



KabadiwallaConnect[®]

**Increasing Waste Recycling in the
Global South Through the Collection
of Better Informal Sector Data**

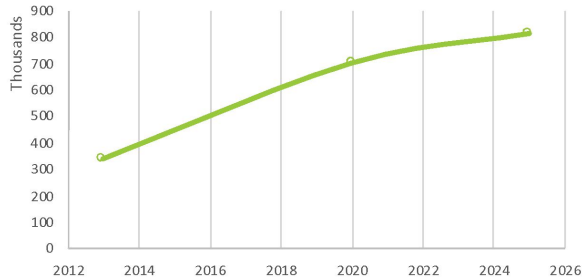
Presented by,

Siddharth Hande

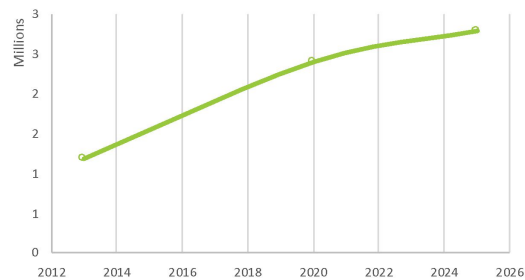
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Waste generation is growing faster than any other environmental pollutant

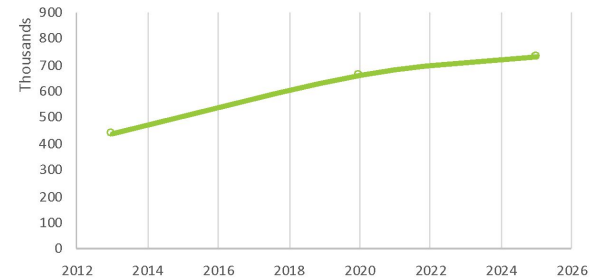
Recent developments in climate science have further accentuated the importance of appropriate waste management to contribute to tackling climate change, especially considering current projections for waste generation and waste composition.



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

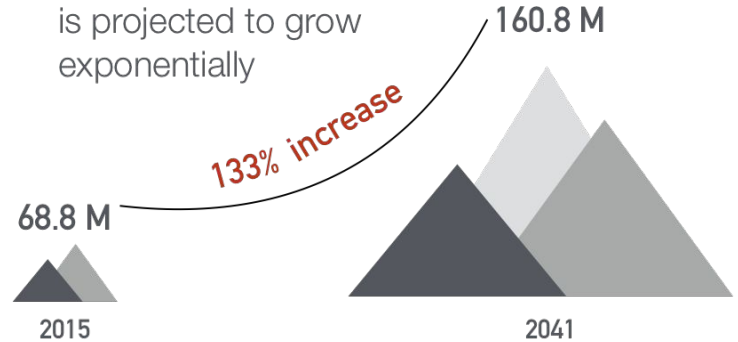
~50% ~20%



91%

Of waste collected is dumped in open landfills

Waste generation in India is projected to grow exponentially



Source: Department of Industrial Policy and Promotion, 2011

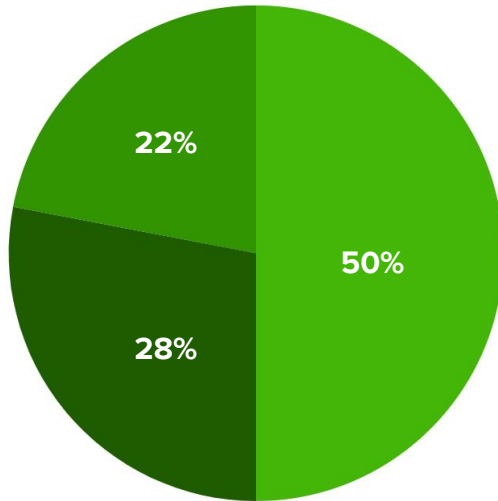
http://www.seas.columbia.edu/earth/wtert/sofos/Sustainable%20Solid%20Waste%20Management%20in%20India_Final.pdf

Waste management systems are costly

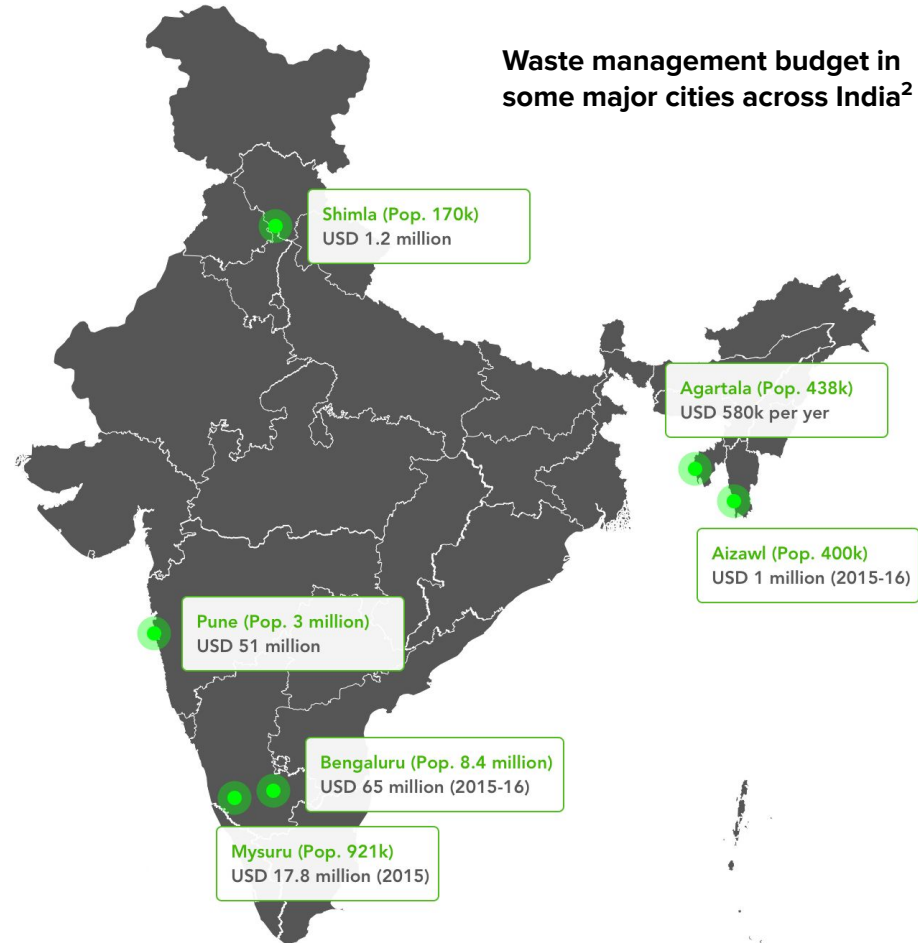
According to the World Bank and USAID, it is common for municipalities in developing countries to spend **20–50%** of their available municipal budget on SWM, which often can only stretch to serve less than **50%** of the population¹

Waste management budget utilisation²

● Salaries ● Waste Collection ● Waste Transportation



Waste management budget in some major cities across India²

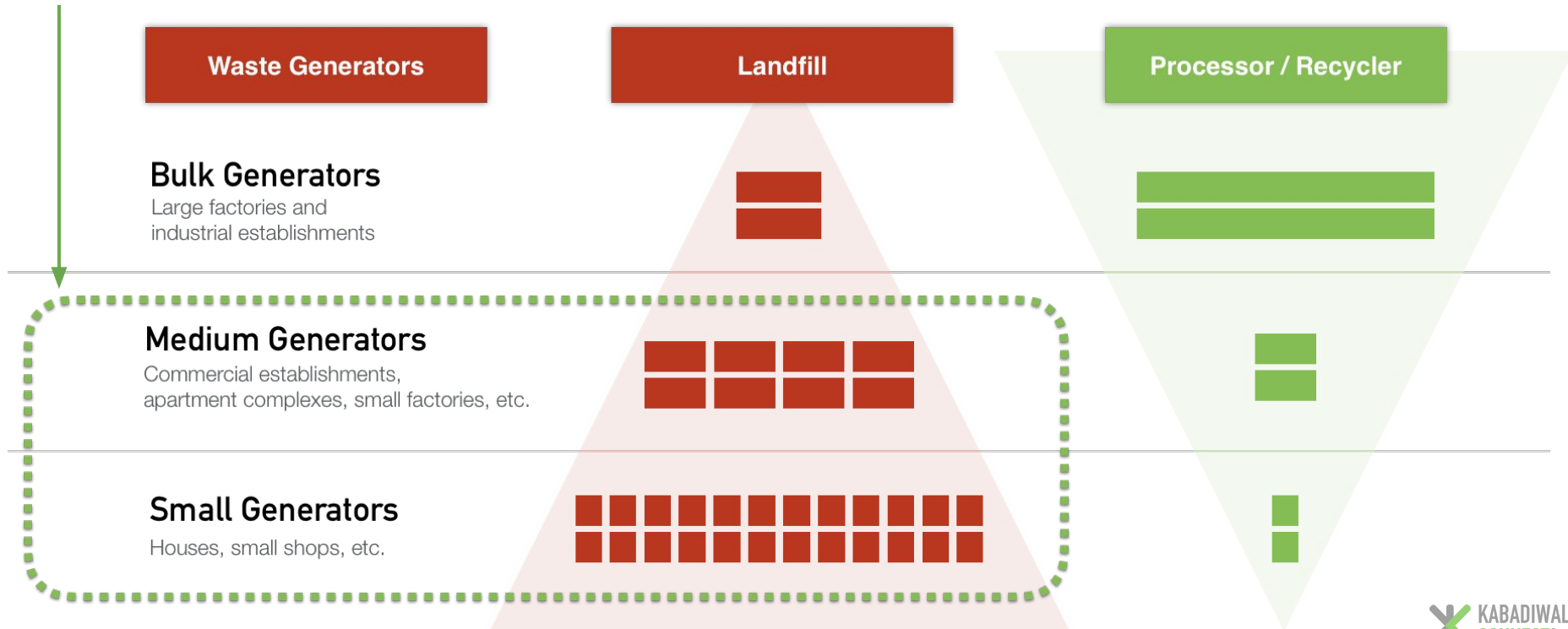


1. https://www.downtoearth.org.in/dte-infographics/57865-clean_your_backyard_2.html

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

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

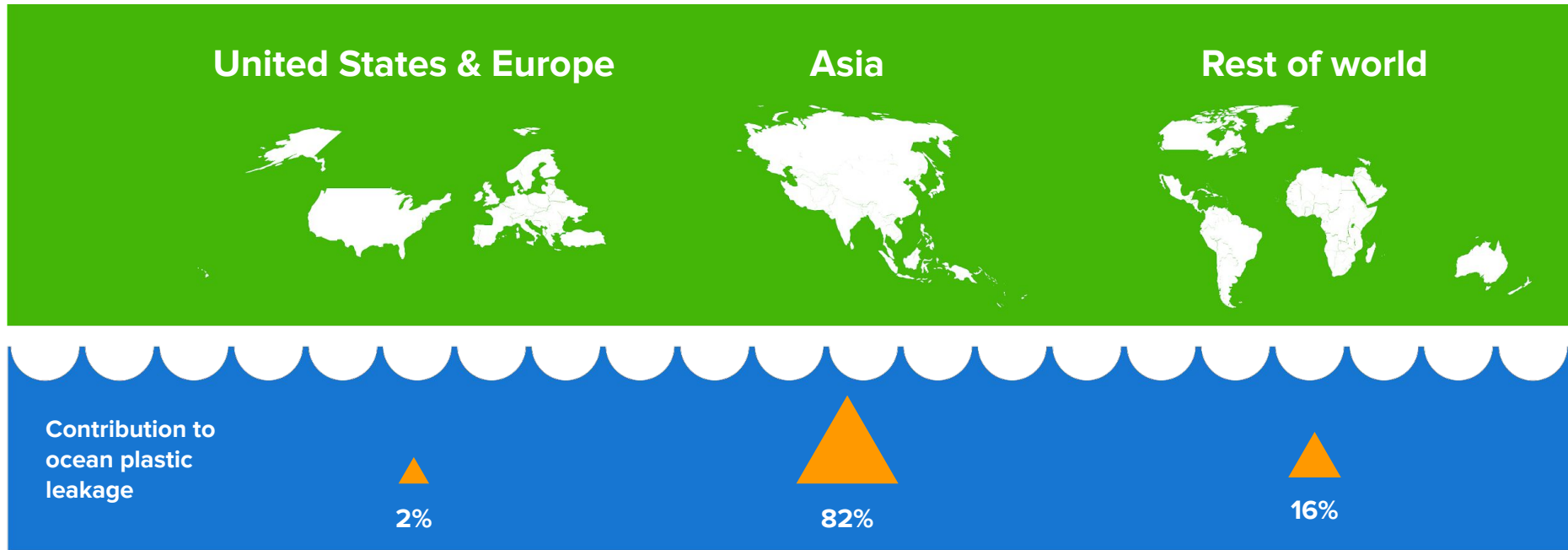
70% of the waste generation in a city like Chennai¹



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%

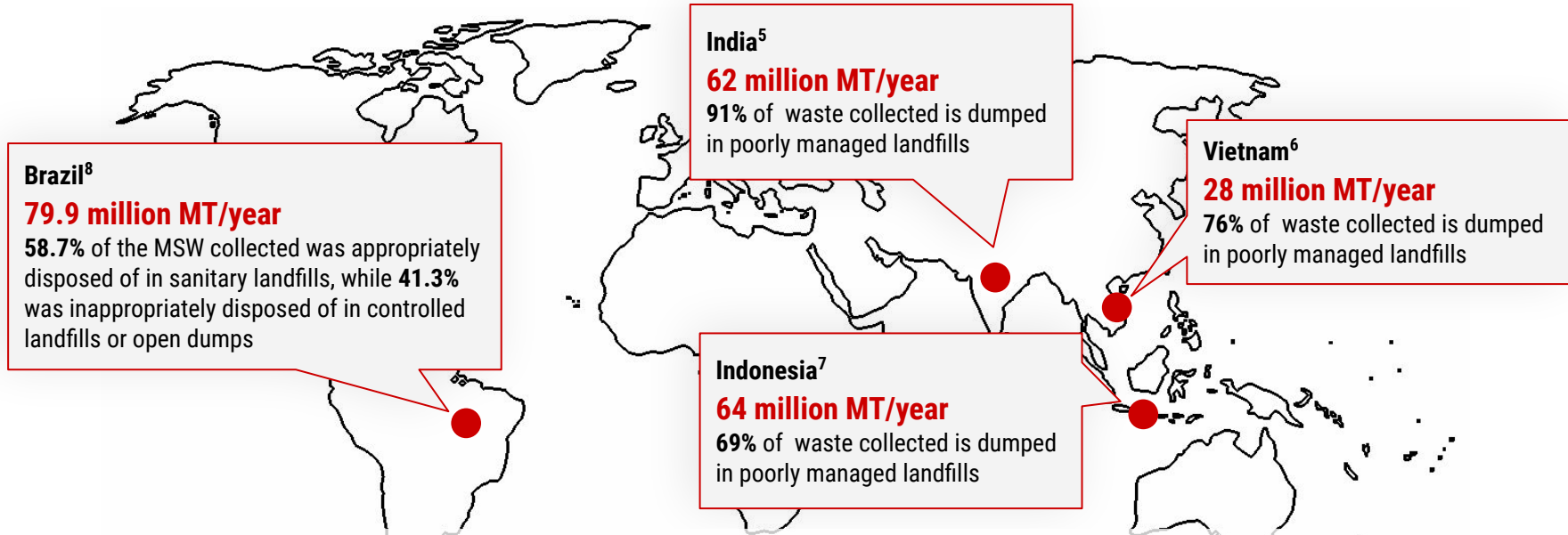
of the municipal budget is spent on waste collection²

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/Volumes3_English_PDF/Vol3_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.

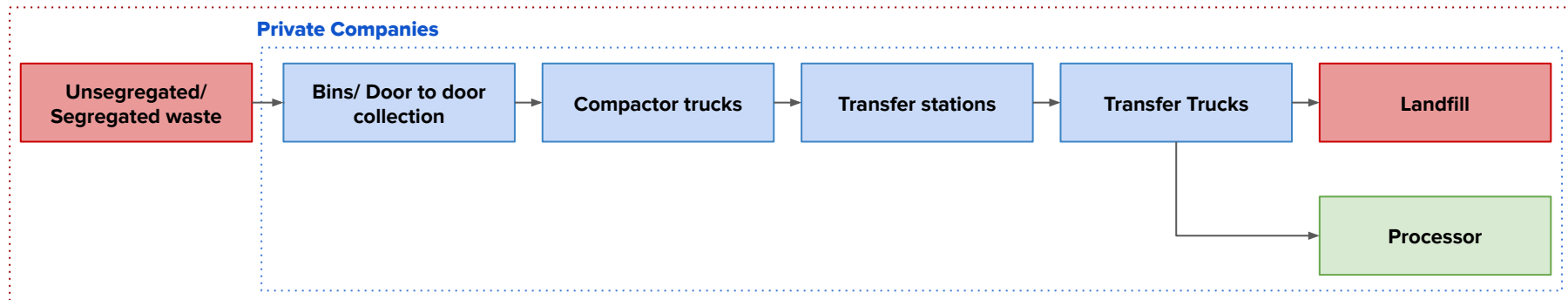
7. Indonesia in state of waste emergency. <https://www.thejakartapost.com/news/2015/10/09/indonesia-state-waste-emergency.html>. Article. Published 2015.

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

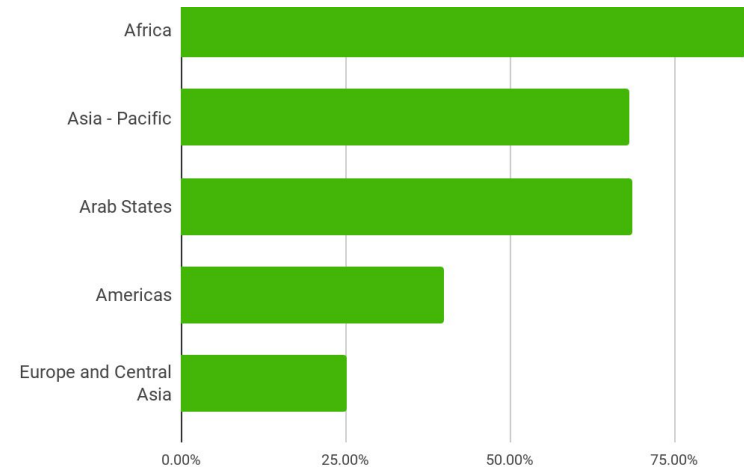
Understanding Informality | Two billion people – more than **61 per cent** of the world's employed population – work in the informal economy.

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 | What we knew before mapping in Chennai

1.5 Million

Waste-pickers across the country¹

20%

Of recyclable materials recovered²

USD 328

Average savings created for municipality per ton (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 [\[Link\]](#)

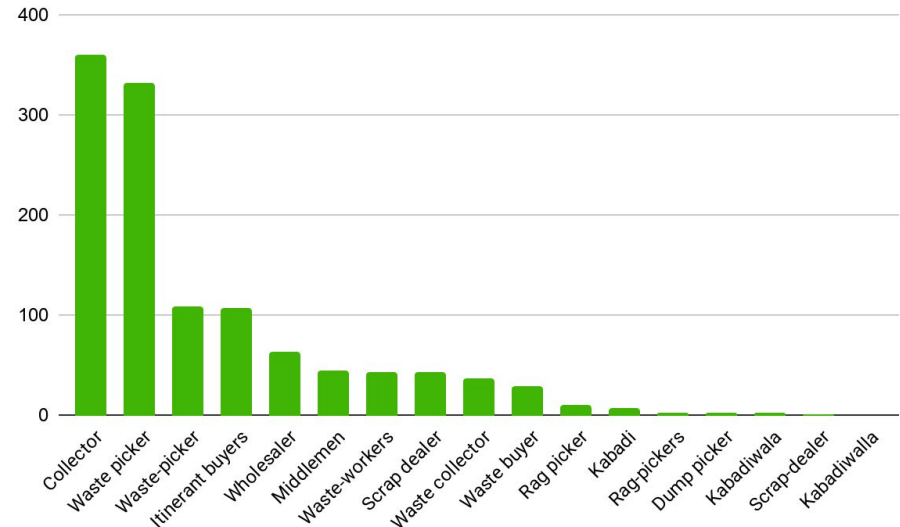
- The informal solid waste management sector is more active and more effective in recovering and valorising resources than the formal one in low- and middle-income countries
- Informal recovery scores considerably better than formal recovery in terms of low or no fossil energy use. This is because many 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

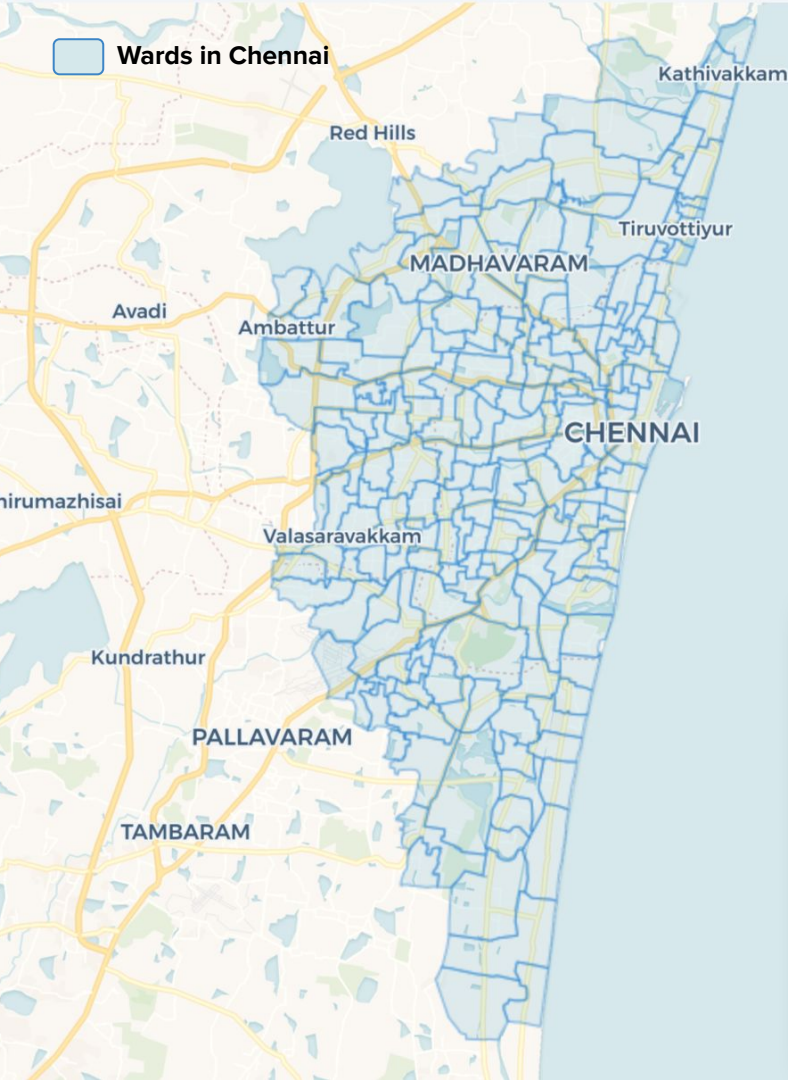
Most studies have focused mainly on waste-pickers when speaking about the informal supply chain, leaving out the informal small scrap shops and large scrap shops. Currently, there is no standardised naming conventions that refer to the different players in the informal supply chain



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



Wards in Chennai

In 2017, Kabadiwalla Connect won a grant from Global Partnership for Sustainable Development Data (GPSDD) to map Chennai's informal waste supply chain

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



Chennai mapping pilot | in brief

The company began a street by street mapping activity to find and enumerate in a 'census style' approach, stakeholders who work in Chennai's informal recycling supply-chain. Over 2500 unique stakeholders were identified and surveyed.

Project Timeline



Key Insights

Identified **3 clear typologies** of informal stakeholders in the supply chain and who were responsible for sourcing back about **130k tons** of recyclable waste every year.

Key Results

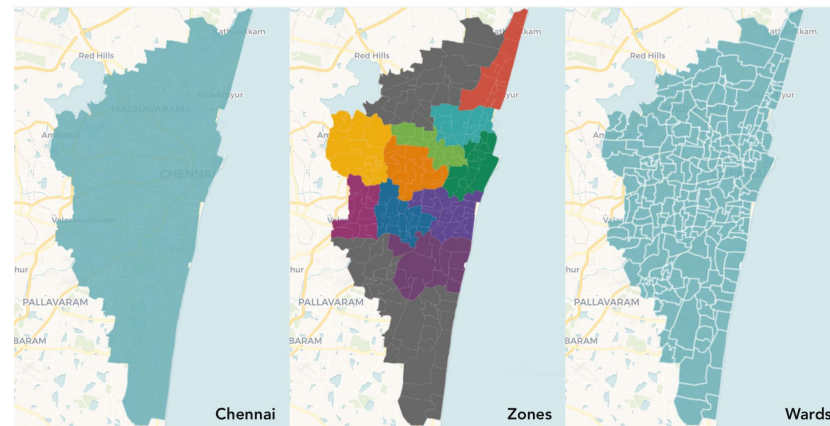
319
Waste-pickers
enumerated (L0)

1969
Small aggregators
enumerated (L1)

280
Large aggregators
enumerated (L2)

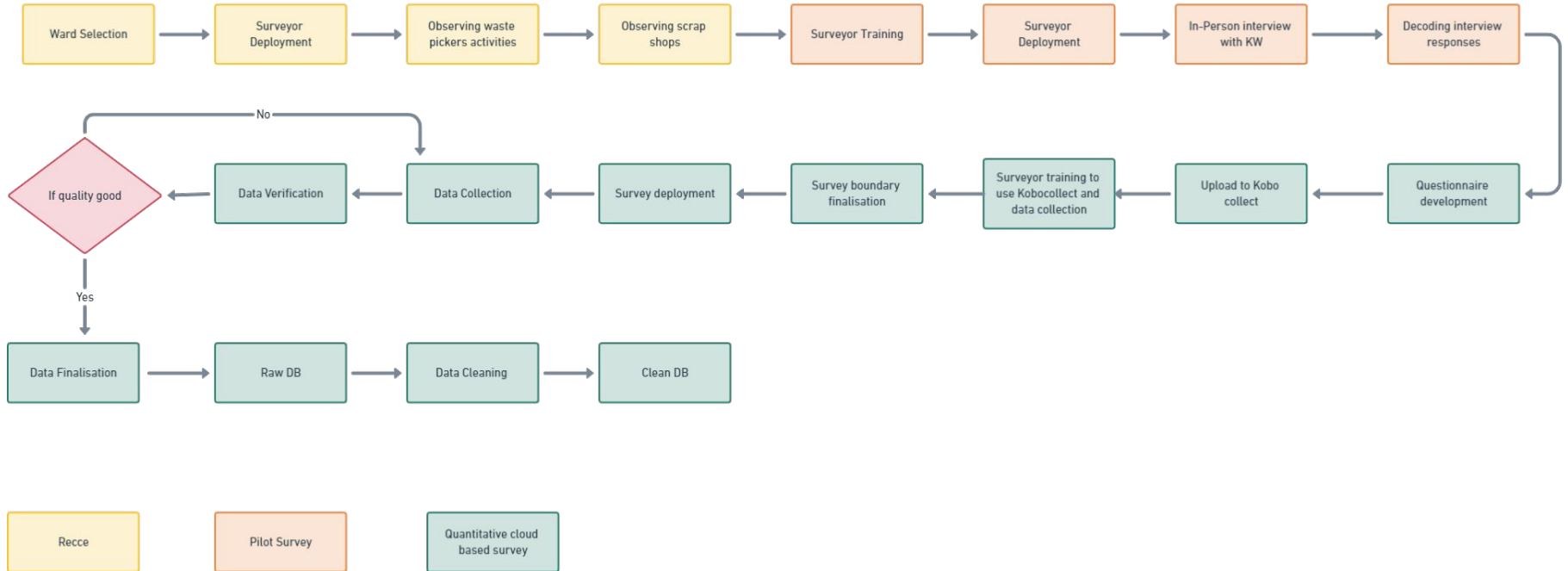
Methodology

- The survey was conducted in Chennai, which is the 6th most populous city in India with a population of 7.5 million
- The city is governed by the Greater Corporation of Chennai (GCC) covering an area of 426 sq. km
- A ward is a local authority area, typically used for electoral purposes. Wards are usually named after neighbourhoods, thoroughfares, parishes, landmarks, geographical features and in some cases historical figures connected to the area. The smallest administrative unit of Gram Panchayats in India is also known as a ward. In Chennai, there are about 200 of them.
- The survey was conducted at each and every ward of the city

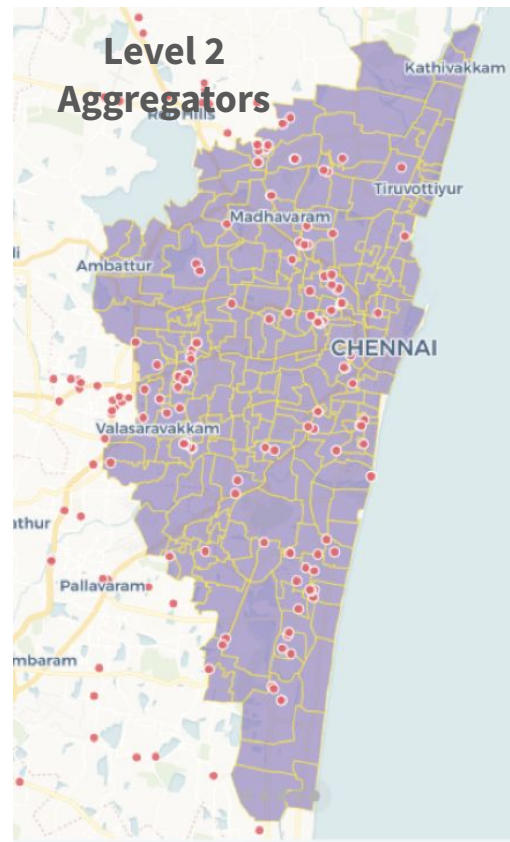
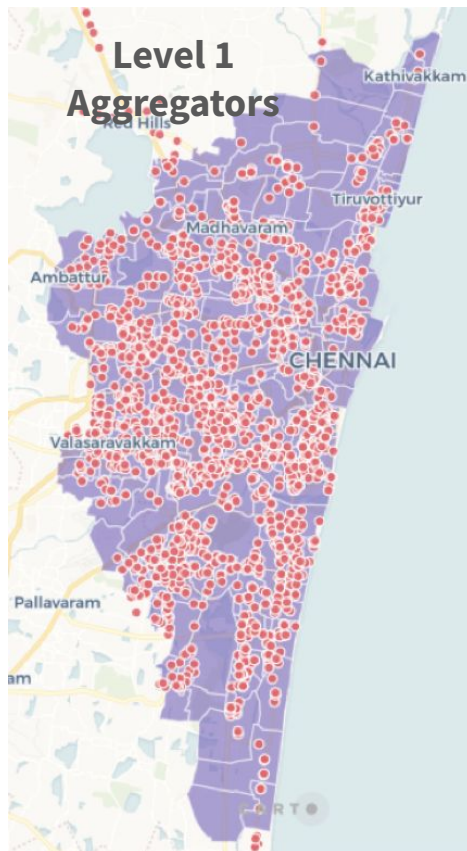


Methodology

Survey Methodology



Geographical spread of informal sector stakeholders enumerated



Kabadiwalla Connects classification of the Informal Sector in India

Level 0 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: 307 kg/month

Material currently sourced: Paper, Plastics, Glass, Metal

Level 1 Aggregators (Small Scrap shops)



Informal sector workers who have a storage space and aggregate material from L0 aggregators 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: 127 sq. ft

Average monthly income: \$384

Smartphone: 49 %

Average Volume: 9293 kg/month

Level 2 Aggregators (Large Scrap shops)



Informal sector workers who buy material directly from L1 aggregators 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: 5213 sq. ft

Average monthly income: \$955

Smartphone: 69 %

Average Volume: 45,966 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.

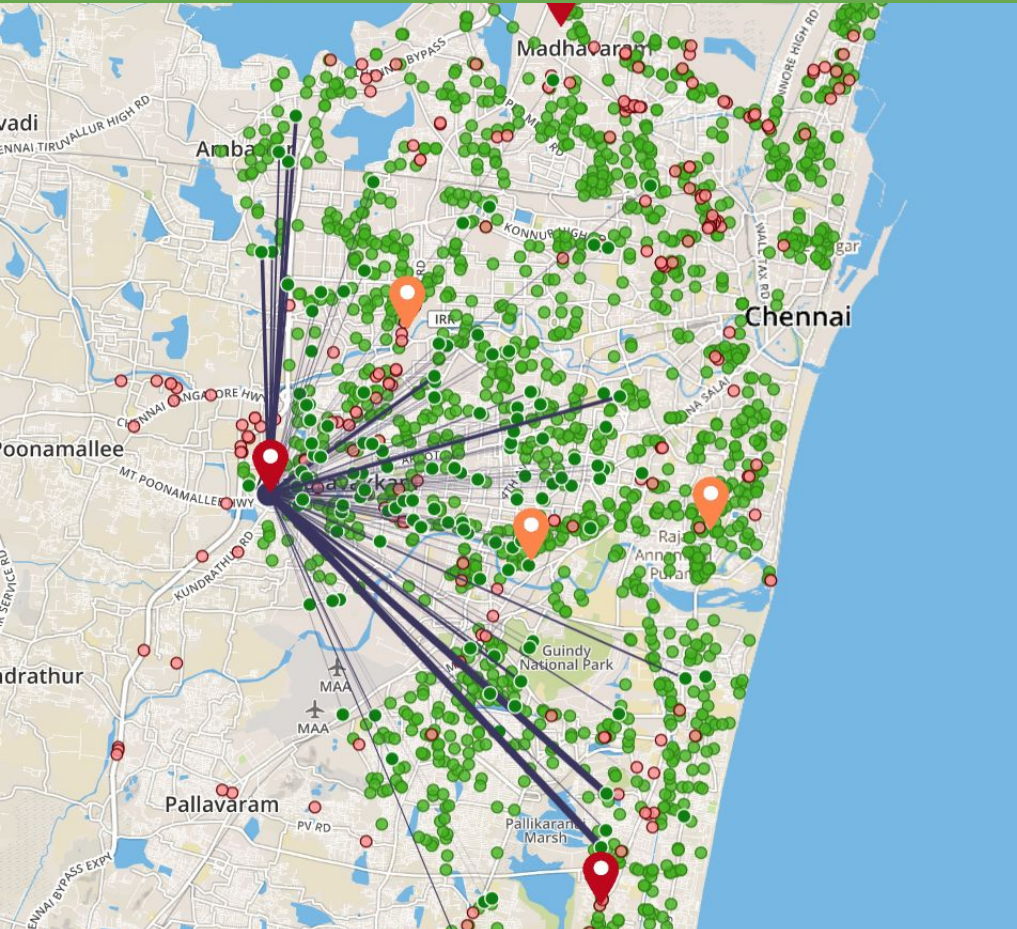
Material Source: L2 Aggregators

Procurement Philosophy: Specialised Material

Tech Adoption: High

Processing: End of life recycling of the material

A summary of the volumes handled by Chennai's informal recycling sector



Total recyclables generated in the city: 542,000 tons/year
Total Recyclables collected by IS: 130,000 tons/year (24%)

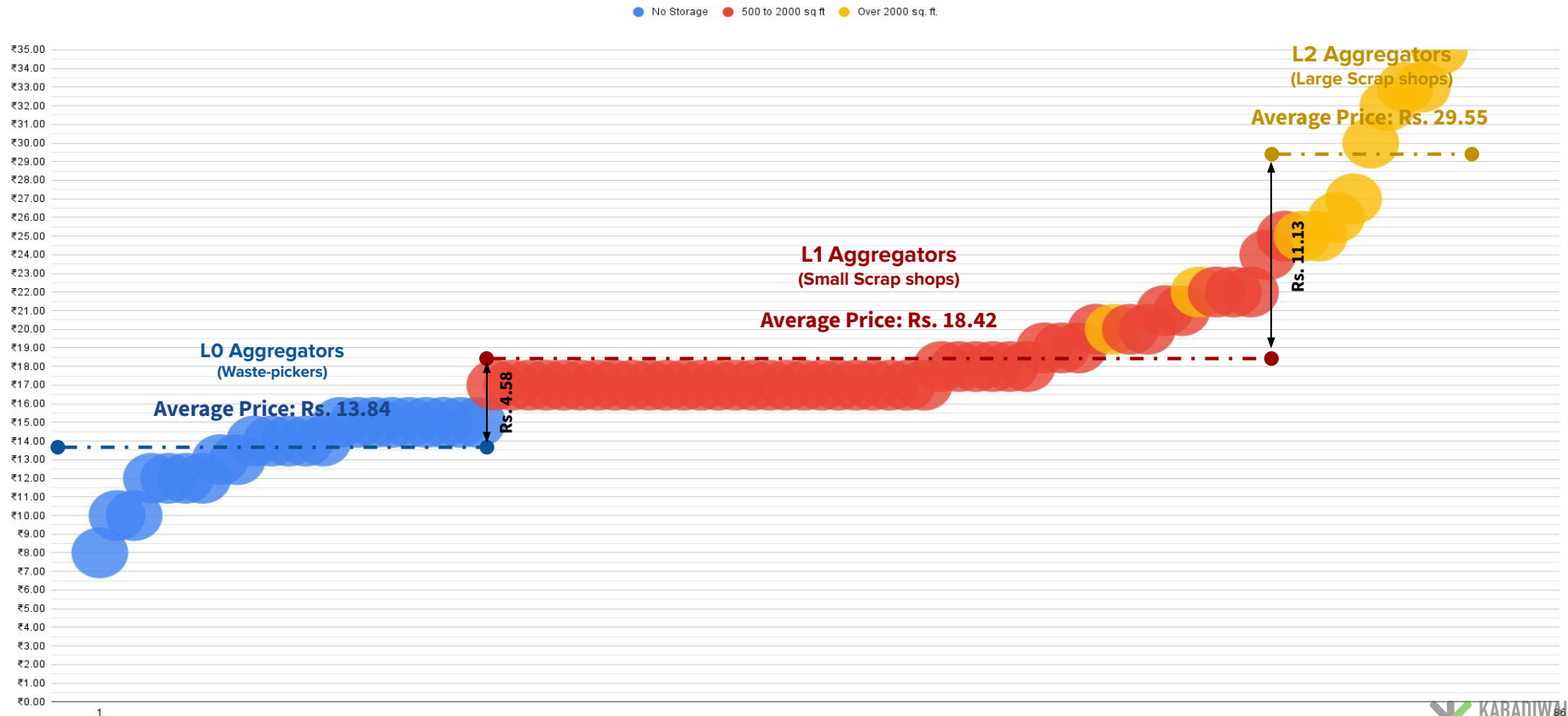
Material types and volumes

Material	Volume recovered (tons/year)	Volume generated(tons/year)	Recovery %
Paper	42000	136875	30.68%
Plastic	20000	205313	9.74%
Glass	30000	114063	26.30%
Metal	38000	22813	166.58%
Total	130000	479063	27.14%

Plastic types handled

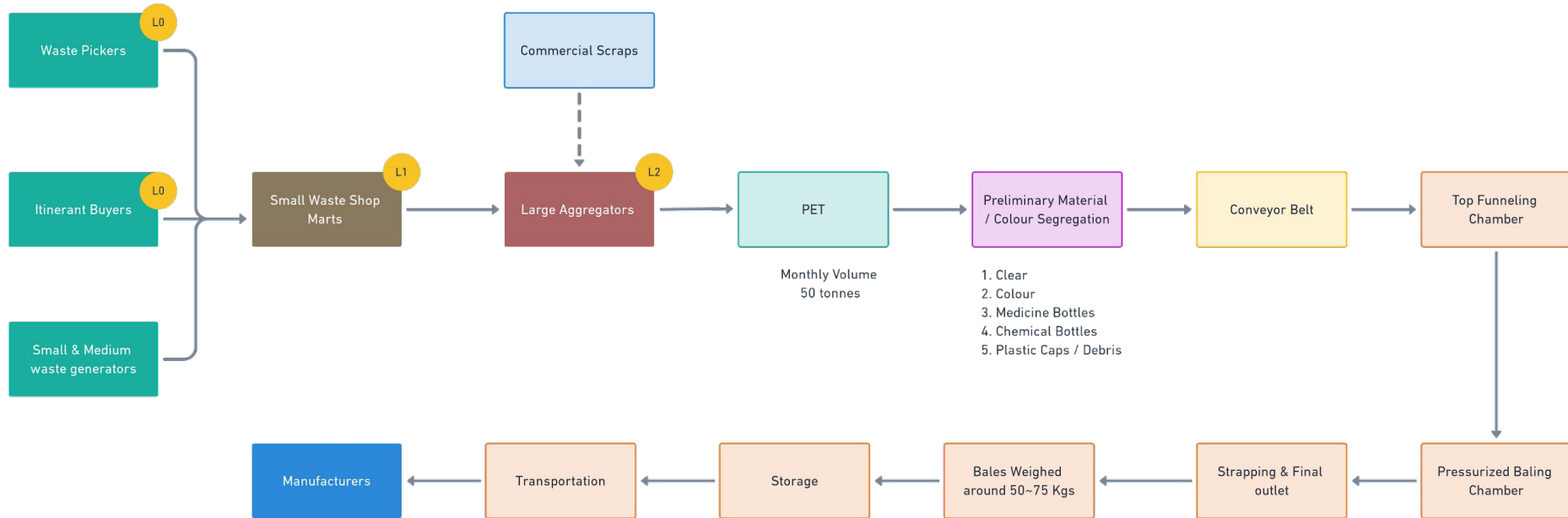
- **PP & PE** (Called *Bomma* by the informal sector and includes detergent bottles, lubricants & toiletries containers, milk packets, and LD Covers etc)
- **PET** (Called as *PET* by the informal sector and includes water & soft drink bottles and 20L water cans)
- **ABS/HIPS** (Called *Odappu* by the informal sector and includes plastic parts covering appliances such as TV, AC, Washing Machine, Fridge etc.)
- **PVC** (Called *PVC/hard piece* by informal sector and includes PVC pipes, PVC joints, electric cables insulation layer, water hose etc.)
- **PC** (Called as *CD/PC sheet* by informal sector and includes roofs made of polycarbonate, CD, DVD, Blu ray discs)

Example | Price differentiation of PET in Chennai's informal supply chain



*Based on data curated between December 2017 and February 2018

Example | Material Flow of PET in Chennai's informal supply chain



1. Tiles & Bath Fittings Manufacturers
2. Non-food grade bottles manufacturers
3. Industrial Strap Manufacturers
4. Automotive Parts
5. Cement Industries.
6. Textiles Industries.



(Clear & Mixed Colour bales)

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The informal waste sector: a solution to the recycling problem in developing countries

Siddharth Hande

p. 28-35

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Abstract

The recovery of post-consumer waste in cities in the developing world is driven by the informal ecosystem. Kabadiwalla Connect, a technology-based social enterprise based in Chennai, has determined that leveraging the informal ecosystem of urban waste recyclers has the potential to decrease the amount of waste sent to landfills in Indian cities by 70 percent.

In the current scenario, municipalities, multinational brands, and waste management companies struggle to work effectively with informal stakeholders – despite increasing evidence of the commercial, environmental, and social benefits of forming mutually beneficial partnerships. Through a unique business process and award winning technology, Kabadiwalla Connect integrates the informal ecosystem into the reverse-logistics supply chain, helping municipalities, brands, and waste management companies

Example of use of data |

KC ↔ Veolia Proof of Concept in Semarang, Indonesia

Working with Informal Collection Centers

Veolia aims to empower waste management's front line workers, like waste pickers, and people working in the informal collection sector to have a better livelihood, access to training and better working conditions.

Veolia is currently working on two main programs:

- Inclusive Recycling Indonesia program**, with Danone Ecosystem, Danone Aqua, YPCII and Veolia.
- VSI Sustainable collection center program** by Veolia.



Proposed integration pathway for the informal waste sector in urban India

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

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 compliance is also an key step in formalisation of the supply chain.

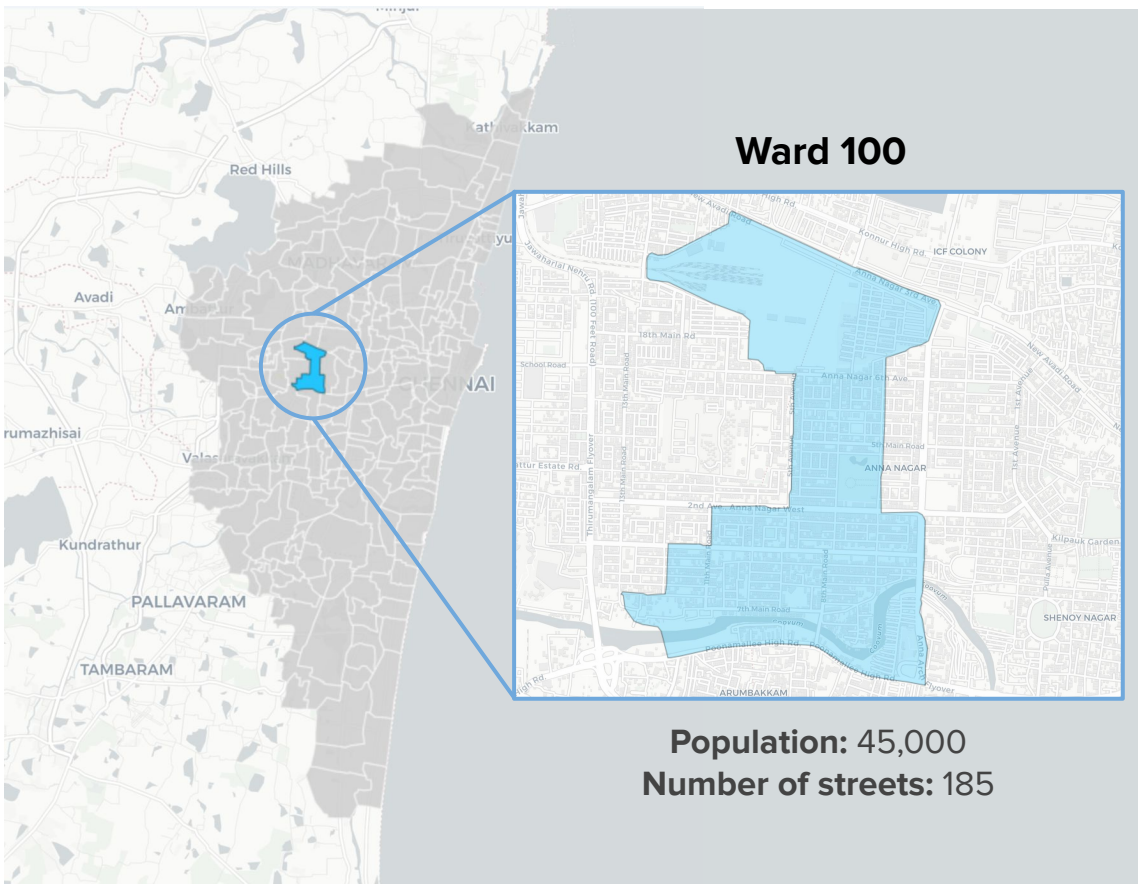
Potential to Scale

Informal sector dominates the collection of post-consumer recyclables in many cities in the Global South, and KC can help catalyze inclusive and compliant integration in these regions.



An example of inclusive ward based integration strategies | A case study of Ward 100 in Chennai

Detailed below is an 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:

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

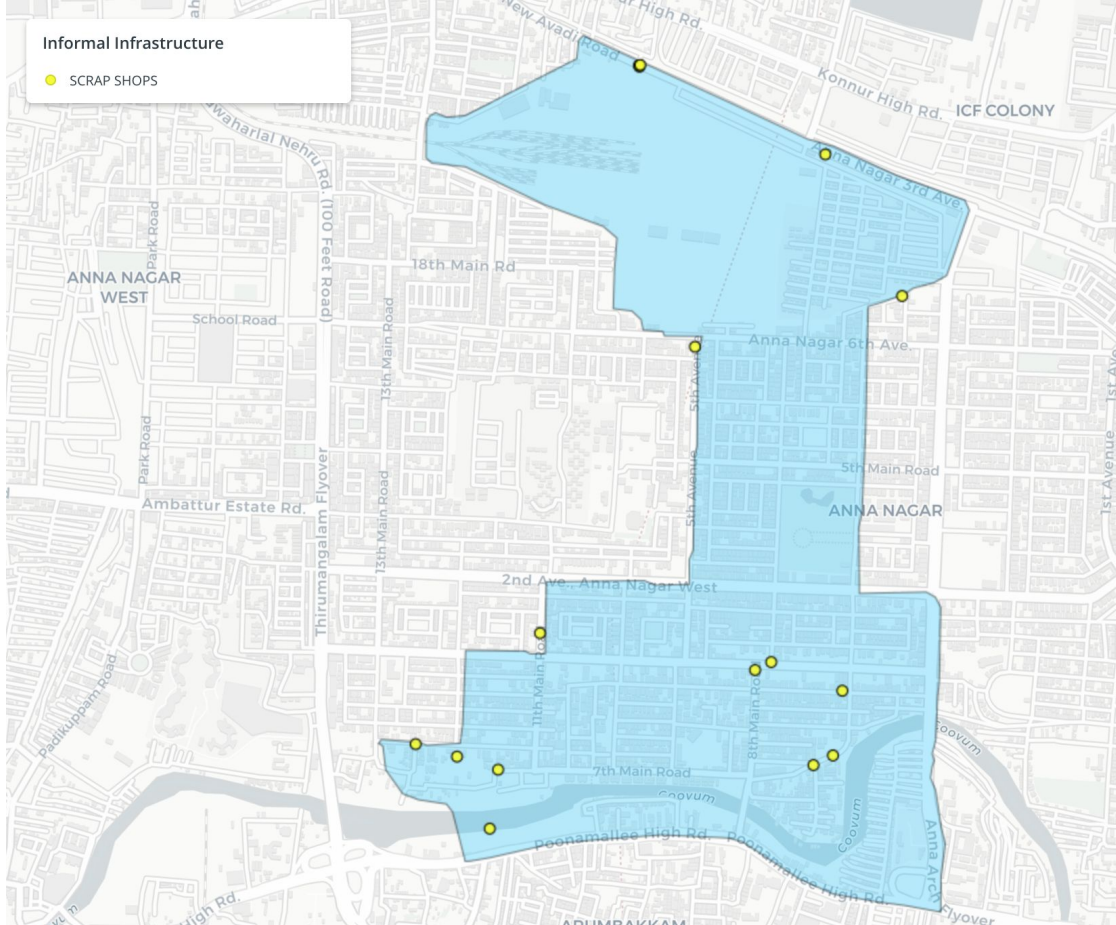
Bio Gas Plant

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 **12 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