Construction and Demolition Waste

A Case Study by Okapi Research and Advisory

An Overview

This case study focuses on developing a comprehensive understanding of the current state of local Construction and Demolition Waste (CDW) management and governance in Chennai. Specifically, it explores gaps in the current practices of Construction and Demolition Waste Management (CDWM) and identifies opportunities for possible technology intervention to better assist stakeholders in CDWM for the city.

This study encompasses crucial observations and findings derived from a combination of secondary literature review, policy analysis, and primary research involving field visits and interviews with stakeholders in CDWM in Chennai.

In terms of field visits, the Okapi team conducted site visits to some zonal secondary collection points and two recycling plants that are being handled by The Premier Precision Surfaces Pvt. Ltd (PPS) and WeStart respectively. Both companies are private contractors tasked by the Greater Chennai Corporation (GCC) with CDWM in selected zones in Chennai.[1]

These visits were key to understanding the on-ground reality of waste flow and stakeholder involvement. The site visits involved, a) detailed interviews with site managers and on site workers to understand the reporting method, surveillance, collection, transportation and processing of CDW and b) direct observation of the site, ticketing processes followed, equipment used, unloading of waste including making note of the site area and location which could affect their accessibility.

Additionally, in person interviews were conducted with a range of stakeholders including representatives from GCC, PPS, WeStart, Pollucare, the PMC, academics, and civil society.

Despite existing government regulations, a significant gap persists between policy and on-ground waste management operations. The primary method of estimating waste generation relies on built-up area, making waste characterization challenging. Illegal dumping by generators poses a substantial challenge, acknowledged by representatives from both GCC [2] and PPS[3], the private contractor involved in CDWM.

Importantly, the existing government policy and guidelines overlook the participation, recovery rates, and existing infrastructure of the informal waste market due to lack of clarity and oftentimes due to lack of funding and manpower to carry out governance. Bridging this regulatory - implementation gap necessitates refining waste characterization, addressing illegal dumping, and recognizing the crucial role of the informal waste sector for a more effective and sustainable waste management approach.

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[1] "Local Bodies | Chennai District | India." n.d. https://chennai.nic.in/about-district/administrative-setup/local-bodies/.

[2] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023

[3] Interview with Premier PPS representative. Interview. Conducted by Akshaya Ayyangar. 11 October 2023.

What is CDW?

According to the Construction and Demolition (C&D) Waste Rules 2016, ‘any waste comprising building materials, debris and rubble resulting from construction, remodeling, repair and demolition of any civil structure is classified as CDW’[4].

CDW also comprises renovation material, excess construction material, damaged products, personnel safety equipment / wearables and product packaging arising out of on-site activities at the construction site[5].

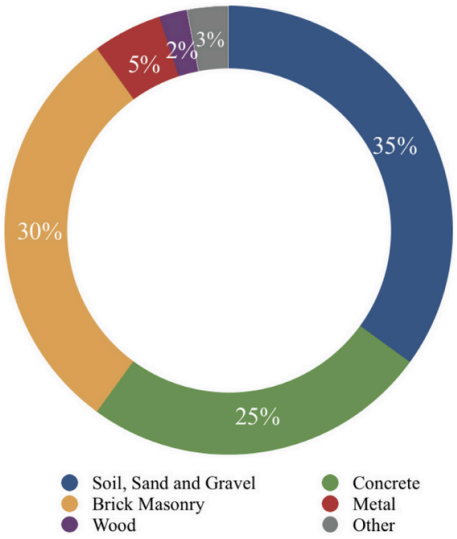

Fig.1 Different constituents of CDW in percentage;
Source : Mayur Jain, 2021[6]

Current Status in India

Significant quantities of CDW is being generated in India. Yet there is no consensus on the actual quantity generated which varies between 10 million and 750 million tonnes per year (Table 1). This raises concerns about the accuracy of the data [7] [8]. According to a CDW factsheet developed by the Centre for Science and Environment (CSE)[9], official figures of CDW generated are based on estimates which quantify CDW as 25% of municipal solid waste collected.

[4] C&D_rules_2016.pdf
[5] waste_matters_construction_waste_handbook.pdf
[6] Fig 2.2, Pg 5 C&DinIndia.pdf
[7] Another Brick of the Wall
[8] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[9] C&D waste factsheet

Table 1: Estimates of CDW generated In India by different studies across the years; Source: CSE 2019[10]

Year	Authority/institute	Estimate (million tonnes per year)
2000	Ministry of Urban Development	10–12
2001	Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science and Technology	12–15
2010	Ministry of Environment and Forest	10–12
2013	Centre for Science and Environment	530
2014	Ministry of Urban Development	No estimates exist
2015	Ministry of Urban Development	10–12
2015	Development Alternative and GIZ	750
2016	Ministry of Environment, Forest and Climate Change (Press release announcing C&D Waste Rules 2016)	530
2017	Building Material and Technology Promotion Council	165–175

In Chennai, GIZ and DA[11] (2015) estimate the CDW generated at 2500 TPD or 0.75 MT per year. According to the NITI Aayog[12] this number reinforces the TIFAC 2001 estimate as an under-estimation[13] highlighting the issue of lack of accurate data.

Table 2: City-wise estimation of CDW generated; Source: GIZ and DA, 2015[14].

City	Population (Census 2011)	Daily CDW generation (tonnes/day)	Annual CDW generation* (million tonnes/annum)
Mumbai	12,442, 373	2,500	0.75
Delhi	16,787, 941	4,600	1.38
Bengaluru	8,443, 675	875	0.26
Chennai	6,500,000	2,500	0.75
Kolkata	4,496, 694	1,600	0.48
Jaipur	3,471, 847	200	0.06
Patna	2,514, 590	250	0.08
Ahmedabad	6,063, 047	700	0.21
Bhopal	1,917,051	50	0.02
Coimbatore	2,618,940	92	0.03

*Daily generation has been multiplied by 300 to calculate annual generation since CDW generation is not constant throughout the year, almost disappearing during the monsoon rainy season

The biggest challenge in estimating CDW generated is that some of this waste is not accounted for as it does not enter into the municipal system and is collected by the informal sector[15]. This makes the estimation of CDW as 25% of the total municipal waste inaccurate. Infact, GIZ and DA[16] (2015) report that approximately 10% of the total CDW is routed to the informal waste

[10] C&D waste factsheet
[11] Resource Efficiency in the Indian Construction Sector
[12] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[13] C&D waste factsheet
[14] Resource Efficiency in the Indian Construction Sector
[15] Thesis -Ram- Final (1) (1)-2.pdf
[16] Resource Efficiency in the Indian Construction Sector

sector for recycling / repurposing. Even then, planning adequately for handling the rest of the CDW will be difficult unless the total quantity per project is estimated accurately.

One way to better estimate CDW generated per project is by issuing demolition permits separately, instead of combining renovation, construction, and demolition activity into a single permit[17]. Issuing demolition permits creates an opportunity for better CDW estimation as the demolition activity accounts for much of the CDW generated, is separated out[18]. NITI Aayog, in their draft strategy for CDWM from 2018, mentions that there is no formal permit for demolition activities and it is taken care of informally. Recoverable / recyclable material is salvaged by the informal waste sector[19] leaving behind “rubble” which is characterized as concrete, stones, brick, mortar etc. Only 10 - 30% of this rubble is used for back-filling in private and government projects while the rest is disposed of illegally or in dumpsites[20]. TIFAC's 2001 assessment also highlights the potential to recover up to 25% of waste from old buildings and 75% from new buildings for reuse[21] from demolition activities. Despite currently issuing separate demolition permits, Chennai does not leverage the additional data to better estimate CDW with critical implications for the provision of services required in next stages of CDWM such as transportation, processing and recycling.

The current recycling capacity in India, according to official estimates is a meager 6500 TPD, which is about 1.3% of the total Building Materials & Technology Promotion Council (BMTPrecycling unitsC) estimate of 150 million tonnes CDW per year[22]. This is reflected in the finding by CSE that only about 13 out of 53 cities have installed recycling units. Among the cities, Delhi is closer to matching its CDW processing capacity to CDW generation with current installed capacity being 5150 TPD[23].

As mentioned earlier, the informal sector plays a significant role in CDW processing receiving about 10% of total CDW being generated. Therefore leveraging their existing operational pathways, actors and infrastructure should be considered for developing an effective and inclusive CDWM system[24] [25]. For example, studying the established connections between the demolition industry and the informal waste sector[26] could prove to be an effective step forward in planning for the required infrastructure for CDW processing.

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[17] Resource Efficiency in the Indian Construction Sector
[18] Resource Efficiency in the Indian Construction Sector
[19] Thesis -Ram- Final (1) (1)-2.pdf
[20] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[21] “India Manages to Recover and Recycle Only about 1 % of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis.” n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[22] “India Manages to Recover and Recycle Only about 1% of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis.” n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[23] Guidance Framework for Better C&D WM
[24] “India Manages to Recover and Recycle Only about 1% of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis.” n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[25] waste_matters_construction_waste_handbook.pdf
[26] Another Brick of the Wall

Why is CDWM a Challenge?

Several roadblocks[27] [28] impede effective CDWM. Importantly, variations in construction materials, practices, city plans and demographics hamper waste characterisation which greatly inhibits planning for the required recycling infrastructure needed to process / handle the different materials in CDW. Personnel from Pollucare Engineers India Pvt. Ltd. (Pollucare), a Project Management Consultant (PMC) hired by the GCC, mentioned that the CDW is mixed with contaminants from municipal waste which cannot be processed and needs to be manually separated[29] [30]. Currently in Chennai, CDW is processed in WeStart's Kodungaiyur and Perungudi plants in two streams (wet and dry) with manual intervention to separate contaminants like metal and plastic[31].

Additionally new age materials pose several recycling challenges and add to the load of effective waste characterization and subsequent processing. These include low-density bulky materials with high transport costs and difficult to recycle epoxy adhesives[32].

Another significant challenge is related to the lack of active coordination among key government entities such as the Public Works Department (PWD), Housing Development Board/Authority, City Development Authorities, and other public sector utility companies actively engaged in substantial construction and demolition (C&D) activities[33]. In Chennai, this problem persists as confirmed by a PMC official that CDW from government projects is not directed to the designated WeStart processing units. This discrepancy is attributed to the absence of a formal system outlining the flow of CDW to designated secondary collection points or processing units, despite the government agencies being responsible for managing their own waste.

Furthermore, the absence of a streamlined process is apparent in the lack of flow of recycled materials back into government projects, with the PWD not providing clarity on the permissible amount of such materials for use[34]. Government projects, in particular, face hurdles due to complicated paperwork associated with the utilization of recycled materials[35]. Recycled materials are also taxed at a higher rate than new materials - at about 18% GST[36] [37]. And although it was found by earlier studies[38] [39] that the actual cost of material produced using CDW is lower than the cost of new material, this higher GST rate seems to increase the overall cost of the recycled material. A revision in the GST rate could bring the price of the recycled material to

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[27] Resource Efficiency in the Indian Construction Sector
[28] "India Manages to Recover and Recycle Only about 1% of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis." n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[29] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[30] Site_Visit_Report_PPLtd.pdf PPS representative. Interview. Conducted by Parama Roy. 3 November 2023
[31] WeStart Kodungaiyur + PPS zone 13 Site Visit + shadowing Field visit. By Ashwaini and Ramchandran. January 2024
[32] "India Manages to Recover and Recycle Only about 1 % of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis." n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[33] "India Manages to Recover and Recycle Only about 1% of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis." n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[34] GCC Meeting Dec 19, 2023 PPS representative. Interview. Conducted by Parama Roy. 10 December 2023
[35] Interview with Premier PPS representative. Interview. Conducted by Akshaya Ayyangar. 11 October 2023
[36] "India Manages to Recover and Recycle Only about 1 % of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis." n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[37] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[38] Utilisation of Recycled Produce of Construction & Demolition Waste A ReADy ReCkoneR
[39] Resource Efficiency in the Indian Construction Sector

a much more competitive range, thereby encouraging both private and public sectors to actively use the material in their projects.

Inadequate resources further complicates efforts to streamline processes. Field assessments by CSE[40] revealed that Urban Local Bodies (ULB) face challenges in both human and financial resources, leading to unreliable and inefficient monitoring of CDW. This resource constraint hinders the enforcement of regulations, given the labor-intensive nature of these activities. The inadequacy significantly contributes to current underestimations due to a lack of thorough on-ground monitoring, worsening infrastructure gaps and interdepartmental coordination essential for effective CDWM. A GCC official also acknowledged enforcement issues within government departments, highlighting a general lack of awareness and the absence of a proper monitoring system for CDW[41].

Despite policy mandate on cities to build CDW processing facilities, limited land availability has been a bottleneck faced by many cities[42]. Recycling initiatives face opposition from residents due to concerns about land value, proximity of noxious facilities[43], outdated zoning by ULBs, and ecological sensitivity of remaining available land[44]. In cities like Kolkata and Gurugram, environmental agencies have halted recycling unit constructions in ecologically sensitive areas due to violations. This intensifies the challenge of establishing necessary infrastructure for recycling. Without viable alternatives, cities grapple with environmental degradation due to the mishandling[45] and illegal dumping of collected CDW[46].

While the 2016 CDWM rules had mandated that cities set-up their own processing units, Chennai took a considerable amount of time[47] before implementing the rules through a private partnership with WeStart. Despite the operational status of these recycling units, there are ongoing concerns regarding non-compliance with contractual obligations.

Inevitably, the environment bears the brunt of these shortcomings in CDWM. The construction industry, not being able to meet development demands[48] with recycled material, relies on virgin sources like sand, soil, stone, and limestone[49] [50]. Importantly, fugitive air pollution[51] [52] due to improper waste handling and disposal has become a persistent concern that impacts overall air quality[53]. Illegal dumping of CDW in water bodies exacerbates flooding and disrupts the aquatic ecosystems by compromising flora / fauna through direct contamination and through long term effects on groundwater quality[54] [55].

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[40] Guidance Framework for Better C&D WM
[41] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[42] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[43] Thesis -Ram- Final (1) (1)-2.pdf
[44] Guidance Framework for Better C&D WM
[45] Utilisation of Recycled Produce of Construction & Demolition Waste A ReADy ReCkoneR
[46] "India Manages to Recover and Recycle Only about 1% of Its Construction and Demolition (C&D) Waste, Says New CSE Analysis." n.d. https://www.cseindia.org/india-manages-to-recover-and-recycle-only-about-1-per-cent-of-its-construction-and-demolition-10326.
[47] Thesis -Ram- Final (1) (1)-2.pdf
[48] waste_matters_construction_waste_handbook.pdf
[49] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[50] Resource Efficiency in the Indian Construction Sector
[51] Interpretation of the Definition of Fugitive Emissions in Parts 70 and 71
[52] AP-42, CH 13.2: Fugitive Dust Sources
[53] Another Brick of the Wall
[54] Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products
[55] WASTE-WISE CITIES

Policy Attention

The CDW rules of 2016[56] serve as a guiding compass, offering a comprehensive overview of stakeholders, criteria for site selection for CDW storage / processing, and disposal norms. There are itemized responsibilities enlisted for the various stakeholders with clear duties of actors like the waste generators, contractors, and the local governing authorities. Particularly, the rules mention that the state and regional government bodies are responsible for devising custom waste management plans, identifying land and setting up recycling units for managing the CDW generated in their jurisdictions.

However, a notable void[57] exists in the on ground implementation of the 2016 CDWM regulations as confirmed by field visits and interviews conducted by Okapi. This gap is evident in the ongoing research of a PhD scholar[58] who also observed that the introduction of digital technology and region-specific policy into the CDWM process could prove to be of benefit.

A region specific policy is also paramount to address the various differences in construction practices, materials and methodologies which vary widely from northern to southern locations in India. These practices impact the quantum of CDW generated and the amount that is recoverable for reuse. As noted in the study by GIZ and DA, machine assisted demolition is prevalent in the southern cities like Chennai and Bangalore while in northern regions manual demolition takes place. This is because the demolition activity is time bound and the quality of material used for construction is also poor. So there is minimal attempt made to recover the material used in the original construction[59].

Additionally, understaffed ULBs struggle with day to day monitoring and enforcement of fines, as corroborated by a GCC official[60]. Currently the GCC, which follows the 2017 Environmental Management of C&D Waste Guidelines of CPCB[61], charge generators based on rough estimates of CDW generated based on built up area. They also have plans to include a user fee for CDW within the building approval plan to ensure proper compliance, especially by BWGs.

At present, the onus of proper disposal of large quantities of CDW is placed on the BWGs even within the public sector departments like the PWD. This is not always reliable as these BWGs tend to bypass formal disposal channels through illegal dumping to cut down on costs (stipulated fines are from INR 500/- to INR 4000/- per tonne). Smaller generators are encouraged to directly deposit CDW in the designated secondary collection points of each zone. Currently majority of the CDW collection is done through a system of public complaints and contractor surveys of illegal dumping hotspots in the zones[62] [63].

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[56] C&D_rules_2016.pdf

[57] Thesis -Ram- Final (1) (1)-2.pdf

[58] Interview with Hammadhu.docx Academic Interview. Conducted by Akshaya Ayyangar. 28 August 2023

[59] Resource Efficiency in the Indian Construction Sector

[60] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023

[61] GUIDELINES ON ENVIRONMENTAL MANAGEMENT OF CONSTRUCTION & DEMOLITION (C & D) WASTES | Central Pollution Control Board

[62] Ganesh, Geetha. 2023. “Dealing with Construction and Demolition Waste in Chennai.” Citizen Matters, Chennai. September 13, 2023. https://chennai.citizenmatters.in/chennai-77672.

[63] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023

A closer look at Chennai's CDWM

Actors and Process Map

In Chennai, CDW management is a joint effort between government and private entities. The city is divided into several zones with the GCC overseeing zones 1, 2, 3, 7, 11, 12, 14, and 15, and the private contractor PPS managing zones 4, 5, 6, 8, 9, 10, and 13 allocated by the GCC[64]. The private contract mode is Design - Build - Finance - Operate - Transfer and commenced in 2021 for an eight year term. It was confirmed by a GCC official that PPS is actively operating only four of the contracted zones and that WeStart gets paid INR 3000/- per tonne of CDW processed[65].

Both the GCC and PPS employ survey teams to manually monitor their respective zones. They also rely on alerts from conservancy workers and citizens through platforms such as the helpline 1913, Namma Chennai app, geo-tags, and the online Public Grievance Redressal System to monitor CDW in their respective zones[66] [67] [68]. BWGs (that generate more than 20MT of CDW) are responsible for transporting their CDW directly to the secondary sites for a user fee that is charged by the GCC[69]. Occasionally, GCC may also direct PPS to pick up bulk CDW or PPS may also do so with appropriate GCC permission. A PPS representative also noted that technology could aid in efficient planning for these bulk pickups by estimating the quantum of CDW and making it easy to assign the right sized vehicle for the job[70].

Approval for CDW collection is granted exclusively by the GCC. Key personnel like the PPS zone Supervisor, PPS zone Manager and the GCC Assistant Engineer (AE) communicate alerts for CDW dumps and subsequent pickup permissions through Whatsapp. The GCC is also solely responsible for handling fines for illegal dumping, although officials from both the GCC and the PPS confirmed that there is no formal system in place for enforcement. PPS notes that the illegal dumping spots, termed 'hotspots,' are typically near transformers and street garage bins. It should be noted that clearance of CDW dumps in Bus Route Roads (BRR) is done immediately without waiting for the GCC AE's permission[71].

Once the waste has been identified the turnaround time for the pickup is 24 hours[72]. The CDW collected by PPS includes some municipal waste and excavated earth mixed in. This waste is transported by tipper vehicles. Dust pollution during collection, transfer and processing is managed by spraying water[73] [74].

From the secondary collection points the CDW is transported to two recycling plants in Perungudi and Kodungaiyur[75] which are delegated to PPS for maintenance and operation

[64] Interview with Premier PPS representative. Interview. Conducted by Akshaya Ayyangar. 11 October 2023
[65] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[66] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[67] "EGOV- Public Grievance Redressal System." n.d. https://erp.chennaicorporation.gov.in/pgr/.
[68] WeStart Kodungaiyur + PPS zone 13 Site Visit PPS representative. Interview. Conducted by Ramchandran. January 2024
[69] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[70] Interview with Premier PPS representative. Interview. Conducted by Akshaya Ayyangar. 11 October 2023
[71] WeStart Kodungaiyur + PPS zone 13 Site Visit PPS representative. Interview. Conducted by Ramchandran. January 2024
[72] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[73] Site_Visit_Report_PPLtd.pdf PPS representative. Conducted by Parama Roy. 3 November 2023
[74] WeStart Kodungaiyur + PPS zone 13 Site Visit PPS representative. Interview. Conducted by Ramchandran. January 2024
[75] Site_Visit_Report_PPLtd.pdf PPS representative. Conducted by Parama Roy. 3 November 2023

through their sister concern, WeStart. WeStart and PPS representatives mentioned that the amount of CDW transported from secondary collection sites to these processing units (with total processing capacity of 400 TPD) was 250 TPD[76]. The zone wise Key Performance Indicator (KPI) for CDW quantum to be transferred to the recycling units is 75 TPD. In Zone 13, where two five-tonne capacity vehicles operate, our field observations indicate a potential shortfall in achieving the KPI. Each vehicle, with a maximum capacity of five tonnes, undertakes three trips a day for two shifts, totaling 12 trips daily. However, our findings reveal that the vehicles are only filled to about 75% of their capacity. Consequently, the total capacity reaches only 60 TPD, and when factoring in the underutilization, the effective TPD is even lower[77].

At the recycling units, the CDW is processed in two lines, wet and dry with manual segregation done for separating out mixed impurities like plastic and metal. The main recycled products are sand, soil, and aggregates. While the recycled products from the Kodungaiyur plant are only used for filling, the products from the Perungudi plant are used for construction purposes. An official from PPS also confirmed that the Kodungaiyur unit does not have the required chemical processing technology to make recycled products fit for reuse in load bearing construction[78].

The overall management and supervision of the private contractor is the responsibility of the PMC, Pollucare which sets the KPIs, specifies deliverables, and oversees the financial aspects of the contractor[79].

[76] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023
[77] WeStart Kodungaiyur + PPS zone 13 Site Visit PPS representative. Interview. Conducted by Ramchandran. January 2024
[78] WeStart Kodungaiyur + PPS zone 13 Site Visit PPS representative. Interview. Conducted by Ramchandran. January 2024
[79] GCC Meeting Dec 19, 2023 PPS representative. Interview. Conducted by Parama Roy. 10 December 2023

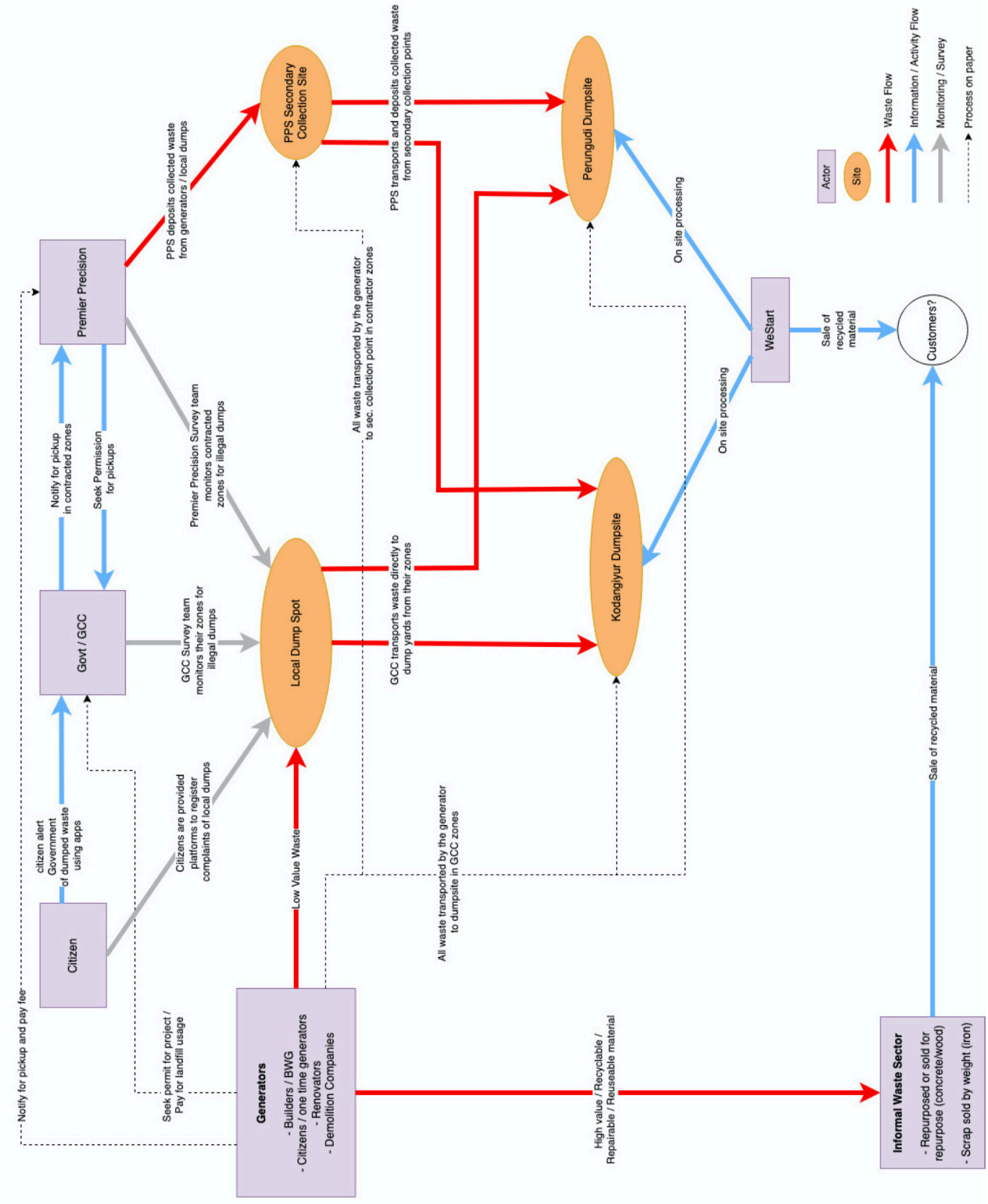

Fig.3 Stakeholder Map and Process Flow, Chennai;
Source : Okapi Research and Advisory, 2023.

On Ground Reality

In the realm of CDWM in Chennai, the significant gap between stipulated procedures and their actual implementation by project holders[80] suggests a potential lack of accountability and awareness within both public and private entities involved in waste generation. The accountability issue is additionally emphasized by a GCC official who proposes the introduction of a BWG user fee of up to 4000/- rupees per tonne to incentivize the BWGs to deposit CDW directly at secondary collection points. This fee is intended to be integrated into the building approval plan as an upfront charge[81]. It is acknowledged however, that any construction activity that by-passes the formal permit process will remain unaffected by this fee[82].

Image.1 Zone 9 secondary collection point;
Source : Okapi Research and Advisory, 2023

Image.2 Zone 8 secondary collection point;
Source : Okapi Research and Advisory, 2023

Image.3 WeStart Kodungaiyur recycling plant;
Source : Okapi Research and Advisory, 2023

Image.4 WeStart Kodungaiyur recycling plant;
Source : Okapi Research and Advisory, 2023

[80] D, Omjasvin M. 2023. “A Chennai of Debriscity of Debris as Pricey Public-Private Partnership Fails.” The Times of India, May 3, 2023.https://timesofindia.indiatimes.com/city/chennai/a-chennai-of-debriscity-of-debris-as-pricey-public-private-partnership-fails/articleshow/99947118.cms?from=mdr.

[81] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023

[82] Thesis -Ram- Final (1) (1)-2.pdf

Image.5 Zone 8 secondary collection point;
Source : Okapi Research and Advisory, 2023

Image.6 CDW collection by PPS;
Source : Okapi Research and Advisory, 2023

Citizens face the brunt of these non compliances as reported by Citizen Matters[83] and Times of India[84]. On-ground workers and residents grapple with issues like illegal dumping, inconvenient dumpsite locations, lack of awareness on formal procedures, concerns about the private contractor's performance which ultimately contribute to waste accumulation, posing risks to pedestrians and motorists.

As previously mentioned, additional concerns persist in the private partnership, with GCC officials confirming that not all zones assigned to PPS are fully operational. The GCC official further noted a breach of contract terms, specifically the Commercial Operation Date (COD), by the private contractor. The official highlighted deficiencies in mandated requirements for delegated sites, including pollution mitigation, worker safety measures, and the installation of protective fencing[85].

Despite all this, there is some hope with Chennai focusing on developing digital technology for CDWM. PPS also emphasizes the potential benefits of technologies like satellite surveillance to optimize logistics[86] and enhance waste identification. An official from PPS confirmed that they are actively working on a GIS-based dashboard accessible to both private and government entities, aiming to provide a clearer overview of waste identification and facilitate efficient collection and transportation.

In conclusion, the challenges in waste identification, quantification and characterization and the marginalization of the informal waste sector, reveal systemic shortcomings. While the city is willing to embrace technology to optimize CDWM (e.g. the CDWM dashboard), operational hurdles and contractual non-compliance persist. The envisioned user fee for BWG reflects a proactive approach, yet its applicability to diverse stakeholders remains uncertain. To address

[83] Ganesh, Geetha. 2023. "Dealing with Construction and Demolition Waste in Chennai." Citizen Matters, Chennai. September 13, 2023. https://chennai.citizenmatters.in/chennai-77672.

[84] D, Omjasvin M. 2023. "A Chennai of Debriscity of Debris as Pricey Public-Private Partnership Fails." The Times of India, May 3, 2023.https://timesofindia.indiatimes.com/city/chennai/a-chennai-of-debriscity-of-debris-as-pricey-public-private-partnership-fails/articleshow/99947118.cms?from=mdr.

[85] GCC Meeting Dec 19, 2023 GCC representative. Interview. Conducted by Parama Roy. 10 December 2023

[86] Interview with Premier PPS representative. Interview. Conducted by Akshaya Ayyangar. 11 October 2023

these complexities, a collaborative, region-specific, and technology-driven strategy is imperative. Chennai's experiences offer valuable insights for policymakers, emphasizing the importance of nuanced guidelines, active stakeholder engagement, and a holistic perspective to usher in a more sustainable and effective CDWM framework for cities across India.