



Increasing Waste Recycling Through Better Informal Sector Data

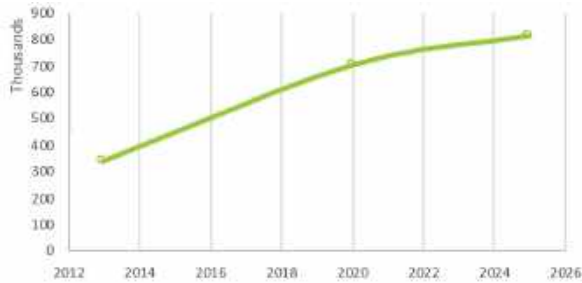
Presented by,

Siddharth Hande

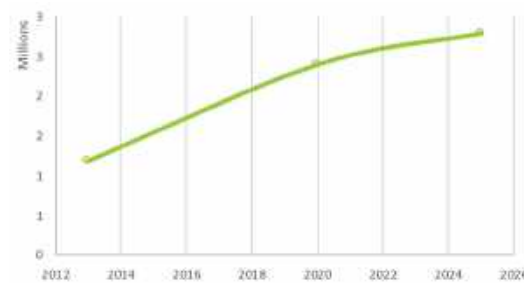
Founder & CEO, Kabadiwalla Connect

Waste generation is growing faster than any other environmental pollutant

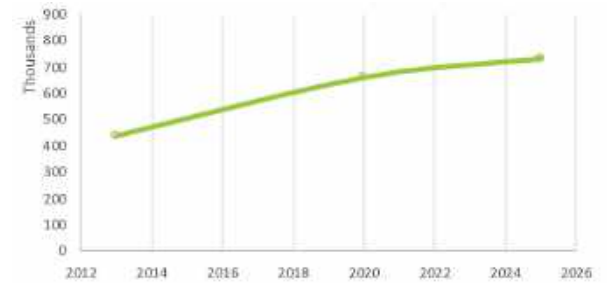
Recent developments in climate science have further accentuated the importance of appropriate waste management to contribute to tackling climate change, especially considering current projections for waste generation and waste composition.



MSW generation estimates for Africa & Middle East
(Tons per day)



MSW generation estimates for Asia
(Tons per day)



MSW generation estimates for Latin America & Caribbean
(Tons per day)

Waste sector emissions can account for up to **15% of GHG**
(including recycling, diversion, organics treatment, offset and disposal)

There is a serious problem with waste management systems in urban India

Urban India generates

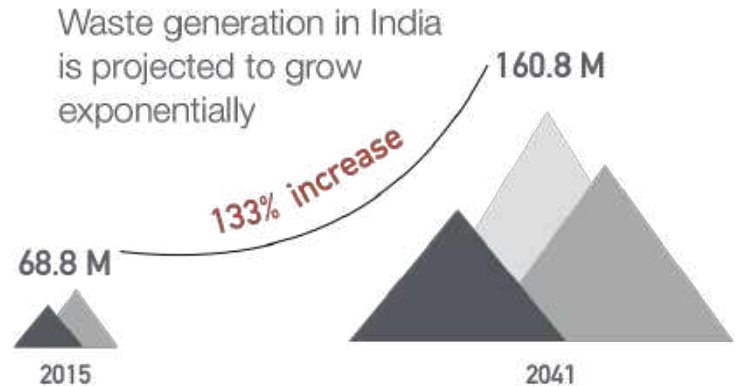
68.8M

Tons of Waste Per Annum



91%

Of waste collected is dumped in open landfills



Source: Department of Industrial Policy and Promotion, 2011

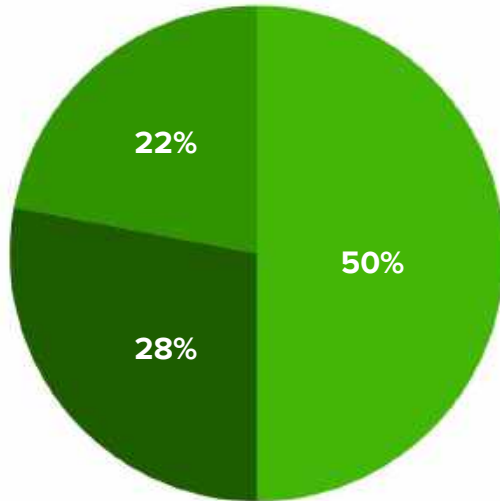
http://www.seas.columbia.edu/earth/wtert/sofos/Sustainable%20Solid%20Waste%20Management%20in%20India_Final.pdf

Waste management systems are costly

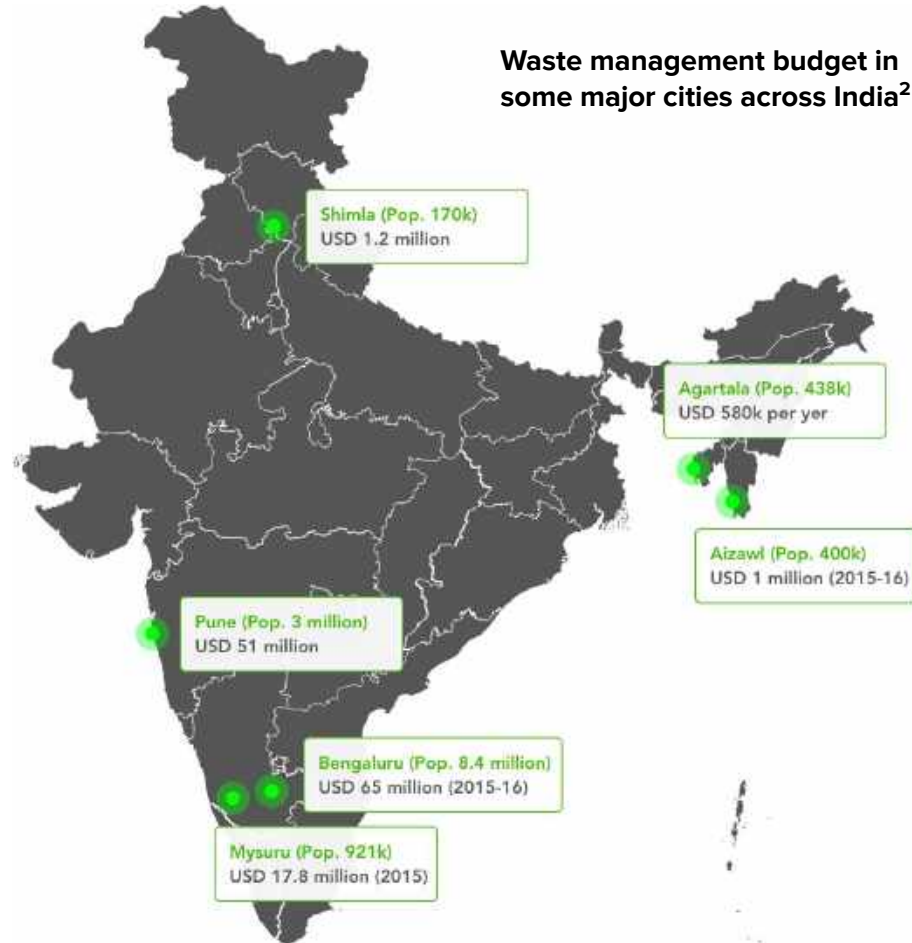
According to the World Bank and USAID, it is common for municipalities in developing countries to spend **20–50%** of their available municipal budget on SWM, which often can only stretch to serve less than **50%** of the population¹

Waste management budget utilisation²

● Salaries ● Waste Collection ● Waste Transportation



Waste management budget in some major cities across India²

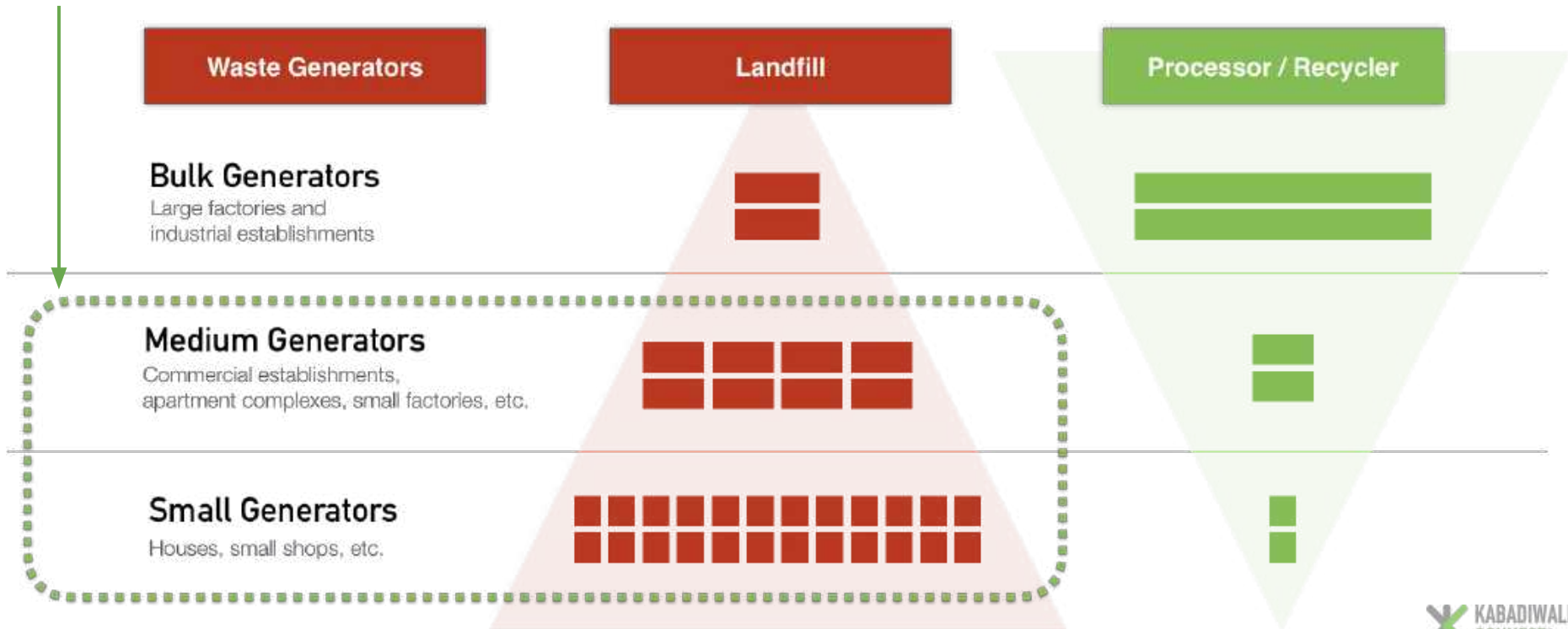


1. https://www.downtoearth.org.in/dte-infographics/57865-clean_your_backyard_2.html

2. <https://www.sciencedirect.com/science/article/pii/S0956053X1300500X>

The management of waste from medium & small generators has currently not been solved

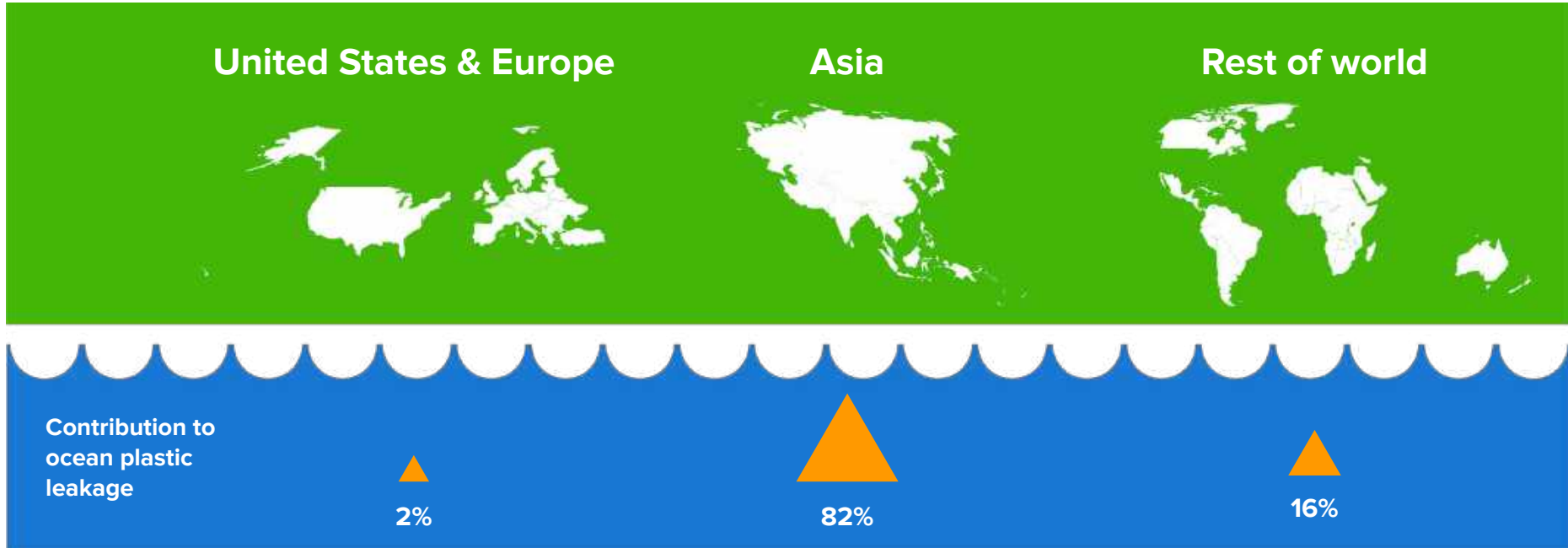
70% of the waste generation in a city like Chennai¹



1. Chennai Corporation - Solid Waste Management. <http://chennaicorporation.gov.in/departments/solid-waste-management/index.htm>. Website.

8 million tons of plastic ends up in our oceans every year ¹

Ocean Conservancy contends that China, Indonesia, the Philippines, Thailand and Vietnam are responsible for as much as 60 percent of the plastic waste that enters the world's seas ²



1. The new plastics economy report. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEC-Hybrid_English_22-11-17_Digital.pdf
2. 5 countries dump more plastic into the oceans than the rest of the world combined. <https://www.pri.org/stories/2016-01-13/5-countries-dump-more-plastic-oceans-rest-world-combined>

There is a serious problem with waste collection systems across SE Asia, Africa & Latin America

70%

of waste is generated by small and medium waste generators¹

20% - 50%

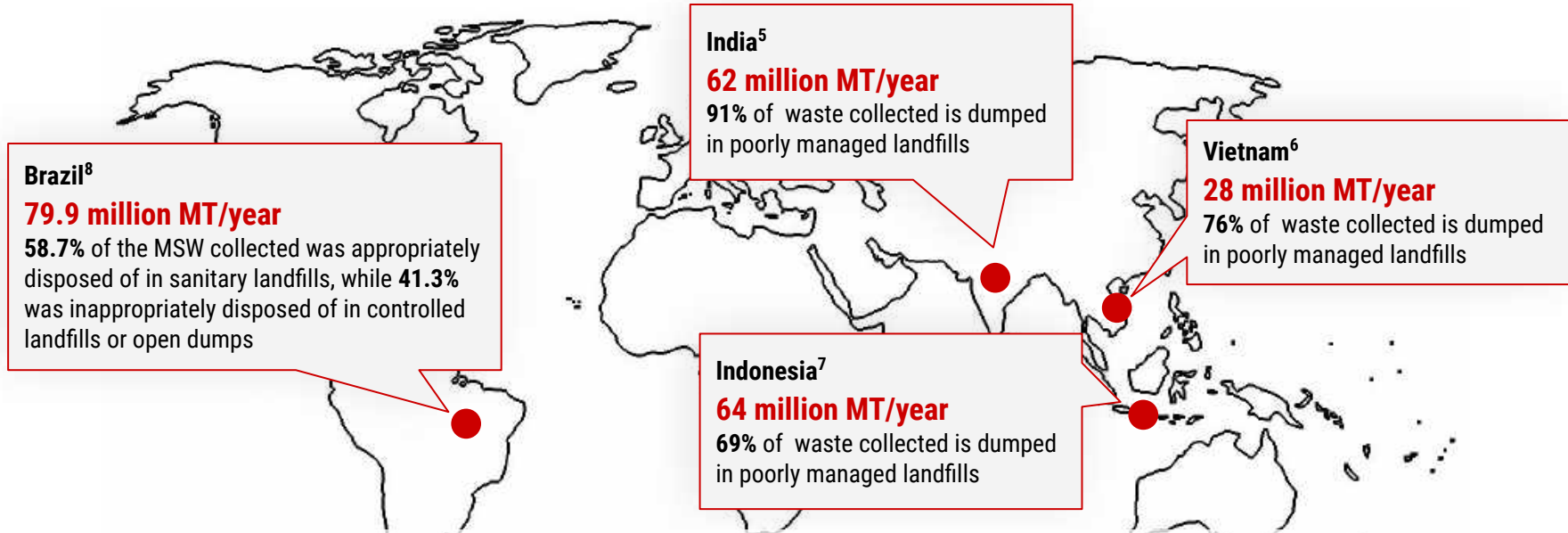
of the municipal budget is spent on waste collection²

8 million

tons of plastic ends up in our oceans every year³

70%

of waste generated in the city can be composted or recycled⁴



1. Chennai Corporation - Solid Waste Management. <http://chennaicorporation.gov.in/departments/solid-waste-management/index.htm>. Website.

2. Financial sustainability in municipal solid waste management – Costs and revenues in Bahir Dar, Ethiopia. <https://www.sciencedirect.com/science/article/pii/S0956053X1300500X#b0155>. Article. Published 2013.

3. The New Plastics Economy - Ellen MacArthur Foundation. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEF-Hybrid_English_22-11-17_Digital.pdf. Published 2017.

4. CMDA - Solid Waste Management. http://www.cmdachennai.gov.in/Volume3_English_PDF/vo3_Chapter09_Solid%20Waste%20Management.pdf. Published 2011.

5. Sustainable Solid Waste Management in India. Columbia University. http://www.seas.columbia.edu/earthwrtter/sofos/Sustainable%20Solid%20Waste%20Management%20In%20India_Final.pdf. Academic Paper. Published 2012.

6. Opportunities in the Waste-to-Energy Sector in Vietnam. <https://www.vietnam-briefing.com/news/opportunities-waste-energy-sector-vietnam.html>. Article. Published 2018.

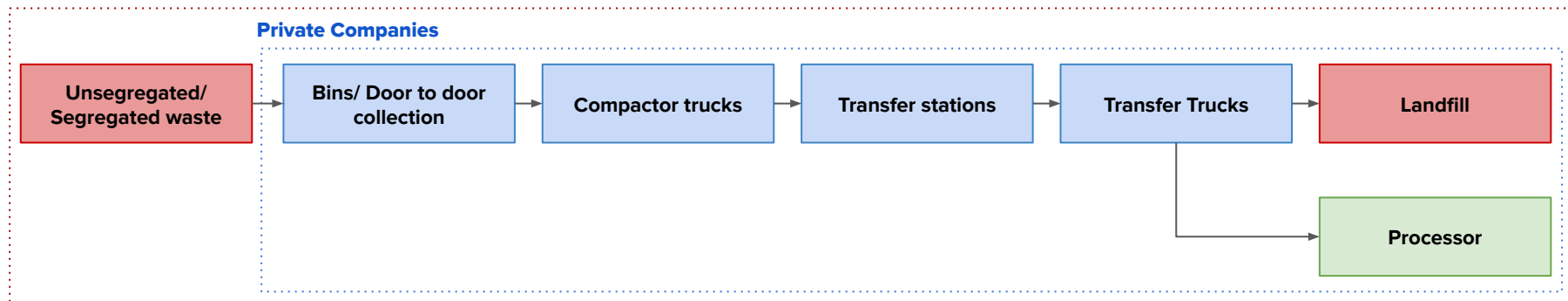
7. Indonesia in state of waste emergency. <https://www.thejakartapost.com/news/2015/10/09/indonesia-state-waste-emergency.html>. Article. Published 2015.

8. Municipal solid waste in Brazil: A review. <https://journals.sagepub.com/doi/pdf/10.1177/0734242X17735375>. Journal. Published 2017.

Current municipal solid waste collection systems are expensive and ineffective



Municipality



Disadvantages of a centralised approach



High transportation cost



High costs for intermediate storage



Land intensive



Difficult to track material flow



Difficult to obtain consistent high-quality feedstock

There is a unique opportunity to leverage the informal waste supply-chain in the Global South — to develop decentralised, Integrated Solid Waste Management (ISWM) systems that galvanises the Circular Economy

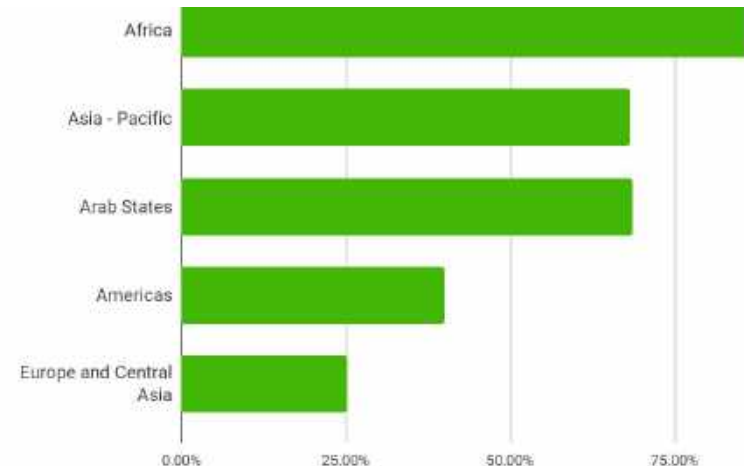
Understanding Informality | Two billion people – more than **61 per cent** of the world's employed population – work in the informal economy.

There is an urgent need to tackle informality. For hundreds of millions of workers, informality means a lack of social protection, rights at work and decent working conditions, and for enterprises it means low productivity and lack of access to finance. Data on those issues are crucial for designing appropriate and integrated policies that are tailored to the diversity of situations and needs.

93 per cent of the world's informal employment is in emerging and developing countries



Major cities in SE Asia, Africa & Latin America with informal sector



Informal employment across the globe

1. https://www.ilo.org/asia/media-centre/news/WCMS_627585/lang--en/index.htm#:~:text=Southern%20Asia%20and%20South%2DEastern.per%20cent%20in%20Southern%20Asia.

Informal waste sector in India

1.5 Million

Waste-pickers across the country¹

20%

Of recyclable materials recovered²

USD 328

Average savings created for municipality per ton per year (INR 24,500)²

USD 4

Average earnings of a waste-picker per day (INR 300)³



- <https://archive.nytimes.com/www.nytimes.com/cwire/2011/05/16/16climatewire-foundations-try-to-legitimize-indias-invisib-79578.html?scp=1&sq=CHF%2520International&st=cse>
- <https://royalsocietypublishing.org/doi/10.1098/rsos.160764#:~:text=Despite%20significant%20development%20in%20social,than%20properly%20landfilled%20%5B2%5D.>
- <https://indianexpress.com/article/cities/delhi/for-waste-pickers-in-noida-constant-fear-of-contracting-covid-19-on-the-job-6531666/>

Important studies on the informal waste sector – focused on India

Role of informal sector recycling in waste management in developing countries

Authors: David C. Wilson; Costas Velis; Chris Cheeseman

Published on: December 2006 [\[Link\]](#)

- Many thousands of people in developing country cities depend on recycling materials from waste for their livelihoods.
- Western experience shows that it is very expensive to establish new formal recovery systems once existing informal ones have been allowed to decline or disappear.
- It has become increasingly evident that incorporating existing informal recycling systems into the operations of formal MSWM can bring significant benefits.

Recovery of consumer waste in India – A mass flow analysis for paper, plastic and glass and the contribution of households and the informal sector

Authors: Biplob Nandy, Gaurav Sharma, Saryu Garg, Shweta Kumari, Tess George, Yengkhom Sunanda, Bärbel Sinha

Published on: 19 May 2015 [\[Link\]](#)

- Despite the fact that the disposal of biodegradable waste and items with no recycling value is currently poorly managed, the current system very efficiently recovers a major fraction of the recyclable matter from the waste stream.
- Overall, at least 30–65% of the paper waste, 50–70% of the plastic waste and almost 100% of all glass bottles produced are recovered either at the household level or through garbage collectors and itinerant waste merchants.
- Promotion of an institutionalized door-to-door collection system run by a large number of self-employed entrepreneurs will not only enhance service quality but also recover more waste for recycling and create sustainable livelihoods for the informal sector in the waste disposal value chain.

The Economics of the Informal Sector in Solid Waste Management

Authors: Ellen Gunsilius, Bharati Chaturvedi, Anne Scheinberg with contributions from Adrian Coad, Sofia Garcia Cortes

Published on: April 2011 [\[Link\]](#)

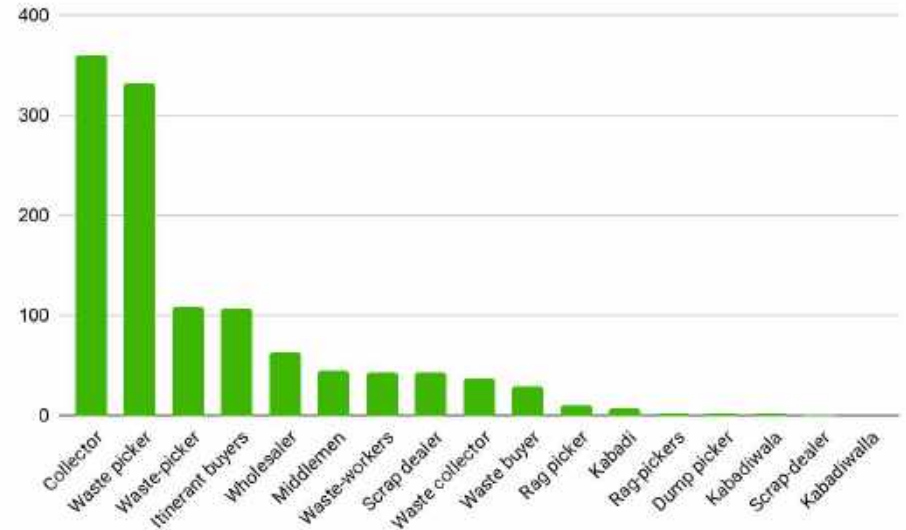
- The informal solid waste management sector is more active and more effective in recovering and valorising resources than the formal one in low- and middle-income countries
- Informal recovery scores considerably better than formal recovery in terms of low or no fossil energy use. This is because many informal activities rely on human or animal muscle power, rather than on motorised transport. This gives the informal sector a considerably smaller carbon footprint.
- Regularising and integrating informal recovery into the overall solid waste system, as modelled in the addition scenarios of the cities, has its main benefits in terms of recovery rates and overall solid waste system costs

There is a lack of consensus on how the informal supply-chain is defined

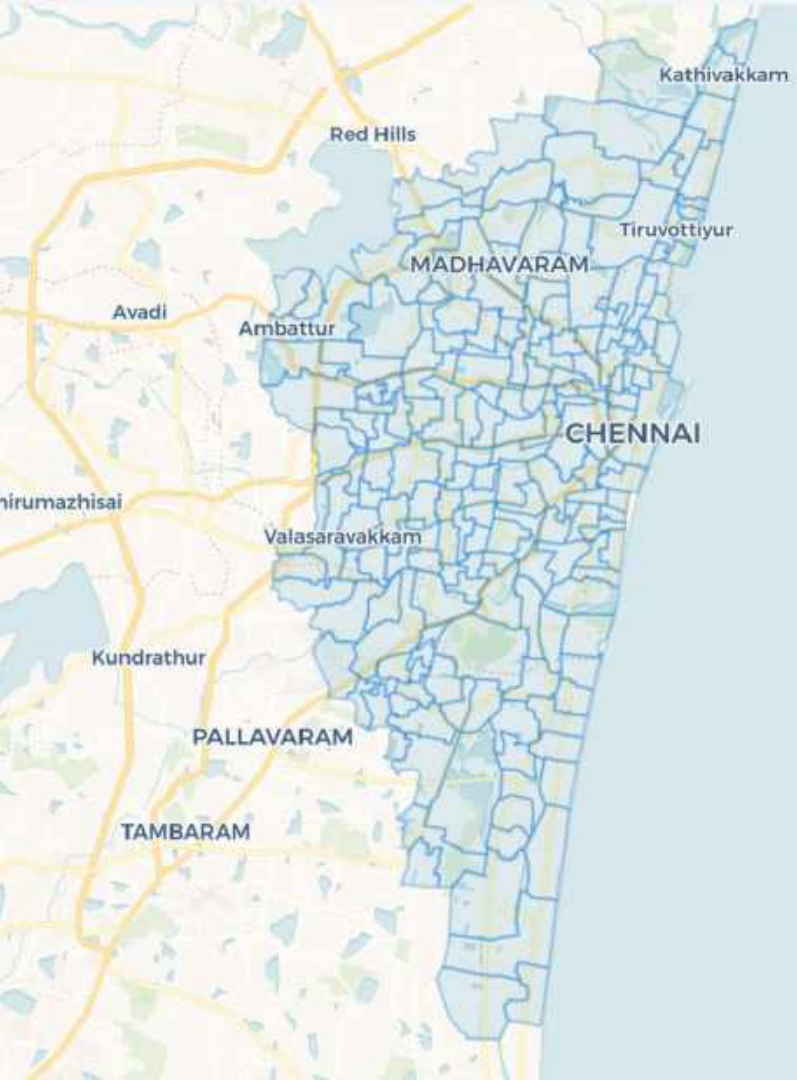
Most studies have focused mainly on waste-pickers when speaking about the informal supply chain, leaving out the informal small scrap shops and large scrap shops. Currently, there is no standardised naming conventions that refer to the different players in the informal supply chain



A word cloud showing the use of naming conventions used to describe the informal sector in India



A graph showing the use of naming conventions used to describe the informal sector in India



In 2015, Kabadiwalla Connect started mapping the informal sector in Chennai



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FOR SUSTAINABLE DEVELOPMENT DATA



Waste-pickers



L1 Aggregators
(Small Scrap shops)



L2 Aggregators
(Large Scrap shops)



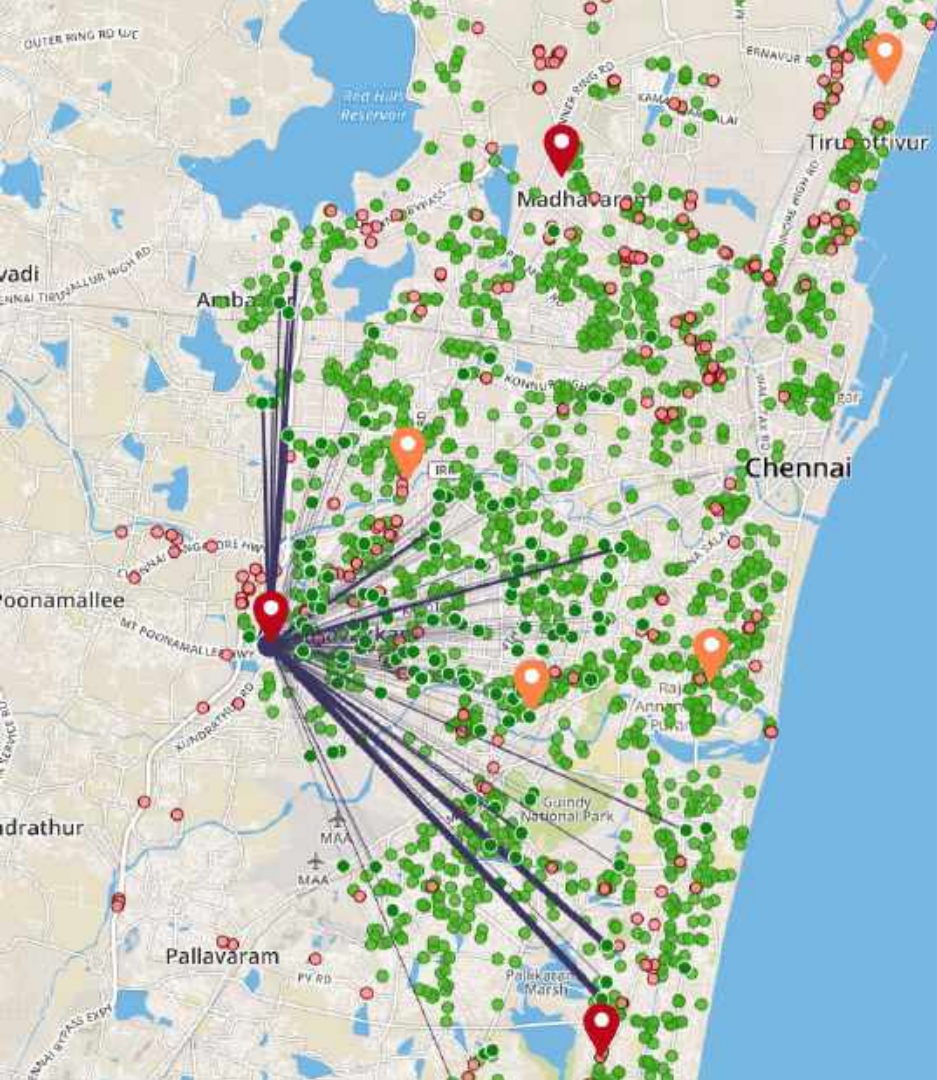
Processor/
Recyclers

Focus area of KC
Study



*Our research was published in the Field Actions Science Reports [Online], Special Issue 19 | 2019

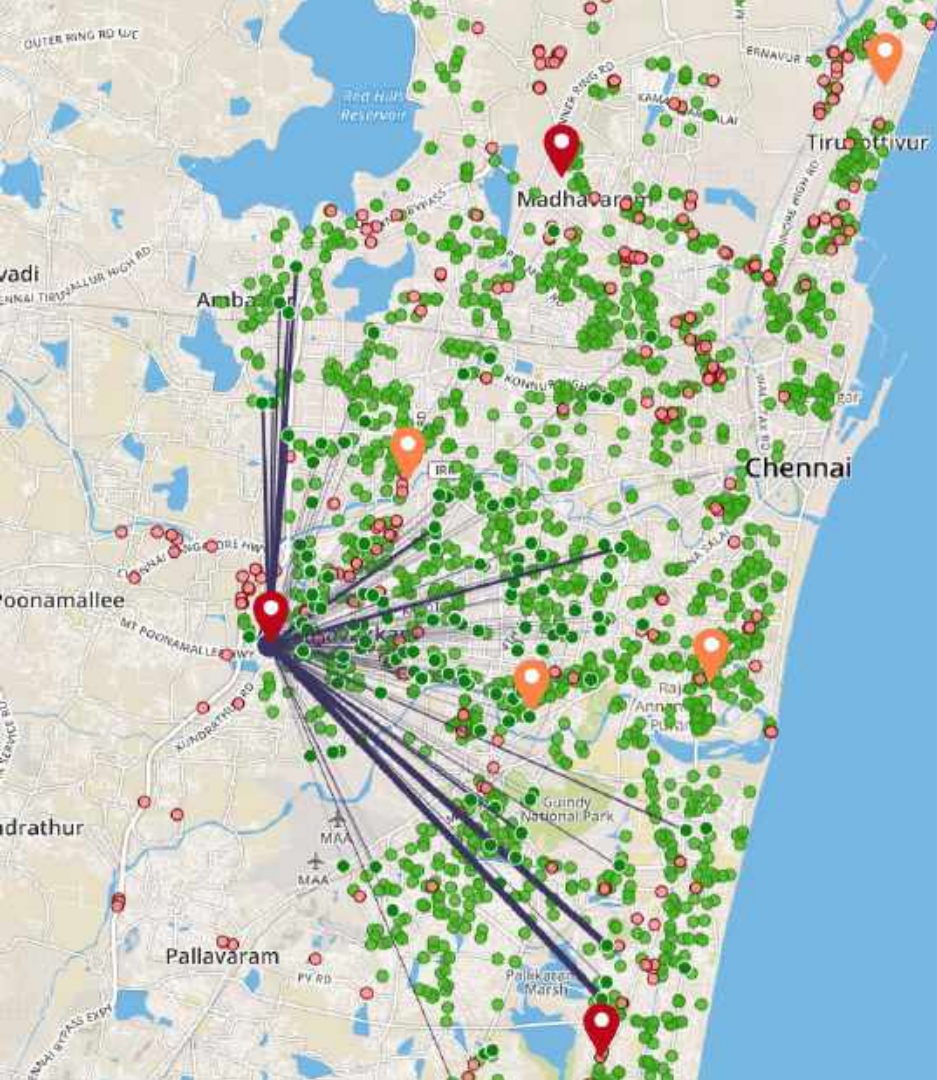
<https://journals.openedition.org/factsreports/5143>



Level 1 Aggregators



Level 2 Aggregators



Level 1 Aggregators

24%

of recyclable waste is already informally sourced back from this network

130k

tons of recyclables saved from landfills every year

52%

of them have smartphones. 100% of them have phones

\$270

earning per month for more than 80% of recyclers (INR 20,000)

74%

can deploy their network to procure from the household

Level 2 Aggregators

69%

of them specialise in a single material (Paper/Plastic/Glass or Metal)

7

employees working under each aggregator

69%

of them have smartphones. 100% of them have phones

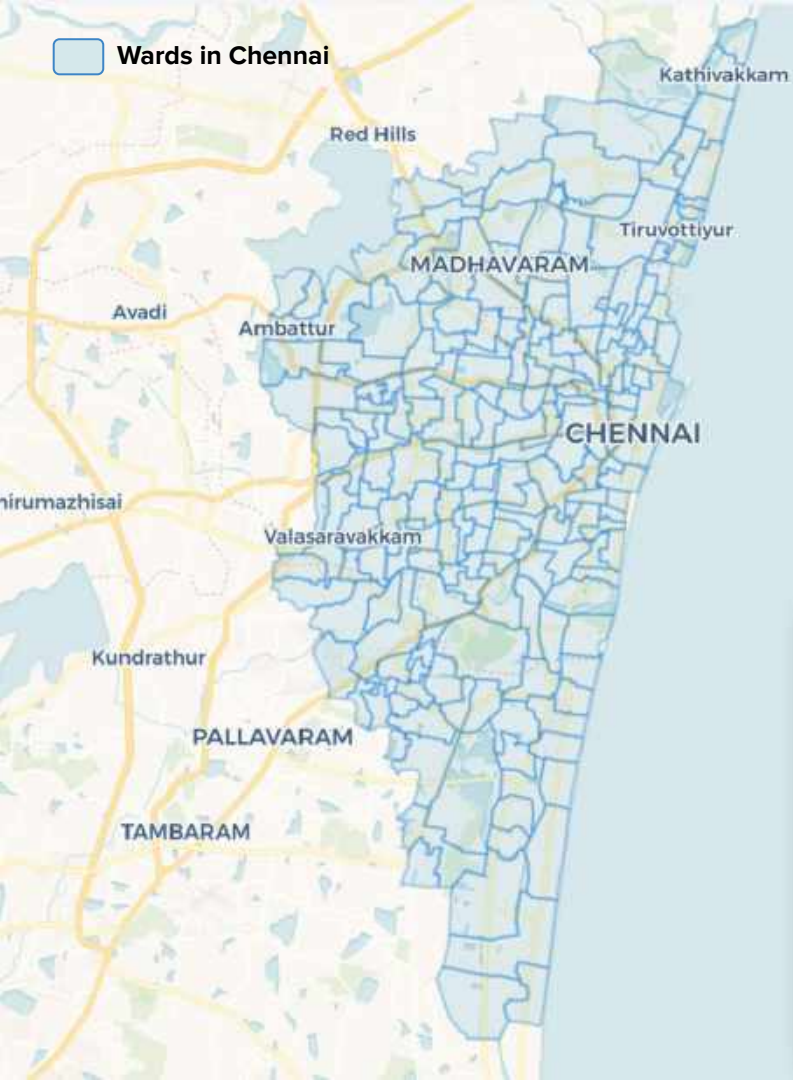
36

tons - average storage capacity

\$12K

average revenue per month





In 2015, Kabadiwalla Connect won a grant from Global Partnership for Sustainable Development Data (GPSDD)

Key goals and activities of the project:

- Street by street surveying of small scrap shops, large informal scrap shops and processors across the 200 wards in Chennai
- A comparative analysis of demographics, business activities and material flow within the informal supply chain
- Build a map based interactive portal allowing the exploration of the data



BETTER DATA. BETTER DECISIONS. BETTER LIVES.

A global network using data to achieve the Sustainable Development Goals - improving lives, fighting inequality, and promoting environmental sustainability.

Also supported by



Survey Methodology & Features

Kabadiwalla Connect has developed a customised platform that helps in making the data collection, visualisation and analysis a lot simpler.

Key steps followed for Mapping



Training

Training the surveyors on using data collection tools and conducting survey with the informal sector. This includes review of questionnaire, training on survey pitch, best practices on data input etc. We have built an separate SOP that will guide the surveyors on collecting quality data



Data Collection

During the data collection phase, the surveyors are assigned a municipal administrative boundary to collect data. They will have to cover every street in the boundary and collect data. Data is then verified by the supervisor and approved to be added to the primary database



Data Analysis

Once the data collection is complete, the data is analysed and visualised on a dashboard. The database structure is also finalised in this phase and all required standards for data storage are maintained. Any KPI required in the future can be easily updated in the dashboard

Key Features

- Mobile based data collection
- Offline data collection
- Admin dashboard for data validation
- Robust database structure
- Language localisation
- Data Collection and Curation SOPs
- Potential to collect all data types including rich data such as photos
- Sophisticated dashboard to explore the data

Kabadiwalla Connect's classification of the Informal Sector

L0 Aggregators (Waste-pickers)



Informal sector workers who may or may not have a means of transportation and incur zero or minimal input cost. These stakeholders primarily collect from roadside dustbins, landfills, and, in the case of those owning a vehicle, from households

Material Source: Street picking and dump sites

Procurement Philosophy: Material agnostic

Tech Adoption: Low

Average Volume: 1000 kg/month

Material currently sourced: Paper, Plastics, Glass, Metal

L1 Aggregators (Small Scrap shops)



Informal sector workers who have a storage space and aggregate material from L0 stakeholders and residents. They do minimal or no processing of the material.

Material Source: L0 Aggregators

Procurement Philosophy: Material agnostic

Tech Adoption: High

Processing: Manual Segregation

Average shop size: 125 sq. ft

Average monthly income: \$270

Smartphone: 52 %

Average Volume: 6000 kg/month

L2 Aggregators (Large Scrap shops)



Informal sector workers who have a storage space which is many times larger than L1 stakeholder and aggregate material directly from L1 and other commercial sources in bulk. They typically specialise in a single super category of material and process it to produce secondary raw materials as well.

Material Source: L1 Aggregators

Procurement Philosophy: Specialised Material

Tech Adoption: High

Processing: Baling, Grinding, Segregation

Average shop size: 5000 sq. ft

Average monthly income: \$1200

Smartphone: 69 %

Average Volume: 30,000 kg/month

Processor/ Recyclers



These are stakeholders who buy specific grades of post-consumer scrap material from L1s and L2s and convert them to usable secondary raw material for the manufacturing industry.

Material Source: L2 Aggregators

Procurement Philosophy: Specialised Material

Tech Adoption: High

Processing: End of life recycling of the material

Pathway for integration



Enumeration

One of the key steps in the integration of the informal sector is to collect data on their operations and infrastructure. This will help understand the gaps and challenges in integration before preparing an integration plan

Social Protection

Stakeholders in the informal supply chain lack any form of social protection to ensure stability in their work. For successful integration it is important that they are provided with health insurance and stable income

Site Compliance & Digitalisation

It important to implement basic site and labour compliance in informal scrap shops to ensure safer work environments. Digitalisation provides an added layer of traceability in the material supply chain which is currently lacking

Dignified Collection

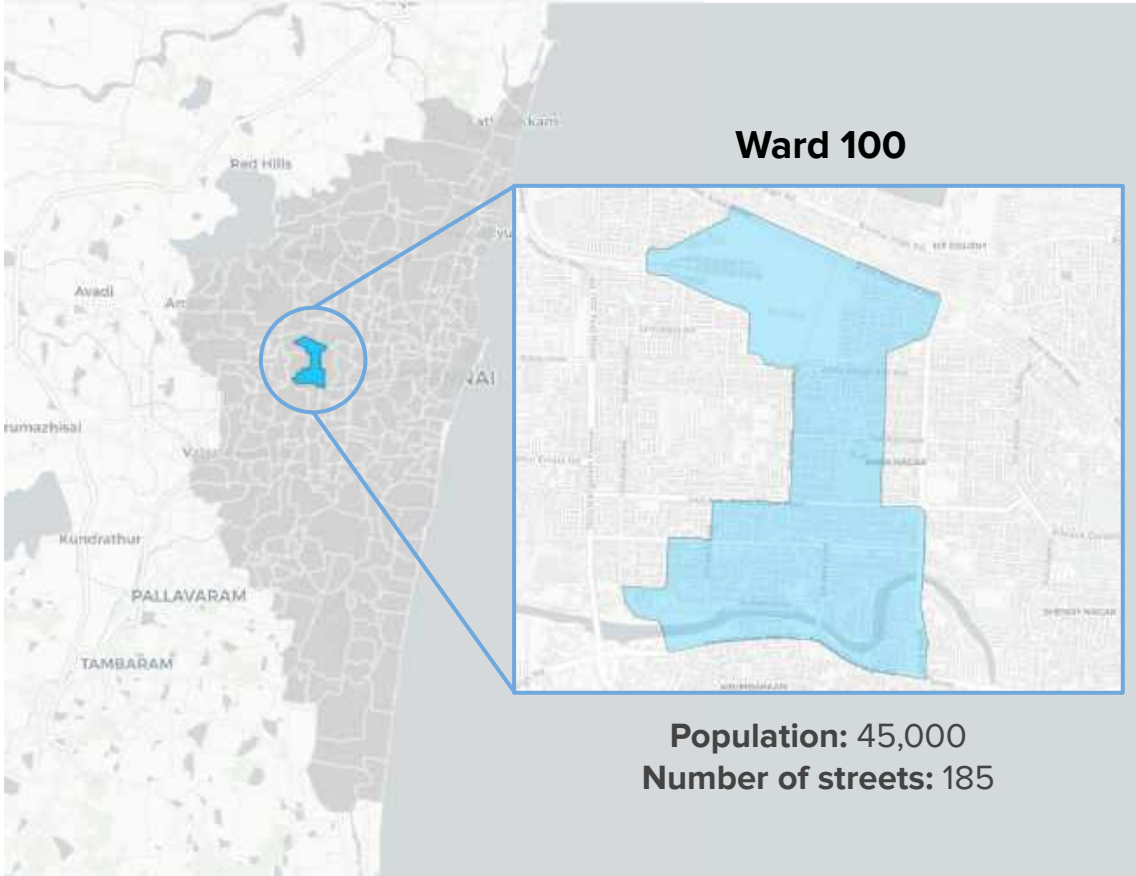
Integration of waste-pickers and small scrap shops to organise last mile collection of municipal waste directly from households.

Registration of informal scrap shops

Registration of informal scrap shops for tax compliance is also an key step in formalisation of the supply chain.

Case study of Ward 100, Chennai

Detailed assessment of the solid waste management data and activities in a specific ward in Chennai (Ward 100)



Waste Generation

Total waste generation per day

39 MT

Per capita waste generation per day

0.86 kg

Waste collected by Municipality per day

37 MT

Waste collected by Informal sector per day

2 MT

Material	Volume per day
Wet Waste	19 MT
Paper	2 MT
Plastic	3 MT
Glass	0.75 MT
Metal	3 MT
Hazardous and Inerts	9 MT

Formal Infrastructure in Ward 100, Chennai



Battery Operated Vehicles

Number: 8
Capacity: 2.8 tons per trip
Operating capacity: 23% coverage

Micro Composting Centers

Number: 2
Capacity: 6 tons/day
Operating capacity: 100%

HMV

Number: 2
Capacity: 16 tons per trip
Operating capacity: -

Corporation Bins

Number: 61
Capacity: 30 tons/day
Operating capacity: -

Well Ring Composting

Number: 2
Capacity: 1 ton/day
Operating capacity: 100%

LMV

Number: 2
Capacity: 6 tons per trip
Operating capacity: -

Tricycles

Number: 36
Capacity: 5.5 tons per trip
Operating capacity: 77% coverage

Bio Gas Plant

Number: 1
Capacity: 80 kg/day
Operating capacity: 100%

Mulch Pits

Number: 2
Capacity: 200 kg/day
Operating capacity: 100%

Informal Infrastructure in Ward 100, Chennai



Waste-pickers

160

Number (Estd)

5 MT/day

Capacity

< 40%

Operating Capacity



Small Scrap Shops

16

Number (Estd)

15 MT/day

Capacity

13%

Operating Capacity

Infrastructure Assessment in Ward 100

Organic waste treatment

There is a requirement for decentralised organic waste processing infrastructures in the ward



Recyclable Waste treatment

There needs to be a strong focus on segregating waste at source to improve the recovery rates



Informal Sector storage utilisation*

There needs to be a strong focus on segregating waste at source to improve the recovery rates



*The informal sector helps collect around **720 tons** of recyclable waste annually making revenues of **\$170,000**

Building waste management strategies for ward 100

Without informal sector data

Door to Door Collection

Hire **78 municipal staff and tricycles** to handle door to door collection of waste

Hire **8 supervisors** to ensure proper scheduling and monitoring of day to day collection activities

Organic/Wet Waste

Wet waste collected from door to door collection by all **78 municipal staff** is deposited in **micro composting centers**

Build **4 micro composting centers** where the wet waste collected is **further segregated** and processed into compost

About **85 tons** of compost generated monthly, can be sold by the municipality at subsidised prices

Dry Recyclable Waste

Dry recyclable waste collected from door to door collection by all **78 municipal staff** is deposited in **resource recovery centers (RRC)**

Build **2 resource recovery centers (RRC)** which can handle about 6 MT of dry waste every day and hire about **20 staff** for further segregation of waste at RRC

Digitalisation at **2 resource recovery centers** that can provide traceability of material, providing a segregation at a ward-level

Different types of segregated material is sold to respective **processors** who process the material

Inert/hazardous/non-recyclable waste

Waste collected from door to door collection by all **78 municipal staff** is deposited in **transfer station**, where it is further segregated

Waste from the **transfer station** is **further segregated** by municipal staff and transported to landfills/incineration plants

With informal sector data

Door to Door Collection

Integrate **78 waste-pickers (50% of existing waste-pickers in the ward)** with tricycles to handle door to door collection of waste

Integrate **8 small scrap shops** who will ensure proper scheduling and monitoring of day to day collection activities

Organic/Wet Waste

Wet waste collected from door to door collection by **78 waste-pickers integrated**, is deposited in **micro composting centers**

Build **4 micro-composting centers** where the wet waste collected is **further segregated** and processed into compost

About **85 tons** of compost generated monthly, can be sold by the municipality at subsidised prices

Dry Recyclable Waste

Dry recyclable waste collected from door to door collection by all **78 waste-pickers integrated**, is deposited in **resource recovery centers (RRC)**

Integrate **12 small scrap shops** with capacity to handle **12 MT** of dry waste every day. Waste-pickers enrolled and the small scrap shops will carry out segregation themselves.

Digitalisation at **12 small scrap shops** and respective **large scrap shops** that can provide traceability of material at a more granular level

Different types of segregated material is sold to respective **large scrap-shops** who aggregate/process the material in turn selling to **processors**

Inert/hazardous/non-recyclable waste

Waste collected from door to door collection by all **78 waste-pickers integrated**, is deposited in **transfer station**, where it is further segregated

Waste from the **transfer station** is transported to landfills/incineration plants