types of waste that were deemed as toxic, flammable, or reactive had to be treated to prevent contamination (*Hazardous Wastes (Management and Handling) Rules, 1989*, n.d.)

#### Biomedical Waste (Management & Handling) Rules, 1998

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These rules and regulations were introduced to regulate the safe segregation, collection, and disposal of biomedical waste that is generated by hospitals, clinics, and laboratories (High Court of Tripura, n.d., 1)

Some of the key provisions included:

1. Segregation at the source using colour-coded bags to prevent mixing of the waste (High Court of Tripura, n.d., 2)
2. Labelling and packaging for quick and safe identification and handling (High Court of Tripura, n.d., 3)
3. Safe storage and transportation to authorised facilities to reduce environmental risks (High Court of Tripura, n.d., 2)
4. Mandatory staff training and record keeping (High Court of Tripura, n.d., 2)

## MSW Rules, 2000

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This set of regulations was an approach to managing the solid waste better. The ULBs were given responsibilities for managing the entire value chain of solid waste (Gohil, 2018, 4). The main features for this were

1. Inclusion of door-to-door collection
2. Mandatory segregation of waste at the household level
3. Prohibition on the burning of waste
4. Emphasis on the treatment of waste
5. Introduction of various treatment technologies (Biological treatment, incineration, pelletization, etc.)
6. Requirement of inert and non-recoverable waste to be disposed of in a scientific landfill

## NUSP, 2008

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The National Urban Sanitation Policy was established in 2008 by the Government of India with the aim of making all the cities and towns completely sanitised, healthy, and livable.

Under this policy, cities were required to make sanitation plans that would cover technical, institutional, and financial analysis and recommendations. Cities also included the solid waste aspect in the plans and hence developed strategies that dealt with this issue.

The key goals were:

1. Awareness generation and behavior change (*National Urban Sanitation Policy, n.d.*)
2. Open defecation-free cities (*National Urban Sanitation Policy, n.d.*)
3. Integrated city-wide sanitation (*National Urban Sanitation Policy, n.d.*)

## MSW Rules, 2016

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The MSW rules established in 2000 were amended after 16 years with new issues and more innovative ideas. Some of the major additions were as follows:

1. The rules were expanded to include areas beyond the municipal boundaries, such as growth centers and townships(Gohil, 2018, 23)
2. Producers were now responsible for ensuring the proper disposal of sanitary waste(Gohil, 2018, 23)
3. The rules promoted collaboration between local governments and private bulk waste generators to ensure proper waste management and disposal(Gohil, 2018, 23)
4. Segregation of waste at source was emphasized(Gohil, 2018, 23)
5. Every state is required to create a policy specific to managing the solid waste(Gohil, 2018, 23)
6. Cities should allocate specific areas for segregation, treatment, and disposal of waste(Gohil, 2018, 23)
7. Integrating informal waste pickers into the formal waste system(Gohil, 2018, 23)
8. Covering old dumpsites and moving to scientific landfills (Gohil, 2018, 23)

## Plastic Waste Management Rules, 2016 (Amended in 2021 & 2022)

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The Plastic Waste Management Rules 2016 mainly focused on mandatory segregation of waste at the source, promotion of the 3Rs, and the ban on plastic bags below a certain micron (Sam, 2025). These were later amended in 2021 and 2022 to add stricter laws for plastic. Some of the key features:

1. Mandatory segregation and labelling based on the content and composability standards

2. Emphasis on extended producer responsibility (EPR)
3. A ban on the use of single-use plastics, which took effect on July 1, 2022
4. ULBs were tasked with assessing the amount of plastic generation and ensuring proper collection, segregation, and processing facilities
5. Annually, producers and stakeholders were required to submit a report on their

#### E-Waste Management Rules, 2016 (Amended in 2022)

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These rules were introduced to address the growing e-waste in the country. They formalized the collection, storage, transportation, and environmentally sound disposal of e-waste.

The key features were:

1. Setting up of collection centers to promote organized collection and recycling, and disposal
2. Again, emphasis on EPR for safe disposal of e-waste
3. Introduction of digital registration and traceability for all stakeholders, producers, recyclers, refurbishers, and dismantlers to further strengthen EPR
4. Mandated quarterly and annual reports by producers

Year	Rule/Policy	Key Features
1989	Hazardous Waste (Management & Handling) Rules	Regulated hazardous industrial waste; required record-keeping and authorized disposal
1998	Biomedical Waste (Management & Handling) Rules	Segregation, labeling, and safe disposal of biomedical waste from healthcare facilities
2000	Municipal Solid Waste (Management & Handling) Rules	First major urban waste regulation; mandated segregation, composting, landfilling
2011	E-Waste (Management & Handling) Rules	Introduced Extended Producer Responsibility (EPR) for electronics manufacturers
2011	Plastic Waste (Management & Handling) Rules	Banned thin plastic bags, mandated labeling and recycling duties
2016	Hazardous and Other Wastes Rules	Consolidated import/export, recyclable and hazardous waste regulations
2016	Solid Waste Management (SWM) Rules	Comprehensive rule applying to all waste generators; emphasized source segregation and decentralized treatment
2016	E-Waste Management Rules	Formalized collection centers and EPR for electronics; penalties for non-compliance
2016	Plastic Waste Management Rules	Strengthened labeling, segregation, and EPR; banned non-recyclable multilayer plastics
2021	Plastic Waste Rules Amendment	Banned certain single-use plastics from July 2022; tightened producer responsibilities
2022	E-Waste Management Amendment	Introduced digital traceability, credit-trading system for compliance

*Table 1. Timeline of the policies that have been implemented*

## 2.3 Implementation in Ahmedabad

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### Early 2000s: Compliance with MSW 2000 Rules

In accordance with the 2000 MSW rules, AMC started setting up infrastructure for door-to-door collection and composting of the wet waste. Initial efforts included awareness drives and the deployment of waste collection vans in mainly the formal neighbourhoods — Prahladnagar, Thaltej, South Bopal, Bodakdev, Satellite, Navrangpura, Vastrapur, etc — but largely the informal settlements were not included.

### 2009–2015: Informal Integration & Public-Private Partnerships

During the period, Ahmedabad moved towards and adopted decentralised waste management models in collaboration with NGOs such as SEWA and Manav Sadhna. The models included the involvement of ragpickers and waste workers. But largely, it supported more composting and waste-to-energy trials

### Post-2016: Adoption of SWM Rules 2016

With the amendment of the 2000 MSW rules, AMC enforced segregation at source, especially within gated communities and commercial areas. Colour-coded bins were implemented for easy segregation, organized waste collection zones, and promotion of composting units within housing societies. Despite implementing all of the segregation still remained below the national target, and dependence on landfill and dumpsites for disposal continued.

## 2017–2021: Plastic Waste Ban Enforcement

With the enactment of the PWM Rules, AMC began banning the single-use plastics below 50 microns. Efforts focused on vendor awareness and incentivising cloth bags. Despite this, enforcement was inconsistent, especially in the informal settlements and local markets.

## 2021–2023: Focus on Informal Waste Integration & EPR Pilots

With stricter rules regarding EPR, AMC during this period initiated pilot projects in partnership with private recyclers.

## 2023 Onward: Smart City & Circular Economy Initiatives

Recent initiatives have been centered around creating Material Recovery Facilities (MRFs), digitizing waste collection, and integrating data to track segregation and recycling rates. AMC has promoted decentralised waste management hubs and has started pilot projects, especially in informal settlements, to segregate waste.

Aside from complying with MSW rules, AMC is planning to set up several different facilities to combat the growing waste, specifically wet waste. They have done the following :

1. Bulk Waste Generator Compliance: AMC has enforced rules where large residential societies, commercial complexes, and institutes generating over 100kg of waste per day have to manage their waste on-site. Hence setting up of decentralized composting, vermicompost, etc (Times of India et al., 2025).
2. Waste-to-Steam Plant: AMC has initiated a 300 TPD capacity waste-to-steam plant under a PPP model with the company Steamhouse India Limited. It's aimed at reducing landfill dependency (WasteRecycling, 2024).
3. Zero Waste Roadmap: Ahmedabad is planning on adopting a Zero waste goal. The roadmap emphasizes increased processing and treatment, resource recovery, and

landfill remediation (Ahmedabad Municipal Corporation & United Nations Centre for Regional Development, n.d.)

The MSW rules have broadened the scope for waste management by emphasizing on decentralised waste hubs, source segregation, but one thing that has not been addressed is what is/will happen to the dry scraps. Wet waste has been focused on heavily, with composting plants set up, which will be talked about in detail further in the chapter. The dry waste/scraps were and are still being disposed of in dumpsites such as Pirana, despite a scientific landfill existing in Gyaspur. This dumping in Pirana has caused seepage of toxic chemicals and materials into the ground, which has led to the contamination of groundwater contamination. Several issues regarding this have been raised, but nothing has been done.

Period	Initiative	Description
2000s	Initial MSW Rule Compliance	AMC initiated door-to-door collection, composting in formal zones
2009-2015	Informal Integration	Partnered with NGOs (SEWA, Manav Sadhna); supported ragpickers, PPPs for sorting and composting
Post-2016	SWM Rules Adoption	Bin segregation system, housing society composting, citywide awareness campaigns
2017-2021	Plastic Ban Enforcement	Banned bags <50 microns, raids on vendors, market sensitization
2021-2023	Informal Sector Inclusion	Launched EPR pilot, issued ID cards to workers, cooperative formation
2023+	Smart City Programs	MRF setup, data-driven waste mapping, decentralized hubs in informal areas

Table 2: Timeline for the initiatives taken by AMC to manage waste

The formal waste management sector in India operates under a structured regulatory framework led by the Union Ministry of Environment, Forest and Climate Change (MoEF&CC) and implemented through Urban Local Bodies (ULBs) such as municipal corporations. Governed by the Solid Waste Management Rules (SWM), 2016, this sector is responsible for systematic waste collection, transportation, treatment, and disposal. However, lack of infrastructure, funding, and enforcement have limited its capacity to manage India’s growing waste burden, which reached 62 million tonnes in 2021, with projections suggesting a rise to 165 million tonnes by 2030.

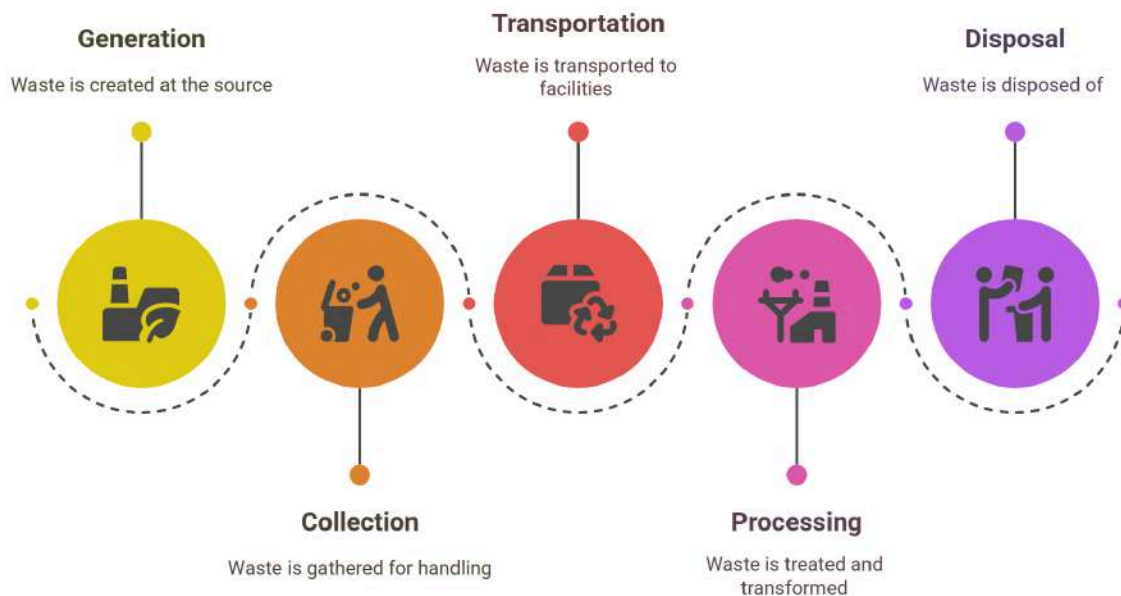


Fig 3. Linear Model of the AMC system

### Collection and Transportation

Since July 2009, AMC has implemented a “Door/Gate to Dump” system for the collection of MSW. They have appointed private contractors for the collection of waste from residential areas during the morning and from commercial areas in the evening. On a daily basis, 600 vehicles are deployed with collection activities starting from 7 am onwards (*Ahmedabad*

*Municipal Corporation Solid Waste Management, n.d.*). Currently, more than 1300 metric tonnes of waste are collected from more than 1.4 million residences each day. It is then transported from each ward to designated transfer stations where they are treated. Across the city, AMC has identified 750 locations as waste collection points, and 800 bins have been placed here (*Ahmedabad Municipal Corporation Solid Waste Management, n.d.*). For the collection, transportation, and disposal of biodegradable waste, AMC has contracts with 3 private agencies. All of this waste is transported to a transfer station where it is segregated.

### Treatment/Processing

From the transfer stations, the waste is segregated and then sent to processing plants. The waste segregated is mainly the wet waste, and about 8% is sent for composting and to RDF plants. The companies listed in Table 3 have collaborated with AMC to treat/process waste. In Ahmedabad, 2 biodegradable waste convertor machines have been built, which are located at Kankaria Zoo and at Lokmanya Tilak Baug. Both these plants have been operational since December 25, 2013 (*Ahmedabad Municipal Corporation Solid Waste Management, n.d.*).

Sr. No	Name of the Company	Daily MSW	Operational since
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		treatment	
1	Excel Industries Ltd	300 tonnes into compost	January 2000
2	Bharuch Enviro Engineers Ltd. (UPL Djai Power Ltd.)	250 tonnes into compost and RDF	July 2009
3	Creative Eco-Recycle Port Pvt. Ltd.	400 tonnes into compost and RDF	December 2012
4	Amdavad Enivro Projects Pvt Ltd	300 tonnes of C&D waste treatment into recyclable products	December 2013
5	Innovative Eco-Care Pvt. Ltd	1 tonne of green waste treatment into compost	December 2013
6	Gujarat Consumer Industry	1 tonne of green waste treatment into compost	December 2013

*Table 3: Companies with which AMC has tie-ups to convert wet waste*

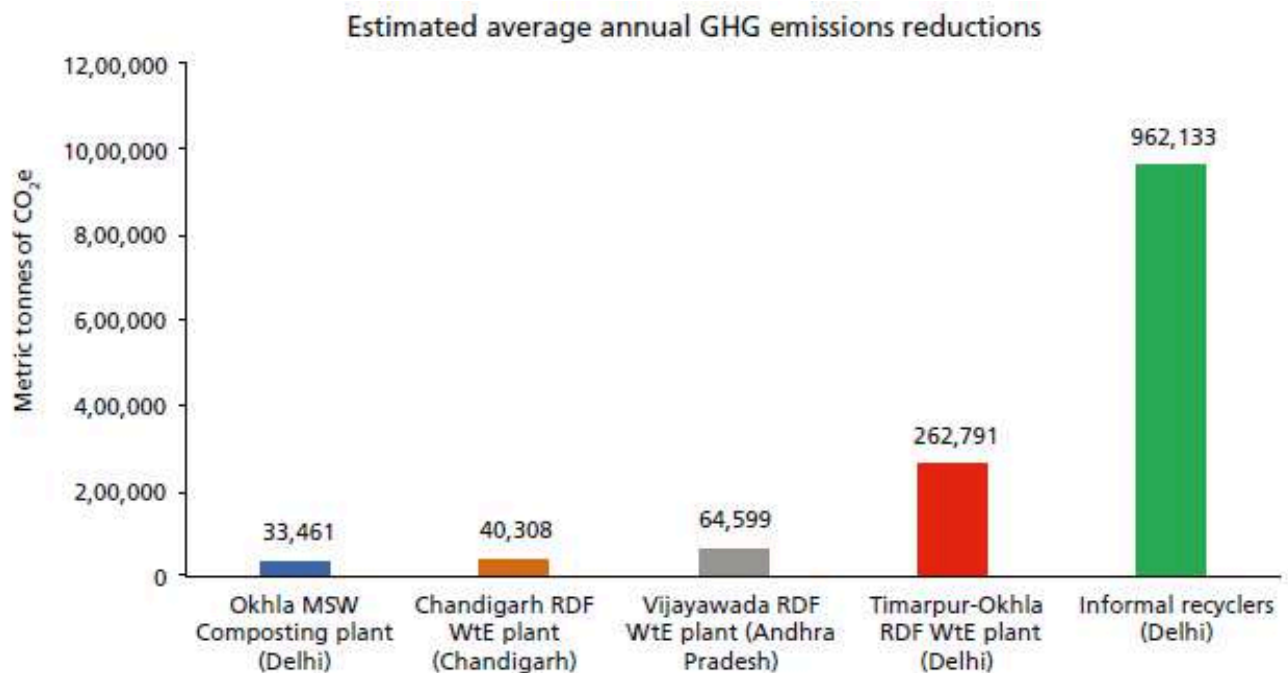
## 2.4 The Informal Sector

## Sustainability

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The informal sector plays a very crucial role in reaching higher recycling rates as it's beneficial for sustaining the livelihoods of the workers involved (Singh, 2021, 25). They sort and segregate the materials based on the needs and demands of the recycling industry. Also, by doing so, the cost of raw materials gets reduced for industries. The sector helps in extending the landfill capacity by diverting a significant amount of the materials that reach the landfill.

It brings about a significant reduction in methane emissions. This can be seen in the case of Delhi, where the informal recycling sector showed a three times higher reduction in GHG than those projected by the Timarpur-Okhla Waste-to-Energy(WTE) plants.



Source: Chintan, 2009

Fig 4. Graph showing how the informal sector helps in reducing GHG emissions

## Economic

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The informal sector contributes greatly to the national economy despite its work being unlicensed and unregulated. They turn waste into usable materials, and due to this, several “new businesses emerge, trade networks develop; capital is accumulated and invested; and raw material, transportation, and energy costs are reduced...” (Singh, 2021, 27).

They even reduce the cost incurred during the treatment and disposal of solid waste by rummaging for and extracting recyclables. This reduces the economic burden of ULBs (Singh, 2021, 27).

In the case of Bengaluru, the municipal corporation, BBMP, registered waste pickers and cataloged scrap dealers. Daily, about 70kg of waste is picked up by a single waste picker. This would mean that about 106671 tons per annum are diverted from the landfills (Singh, 2021, 27). Registering the waste pickers has saved the city about Rs 23 crore annually (Singh, 2021, 27).

### Organization of the sector

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The informal waste sector refers to individuals and small enterprises who are involved in waste management activities outside of the formalized systems. These activities are neither organized, sponsored, financed, nor regulated by the governmental authorities. According to the SWM Rules(2016), informal waste collectors include individuals associated with the collection, sorting, segregation, selling, and purchasing of recyclable materials. But first, how is this sector organized (Singh, 2021, 12)?

### Classification of the sector:

1. Stage 0 recyclers: Informal workers who may or may not have the means of transportation. The stakeholders primarily comprise rag pickers and kabadiwalas

who collect scraps from roadsides, dustbins, landfills, and households (Singh, 2021, 12).



*Fig 5. Image showing a stage 0 recycler collecting waste from community bins*

2. Stage 1 recyclers: These are the workers who collect the scraps/materials from the stage 0 recyclers and store them. Here, the most minimal amount of processing is done.



*Fig 6. Image showing stage 1 recycler buying scraps from stage 0 recycler*

3. Stage 2 recyclers: The individuals in this stage need larger storage capacities to store the scraps and supply them based on market demand. The storage facilities are much larger than the stage 1 recycler, and they directly receive the scraps from them and other commercial sources. They specialize in single-source categories of materials and usually get their scrap supply from small kabadiwalas (Singh, 2021, 13).
4. Waste Processors: They buy specific grades of scraps from Stage 1 and 2 recyclers and transform them into secondary raw materials to be used in the manufacturing industry (Singh, 2021, 13).

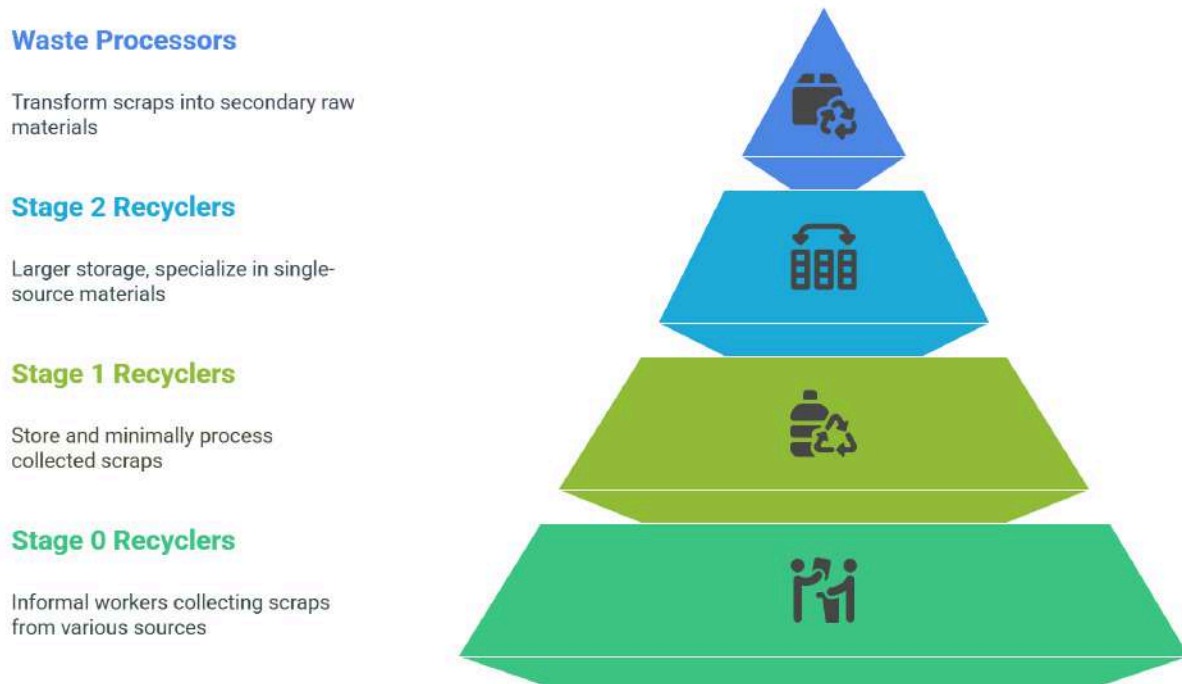


Fig 7. Organization of the Informal Sector

In Stage 0, recyclers can be further segregated based on where they collect scraps from and how they collect them.

### Itinerant Waste Buyers (kabadiwalas)

They come to your doorstep and collect scraps like newspapers, plastics, metals, glass, cartons, etc. Their primary mode of transport is either a bicycle or a cart. After gathering these materials, they sort the scraps and sell them to specialized waste traders (kabadiwalas).

### Street waste pickers

These workers recover recyclable materials from mixed waste heaps along the roadside and commercial bins before they are collected by the formal waste workers. Any scrap that can be cleaned is rummaged for and collected. After collecting the items, they do a base-level segregation of the items collected to receive a better rate. Rag pickers do not have a mode of transport, and they walk to most places.

Waste from collection vehicles: Several scrap materials are recovered from municipal trucks transporting solid waste.

### Waste from dumpsites

Waste pickers collect Scraps from dumpyards and landfills before they are processed and treated. It is done by several communities that live close to the dumpsites.

## The quantity of waste collected by the Informal Sector

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The informal sector is a decentralized, multi-tiered system that recovers recyclable materials. The sector handles 30-60% of all the paper and cardboard, 50-80% of the plastics, and almost 100% of the glass bottles in India (Singh, 2021).

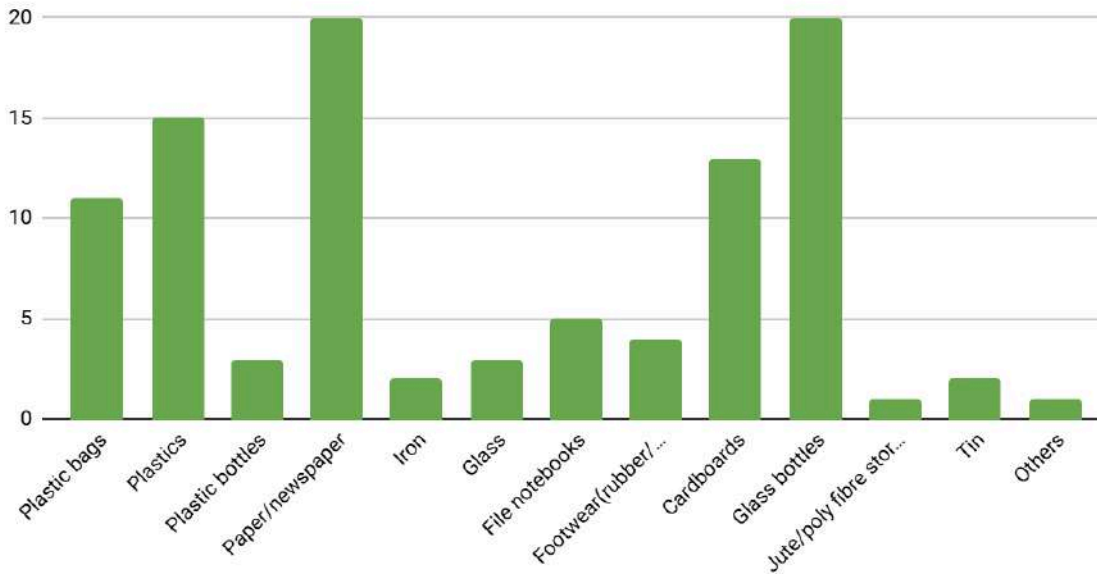


Fig 8: Graph showing the most recycled materials

A major part of scraps collected by waste pickers consists of paper and newspaper, glass bottles, cardboard waste, and plastic waste (Singh, 2021, 16). This shows the importance of certain materials, and even if there are price fluctuations, these materials are still sought, even if they are less in quantity (Singh, 2021, 16). On average, waste pickers collect 60-90 kg of waste and work for about 8-10 hours. But this varies for waste collectors who collect waste in sacks and travel with it on foot, and those who have pushcarts.

Those who have tempos or pushcarts collect more than those who travel on foot. This we will see in Chapter 3 in the mapping of the different stakeholders.

But how does this waste move?

The first step is the households and the shops that dispose of waste regularly. Besides disposing of the waste, they also store recyclable materials/ scraps like newspapers, metal objects, cardboard, and glass bottles. The scraps are then sold to kabadiwalas.

The waste is collected by ULBs and private contractors from the municipal bins and the streets. In the case of Ahmedabad, the AMC and AMC-appointed contractors collect almost 50% of the waste. The waste is then taken to dumpsites, landfills, or treatment facilities. In Ahmedabad, these dumpsites and landfills are Pirana and Ajmeri dumpsites, and Gyaspur Sanitary Landfill.

From these sites, waste pickers rummage through the mixed waste to collect more recyclables. Once collected, it is sold to kabadiwalas, who further segregate it. It's then sent to recyclers or re-processors who use this to convert it into new materials that can now be used again.

## Chapter 3

### 3.1. Research findings - Behrampura

- I. Mapping of routes taken to collect and transport waste
- II. Spatial organization of stakeholders and analysis

### 3.2. Research findings - Vanjaravas

- I. Mapping of spaces occupied

### 3.3. Supply chain system and Waste Value Chain

### 3.1 Research Findings

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#### Behrampura

Behrampura is a densely populated neighborhood that is located on the east bank of Ahmedabad, Gujarat. It lies along the Sabarmati River and is administered by AMC. It is 1033 hectares in area with a population of 159181 (census 2011)(Bhupendrasinh, n.d.). The ward is a mix of industrial and residential. They lie in close proximity to each other, which can cause several health issues for the residents (Bhupendrasinh, n.d.). The site is also close to the Pirana dumpsite and other markets like Jamalpur and Ravivari markets. These are also sites from where many waste pickers go to collect and sort scrap materials.



*Fig 9. Map showing Behrampura and all the important landmarks around it*

For the Behrampura site in Ahmedabad, a comprehensive mapping of waste collection and transportation routes was done by interviewing key informal waste actors such as the ragpicker (Nasimben), kabadiwala, and sorters (Gulshanben and Nasir Pathan). This process involved interviewing each individual throughout their daily routines to document the

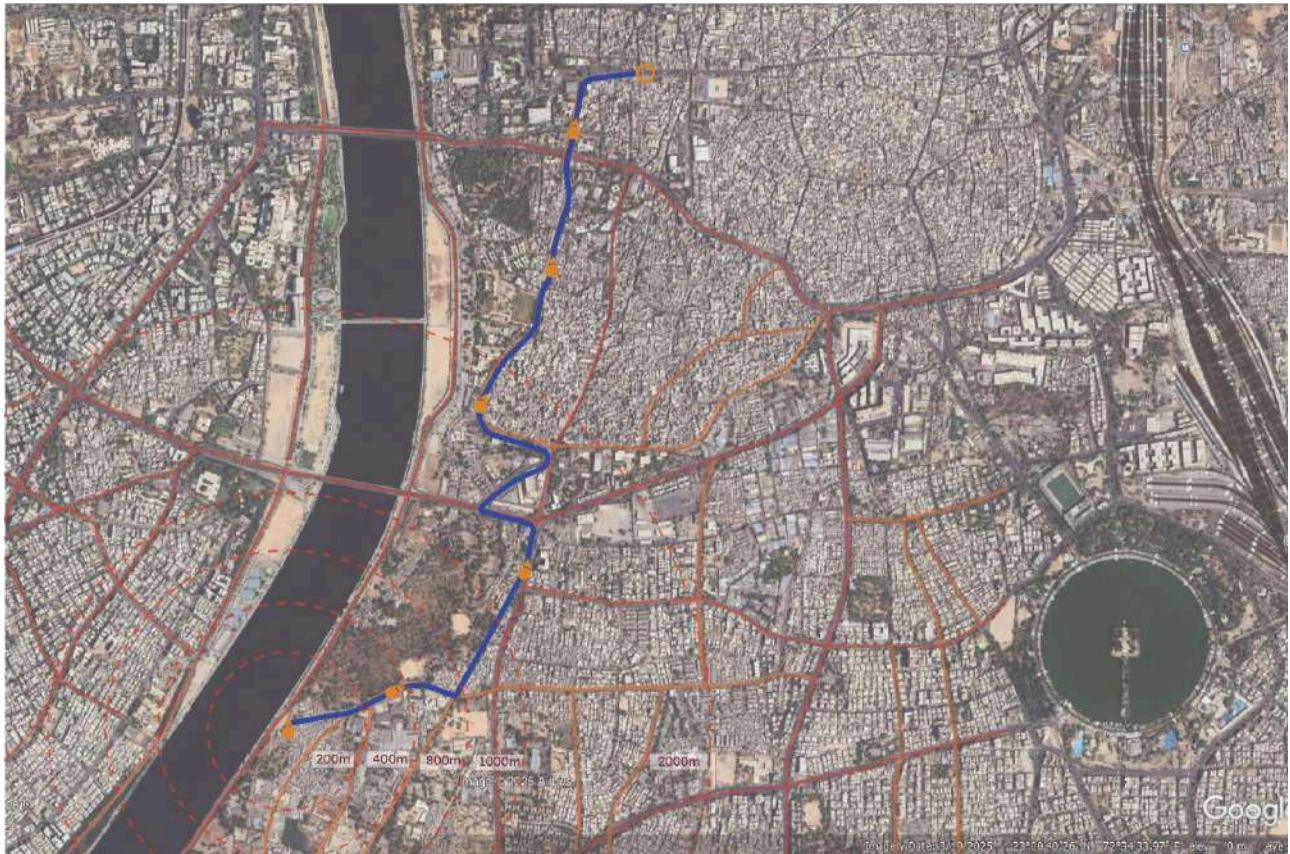
locations they visited, the types of waste collected, their transportation methods, and the final destinations as scrap shops or aggregation points.

#### Nasimben (Ragpicker) - S0 Recycler

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Nasimben is a 78-year-old woman who has been in the ragpicking job for the past 40+ years.

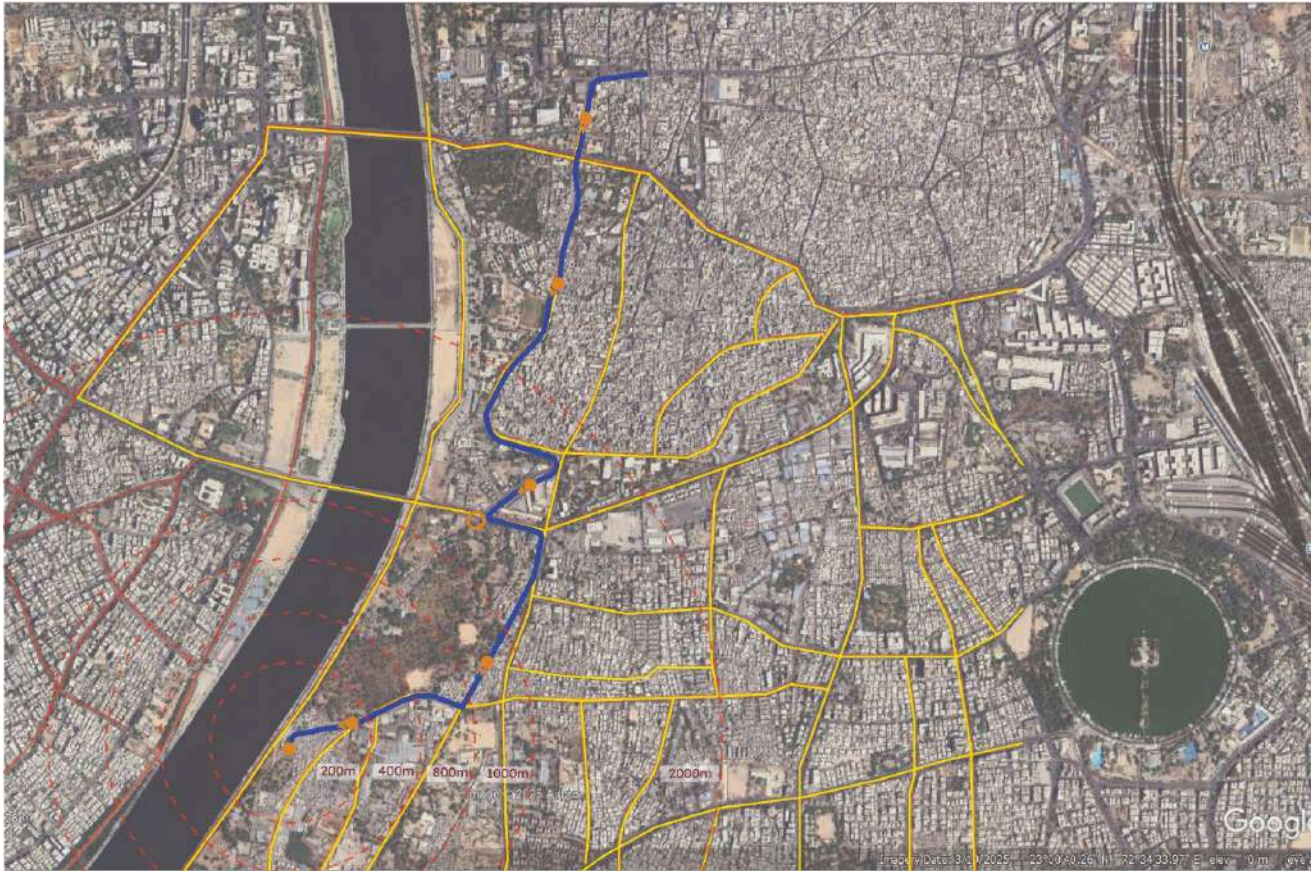
The map looks at her mobility patterns. She begins her day at Teen Darwaza at 3 am. She arrives at that time so that she can sort and extract recyclable materials before the AMC truck arrives to pick up the waste. Despite the average walkable distance being 400-800m, Nasimben travels more than 2km daily on foot. She walks mainly on the primary roads, which are filled with commercial activities. This allows her to sort through high volumes of waste rather than that found in residential areas. Her only mode of transport is by foot, and the scraps she collects are lightweight so that she can travel long distances.



*Fig 10. Map showing the route taken by Nasimben to reach Teen Darwaza*

Once she is done sorting for scrap at Teen Darwaza, she makes her way to Jamalpur Market. These two locations are the ones she travels to on a daily basis. She sorts at Jamalpur Market from 6 am to 8 am.

Most of the sorting is done on site, as picking up valuable recyclables on the spot is easier to search for than taking them back. Second, the houses don't have enough space for the storage of all kinds of scrap. I will go into detail later in the chapter. Third, carrying everything is not possible, and in most of, the waste is majority cases is mixed waste, which becomes a huge problem for the ragpickers as they have to look for recyclables that are not spoiled.



*Fig 11. Map showing Nasimben sorting at Jamalpur market*

More often than not, these workers operate in the dark and are often injured on their job. Going to areas like Teen Darwaza in the morning, where it is dark, and having no other means of light, they often injure themselves. This has happened to Nasimben previously, where she slipped and sprained her ankle and wasn't able to go to work for a few days. Losing out on work for a few days means a loss of income, which they can't afford.

Nasimben then sells her scraps to Gulshanben, who is a sorter and a kabadiwala

## Gulshan ben (Kabadiwala+sorter)- S1 Recycler

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Gulshanben is a 65-year-old woman who has been in this business for the last 25 years.

After buying the goods from Nasimben, she then further segregates them and cleans the scraps if required. Aside from buying scraps from ragpickers and other kabadiwalas, she and her family are also kabadiwalas and mainly go around sites to collect scrap. Often, the residents themselves come to give their scraps. She works from home and sorts and segregates at her house. To transport the scraps, she has a tempo that she uses. Some of the scraps she even sells at Ravivari market. She mainly collects plastic bags, PET bottles, textiles, e-waste, and construction materials. Being a kabadiwala, her movement is restricted mainly to the main roads as her cart cannot fit within the dense settlement. And due to this, she/her family, and also other kabadiwalas, have to scream to get people's attention.

From here, she sells her scraps to Nasirbhai, who is an S2 recycler.



Fig 12. Map showing the movement of Kabadiwala around the settlement



Fig 13. Map showing the Gulshanben transporting the scrap to Nasirbhai via a tempo

## Nasir Khan Pathan(Sorter)- S2 Recycler

---

Nasir bhai has been in the sorting business for the past 25 years. He buys scraps from kabadiwalas like Gulshanben and further segregates and sorts the scraps, and then sells them to wholesalers in large quantities. His shop is located on a primary road so that it is visible to the scrap dealers and kabadiwalas who come to sell to him. This also allows for large trucks to come and collect large quantities of scraps. He opens his shop post 2pm, as the majority of the scrap collecting activities are done in the morning, after which the kabadiwalas come to sell their scrap.

After buying the scraps, he segregates them and sells them to wholesalers and dealers who specialise in specific materials like glass, PET bottles, aluminium cans, and paper, etc. He even sells it at the kabadi market where a lot of scrap dealer sell their scraps.

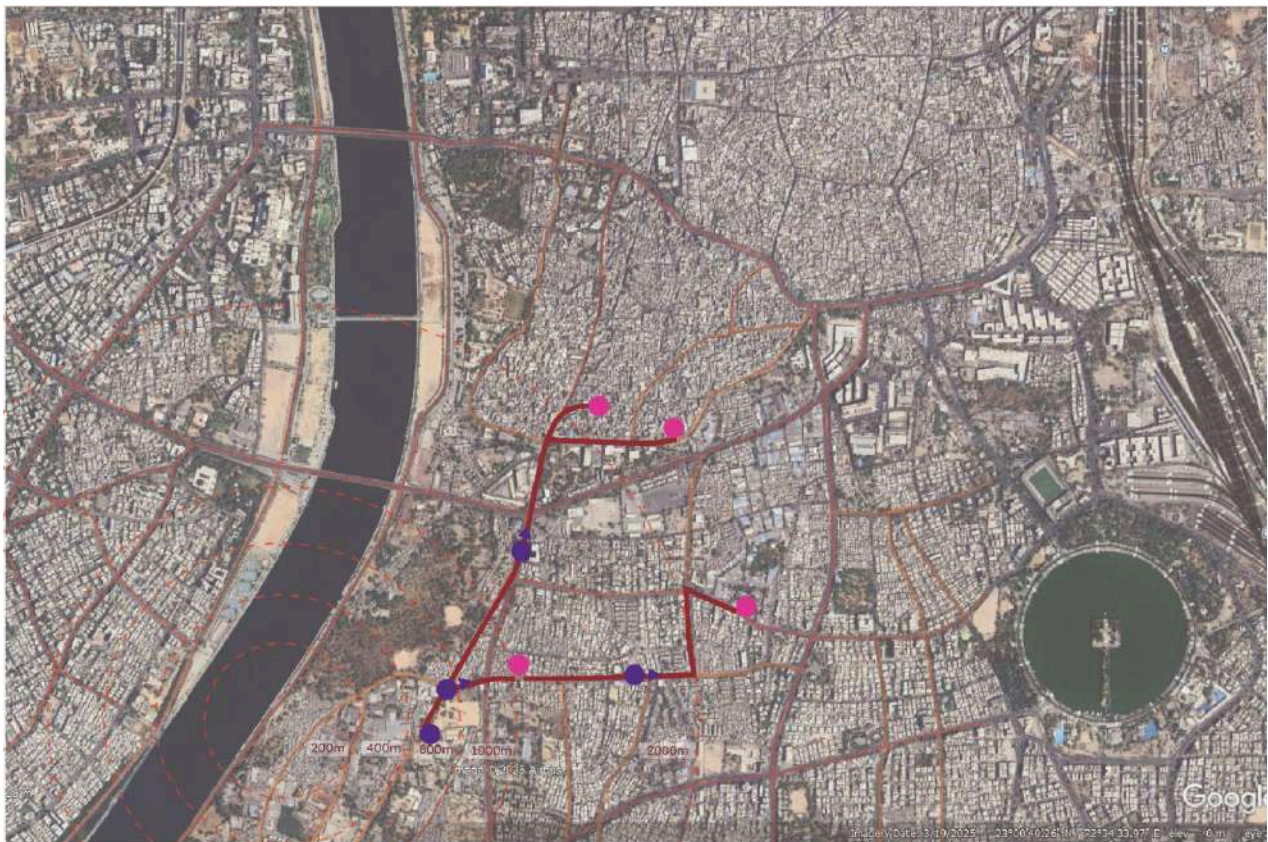


Fig 14. Map showing the transport of scrap from Nasirbhai to other wholesalers

## Spatial Organization

### Gulshanbens' House

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Gulashanben's house is located alongside the Sabarmati River (as seen in the picture below). The location allows other kabadiwalas to easily spot her and sell their goods to her. In addition to this, trucks and tempos can also easily access her house. This makes moving scraps in large quantities easy.



*Fig 15. Map showing the orientation of Gulshanben's house*

Her house has been incremented over the last 20 years. The front part of the house is the most public space, as highlighted in yellow. This is where the sorting and segregation of the scraps take place, in addition to the storage of these materials. Since this part directly faces the Sabarmati River, cool winds blow, making it comfortable to stay during daytime due to the cool winds.

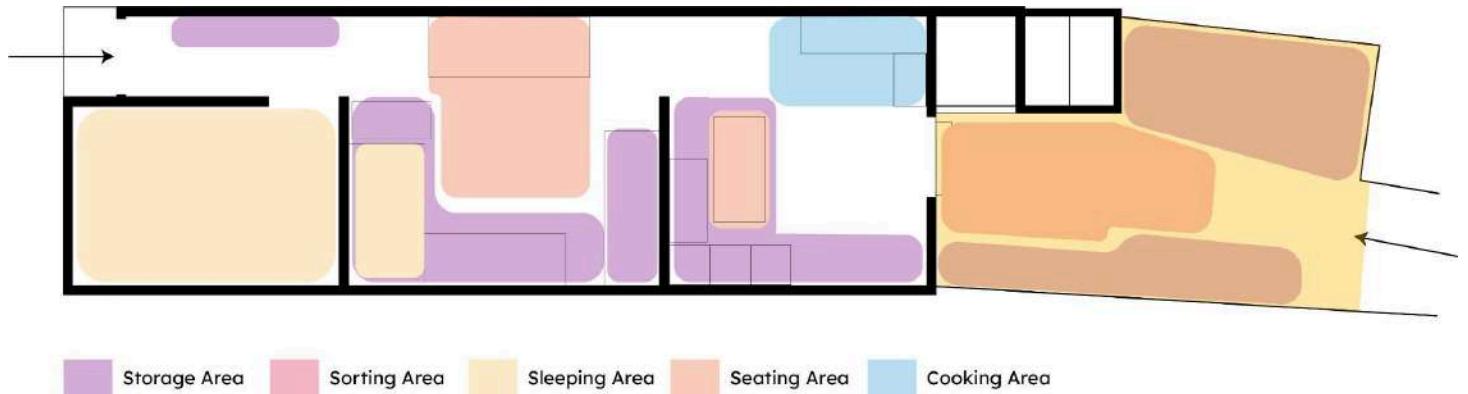


Fig 16. Spatial plan of Gulshanben's house

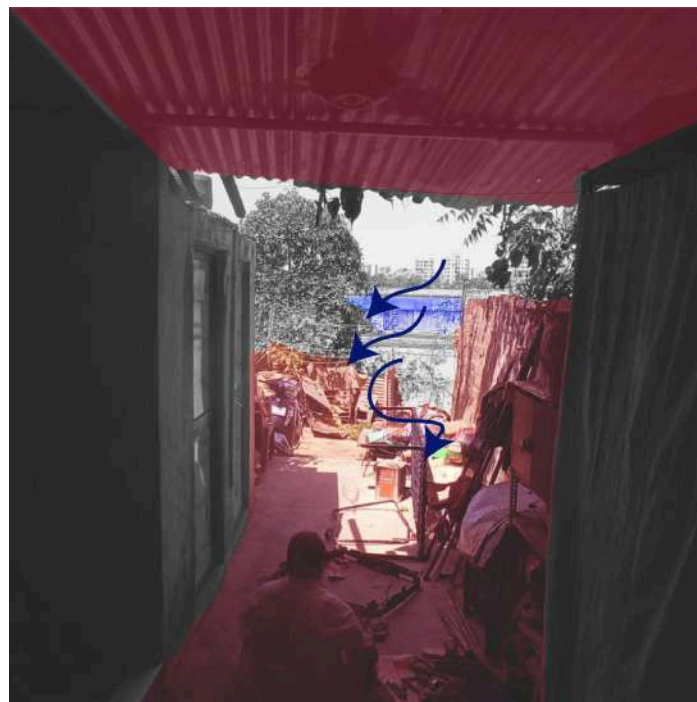


Fig 17. The front of her house, where segregation and storage take place

Next, as we move inside, the house becomes a semi-private area. The first room includes the kitchen and the seating area. This also acts as a gathering space for certain vendors who sell their goods to her. Here, as can be seen from the plan below, the seating and storage areas overlap. The next space is a semi-private one where only certain people are allowed to enter, mainly those who come from the residential houses close by. The spaces in this room overlap much like the previous room, and the majority of the storage is of e-waste and other textile goods. The last area is the bedroom, which is the most private space in the house.



Fig 18. Plan showing the semi-private and private areas in purple and pink, respectively



Fig 19. Image showing the storage space overlapping with the cooking and seating space



*Fig 20. Showing the overlap of storage and sleeping space on the right*

Facing the other houses, the bedroom is placed. Since she works out of her house, she can only collect and store a certain amount of scrap. This allows her to collect scraps over a few days and then sell them to Nasir Bhai. During the Diwali season, she sells her scraps more frequently as everybody is cleaning and clearing. This is when she gets the most sales.

## Nasir Khan Pathans shop

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His shop is located on the main road, allowing other sellers to spot it easily. This also makes it accessible for large trucks to come and collect scraps in large quantities.



*Fig 21. Location of Nasirbhai's shop*

Nasirbhai does not work out of his own house and has to shop. This allows him to collect scraps in much larger quantities and sell. As seen in the plan below, his shop is divided into storage, sorting, and weighing areas.

Sorters like Nasirbhai collect scraps over a period of time, usually a week. The amount usually is between 210-245k,g and this amount also varies from sorter to sorter and can sometimes be even more than this (Kala et al., 2022).

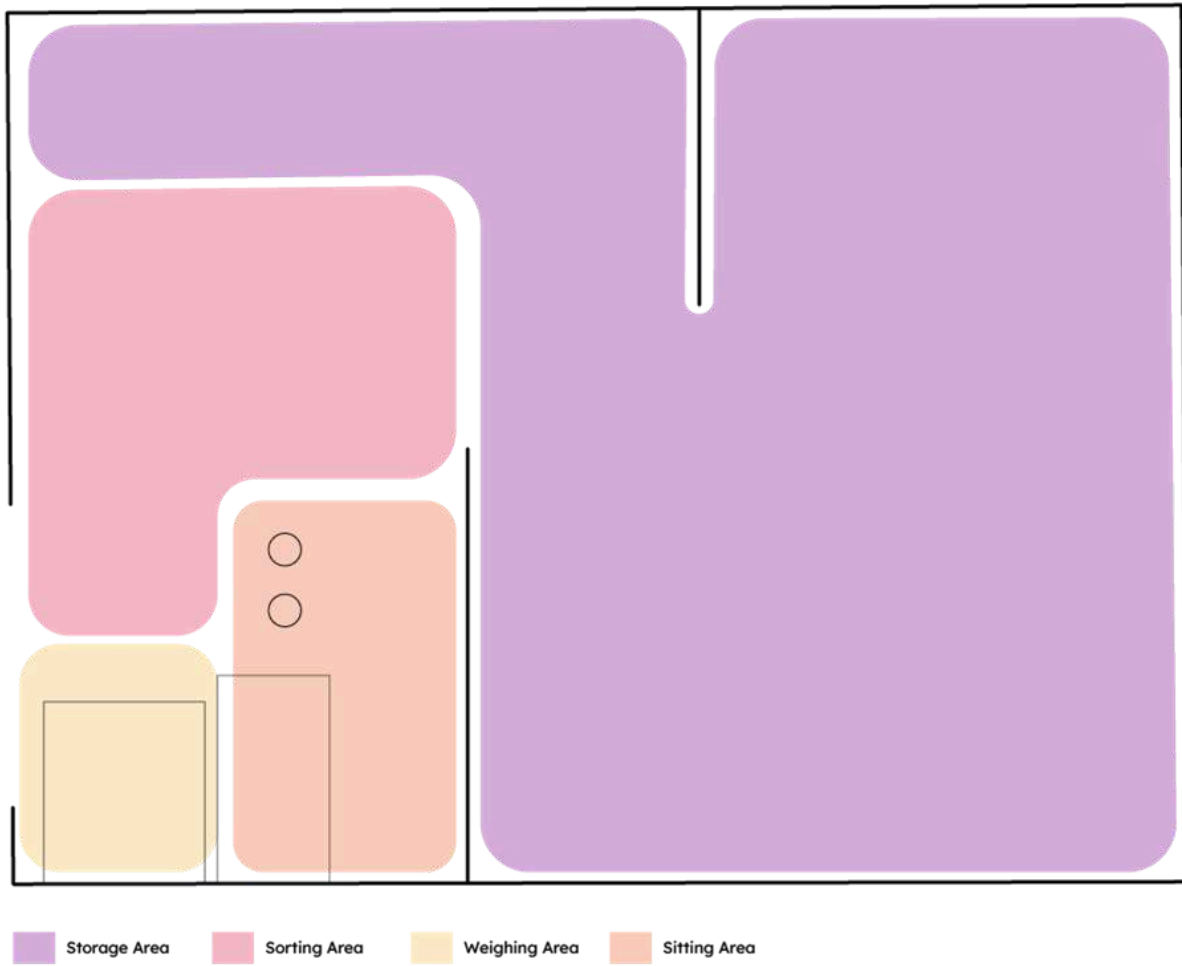


Fig 22. Plan of Nasir Bhai's shop



*Fig 23. Image showing the storage space*



*Fig 24. Image showing the storage space*



*Fig 25. Image showing the weighing and sitting area*

### 3.2 Vanjaravas

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Vanjaravas is located on the outskirts of Ahmedabad. Its surrounded by industries which comprise plastic/resin factories, automobile factories, textile, and wood factories. It has a population of around 16,769 according to the 2011 census (CEPT University et al., 2014, #). But this would have increased in the last 14 years. The site is comprised of several different communities. The residents usually work at construction sites and the women as domestic workers in societies nearby.



*Fig 26. Industries around Vanjaravas*

Vanjaravas faces several issues, one of the main problems being that of waste. Open dumping takes place due to AMC trucks arriving during the late morning, mainly around 11 am. By this time, most of the residents have already left for work. Due to this majority of them throw it in the open fields in front of their house. Aside from this, when the trucks do

come, they only travel along the main road and do not enter the site. Residents often do not know that the truck has come, and cannot hear it either.

Due to the open dumping, several diseases, specifically vector-borne diseases, spread, especially during the monsoon. Malaria and chikungunya are most common, especially among children, as they play amongst the trash since there is no proper open space for them to play. The waste clogs up drains and causes flooding, which enters the houses during monsoons.

On site are present 3 recycling centers, one for glass, then wood and metal, and then plastics.



*Fig 27. Trash strewn around the lake edge, and open dumping in front of the houses*

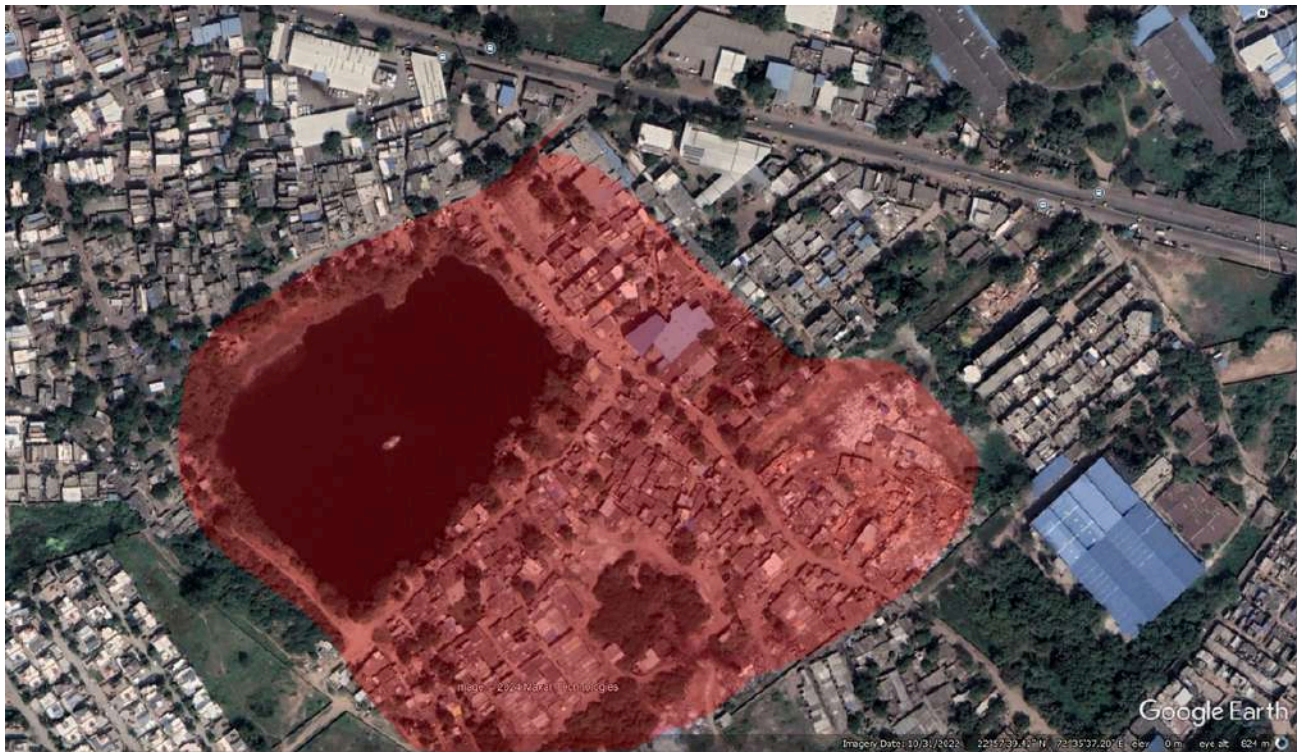


Fig 28. Vanjaravas Site

## Glass Recycling Center

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It occupies an area of 3789 sqm, and the majority of the glass comes from pharma companies they have contracts. Very few scrap dealers sell their scraps to them. This is also cause a lot of the workers do not want to work with glass bottles since they can involve alcohol bottles, and this can get them in legal problems with the authorities.

On a daily basis, 20 tonnes of glass are received. They are sorted based on colour. From these centers, the glass is sent to manufacturing units in Firojpur, where they make bangles.



*Fig 29. Glass Recycling area*

## Wood and Metal Recycling Center

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The recycling center occupies an area of approximately 3473 sqm. The main scraps dealt with are wood, rubber, Torrent wire, and other small scraps. The wood comes from tenders with other companies. They segregate the wood based on its type and size. Wood, which is broken and of bad quality, is usually broken further to be used as fuel. Wood types like teak are sent to manufacturing units where they are made into planks to be sold again.

Aside from wood, they also receive wires from Torrent power. On a daily basis, they receive 10-20 tonnes and some more wires. They then collect in large quantities and sell it to metal manufacturing units, where they melt it to reuse it as whole metal. On this site, 100% recycling takes place when speaking with the founder of the company.



*Fig 30. Wood and metal recycling area*

## Plastic Recycling Center

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The plastic recycling center is approximately 1520 sqm in area. This space has been abandoned for the longest time. Due to this, this area has become an open dumping ground for the residents nearby.



*Fig 31. Abandoned Plastic recycling area*

Having analysed both the sites and the stakeholders involved, a supply chain system has been derived along with the waste value chain.

### 3.3 Waste Supply Chain

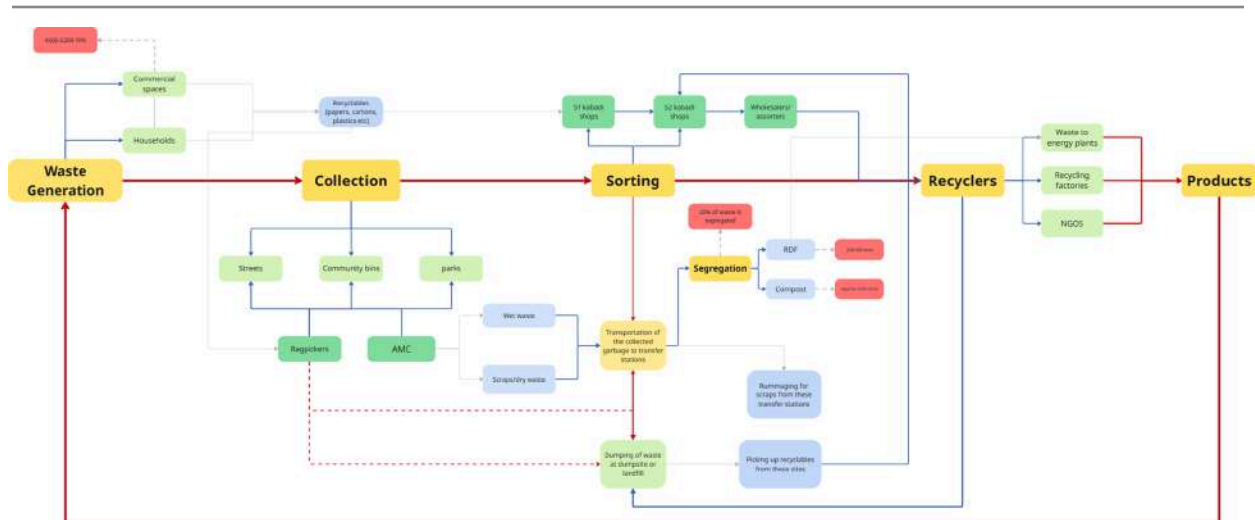


Fig 32. Supply chain system

The first step is the generation of waste from households and commercial spaces. On a daily basis, Ahmedabad produces 4500- 5200TPD. Most of the waste generated is wet waste, which households produce around 0.3-0.7kg per day. The recyclables like metal, cardboard, paper, newspaper, etc, are stored and sold to kabadiwalas. From the commercial areas, waste is usually sorted through by the ragpickers who extract PET bottles, plastic bags, aluminium cans, cardboards, etc. From here, the waste is then sold to S1 recyclers such as Gulshan Ben, who are small sorters, and they then, after minimal sorting, sell it to S2 recyclers such as Nasir bhai. The scraps are then sold to wholesalers who sell them to recyclers who run waste-to-energy plants, manufacturing units, NGOs who make new products, etc. The formal sector, on the other hand, collects the waste from households and commercial areas and takes it to transfer stations to segregate, but only 8% is sent to composting plants and waste-to-energy plants, while the rest is dumped at pirana. From pirana, another set of S0 recyclers pick waste who only specialise in scavenging waste from landfill sites and dumpsites.

Amongst all this, the informal workers, especially the S0 recycler, are prone to several health issues, especially those who work directly at landfill sites. This legacy waste releases toxic gases such as methane, which over the course of time cause lung problems. The burning of

the waste on these sites is also hazardous to them. The Deonar dumpsite in Mumbai caused smoke to linger for 6 weeks after it caught fire. Those staying beside the site faced several pulmonary diseases. In addition to this, most of them work without any protective gear.

Despite all these problems, they still continue to work as they have no other means to earn a living. They recycle about 60-90% of the scraps, but still, there are materials that never get completely recycled. This is MLPs. This can be found in chip packets, biscuit packets, juice boxes, cigarette packets, etc. It is very difficult to separate them, and most workers avoid picking them up as there isn't much value to them. But with the rate at which consumption patterns are changing, the waste is only going to continue to grow and be dumped without being recycled.

Another issue that was recognised was that despite AMC trying to include the informal workers into the system, no actual effort was made. They still work as a single system.

## Chapter 4

### 4.1. Case Studies

- I. BBMP
- II. SEWA
- III. SWaCH

### 4.2. Conclusion

## 4.1 Case Studies

### BBMP's Solid Waste Management Initiatives in Bengaluru

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On a daily basis, Bengaluru generates 5000 TPD, which is expected to rise to 6000 TPD by 2050 ("Why Is Bengaluru Expanding Its Waste-Management Capacity? | Explained," 2023). The Bruhat Bengaluru Mahanagara Palike (BBMP) is an agency that provides waste management services in 198 wards in the city of Bengaluru (Singh, 2021, 36). It is focused on an inclusive government, decentralised waste infrastructure (DWCCs), and environmental sustainability. The main focus of this model was the integration of the informal workers. Doing this has significantly improved operational efficiency and social stigma that surrounds waste and its handling.

Some of the Key Features are:

1. Door-to-door collection:
  - a. BBMP ensures daily door-to-door collection for households, informal settlements, and commercial units. They do this with the help of auto tippers and pushcarts (BBMP, n.d.).
  - b. There are 16 units of Biomethanation Plants that process wet waste and generate biogas for street lighting
  - c. More than 200+ DWCCs that segregate recyclables and are managed by informal workers who have been formalised.
2. Formalizing the Informal Sector:
  - a. BBMP partnered with Hasiru Dala to integrate more than 9000 informal waste pickers into DWCCs. The workers received training, ID cards, PPE, and fixed wages.
  - b. They have been recognised as green warriors and are even included in SWM contracts.
  - c. The DWCCs act as points allowing waste pickers to sell segregated materials directly to recyclers.

### 3. Technology and Monitoring:

- a. 670 vehicles are GPS-monitored for efficient transportation
- b. Waste collection and movement are tracked to prevent illegal dumping

The DWCCs are one of the most important aspects of this entire system. It has been based on the principle of the 3Rs at a neighbourhood level (Singh, 2021, 37). They facilitate the collection and buying of all the dry waste from local residents, waste workers, and scrap dealers. Currently, 11 DWCCs receive 300-500kg of waste per day, and 9 receive 500-800kg per day (Singh, 2021, 37).

With the setup of these units, they have managed to divert close to 2871 tonnes of plastic from landfills, and in 2020, almost 5508 tonnes of plastic waste was sent for recycling (Singh, 2021, 37).

Despite this, there are still some challenges that have been faced. Out of 4500 TPD of construction and demolition waste, only 39% of it is processed. 40% of the households still mix the waste and don't segregate.

But in spite of these challenges, the model is one that has shown promising results. Other cities like Mysuru and Chennai have even made similar frameworks. Their efforts to incorporate have not only had an effect on the amount of waste that was being sent to landfills but also created livelihoods and formalised jobs for the informal workers.

## Case Study

### SEWA

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SEWA was founded in 1972 in Ahmedabad as a trade union for poor self-employed women (*History – Self-Employed Women's Association*, n.d.). They have worked for decades to organise, empower, and improve the livelihoods of women who work as vegetable vendors, incense stick rollers, and waste recyclers (*History – Self-Employed Women's Association*, n.d.).

Their key initiatives were:

1. Organizing and Cooperation formation
  - a. SEWA formed women-led cooperatives to provide a platform for negotiating with municipal authorities. These cooperatives enabled waste pickers to secure contracts for door-to-door collection and recycling services.
  - b. The dual strategy of “struggle and development” involved fighting for rights and building economic institutions that were owned and run by the waste pickers, thereby empowering them (*SEWA's Presentation*, n.d.).
2. Securing Municipal Contracts:
  - a. In 2004, a SEWA-promoted women’s cooperative signed a contract with AMC to collect waste from 46000 households.
  - b. The waste pickers were responsible for collecting wet waste for the AMC and segregating dry waste for recycling (*SEWA's Presentation*, n.d.).
  - c. Waste pickers received recognition, ID cards, and the right to collect and sell recyclable materials
3. Infrastructure and Social Recognition
  - a. SEWA helped establish decentralised waste management units, including MRFs, where women waste pickers sort and process dry waste from different wards.

- b. They have even advocated for and secured access to social security benefits, including the creation of the Gujarat Informal Economy Workers Welfare Board in 2007.

Impact :

1. 76% of waste recyclers were members of SEWA and were cleaning almost 37.5% of the city's daily waste (*SEWA's Presentation*, n.d.)
2. Waste pickers gained recognition, legal identity, and their social status improved
3. SEWA's advocacy helped bring about changes in national and state-level policy regarding the role of informal sectors in waste management (*SEWA's Presentation*, n.d.)

Challenges:

1. Despite SEWA's cooperatives, they eventually lost contracts to larger private companies
2. While the MSW Rules 2016 recognise the need for informal waste workers, no efforts have been made for the integration
3. SEWA continues to push for policy reform and better working conditions, and inclusion of the waste pickers in the formal waste management system

## Case Study

### SWaCH

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Solid Waste Collection and Handling is a worker-owned cooperative of waste pickers in Pune. Established in the early 1990s in response to the growing waste and to give recognition to the waste pickers for the work they were doing. SWaCH was formally recognised in 2008. The cooperative is owned by 3761 waste members, 70% of whom are women and from marginalised communities. The members were organised into 155 local groups with elected leaders.

Some of the initiatives were

1. They provide door-to-door waste collection daily to over 4 million residents
2. The waste pickers collect a user fee from the households directly
3. SWaCH workers recycle over 200 tonnes of waste daily, thereby reducing the pressure on the landfill
4. 264 '*Pinjras*', which are dry waste storage units, were installed, allowing for the recycling of up to 50 tonnes of scrap (Ministry of Housing and Urban Affairs, n.d.)
5. SWaCH organises regular awareness campaigns, workshops, and community meetings to promote waste segregation and recycling
6. The presence of the cooperative in 70 informal settlements has led to 100% door-to-door collection and segregation
7. They have an agreement with PMC, which provides infrastructure and incentives. This collaboration is needed for scaling up operations
8. By integrating the waste pickers into a formal system, SWaCH has saved the city substantial operational costs

SWaCH's model shows us the importance and benefits of integrating informal waste workers into a formal system. It was not only the workers who made the difference, but the response of the citizens themselves also made it possible. Due to the outreach and awareness programs' emphasis on segregation at source. Doing this helped gain respect

and the cooperation needed for efficient door-to-door collection. They created a model that is replicable by other cities.

## 4.2 Conclusion

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The informal waste sector is crucial to India's waste management system and plays a vital role in moving the country towards a circular economy. This can be done when we start looking and adding value — which is already being done by the informal sector— to the recyclable, instead of just composting and using wet waste.

Just to summarise why it's important:

1. Key Driver of Recycling and Material Recovery:

Informal waste workers are responsible for collecting and segregating a significant portion of post-consumer waste, often recovering far more recyclable materials than formal waste management systems. This keeps valuable materials like plastic in circulation rather than in landfills.

2. Cost Reduction for Municipalities:

By extracting recyclables early in the waste stream, the informal sector reduces the volume of waste that needs to be transported, treated, or landfilled, thereby lowering the economic burden on urban local bodies.

3. Environmental Impact and Sustainability:

Their work contributes to reducing greenhouse gas emissions from landfills, conserving natural resources, and limiting pollution.

4. Organic, Efficient Ecosystem:

Despite lacking formal recognition or support, the informal recycling system has evolved over the decades into a highly efficient, self-organized network. It shows how decentralized, community-based efforts can outperform top-down approaches in resource recovery.

5. Social and Economic Contribution:

With over a million informal waste workers engaged, the sector provides a livelihood to some of the most marginalized communities.

6. Opportunity for Improvement and Integration:

Though diverse and complex, understanding the functioning of this sector offers

valuable insights. By identifying challenges like lack of space, infrastructure, income security, and access to welfare, solutions can be designed to integrate informal workers into formal systems without disrupting their vital role.

In short, the informal waste sector is the unsung backbone of India's recycling ecosystem. They face several health problems due to the work they do, but still continue to do it as it is their only mean of income. But despite this, they have the highest recycling rates. Recognizing, supporting, and integrating it is essential for advancing sustainability, reducing municipal costs, and achieving a truly circular economy, and the formal system can learn a lot from it.

## Bibliography

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Ahmedabad Municipal Corporation & United Nations Centre for Regional Development.

(n.d.). *Road Map for Zero Waste Ahmedabad*.

[https://uncrd.un.org/sites/uncrd.un.org/files/6th-3r\\_city-rep\\_ahmedabad\\_ref-doc3.pdf](https://uncrd.un.org/sites/uncrd.un.org/files/6th-3r_city-rep_ahmedabad_ref-doc3.pdf)

Ahmedabad Municipal Corporation Solid Waste Management. (n.d.). AMC. Retrieved April 6, 2025, from

[https://ahmedabadcity.gov.in/Uploads/FormsFonts/SolidWasteManagement/SWMPPro file\\_English.pdf](https://ahmedabadcity.gov.in/Uploads/FormsFonts/SolidWasteManagement/SWMPPro file_English.pdf)

Basel Convention. (2011, 10 05). *National definition of waste*. Retrieved 04 21, 2025, from

<https://www.basel.int/Portals/4/Basel%20Convention/docs/natreporting/2009/compl/2009-question-2a.pdf>

BBMP. (n.d.). *Solid Waste Management Overview*.

<https://site.bbmp.gov.in/documents/Overview.pdf>.

Bhupendrasinh, J. R. (n.d.). *Behrampura Ward Planning Exercise*.

<https://portfolio.cept.ac.in/fp/ward-planning-exercise-4500-2-monsoon-2016/behrampura-ward-planning-exercise-monsoon-2016-pp0004216>

Break Free From Plastic. (2024, September 06). *Study by European University blames Global South for plastic pollution, overlooks the role of plastic industry and waste trade*.

Retrieved April 28, 2025, from

<https://www.breakfreefromplastic.org/2024/09/06/european-study-blames-global-south-for-plastic-pollution/>

CEPT University, Ahmedabad Municipal Corporation, Mahila Housing Trust Team, & Smith, M. (2014, Septemeber). *Ahmedabad Slum Free City Action Plan*.

[https://pas.org.in/Portal/document/PIP%20Application/Ahmedabad%20Slum%20Fre  
e%20City%20Action%20Plan%20RAY.pdf](https://pas.org.in/Portal/document/PIP%20Application/Ahmedabad%20Slum%20Free%20City%20Action%20Plan%20RAY.pdf)

CPCB. (2017, September 14). CPCB | Central Pollution Control Board. Retrieved May 9, 2025, from <https://cpcb.nic.in/bio-medical-waste-rules/>

Filipenco, D. (2024, May 21). *World waste: statistics by country and brief facts*. Development Aid. Retrieved April 6, 2025, from

[https://www.developmentaid.org/news-stream/post/158158/world-waste-statistics-  
by-country](https://www.developmentaid.org/news-stream/post/158158/world-waste-statistics-by-country)

Gohil, V. (2018). *ISSUES & CHALLENGES IN MEASURING THE SERVICE LEVELS AND IMPROVING THE SERVICE DELIVERY A CASE OF SOLID WASTE MANAGEMENT IN THE CITIES OF GUJARAT*. CEPT University.

Green Planet Solutions. (2024, November 29). *The Hidden Crisis: How India's Informal Waste Sector Can Lead the Way to Sustainable Waste Management Solutions*.

[https://thegreenplanetsolutions.com/blog/the-hidden-crisis-how-indias-informal-was  
te-sector-can-lead-the-way-to-sustainable-waste-management-solutions/#:~:text=  
Despite%20the%20critical%20role%20they,due%20to%20poor%20working%20con  
ditions](https://thegreenplanetsolutions.com/blog/the-hidden-crisis-how-indias-informal-waste-sector-can-lead-the-way-to-sustainable-waste-management-solutions/#:~:text=Despite%20the%20critical%20role%20they,due%20to%20poor%20working%20conditions)

The Guardian. (2024, February 12th). *Revealed: the 1,200 big methane leaks from waste dumps trashing the planet*.

<https://www.theguardian.com/environment/2024/feb/12/revealed-the-1200-big-meth>

[one-leaks-from-waste-dumps-trashing-the-planet#:~:text=Landfills%20emit%20methane%20when%20organic.being%20released%20from%20the%20landfills.](#)

*Hazardous Wastes (Management and Handling) Rules, 1989.* (n.d.).

<https://guihealth.gujarat.gov.in/images/pdf/Act/hazardous-wastes-rules-1989.pdf>

High Court of Tripura. (n.d.). *The Bio-Medical Waste (Management and Handling) Rules, 1998.*

[https://thc.nic.in/Central%20Governmental%20Rules/Bio%20-%20Medical%20Waste%20\(Management%20and%20Handling\)%20Rules.%201998..pdf](https://thc.nic.in/Central%20Governmental%20Rules/Bio%20-%20Medical%20Waste%20(Management%20and%20Handling)%20Rules.%201998..pdf)

*History – Self Employed Women's Association.* (n.d.). Self Employed Women's Association.

Retrieved May 11, 2025, from <https://www.sewa.org/about-us/history/>

India Spend. (2017, May 12). Why Ragpickers, Unrecognised And Unpaid, Are Critical For Waste Management In India.

<https://www.indiaspend.com/why-ragpickers-unrecognised-and-unpaid-are-critical-for-waste-management-in-india-43164>

Iyer, M., & Mahato, P. R. (n.d.). Informal Sector Waste Recyclers in Municipal Waste:

Prospects and Challenges – Case of Ahmedabad, India. 10.

Kala, K., Bolia, N. B., & Sushil. (2022, July 16). *Analysis of informal waste management using*

*system dynamic modelling.* <https://pmc.ncbi.nlm.nih.gov/articles/PMC9389189/>

Kaza, Silpa, Yao, L., Bhada-Tata, P., & Woerden, F. V. (2018). *What a Waste 2.0: A Global*

*Snapshot of Solid Waste Management to 2050.*

<https://openknowledge.worldbank.org/server/api/core/bitstreams/92a50475-3878-5984-829e-0a09a6a9badc/content>

MINISTRY OF ENVIRONMENT & FORESTS. (n.d.). *BIO-MEDICAL WASTE (MANAGEMENT AND HANDLING) RULES, 1998.*

<https://www.rfhha.org/images/law/7.1%20BMW%20Rules.pdf>

Ministry of Environment, Forest and Climate Change. (n.d.). *Waste Management. Waste Management.* <https://moef.gov.in/waste-management>

Ministry of Housing and Urban Affairs. (n.d.). *Transforming Urban Informal Settlements. Swachh Bharat Mission-Urban.*

<https://sbmurban.org/transforming-urban-informal-settlements>

*National Urban Sanitation Policy.* (n.d.). Philipines 2. Retrieved May 9, 2025, from

[https://www.mohua.gov.in/upload/uploadfiles/files/NUSP\\_0.pdf](https://www.mohua.gov.in/upload/uploadfiles/files/NUSP_0.pdf)

Panchal, P. (2018). *LOCATIONAL AND SPACE USAGE CONSIDERATION OF INFORMAL SCRAP COLLECTORS (ITINERANT WASTE BUYERS):A CASE OF AHMEDABAD.*

Patrick, L. (2022, December 17). *Global Waste Trade: What is it? Why does it happen and How to solve it.* Modern Diplomacy. Retrieved April 6, 2025, from

<https://moderndiplomacy.eu/2022/12/17/global-waste-trade-what-is-it-why-does-it-happen-and-how-to-solve-it/>

PrintWeek Team. (2022, April 4). *Plastic waste imports to India go up: report. PrintWeek India.*

<https://www.printweek.in/news/plastic-waste-imports-to-india-go-up-report-55929>

Sam, K. (2025, February 19). *Plastic Waste Management Rules in India: Key Laws & EPR.* Banyan Nation. Retrieved May 9, 2025, from

<https://www.banyannation.com/blog/plastic-waste-management-rules/>

SEWA's Presentation. (n.d.). International Labour Organization. Retrieved May 11, 2025,

from

[https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@asia/@ro-bangkok/@sr-o-new\\_delhi/documents/meetingdocument/wcms\\_142513.pdf](https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@asia/@ro-bangkok/@sr-o-new_delhi/documents/meetingdocument/wcms_142513.pdf)

Sharma, P., Gupta, N., & Verma, M. (2022, July 28). *Overview of Hazardous Waste Management Rules in India*. Enterclimate. Retrieved May 8, 2025, from

<https://enterclimate.com/blog/hazardous-waste-management-rules-in-india/>

Singh, R. (2021). *Integration of Informal Sector in Solid Waste Management: Strategies and Approaches* (A. A. Parrey, Ed.). Centre for Science and Environment.

Times of India, Parmar, J., & Dave, P. (2025, February 20). *From Oct, large societies will need to manage their waste*.

<https://timesofindia.indiatimes.com/city/ahmedabad/from-oct-large-societies-will-need-to-manage-their-waste/articleshow/118396437.cms>

V, S. (2017). *Performance audit of Municipal Solid Waste Management*. Cept University.

Vidhi Center for Legal Policy. (2021, April 16). *Garbage Matters - A Documentary on Solid Waste Management Issues in Delhi*.

<https://www.youtube.com/watch?v=MC7a-FkHQMA>

*Waste Management in India: Facts, Challenges & Solutions*. (2024, September 8). NEXT IAS. Retrieved May 8, 2025, from

<https://www.nextias.com/blog/waste-management-in-india/>

WasteRecycling. (2024, March 25). *Ahmedabad Municipal Corporation to build MSW to steam plant under the PPP model*.

<https://www.wasterecyclingmea.com/ahmedabad-municipal-corporation-to-build-msw-to-steam-plant-under-the-ppp-model>

Why is Bengaluru expanding its waste-management capacity? | Explained. (2023, October 16). *The Hindu*.

<https://www.thehindu.com/sci-tech/energy-and-environment/bengaluru-expanding-solid-waste-management-capacity-explained/article67426926.ece>

Yajnik, C. (2024, March 29). *Urban Solid waste management: Challenges and opportunities*.

Retrieved April 28, 2025, from

<https://www.linkedin.com/pulse/urban-solid-waste-management-challenges-opportunities-chinmay-yajnik-fvvif/>

