The Formal E-Waste Diversion Gap in India: A Review of Government and Institutional Data

Vivek Shukla[1*], Shalini Chandra[2]

[1*]Researcher, Strategic projects and operations, SP JAIN School of Global Management, Mumbai , India, Orcid ID 0009-0009-7747-2595. Email: mailvivek1985@gmail.com
[2]Professor, Information Systems, SP Jain School of Global Management Singapore. Orcid ID 0000-0002-7808-4617 Email: shalini.chandra@spjain.org

Abstract
Over one million tonnes of electronic waste (e-waste) is generated annually in India and the figure is increasing rapidly. The government has created regulations to ensure proper collection and recycling of this waste. However, most independent studies indicate that a significant proportion of e-waste in India is not collected through such formal and safe systems. This paper collates the information provided by the Central Pollution Control Board (CPCB), records of the Indian Parliament, the United Nations (UN) Global E-waste Monitor and academic and non-governmental studies to illustrate this gap. It demonstrates that official figures indicate a rapid increase in the rate of formal collection, but independent studies show that informal waste collectors still collect the majority of e-waste. The paper analyzes the reasons behind the difference between these two pictures, examines the results of household-level studies examining why people are not using formal collection points, reviews some examples of initiatives that seek to link informal and formal systems like the SWaCH cooperative in Pune, and analyzes the implications of these findings. It concludes with some suggestions for policy and a straightforward list of what the available data can and cannot inform us.

Keywords: e-waste, India, Extended Producer Responsibility, informal sector, CPCB, formal recycling.

1. Introduction

Electronic waste (e-waste) refers to any item that has been discarded because it is plugged in or has a battery, such as phones, laptops, televisions, refrigerators and others (Baldé et al., 2024). One of the fastest growing types of waste in the world. E-waste is an issue as it contains valuable materials such as gold and copper, as well as hazardous materials such as lead and mercury (Baldé et al., 2024).

India is a huge e-waste producer in the world. According to the government data provided to the Parliament, the country has generated e-waste of approximately 12.54 lakh tonnes (1.25 million tonnes) in FY 2023-24 and approximately 13.98 lakh tonnes (1.40 million tonnes) in FY 2024-25 (Press Information Bureau [PIB], 2025a). This represents an 11–12% increase in one year.

There is also a legal framework put in place by the Government of India to deal with this waste. The E-Waste (Management) Rules, 2016 and its replacement E-Waste (Management) Rules, 2022 have shifted the responsibility of collection and recycling of e-waste to the electronic product manufacturers and sellers. This is known as Extended Producer Responsibility or EPR (Central Pollution Control Board [CPCB] 2024). This edition of the Rules, 2022, affects 106 types of electrical and electronic equipment and entered into force on 1 April 2023 (PIB, 2025a).

The simple question that this paper seeks to ask is: How much e-waste being passed through these formal and safe routes is actually being passed through them and how much isn't?

It is not an experiment new. It does exactly what the name implies: It is a compilation and comparison of previously published figures from the CPCB, Parliament, the United Nations and independent studies, in order to make the dimensions of the waste gap between “waste generated” and “waste formally recycled” more visible. A small-scale field experiment was reported earlier in this paper, and this is omitted here as government reports are unable to provide ward level trial data. This paper, however, relies on secondary data, that is, data already gathered and published by other organisations.

2. Global and National context

2.1 The Global Picture

The most comprehensive source of world e-waste data is the Global E-waste Monitor (GEM) which was developed by the United Nations Institute for Training and Research (UNITAR) and the International Telecommunication Union (ITU). According to its 2024 edition, in 2022, the world produced 62 million tonnes of e-waste (Baldé et al., 2024). Only 22.3% of this amount was reported as correctly collected and recycled (Baldé et al., 2024). The report also states

that the world e-waste is increasing by approximately 2.6 million tonnes annually, and will reach around 82

million tonnes by 2030 (Baldé et al., 2024).

The study also highlights that the rate of e-waste generation is roughly five times higher than the world's reported e-waste recycling (United Nations Institute for Training and Research [UNITAR], 2024). At the global level, the increasing volume of e-waste and how much of it is handled safely are widening rather than narrowing.

2.2 India's Regulatory Framework

The first set of rules on e-waste was introduced in India in 2011, with amendments in 2016 and 2022 (CPCB, 2024). The E-Waste (Management) Rules, 2022 implement the EPR system, where a registered producer (a company that produces or imports electronics) is required to collect and return a specific proportion of the e-waste produced by its products, according to the national sales data and average life of each product type (CPCB, 2024).

EPR collection rate increases with time. Producers are required to gather an equivalent amount of waste from their products for financial years 2023–24 and 2024–25, which is equivalent to 60%. This target rises to 70% for 2025–26 and 2026–27, and to 80% from 2027–28 onward (CPCB, 2024). The producers achieve these targets through the purchase of EPR certificates from registered recyclers who are the ones that actually process the waste (CPCB, 2024).

3. National-Level Data: Generation vs. Formal Processing

3.1 Generation Over Time

The national e-waste generation is estimated by CPCB based on the sales data reported by the producers and an average product life span for each category of equipment (PIB, 2025a). Generation estimates given to Parliament show a rise from roughly 13.5 lakh tonnes in FY2020–21 to nearly 16 lakh tonnes in FY2021–22 (PIB, 2023), and then to 12.54 lakh tonnes in FY2023–24 and 13.98 lakh tonnes in FY2024–25 (PIB, 2025a). The dip in 2021-2022 to 2023-2024 is not necessarily a decrease in waste generated, but is more likely due to a change in the way waste was reported and estimated after the new EPR portal was launched under the 2022 Rules (PIB, 2025a).

Figure 1. Reported National E-Waste Generation by Year
(CPCB estimates via Parliament replies)

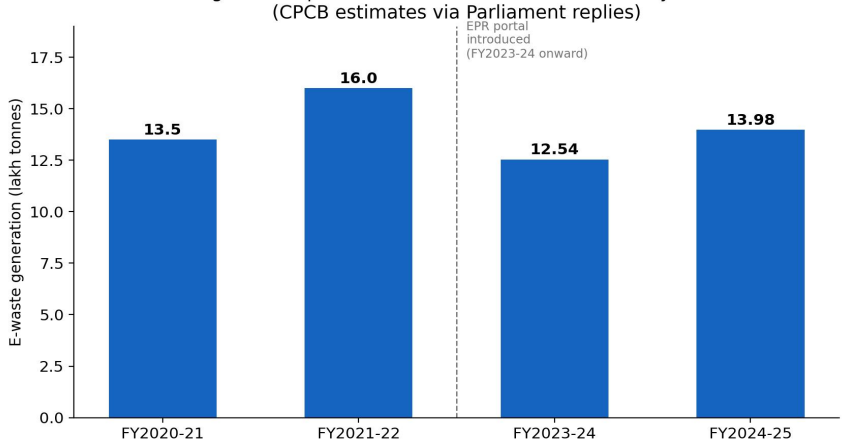

Figure 1. Reported national e-waste generation by year (CPCB estimates via Parliament replies). The series break reflects the change to portal-based reporting under the 2022 Rules, not a confirmed drop in real generation.

3.2 The Reported Formal Collection Rate

The national e-waste diversion rate, which is the closest official data that can be considered a diversion rate, was estimated at around 61.94% during FY2023-24, and increased to an estimated rate of 70.71% during FY2024-25 (summarised from the data released by the CPCB, as reported on the EPR portal, ClarityUPSC, 2026; Tribune India, 2026).

It's a very interesting number, and it must be read carefully. This is more a reflection of progress with waste tracking and reporting than a real threefold increase in recycling across the country; especially given that the new EPR portal and reporting system has only been in place for a year. Another explanation, provided by the CPCB's history, is that the increase was due to a new, more comprehensive reporting system that includes items that had always been happening but had not been reported before using producer sales data to do so (PIB, 2025a). So this paper does not claim that the 61.94-70.71% compliance rate is the real compliance in the processing of e-waste in India, but rather it is a reported compliance rate under a new measurement system.

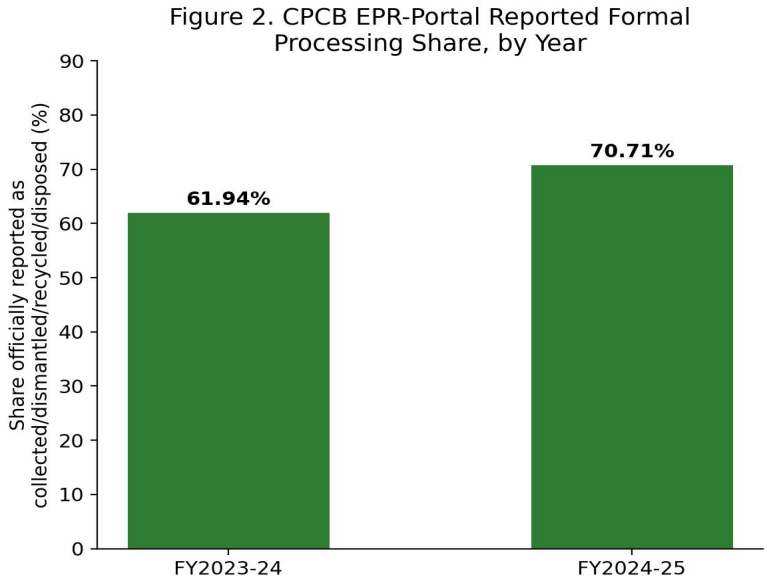

Figure 2. CPCB EPR-portal reported formal collection/processing share, FY2023-24 vs. FY2024-25.

3.3 Registered Producers, Recyclers, and Dismantlers

CPCB's EPR portal lists the entities registered to operate under the Rules. As of the most recent published count referenced in secondary literature, about 1,606 producers had registered with CPCB (Centre for Science and Environment [CSE], n.d.). Separately, industry sources report roughly 500 registered dismantlers and about 80 Producer Responsibility Organisations under earlier arrangements, though the 2022 Rules shift responsibilities away from this PRO model toward CPCB-authorised recycling companies directly (Corpseed, 2023). These figures should be read as approximate and are likely to change as more entities register or deregister.

Parliament has also been told that registered e-waste recyclers are located in only 19 states of India (PIB, 2025b). This means a majority of India's states and union territories currently have no CPCB-registered recycler operating within their borders, which is a meaningful constraint on how easily a household outside those 19 states can access a formal disposal channel at all.

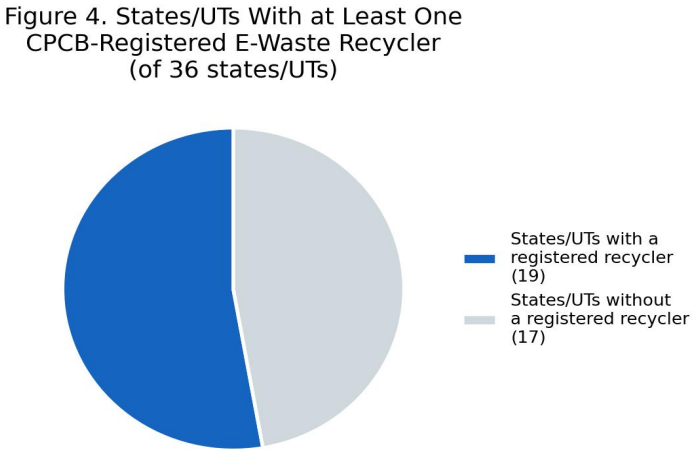

Figure 4. States/UTs with at least one CPCB-registered e-waste recycler, out of 36 states/UTs.

3.4 Reading the National Numbers Together

The compilation of Sections 3.1-3.3 suggests that e-waste generation is increasing at about 11-12% per year and the officially reported formal collection share has seen a dramatic increase since the introduction of the new EPR portal; the number of registered processing entities (RPEs) is increasing, but is still limited to a few states in India. This official picture is compared in Section 5 below with independent, non-

government estimates of the amount of e-waste that is actually processed informally—and the two pictures do not dovetail closely.

4. Sub-National and State-Level Variation

The available state-by-state processing volumes do not fully constitute one data set, however, the available pieces of it suggest strong geographic concentration. As per the estimates by the market-research firm Mordor Intelligence, the e-waste management market is expected to see the highest growth rate in North India in the coming years, and West India is projected to contribute approximately 28.5% to the Indian e-waste management market in 2025. These are not official statistics but estimates made by private market-researchers and should be used as indicative only and not as accurate.

Pollution control boards like the Maharashtra Pollution Control Board have their own lists of authorised recyclers and dismantlers within their state of Maharashtra (Maharashtra Pollution Control Board, n.d.). The Maharashtra list does not even include all the registered facilities, making many more than the 19-state national footprint reported to Parliament (PIB, 2025b).

There is also a huge diversity of city-level programmes in terms of their design. Pune has developed a unique system (Small Scale Collection and Channelling of e-waste) (SWaCH, n.d.) that allows waste-picker co-operatives to be formally given the right to collect and channel e-waste as far back as 2012. Formalized roles of existing waste-picker networks do not exist in most Indian cities.

5. The Informal Sector: Scale and Function

5.1 How Big Is the Informal Sector?

This is the place where there is most difference in the data and that difference is itself a significant discovery.

According to government reported data, the proportion of the formal collection/processing of waste is estimated to be approximately 70.71% for FY2024-25 (ClarityUPSC, 2026; Tribune India, 2026).

Independent researchers, on the other hand, still find that informal sector is responsible for the majority of e-waste in India. Assessment of e-waste not collected through formal channels in the peer-reviewed and NGO literature varies from approximately 70% up to 90-95% of total e-waste (Sengupta et al., 2022; Global Information Society Watch, n.d.).

According to a 2026 news report, there are only 322 officially authorized e-waste recyclers in the country, even though it is estimated that nearly 95% of discarded electronics are recycled in India through the informal sector (Al Jazeera, 2026).

In the city of Delhi, Mumbai and Bengaluru, only 3% of the total e-waste is processed in authorised recycling centres while the rest is processed in informal centres (According to one academic study on Indian cities, ISPRS Annals, 2025).

All these numbers cannot refer to the same thing, at the same time: “formal collection rate” is a measure of something different than “informal sector share” for instance, and of something different than “authorised processing capacity” again – and using a different definition, in a different year – from a different type of organisation (government portal data vs. household surveys vs. facility counts). This paper does not use a single number to explain the finding, instead, the range itself is the finding: independent, ground-level estimates of informal collection rates are remaining high (around 70-95%) while the official reported formal collection rate has risen towards 70%. The most plausible explanation is that the e-waste entering the formal reporting system is through the CPCB's portal, and the e-waste from millions of households continues to flow through the informal waste system, which is a smaller proportion of the total e-waste in India (Wikipedia, n.d.-a), and is easier to track than the household-level e-waste.

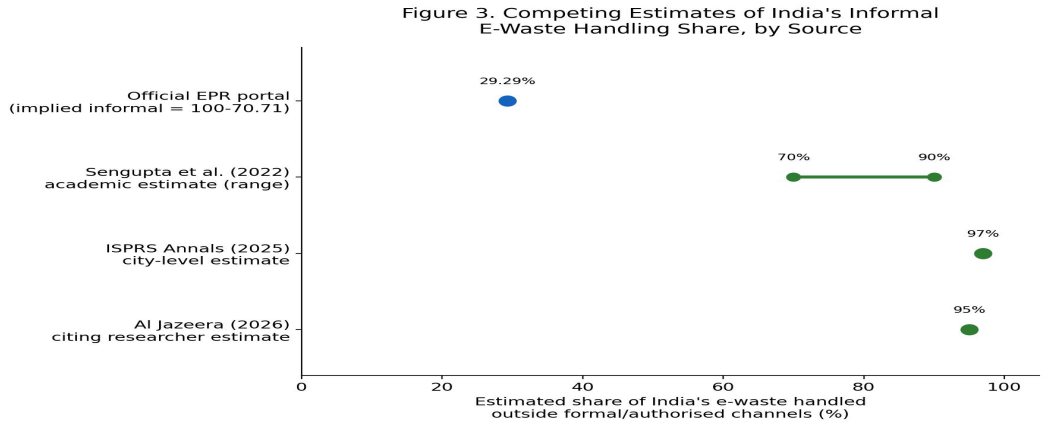

Figure 3. Competing estimates of India's informal e-waste handling share, by source. The gap between the official EPR-portal figure and independent academic/NGO estimates is the central finding of this review.

5.2 The Kabadiwala System

The informal waste collectors in India are called as kabadiwalas. They pick up e-waste, and other household items that can be recycled, from households directly, sometimes for a nominal amount of money. Sengupta et al. (2023) conducted a GPS-based research study of informal collectors' routes and found that approximately 45% of the households surveyed indicated that they preferred to drop off their e-waste at a kabadiwala as opposed to any other disposal method. This preference is largely attributed to convenience, cash payment, and existing of informal collection points which is not as common as kabadiwalas visiting most residential area regularly (Sengupta et al., 2022, 2023).

5.3 Health and Environmental Evidence from Informal Recycling

There are several studies that record actual health dangers associated with e-waste recycling in India. A 2019 study by NGO Toxics Link (2019) identified 15 informal e-waste recycling centres (IREWRC) in Delhi that were not equipped with occupational safety and environmental control measures.

A cross-sectional study of 220 informal e-waste handlers in three slums of Delhi (Seelampur, Mustafabad, and Mandoli) revealed that only 24% of the workers had an understanding of the term "e-waste," only 36% knew about the chemicals that could be released during e-waste handling, and only 12% of workers used any personal protective equipment (Singhal et al., 2021). Lead was measured in hair samples from a sub-population of these workers as a biomarker of exposure in the same study (Singhal et al., 2021).

There are still ongoing risks to the informal recyclers, such as cuts and infections from handling sharp, damaged devices, and there are not many authorised recyclers in India compared to the amount of waste produced (Al Jazeera, 2026). According to a wider study, pollutants from informal recycling practices, such as open burning and the use of acids to extract metals, harm the environment, particularly soil, air and water quality in the vicinity of the recycling operations (Gangopadhyay & Ghosh, 2024).

5.4 Formal–Informal Integration: The SWaCH Model

Not all responses to the informal sector have been to end the informal sector. An alternative model is provided by SWaCH (Solid Waste Collection and Handling) cooperative in Pune, which is creating an alternative to the informal waste pickers by formally organising them for waste collection as authorised service providers.

SWaCH is an outcome of a trade union of waste pickers, Kagad Kach Patra Kashtakari Panchayat (KKPKP) which was established in 1993 (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ] 2017). Established in partnership with the Pune Municipal Corporation, between 2006 and 2008, and owned and operated by its waste-picker members, SWaCH was formally established (GIZ, 2017; SWaCH, n.d.). The Maharashtra Pollution Control Board in 2012 gave special permission to SWaCH to collect and channel e-waste under the e-waste rules (then in effect) and currently SWaCH works with a registered e-waste recycling company to process the e-waste it collects (SWaCH, n.d.). Now, the cooperative has thousands of members and extends its service of door-to-door collection to a major part of the households in Pune (SWaCH, n.d.).

There are other similar initiatives run by NGOs. In Delhi, the NGO Chintan has been working to upskill informal waste pickers as "aggregators" who purchase e-waste from other waste pickers and sell to formal registered recyclers, reportedly to increase the income of the informal waste pickers by about 7% and establish a formal chain for the e-waste (Mongabay India, 2026). Integration is one viable path to making e-waste more visible and processed safely, without taking jobs away from the people who are already doing most of the collection work, as these examples demonstrate.

6. Household and Consumer Behaviour Evidence

6.1 What Existing Surveys Say

In addition to kabadiwala use (Section 5.2), there have been a few studies that directly focus on attitudes towards and disposal options for household waste.

Toxics Link's study of the repair sector also in five major cities of India (Delhi, Hyderabad, Kolkata, Nagpur, Ranchi; Toxics Link, 2026a) revealed that while the number of electronics consumed continues to grow, the habit of repairing them before replacing them is steadily declining. The study also identifies a lack of skilled, certified repair technicians and the lack of ease at obtaining spare parts as a challenge consumers face when deciding to repair rather than replace (Toxics Link, 2026a). As repair becomes a more underdeveloped culture, it will only increase pressure on future generation numbers as it helps to prolong a device's life and avoid it being placed in the waste stream altogether.

A separate report (Toxics Link, 2026b) on the EPR system itself, which was not publically available for this review, highlights some structural shortcomings in the current system.

6.2 Cross-Study Comparison

Study	Location / Sample	Main finding relevant to disposal behaviour
Sengupta et al. (2023)	GPS-tracked kabadiwala routes, household survey	~45% of surveyed households prefer giving e-waste to a kabadiwala
Singhal et al. (2021)	220 informal workers, 3 Delhi hotspots	Only 24% of workers understood "e-waste"; only 12% used protective equipment
Toxics Link (2019)	Delhi	At least 15 informal e-waste hotspots operating without safety controls
Toxics Link (2026a)	Delhi, Hyderabad, Kolkata, Nagpur, Ranchi	Repair culture declining; spare-part and skilled-technician shortages are key barriers
ISPRS Annals (2025)	Delhi, Mumbai, Bengaluru (cited estimate)	Roughly 3% of city e-waste processed through authorised facilities

6.3 Where the Evidence Is Thin

Nearly every household-level study reviewed here is city-specific, and Delhi appears disproportionately often. Rural areas and Tier-2/Tier-3 towns are largely missing from the published evidence base. There is also very little published before–after or longitudinal data tracking the same households over time as formal collection options are introduced — most of the available evidence is a one-time snapshot. This is precisely the kind of gap that a primary, field-based study (of the type in the earlier draft of this paper) would be well placed to fill, but it cannot be filled using secondary data alone.

7. Synthesis: The Diversion Gap

7.1 A Simple Picture of the Gap

Bringing Sections 3–6 together, the general shape of the gap is as follows:

1.**Generation** is rising by roughly 11–12% a year in official CPCB estimates (PIB, 2025a).

2.**Reported formal collection** through the EPR portal has risen sharply, to about 70.71% by FY2024–25, but this rise coincides closely with a change in reporting infrastructure rather than a proven change in underlying household behaviour (PIB, 2025a; ClarityUPSC, 2026).

3.Registered formal processing capacity remains concentrated: recyclers operate in only 19 of India's states and union territories (PIB, 2025b), and even in well-covered states like Maharashtra, formal facilities are clustered in specific industrial districts (Maharashtra Pollution Control Board, n.d.).

4.Independent, ground-level estimates of informal-sector handling remain high — commonly cited in the 70–95% range even in recent years (Sengupta et al., 2022; Al Jazeera, 2026; ISPRS Annals, 2025).

5.Household behaviour research shows real, understandable reasons for using informal channels: convenience, cash payment, and the sheer availability of kabadiwalas compared with formal drop-off points (Sengupta et al., 2023) — plus a declining culture of repair that adds more waste to the system in the first place (Toxics Link, 2026a).

7.2 Triangulation Table: Reconciling Different Estimates

Metric	Estimate	Source type	Year
National e-waste generation	13.98 lakh tonnes (FY2024–25)	Government (CPCB via Parliament)	2025
Official "collected/dismantled/recycled/disposed" share	70.71% (FY2024–25)	Government (CPCB EPR portal)	2025
Global documented recycling rate	22.3% (2022)	UN (Global E-waste	2024

Metric	Estimate	Source type	Year
		Monitor)	
Informal-sector handling share, India	~70–95% (various years)	Academic / NGO	2019–2026
Authorised recyclers, national count	322	News report citing government data	2026
States with a registered recycler present	19	Government (Parliament reply)	2025
Household preference for kabadiwala over formal channel	~45%	Academic (survey)	2023

The central analytical contribution of this paper is the ability to read across the rows and understand that India's official measurement of compliance (the number on the EPR portal) and the independent, off-the-ground measurement of where e-waste ends up (the number on the E-Cycle India platform) are not currently measuring the same thing, and that any single number from either platform on its own would give an incomplete picture.

7.3 What Secondary Data Cannot Tell Us

Secondary data may provide a reasonable description of the size of the gap. It cannot completely account for its socialization at the household level since:

Most studies on Consumer Behaviour are conducted in the city (mostly Delhi) and cannot be extrapolated to the rest of rural India or other states.

Very little longitudinal data exists that tracks the same households over time before and after an opening of a new formal option (such as a door step collection service).

Definitions of “formal,” “informal,” “collected,” and “recycled” are not necessarily uniform across sources, in part to explain the discrepancies in the numbers in Section 7.2.

The need for a controlled primary field study, such as the ward-level, household-level design proposed in the earlier draft of this paper, to address this gap in the future is ideal.

8. Policy Implications

Enforcement of EPR and target design. The findings of Section 3.2 (i.e., the reported jump in compliance is closely corresponding with a change in the reporting system) indicate that the targets should be validated by the CPCB and independent auditors, which are a reasonable structure, particularly as targets continue to increase (CPCB, 2024).

Informal–informal integration. As demonstrated in Section 5.4, SWaCH and Chintan, by formally authorising and remunerating informal collectors, can ensure greater e-waste is transferred to a documented chain that is safer without compromising the livelihoods of informal collectors (GIZ, 2017; Mongabay India, 2026). It is better to scale up these city-level partnerships than to attempt to take the place of the kabadiwalas with an entirely new institution, because this may be a more expedient path to tangible improvements.

Formal capacity expansion geographically. Even if they know how to recycle and are willing to do so, there may not be a registered recycler within reach in a significant portion of the country (PIB, 2025b). It is a fundamental lack of infrastructure that more facilities are needed or, at the very least, more authorised collection points are needed that are connected to out of state recycling facilities.

Assisting the repair industry. The barriers mentioned by Toxics Link (2026a) — shortage of certified technicians and spare parts — are legitimate policy objectives besides end-of-life collection, as it worsens the amount of e-waste that is generated initially.

9. Limitations

There is no primary data in this paper, which means that it is based on information collected and published by other organisations rather than by this study. This imposes some restrictions:

- Inconsistent definitions. The terms used in this section to describe the sources of the collected waste are not synonymous in the various sources, which makes it difficult to compare the numbers precisely.

•Self-reported producer data. The national generation estimate is made by CPCB based on the sales figures reported by the producers themselves and the average product life span (consumption) assumed in the estimates (PIB, 2025a) — not on direct measurements of waste as it is produced.

•The change over to a different measurement system. The increase in the apparent collection rate reflects the implementation of a new EPR reporting portal and it is difficult to distinguish between a behaviour change and enhanced bookkeeping (PIB, 2025a).

•Geographic and demographic evidence bias. Very few detailed studies on the household/worker level were available for this review from outside of Delhi, and very few from rural India.

•Give estimates of values, not numbers. Answering this question for the informal sector – that is the segment based on current evidence – is not so simple as it seems: the honest answer is a range, say 70 – 95%.

10. Conclusion

India's e-waste has been rapidly increasing and according to government data, the percentage of e-waste formally reported as collected or recycled is increasing. However, independent, bottom-up studies persist in documenting an informal system in which the vast majority of e-waste (particularly household) still circulates among kabadiwalas and unregulated recycling centres, and which is not regulated. These two pictures are not mutually exclusive, but rather represent two different, but overlapping, aspects of the same system, viewed from a different perspective. The evidence base is clear that formal recycling capacity, significant efforts of informal-sector integration and access to formal recycling at the household level are still not well developed across India and that effective implementation of the EPR targets through more rigorous enforcement and better audits, coupled with ongoing, broad engagement with the existing informal sector, will be necessary to further close the diversion gap.

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