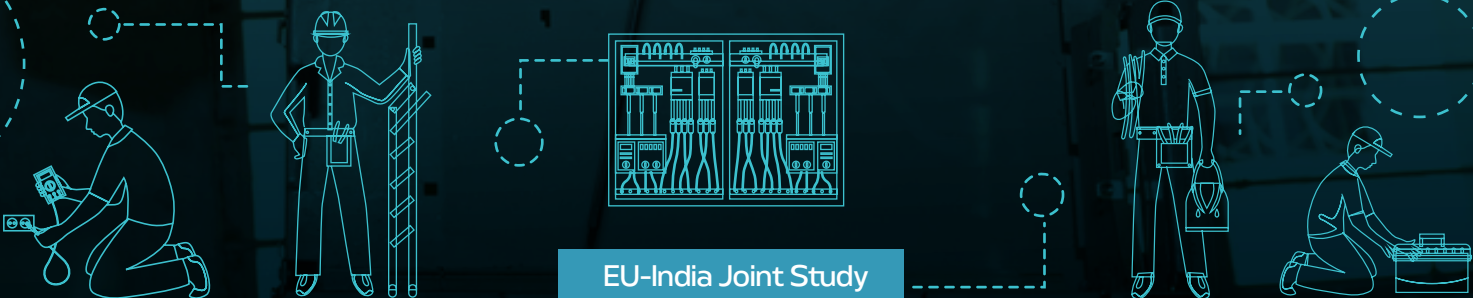


# Report on Measures for Upgradation of the Informal Workers in the Value Chain in Electrical and Electronics Sector in India

October 2023



EU-India Joint Study

**Published by:**

Ministry of Electronics and Information Technology (MeitY) with support from the European Union's Resource Efficiency Initiative (EU-REI) has prepared this study report.

**About EU-REI**

The European Union (EU) funded Resource Efficiency Initiative (EU-REI) led by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in consortium with The Energy and Resources Institute (TERI), Confederation of Indian Industry (CII) and adelphi.

**Authors****Toxics Link**

Mr. Satish Sinha, Ms Priti Banthia Mahesh, Mr Sudhanshu Shekhar

**Reviewers****WEEE Forum**

Mr Pascal Leroy, Ms Lucía Herreras Martínez

**Project Consortium Lead and Review**

Dr Rachna Arora, Dr Reva Prakash, Dr Katharina Paterok, Ms Mehar Kaur

**Disclaimer**

This production is produced under the European Union – Resource Efficiency Initiative contracted by the European Union Delegation to India. The content for this publication does not reflect the official position of the European Union. Responsibility for the information and views expressed therein lies entirely with the authors.

The data and information used for preparing this report have been sourced from secondary sources including state government departments and officials, published sources of Government of India, interviews and consultations done by the consultants. While due care has been taken to ensure authenticity of the data and other information used, any inadvertent wrong data or information used is regretted. We are not liable to any legal or penal responsibilities arising from this and also from the use of this report by anyone.

Reproduction is authorised provided the source is acknowledged.

**Report on  
Measures for Upgradation of  
the Informal Workers in the  
Value Chain in Electrical and  
Electronics Sector in India**



एस. कृष्णन, आई.ए.एस.  
सचिव  
**S. Krishnan, I.A.S.**  
Secretary



इलेक्ट्रॉनिकी और सूचना प्रौद्योगिकी मंत्रालय  
भारत सरकार  
**Ministry of Electronics &  
Information Technology (MeitY)**  
Government of India

## Foreword

'Circular Economy' is the new 'Mantra' for future development and growth. Circular economy approach is imperative to fulfill the need of resources for the growing economy, like India. It minimizes the wastage at each life-cycle stage and promotes 4Rs (i.e. reuse, repair, recover, re-manufacture) and also ensures regeneration of products and materials.

India is the third largest consumer of raw materials produced globally. If current economic trends persist, then India's material consumption would reach nearly 15 billion tonnes by 2030 and above 25 billion tonnes by 2050. In order to fulfill the resources need, it is essential to follow circular economy approach rather than the current linear economy principle of take-make-dispose.

This study report prepared under European Union – Resource Efficiency Initiative (EU-REI), India on circular economy in E-waste provides an international scenario on global best practices to be adopted by Indian Manufacturer and Recyclers. Promotion of eco-design & Green products, scientific extraction and reuse of SRM & CRM in manufacturing value chain would be a forthcoming step in the country. This report ensures an India-centric approach to understand the preparedness of circular economy business models, identify gaps and opportunities, as also to formulate evidence-based policy recommendations.

I compliment EU-REI team for this comprehensive well-researched report on Global best practices in circular economy in E-waste.

Best Wishes,

(S. Krishnan)

Dated: 22.9.2023  
Place: New Delhi





# CONTENTS

I.	Introduction	1
II.	Objectives and Methodology	4
III.	Informal actors in WEEE sector: Global Overview	6
IV.	Informal Sector and WEEE Management: Indian Overview	8
A.	The informal sector actors involved in WEEE business in India.	9
B.	Legislative frameworks to regulate WEEE in India	11
C.	Integrating Informal sector in WEEE management: Analysis and Key Findings	11
D.	Existing models that have engaged informal sector actors in WEEE sector	12
i)	Private company and informal workers collaboration model:	12
ii)	Skill Development and Training based model:	13
iii)	Extended Producer Responsibility (EPR) Framework based model:	14
iv)	Cooperative or union-based model:	15
v)	Model based on aggregating informal collectors under aPRO umbrella:	16
V.	Proposed prototypes for upgrading informal sector actors	19
VI.	Conclusion and Suggestions	24
	Annexure 1	26





# I. INTRODUCTION

Electronic and electrical equipment (EEE) have steadily become a fundamental part of modern life. The emergence and adoption of incandescent lamps at the end of the 19th century signalled the arrival of EEE on commercial platforms and they soon became an integral part of the economic and social spheres. The 20th century witnessed a steady rise in the plethora of products that the EEE sector came to offer, such as televisions, refrigerators, washing machines, and many more household appliances became available to large sections of the world, first in developed and subsequently in developing economies.

With innovations and scientific advancements, especially in Information and Communication Technology (ICT), the nature and features of EEE appliances changed drastically. As the 20th century was winding up (1990s) the penetration of ICT in EEE led to the emergence of innovative products like computers, mobile phones, laptops, etc.

The skyrocketing consumption, and rapid advances in technology have also been the reasons for the sustained shortening of lifespan within EEE products which fuels the generation of humongous volumes of waste electronic and electrical equipment (WEEE). WEEE has now become one of the fastest-growing waste streams around the globe.

United Nation's Global E-waste Monitor ascertained that the world generated 53.6 million tonnes of WEEE – 7.3 kgs per capita on average – in the year 2019, and India alone generated about 3 Mt, which is the third highest amount of e-waste produced by any country, following the USA and China. At this pace of consumption, waste generation is expected to increase to 74.7 Mt by 2030 and reach as much as 110 Mt in 2050.

The WEEE comprises a complex mixture of metallic, non-metallic, and toxic fractions which can cause severe discrepancies in our ecosystem, endangering not just human health but also other living species, if these are not managed safely. However, the current linear economic model of production, consumption, and disposal in the EEE sector is bound to ensure a perpetual rise in WEEE and depletion of the finite reserves of raw material.



**The adoption of the 17 Sustainable Development Goals (SDGs) by the United Nations in 2015 was one of the most important global initiatives in recent times.**

Circular economy as a concept offers a solution to this unsustainable model of production consumption and disposal. It envisions not just changes in design, resource efficiency and altering consumption patterns of EEE to make them last longer but also reintroduction of discarded material, as secondary material, into the original production cycle through recycling and recovery processes, in order to close the loop. In developing economies like India, the informal sector actors have been actively engaged in the collection, dismantling, and recovery of a significant quantum of WEEE.

The International Labour Organization (ILO) defines the informal sector as, 'All workers in unincorporated enterprises that produce at least partly for the market and are not registered. It excludes households that produce exclusively for own final use, subsistence agriculture, construction of own dwellings, etc.' According to ILO, globally, 81% of all enterprises are informal.

Most of the world's employed population is in informal employment, excluding agriculture, every second worker is in informal employment. Limited job options in the formal sectors and poor educational qualifications push many people to seek livelihood options in the informal economy. More than 80 percent of non-agricultural employment is in the informal economy in India.

## Context of the Study

A significant group of workers in informal employment are contributing to the management of all kinds of waste including WEEE. While it remains difficult to estimate the number of informal workers dealing with waste, especially WEEE, in India accurately, the country's legal statutes are quite divergent when it comes to recognising their role and defining their contribution.

The role of informal sector workers is recognised by the Indian Municipal Solid Waste Management (MSWM) rules. The Rules acknowledge waste pickers as an integral part of the waste management system, recognises their contribution to resource recovery, and promote their integration into the formal waste management system. It defines waste pickers as individuals or groups who are engaged in manually picking, sorting, and segregating recyclable materials from solid waste. It also encourages local authorities to:

- collaborate with waste pickers,
- include them in their waste management plans,
- mandates issuance of identity cards to them,
- promotes the formation and strengthening of waste picker cooperatives and self-help groups,
- endorses the provision of protective gear,
- suitable working conditions,
- access to healthcare services,
- training on occupational health and safety practices.

Furthermore, the importance of skill development programs, training and capacity building initiatives, and provision of social security measures such as insurance, pension, and other welfare schemes for these workers are also mentioned in the MSWM rules.

On the contrary, the Indian e-waste management framework, comprising the E-Waste (Management and Handling) Rules 2011, 2016, and 2022, has a different perspective on the role of informal sector workers in managing e-waste. The rules do not acknowledge the presence of informal sector workers in collecting, segregating, and dismantling of e-waste. The emphasis of these rules has always been on mandating registration and legal authorisation of all enterprises involved in the e-waste management system.

Civil society and non-government organisations have also studied the socioeconomic condition of informal e-waste workers, extensively, over the years. Many of them suggest that informal workers have demonstrated remarkable ability

of accessing and dismantling e-waste, displaying their role in electronic waste management. The workers consisting of skilled, semi-skilled, non-skilled workers largely connected with micro or small-scale enterprises. These individuals and small businesses actively engage in collecting discarded electronic devices from various sources, including households, businesses, and even dump sites. Through their knowledge and experience, they can identify valuable components and put them back in reuse, they also engage in the extraction of metals by adopting crude methods and placing recovered metals back in the supply chain process but at a cost to the environment and human health.

This is the context of this study as it tries to reflect on the contributions of the informal sector in managing WEEE in India, the constraints they face in the process, and offers insights on the ways in which the upgradation of the informal workers in the value chain keeping in mind their skills. The upgradation of informal sector actors is indeed paramount, for the crucial and defining role they have in helping close the material loop and transition to a circular economy framework, and in helping reduce the threats of environment pollution and public health associated with existing practices.

The background of the study is clearly aligned with the Sustainable Development Goals particularly with SDG 8 - decent work and economic growth, SDG 11 - sustainable cities and communities, and SDG 12 - responsible consumption and production.



## II. OBJECTIVES AND METHODOLOGY

The primary goal of this research is to explore the measures for upgrading the informal workers in WEEE sector into the formal value chain keeping their skills-sets under consideration. The specific objectives are:

Assessing the current practices of informal workers managing WEEE and identifying the potential barriers to their upgradation by –

- Identifying the major tasks performed by them and the key roles, which they are involved in.
  - Identifying key skill sets required for the various jobs, which informal workers undertake in the WEEE sector.
  - Evaluation of contemporary models, which have had relative success in the upgradation of workers in the informal WEEE economy.
- A. Ascertaining measures for the upgradation of informal workers managing WEEE by–
- Identifying models to encourage the upgradation of the informal workers in the value chain.
  - Enlisting steps to facilitate the upgradation of the informal workers in the value chain.
- B. Developing recommendations for policymakers and stakeholders to facilitate the upgradation of informal workers into the formal value chain.

The study is primarily qualitative in nature and the research design followed the chronological order:

Review of relevant secondary literature, including publications, research reports, government documents, policy documents, legislations like the three E-waste rules passed by the Indian government, and research material produced by think tanks, NGOs, etc.

Literature from relevant academic publications, other reports, government documents, etc. also informed current practices in the informal WEEE management sector and measures undertaken by various institutions/organisations to upgrade the informal workers in the WEEE sector.

In-depth interviews with relevant shareholders and experts in the WEEE sectors.

Following the desk review, communication with stakeholders in the informal e-waste sector and the experts of the sector was established. In-depth, semi-structured interviews were then conducted with;

- A national NGO representative (working on WEEE),
- The head of a PRO agency,
- Two formal e-waste workers who were previously in the informal sector,
- Half a dozen informal e-waste workers during two field visits,
- Central government officials (both online and in person), to gain an understanding of their perspective.

The data collection tools used to collect information from the above-mentioned research participants included;

- A semi-structured schedule: This assisted in exploring the topic intensely and in comprehending meticulously the answers provided by the interviewee. These semi-structured interviews provide requisite flexibility to the interviewer to delve deeply into a conversation in search of possible relevant responses. A Prior oral consent was obtained for conducting the interviews.

The interview schedule, which is attached in the annexure, had two sections:

1. Dealing with existing models and challenges in the upgradation of informal e-waste workers and
  2. Dealing with the possible strategies for the upgradation of informal e-waste workers.
- Observation guide: The observation guide was used during the two field visits made to observe and record the daily activities and interaction of the different stakeholders at identified informal e-waste handling and dismantling sites.

The information sieved from the reviewed literature and data collected form field visits and stakeholders' interviews were used to find answers to the major objectives and research questions of the study.



### III. INFORMAL ACTORS IN WEEE SECTOR: GLOBAL OVERVIEW

The informal sector has a significant role to play in managing WEEE globally. It encompasses a diverse range of actors, including waste pickers, scrap dealers, refurbishes, and informal recycling operators. These individuals and groups are often involved in collecting, dismantling, repairing, reusing, and recycling electronic waste.

In this global overview, we will highlight the quantum of WEEE generated by different regions across the world, the contributions of the informal sector in managing it, their key characteristics, challenges, and implications of their involvement in WEEE management.

Africa generated 2.9 Mt of e-waste (2.5 kg per person), but only 0.03 Mt was properly treated. The continent imported 546 kt of e-waste, mainly from Europe, with North, East, and West Africa as the main import hubs. Inadequate legislation, enforcement, and financing hinder proper management of domestic and imported e-waste, resulting in health and environmental problems and resource loss. The continent lacks e-waste management infrastructure, leading to a strong presence of the informal sector that collects valuable parts while the rest is either dumped or burned, causing serious damage.

North and South America generated 13.1 Mt of e-waste (13.3 kg per person), but only 1.2 Mt was treated properly. North America is the exporting hub, while Central and South America are net importers. A significant amount of e-waste, 430 kt, is exported to countries in East and South Asia and Central and South America that rely on informal sector workers with insufficient e-waste management infrastructure and low collection rates, resulting in environmental damage and resource loss.

South and Central America serve as import hubs for e-waste in the region, importing 300 kt while exporting 114 kt. Only 1% of e-waste is managed, and there is fierce competition between the formal and informal sectors for valuable components. In this region, only a few countries have specific e-waste management laws. In most cases, e-waste is regulated under general hazardous waste legislation, and discussions, legislative processes, are underway for specific policies or technical guidelines and their implementations.

The application of the principle of Extended Producer Responsibility (EPR) is quite inconsistent and waste generators are generally financially responsible for managing waste under existing hazardous waste laws. The region does have some basic e-waste management and recycling infrastructure, mainly for metal scrap processing, the development of dedicated e-waste processing facilities is expected to increase in the future.

As many countries still rely on manual dismantling in their pre-processing facilities, the informal sector plays a crucial role in the region, where a significant amount of e-waste from North America also ends up. However, there is a lack of suitable options for processing or disposing of critical fractions of e-waste, leading to their exportation or rudimentary processing by the informal sector generating low yields and inefficient disposal.

Asia generates 24.9 Mt of e-waste annually, with only 2.9 Mt properly treated. The informal sector manages the remaining 22.0 Mt in an environmentally unsound manner due to the lack of e-waste management infrastructure and competition between formal and informal processors for valuable components.

Southeast Asia and East Asia are primary import and export hubs, while Southern Asia has minimal e-waste imports and exports. Southern Asia generates 4.8 Mt of e-waste with a dismal 1% formal collection and recycling rate, indicating a widespread domestic informal market for e-waste management.

Europe generated 12 Mt of e-waste in 2019, ranking third after Asia and the Americas, with the highest per capita generation of 16.2 kg. Europe leads in environmentally secure e-waste management, accounting for around 42% of the total. To tackle the issue of the growing amount of WEEE the European Union has brought in legislation on EEE and the RoHS (restriction of the use of certain hazardous substances) directive to tackle.

However, all regions in Europe export uncontrolled e-waste to West Africa and Southeast Asia, burdening countries with insufficient formal e-waste management capacities, largely reliant on their informal sectors. Eastern Europe is emerging as an e-waste hotspot, with over half of its uncontrolled e-waste flowing from Western Europe. The prevailing geopolitical situation may impact the flow of e-waste.

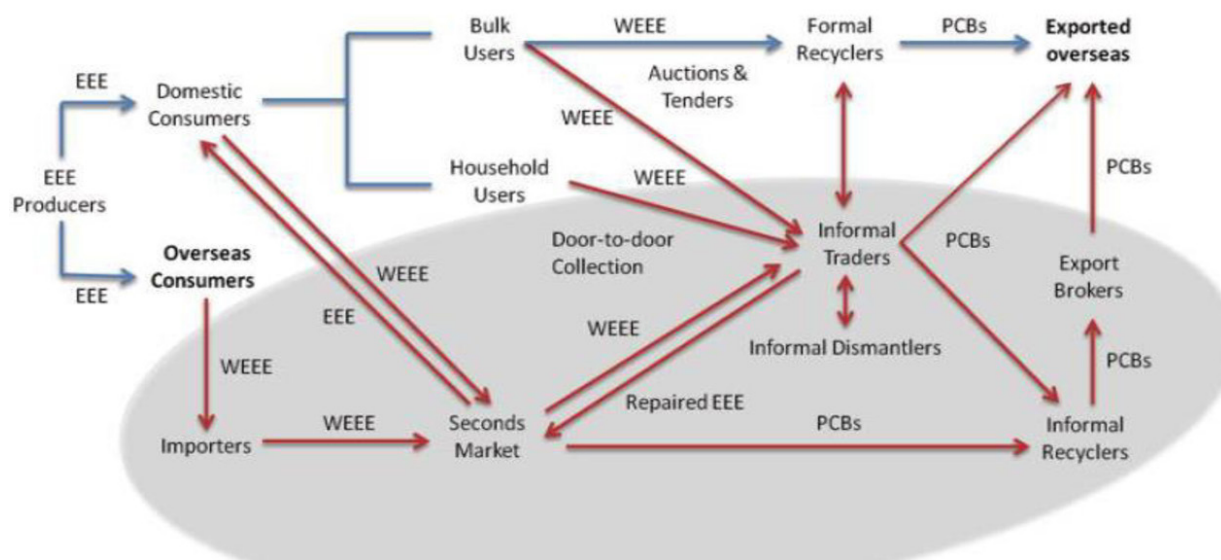
Oceania generated 0.7 Mt of e-waste in 2019, ranking second globally in per capita generation at 16.1 kg. Only 9% of this waste (0.06 Mt) is collected and recycled properly, while the fate of the rest is unknown or ends up in landfills. Lack of information about e-waste movement to and from the region hinders efforts to understand and improve e-waste management.

The above discussion, about the regional trends in the generation, management, and movement of WEEE, highlights the relevance of the informal sector in managing such waste. Informal sector actors are crucial in e-waste management and they operate in both developed and developing countries, where they fill gaps in formal waste management systems. These actors often collect e-waste from various sources, such as households, businesses, and waste disposal sites. They manually dismantle electronic devices to extract components and materials that can be reused or processed further.

## IV. INFORMAL SECTOR AND WEEE MANAGEMENT: INDIAN OVERVIEW

In India, the management of WEEE has become a pressing environmental and health concern due to the country's rapid technological advancement and high electronic goods consumption. The informal sector plays a significant role in managing e-waste, although it operates outside the formal regulatory framework. Figure. 1 below provides a representative picture of the dependency on the informal economy for the flow of material in the WEEE sector.

FIGURE 1: MATERIAL FLOW IN INDIA ACROSS WEEE FORMAL AND INFORMAL ECONOMIES



Legend:  
 EEE electrical and electronic equipment  
 WEEE waste electrical and electronic equipment  
 PCB printed circuit board  
 grey zone informal economy  
 blue arrows formal activities  
 red arrows informal activities

Source: based on Laha, 2014



Let us now consider the various actors involved in the informal e-waste economy in India and their contributions to management of e-waste.

## A. The informal sector actors involved in WEEE business in India.

**Kabadiwalas:** or waste collectors, are key players in the informal sector e-waste management chain. They collect discarded electronic devices from households, commercial establishments, and informal markets. Kabadiwalas then sort the collected e-waste based on its potential value and sell it to subsequent actors in the value chain, like scrap dealers and dismantlers. Their informal networks and extensive reach contribute to the collection and channelling of e-waste into the recycling system.

**Scrap Dealers:** Scrap dealers play a crucial role in WEEE management by purchasing e-waste from kabadiwalas and other intermediaries. They often operate in local markets where they buy, sort, and store e-waste before selling it to formal or informal recycling facilities. This means that most of them maintain some sort of storage space and some petty working capital to finance the purchase of WEEE. However, their practices are often informal and unregulated and can lead to improper handling and disposal of e-waste, causing environmental pollution and health risks.

**Dismantlers and Recyclers:** Dismantlers and recyclers, primarily located in informal setups are responsible for breaking down e-waste into its component parts for further processing. The process of dismantling is followed by initiating the recovery process, which also happens in-house in these facilities and premises, involves the extraction of valuable materials like gold, silver, copper, and other metals using rudimentary techniques, such as open burning and acid leaching, which pose serious health hazards to workers and the environment.

**Refurbishers and Resellers:** A subset of actors involved in e-waste management, which exist in both formal and informal sectors, includes their refurbishes and resellers. They repair and refurbish discarded electronic devices to restore their functionality and sell them in the second-hand market, both domestically and internationally. Refurbishing helps extend the lifespan of electronic devices and reduces the need for raw material extraction.

The involvement of the above-mentioned informal sector actors in e-waste management in India presents both opportunities and challenges.

### **The contributions of the sector in e-waste management are multifold;**

- They help in reducing the environmental impact of e-waste by diverting it from landfill disposal and recovering valuable resources.
- This conservation of raw materials reduces energy consumption and greenhouse gas emissions associated with primary production processes.
- They provide employment opportunities for marginalized communities, including waste pickers and informal recycling operators.
- In developing economies, like India, informal actors operate through vast networks, expanding their reach and access using door-to-door collection strategy and establishing personal connections, which ensures consistency in waste flows and volumes.
- They have local knowledge of consumption patterns and disposal practices which helps identify potential sources and their flexibility and adaptability assist in adjusting collection routes and methods accordingly.
- They collaborate with scrap dealers, recyclers, and refurbishes which assist the integration, optimisation, and profit maximisation within the e-waste value chain.

However, informal sector actors also face numerous challenges in e-waste management. As most of the labour involved in informal e-waste management, especially collection and dismantling, are migrant, they are confronted with myriad

vulnerabilities. These workers join the urban waste economies after leaving their homes and communities behind, lacking any support system in an unfamiliar environment, which makes them susceptible to exploitation.

Moreover, social institutions like gender, caste, and religion influence the experience of individuals engaged in unregulated e-waste management. Women, who constitute a substantial portion of this workforce, often encounter discrimination, unequal pay, and other forms of marginalisation including lack of access to healthcare or any other social security.

Similarly, caste and religious identities (which is mostly lower castes and of minority religion) of those involved in waste management also exacerbate their vulnerabilities and perpetuate their marginalised status. Collectively, these intersecting factors compound the challenges faced by migrant labourers involved in e-waste management in India. Some of the **challenges they face in their occupational setting** involve:

- They often work under hazardous conditions without proper safety measures and manually dismantling and processing of e-waste exposes them to toxic substances and pollutants, such as lead, mercury, cadmium, arsenic, and brominated flame retardants, which pose health risks.
- There is also a lack of awareness and knowledge regarding safe e-waste management practices among informal sector actors.
- These practices in e-waste management often involve crude techniques such as open burning, acid baths, and manual dismantling.
- This leads to improper handling, storage, and disposal of e-waste, further exacerbating environmental and health issues.
- The rudimentary nature of these practices also impedes the efficient recovery of resources, leading to the loss of finite materials.
- There is also an acute shortage of any information or data, about the flows of e-waste in the informal sector, making tracking of material flow extremely difficult.

Despite their contributions, wherever informal sector is involved in e-waste management, it has **implications for the formal sector and policy frameworks**. They include:

- The presence of informal actors can create competition and market dynamics that affect formal recycling businesses. Their presence is known to make the entire sector fiercely competitive.
- Informal recycling disrupts market equilibrium by offering cheaper services, than the formal sector, but they fail in meeting environmental and occupational health standards.
- Improper handling of hazardous substances and exposure to toxic chemicals pose dangers to the health of informal workers, nearby communities, and the ecosystem.
- Additionally, the informal sector's unregulated nature makes it difficult to implement and enforce e-waste management policies effectively.

Hence, the significant role of the informal sector in e-waste management cannot be ignored as they contribute to resource recovery, provide employment opportunities, and fill gaps in waste management systems. However, they face challenges related to health hazards, lack of awareness, and competition with the formal sector.

Addressing these challenges and integrating informal sector actors into formal recycling systems can lead to more sustainable and efficient e-waste management practices. While these actors do contribute to waste collection and resource recovery, their unregulated practices pose significant environmental and health risks. To regulate the management of e-waste Indian government has introduced many legislations from time to time. The next section provides a brief account of the same.

## B. Legislative frameworks to regulate WEEE in India

The table below presents a summary of legislations regarding e-waste in India.

**TABLE 1: SUMMARY OF THE E-WASTE MANAGEMENT REGULATIONS IN INDIA IN CHRONOLOGICAL ORDER.**

Regulation	Changes/Impacts
The Environment (Protection) Act, 1986	India's first comprehensive environmental law to delegate the responsibility of implementing management plans for hazardous waste.
The Hazardous Wastes (Management and Handling) Rules, 1989	Classification of hazardous waste into 18 categories (e-waste was not specified) based on their constituents and the quantities of generation.
The Hazardous Wastes (Management and Handling) Rules, 2003	Classification of hazardous waste by process of waste generation (Schedule-1), waste characteristics (Schedule-2) and imports/exports (Schedule-3).
The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008	Prohibition of transboundary movement of hazardous waste. Registration of all entities involved in recycling or reprocessing hazardous waste (including e-waste) under the CPCB.
E-waste (Management and Handling) Rules, 2011	India's first legislation specifically designed for e-waste management, highlighting the significance of recovery and/or reuse of useful material from e-waste. Introduction of EPR schemes in India.
E-waste (Management) Rules, 2016	Expansion of the EPR concept to ensure its effective enactment by EEE producers. Introduction of manufacturers, dealers, refurbishers and PROs as additional stakeholders.
E-waste (Management) Amendment Rules, 2018	To ensure the majority of the generated e-waste is channelised towards formal dismantlers and recyclers. Revised collection targets along with new targets for EEE producers

As the table above suggests, the Extended Producers Responsibility (EPR) schemes came into being with the introduction of e-waste management rules. EPR was aimed to involve the producers in the management of e-waste, thereby increasing volumes of waste in formal sector and reducing associated hazards of e-waste in the country and promoting resource efficiency.

However, for the limitations of the formal recycling infrastructures, the EPR guidelines have also led to untraced movements of e-waste materials from informal to formal sectors, meant to ensure that producers are able to meet their EPR targets. This has given rise to several discrepancies in waste flows and its accounting methodology since the waste flows are not transparent with no means to verify quantities and source, leading to multiple accounting of dismantled waste. The guidelines inability to assign any role to informal sector in e waste management can be seen as one major flaw in the system to account for all waste generated and processed and the critical need to bridge this regulatory gap.

## C. Integrating Informal sector in WEEE management: Analysis and Key Findings

To improve the existing situation and make informal sector sustainable, several studies have enlisted a host of recommendations to consider. For example, Ghosh et al. (2021) suggests that efforts should be made to formalise and regulate the informal sector's activities through appropriate legislation and policies, which would ensure that e-waste management is conducted in an environmentally desirable and socially responsible manner.

Whereas others have suggested training programs and capacity-building initiatives to be implemented to educate informal sector workers about safe handling, dismantling, and recycling techniques. This would enhance worker safety, reduce health risks, and promote environmentally friendly practices (Turaga et al., 2020).

Partnership between formal recycling facilities and the informal sector, where government and industry collaborations can provide incentives to facilitate such partnerships has been suggested by Awasthi et al.(2019) as it would lead to creation of a mutually beneficial relationship between formal and informal actors and encourage responsible e-waste management practices.

Owing to the significance of informal sector in e-waste management in India, primarily as they perform collection, sorting, and recycling activities, efforts are being made to address the challenges associated with their functioning. These include:

- Capacity building programs and awareness campaigns,
- Promoting of formalization and integration of informal sector actors into formal recycling systems,
- Providing access to appropriate technologies,
- Ensuring occupational health and safety by, provisioning for appropriate protective gear and equipment and establishment of formalized collection centres.

Some of these steps can be viewed as stepping stones towards development of comprehensive strategies that involve acknowledging the role of informal sector actors and upgrading them in the WEEE value chain, ensuring proper e-waste management, environmental sustainability, and the protection of workers' health and well-being. The subsequent section will discuss some of the comprehensive strategies or models, which have been implemented in different parts of the country to facilitate upgradation of informal sector actors.

## D. Existing models that have engaged informal sector actors in WEEE sector

There have been many initiatives undertaken by civil society, non-government organisations and for-profit companies to develop and implement a frame work for the upgradation or formalization of informal actors in the e-waste sector in India. Some of these models have had relative success in their efforts and have generated good amount of literature, which offer a host of insights and learning. Most of these models can be clubbed under the following themes;

### i) Private company and informal workers collaboration model:

This model focuses on integrating informal sector actors into the formal e-waste supply chains by providing them with necessary infrastructure, training, and support. This approach aims to enhance the capacity and efficiency of informal actors while ensuring compliance with environmental and safety standards. Let us discuss a case wherein integration of informal sector with formal supply chain was made possible.

**Green E-waste Recycler:** An e-waste cooperative called 4R (Reuse, Repair, Recycle, Recover) was established in 2009 in Shastri Park, Delhi, consisting of around 35 informal actors engaged in e-waste recycling. However, they were unable to obtain a license for collection and dismantling of e-waste from the Delhi Pollution Control Committee (DPCC), leading to the termination of their operations. DPCC in its informal comments stated that there was a lack of precedence for awarding a license to a non-profit entity.

Consequently, one of the cooperative members, Mohammad Sabir, founded a private limited company called Green E-waste Recyclers Pvt Ltd in 2011, which received a license from DPCC to collect e-waste. Green E-waste Recyclers collaborates with formal recyclers Earth Sense and E-WaRDD and engages around 20-25 informal collectors. The company's business processes involve screening and separating e-waste collected by the informal collectors it engages, repairing reusable products, and sending damaged ones to formal recyclers.

Collaboration with producers has not been established. Initially, informal collectors were part of the 4R cooperative, but now they work with Green E-waste Recyclers based on Mohammad Sabir's reputation as an e-waste dealer. While the impact of the initiative has been limited, the company did manage to collect 2.5 tonnes of used products, between 2011 and 2016, through competitive bidding and purchases from informal actors. They have conducted trainings on e-waste practices and increased awareness among consumers, collectors, and policymakers.

The challenges that Green E-waste Recyclers face after the implementation of new e-waste rules is the need to establish a partnership with a producer or apply for a recycling license to continue collection, which would require significant capital costs.

## ii) Skill Development and Training based model:

Several initiatives focus on providing skill development and training programs to informal sector workers in e-waste management. These programs aim to enhance their knowledge of safe handling, recycling techniques, and environmental best practices, ultimately leading to the formalization of their activities. One such initiative is Safai Sena by Chintan Environmental Research and Action Group.

**Safai Sena by Chintan:** Chintan, a Delhi-based NGO, started focusing on e-waste in 2007 and joined the 'Toxics Coalition' in Silicon Valley to gain knowledge and effective management approaches. Chintan was the first and only NGO to receive a collection license from the Delhi Pollution Control Committee when the E-waste Management and Handling Rules came into effect in 2012.

They collaborate with two authorized recyclers to process collected materials and closely work with waste pickers through their Safai Sena cooperative. Chintan provides training on e-waste composition, toxicity, and safety hazards to these workers and enables them to access e-waste generators and earn additional income through ID cards issued by Safai Sena.

Chintan establishes partnerships with the informal sector by providing direct payments based on the quality and quantity of collected e-waste. They also assist informal collectors gain access to e-waste sources and residential areas where citizens generate e-waste. Collected materials are stored at Chintan's collection office, and if informal workers can't reach the center, Chintan retrieves the materials using vehicles that collect waste from bulk consumers. Once enough e-waste is collected, it is sent to authorized recyclers for further processing.

Chintan also offers non-monetary incentives, such as education centers for collectors' children, and conducts training programs called "Scavengers to Managers" in partnership with Safai Sena, formal recyclers, and volunteers. These programs focus on safe access to e-waste, proper handling of toxic materials, and occupational health and safety conditions.

Chintan resolves issues faced by the informal sector through the Safai Sena secretariat and aims to attract more waste pickers in different parts of Delhi. By joining Safai Sena, waste pickers receive identification cards that enable them to obtain e-waste directly from bulk consumers and institutions.

Chintan provides a helpline for immediate assistance, even on Sundays. They have signed written agreements with Attero and TES-AMM, which specify fixed monetary rates for certain e-waste fractions, ensuring minimum payments and maintaining a continued relationship with informal workers.

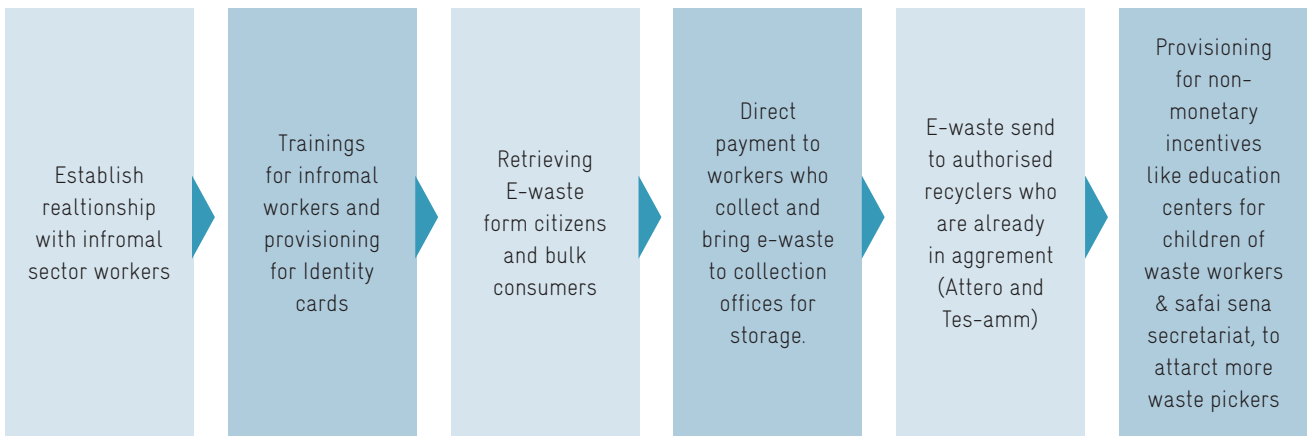
Chintan has faced challenges in:

- Establishing relationships with producers for e-waste collection due to their reluctance to work with NGOs and the informal sector.

- Financial income is also a challenge, as expanding the initiative would require significant investments in improving access to e-waste for informal actors and increasing the NGO's outreach through additional staff, marketing, and awareness campaigns.
- Enhancing the skills of informal workers is another challenge to increase their interest in the e-waste sector as a livelihood opportunity.

Chintan currently collects one ton of e-waste per month, positively impacting waste pickers' livelihoods and increasing their income by 25%. Chintan's involvement in Delhi's communities has led to capacity building, education for children, and new livelihood opportunities. The scalability of this model depends on organizational capacities, human resources, and long-term trust-building with the informal sector.

**FIGURE 2: FLOW DIAGRAM OF CHINTAN'S SAFAI SENA INITIATIVE**



**iii) Extended Producer Responsibility (EPR) Framework based model:**

The EPR framework makes manufacturers and producers of electronics and electrical equipment responsible for the management and proper disposal of their products at the end of their life cycle. The mandatory nature of this legal provision has compelled many manufacturers to collaborate with the informal sector to ensure that their EPR targets are met and there is responsible management of e-waste. Let us discuss one such initiative by a prominent producer.

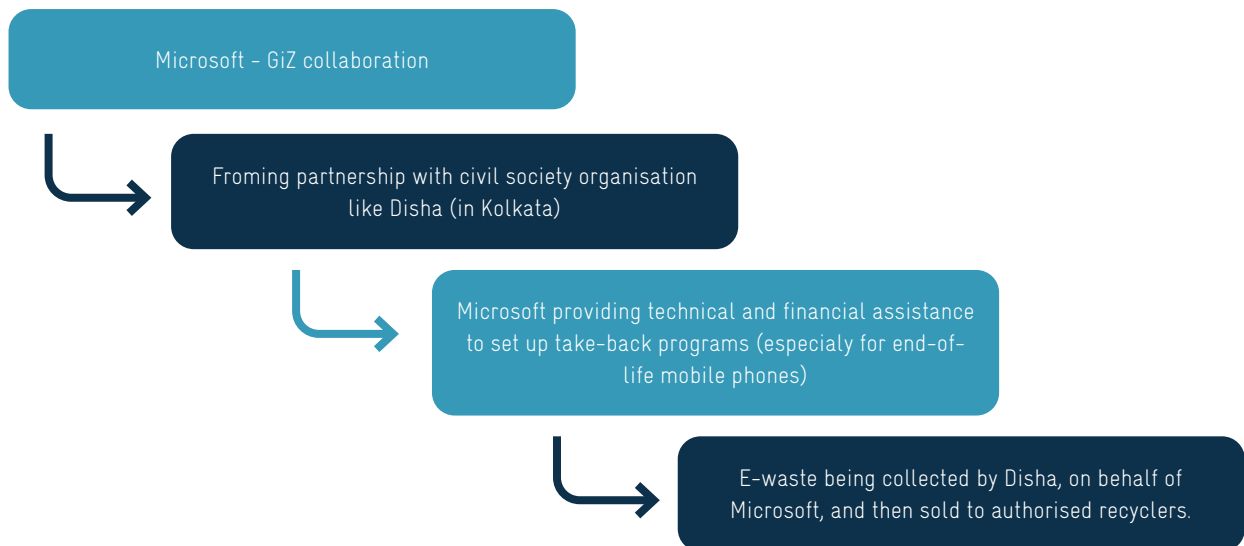
**Microsoft - GiZ:** Microsoft, a multinational technology corporation, collaborated with the informal sector in India through a pilot program with Nokia. The program was assisted by GiZ and aimed to formalize informal waste collectors by working with civil society partners, such as NGOs, in New Delhi, Kolkata, and Ahmedabad. Microsoft provided technical and financial assistance to set up take-back programs for managing end-of-life mobile phones and accessories.

However, after Microsoft's support ended, two of the three programs ceased to exist. Only Disha in Kolkata continued its collection efforts. The partnership allowed Disha to collect e-waste on behalf of Microsoft and sell the materials to an authorized recycler.

The program faced challenges due to lack of monitoring and collection of large volumes of low-quality waste for the recyclers were unwilling to receive the collected e-waste fractions as the most profitable materials had been removed beforehand and the residual value of delivered WEEE was minimal hence not attractive to recyclers.

Hence, in order to implement similar programs on a larger scale, redesigning partnership models and improving monitoring methods would be necessary.

FIGURE 3: FLOW DIAGRAM OF MICROSOFT-GIZ'S DISHA MODEL



#### iv) Cooperative or union-based model:

These models involve collaborations between government agencies, private companies, and informal sector actors to improve e-waste management. This approach facilitates the transfer of knowledge, technology, and resources to the informal sector, enabling them to upgrade their operations and comply with regulations. Let us consider an example of one such model.

**SWaCHby KKP KP:** In 1993, waste pickers and itinerant waste buyers formed the Kagad Kach Patra Kashtakari Panchayat (KKPKP), a trade union in Pune and Pimpri Chinchwad. The union aimed to recognize waste pickers' contribution to the environment, their worker status, and their role in Solid Waste Management (SWM). KKP KP has over 9000 members, mostly marginalized women who pay annual fees and receive benefits like insurance and educational support.

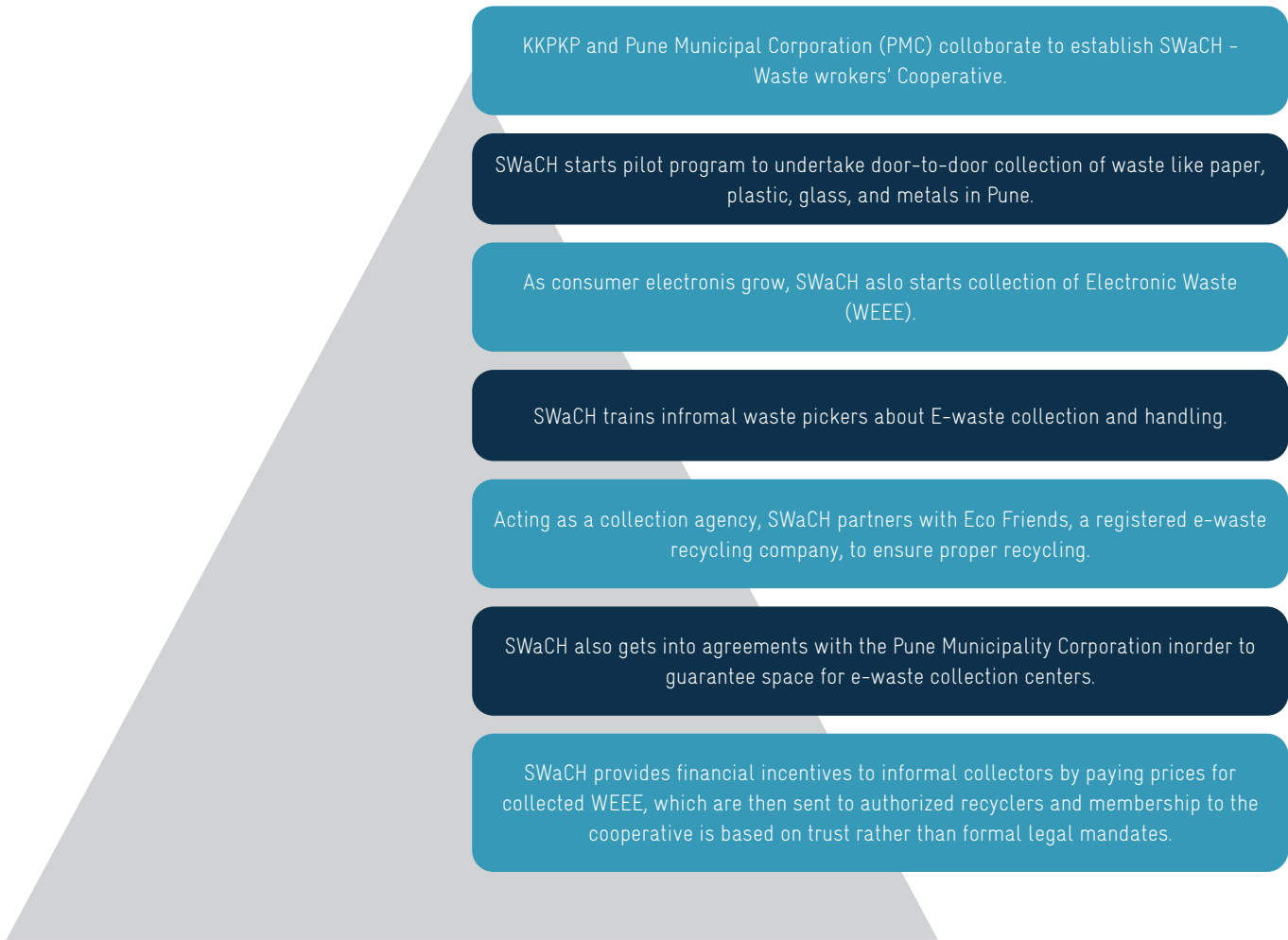
KKPKP advocated for better working conditions, rights protection, and integrating waste pickers into the waste collection system. In 2005, KKP KP collaborated with the PMC to integrate waste pickers into door-to-door waste collection. This led to the establishment of SWaCH, a wholly-owned workers' cooperative as a pro-poor Public Private Partnership focused on sustainable waste management. SWaCH started as a pilot program from 2006 to 2008, involving 1500 waste pickers serving 1,25,000 households. It improved their livelihoods and bridged the gap between households and municipal waste collection. SWaCH expanded its services and activities over time, including verticals like composting, e-waste disposal, and awareness events.

The door-to-door waste collection in Pune is handled by informal collectors who primarily gather paper, plastic, glass, and metals at market prices. With the growth of consumer electronics, the collection and recycling of electronic waste (WEEE) became a more significant issue. During the WEEE Recycle project, around 100 waste collectors joined the SWaCH initiative and received training on e-waste collection and handling. SWaCH acts as a collection agency and has partnered with Eco Friends, a registered e-waste recycling company, to ensure proper recycling. Agreements with the Pune Municipality Corporation guarantee space for e-waste collection centers.

SWaCH's link to the informal economy is based on its long-term involvement in waste management, activities in Pune's civil society, and its relationship with the municipality. SWaCH provides financial incentives to informal collectors by paying prices for collected goods, which are then sent to authorized recyclers. Membership is based on trust rather than formal legal mandates.

The main challenge is the low financial returns for waste collectors, leading them to sell e-waste to unauthorized recyclers, as a result, SWaCH and informal collectors now operate independently.

FIGURE 4: PROCESS FLOW OF THE SWaCH INITIATIVE BY KKP KP



**v) Model based on aggregating informal collectors under a PRO umbrella:**

These models involve the establishment of Producer Responsibility Organizations (PRO), which are responsible for managing the entire lifecycle of electronic products, including collection, recycling, and safe disposal. These organizations collaborate with the informal sector to ensure efficient collection and to formalize and regulate their activities. For example;

**Karo Sambhav:** It is a PRO offering e-waste solutions and extended producer responsibility services to producers. Karo Sambhav not only assists producers in making robust EPR plans but also runs awareness campaigns, sets up collection channels in the informal sector, and sends collected e-waste for responsible recycling. The startup has countrywide operations and has worked with producers and brands like Apple, Dell, HP, Lenovo and HMD to implement their Extended Producer Responsibility (EPR), helping close their material loop.

For the large amount of e-waste generated and the relative lack of formal aggregator, many producers are aligning with PROs like Karo Sambhav to fulfil their EPR targets. The organisation had integrated with many NGOs and agencies who work on the issue of e-waste across the country, while also fortifying sustainable livelihoods for thousands of waste pickers. They engage with informal e-waste collectors by conducting capacity-building programs and training sessions to enhance the collectors' knowledge and skills related to e-waste collection, segregation, and safe handling practices.

Karo Sambhav has also established country wide network of collection centers, in partnerships with informal e-waste collectors, by collaborating with local NGOs working on e-waste related issues in diverse regions. These collectors are



provided with the necessary infrastructure, tools, and support to efficiently collect and manage e-waste in their respective areas.

It also conducts awareness campaigns and educational programs targeting informal e-waste collectors to create awareness about the importance of proper e-waste management, health and safety precautions, and environmental impact. It has ensured fair and transparent processes for informal e-waste collectors by implementing systems for accurate weighing, fair pricing, and transparent documentation. This helps build trust and maintain a positive working relationship with the collectors.

Through its collaboration with authorized formal recyclers, Karo Sambhav is ensuring safe transport and processing of collected e-waste, where Informal e-waste collectors play a vital role in this by undertaking collection and aggregation of e-waste, which is then handed over to the formal recyclers for proper recycling and disposal.

Overall, Karo Sambhav recognizes the importance of involving informal e-waste collectors in its operations which would lead to more effective and sustainable e-waste management. It aims to create a mutually beneficial ecosystem that promotes responsible e-waste collection and recycling practices while improving the livelihoods of informal e-waste collectors and it has also launched a mobile-based application with the aim to provide a user with 360-degree solution for their e-waste by connecting them with refurbishers and waste collector on a single platform.

Let us now enlist a brief summary of all the models discussed so far, their key characteristics and challenges they faced which have constrained their scalability and replicability.

**TABLE 2: EXISTING MODELS, KEY CHARACTERISTICS AND CHALLENGES**

Name of the Model	Key characteristics	Challenges faced
Green E-waste Recycler	<p>Collaboration between informal sector workers and formal recyclers.</p> <p>Informal workers engaged by Green E-waste not only screen and separate collected e-waste fractions, but also repair reusable products and send discarded ones to formal recyclers.</p>	<p>It has faced challenges of establishing a partnership with producers and in applying for a recycling license, which requires significant capital costs.</p>
Safai sena by Chintan	<p>It works closely with waste pickers through their Safai Sena cooperative, providing training, ID cards, and direct payments based on e-waste quality and quantity.</p> <p>It has a collection license and stores collected e-waste at their office, and once enough e-waste is collected, it is sent to authorized recyclers, with whom it has agreements, for further processing.</p> <p>It used to collect up to one ton of e-waste per month, positively impacting waste pickers' livelihoods and increasing their income by twenty-five per cent.</p>	<p>It has faced challenges in establishing relationships with producers, in expanding the initiative, and enhancing the skills of informal workers.</p> <p>Scalability of its model is also too dependent on organizational capacities, human resources, and the ability to build trust among the informal sector workers.</p>

Name of the Model	Key characteristics	Challenges faced
Microsoft - GiZ	<p>The program aimed to formalise waste collectors by working with civil society partners and provided technical and financial assistance to set up take-back programs for managing end-of-life mobile phones and accessories.</p> <p>It focused on the ethos that e-waste management success depends on collaboration among civil society partners, formal recyclers, informal collectors, and government authorities.</p>	<p>It faced challenges such as lack of monitoring, low-quality waste collected, and a lack of enforcement of e-waste management rules.</p> <p>Scalability of similar programs would depend on redesigning partnership models and improving monitoring methods</p>
Swaach by KKPKP	<p>Started as a pilot program from 2006 to 2008, involving 1500 waste pickers serving 1,25,000 households to collect MSW and later expanded services to include e-waste disposal.</p> <p>It acts as a collection agency for e-waste and has partnered private e-waste recycling company, to ensure proper recycling and with Pune Municipality Corporation, to guarantee space for e-waste collection centers.</p>	<p>Due to low financial returns, informal collectors sometimes sell e-waste to unauthorized recyclers, hence the main challenge for the model is to ensure higher financial returns for waste collectors.</p>
Karo Sambhav	<p>Collaborates with various NGOs and agencies working on e-waste across the country in order to engage informal collectors, fostering partnerships and strengthening sustainable livelihoods for informal waste pickers.</p> <p>Program aims is to assist producers in developing robust Extended Producer Responsibility (EPR) plans to manage their e-waste effectively.</p>	<p>The focus of the model is to help producers by providing them with extended producer responsibility services, hence, the task of interlinking and upgrading informal workers becomes an afterthought.</p>



## V. PROPOSED PROTOTYPES FOR UP-GRADING INFORMAL SECTOR ACTORS

In this section a few prototypes which could assist in upgradation of informal sector actors will be discussed, keeping in mind the challenges and constraints that the above-mentioned models and prototypes have encountered.

**The E[co] work model** – A model for upgradation of informal sector actors in e-waste, based on the idea of co-working space.

As we know, in India, informal micro-entrepreneurs for e-waste collection and recycling handle 95 per cent of the approximately 3 million tonnes of e-waste generated annually in the country. E[co]work was founded to address the challenges faced by informal workers in the e-waste sector.

Model based on shared co-working space, equipped with necessary tools, ergonomic equipment and other amenities. The physical dismantling facility they provide is attested with all legal permissions and in compliance with environmental and occupational safeguards.

Further, training on dismantling, health and safety, business and regulatory aspects to enhance efficiency and safety will also be provided

Informal sector waste collectors use this facility to dismantle and segregate e-waste, while also availing additional service by paying a fair rental price.

The facility establishes linkages between informal workers, authorised recyclers and also connects with TSDF.

The dismantled e-waste can be sold to recyclers and by the informal workers on a pay-as-you-go basis.

The facility operator takes responsibility for digitally documenting and recording the Inflow and outflow of waste from the facility.

Would require government assistance in scaling up by means such as allocation of land etc.

Their concept involves creating safe co-working spaces equipped with the necessary tools, providing training on dismantling, health and safety, and business and regulatory aspects.

E[co]work aims to make the dismantling process more efficient and safer by offering reliable electricity, ergonomic equipment, good lighting, ventilation, and other tools. They also plan to develop a digital platform for tracking material and connecting micro-entrepreneurs with recyclers, producers, and e-waste generators.

E[co]work intends to facilitate the transition of informal sector entrepreneurs to mainstream businesses as regulations and documentation requirements evolve. They also aim to offer storage space for separated materials and provide documentation and traceability for efficient financial transactions.

E[co]work also plans to provide training, business support services, and explore innovative approaches for financial security and benefits for micro-entrepreneurs.

The business model of E[co]work operates on a pay-as-you-go basis, with additional services offered at fair prices. They are in the process of obtaining legal approvals and expect to commence operation in the NCR region. It has also gained interest from other cities in India and organizations from Africa looking to replicate their business model.

The organisation has in the process overcome many legal hurdles which involve, navigating licensing and compliance requirements, under different legislative frameworks including e-waste management, environmental protection, and labour laws. They also need to apply data protection and privacy rules as they plan to develop a digital platform, which necessitates measures to safeguard personal information. The services they plan to offer to the informal sector entrepreneurs in transitioning to mainstream businesses would involves understanding and complying with registration, licensing, taxation, and documentation requirements.

**Aggregator-style model** – In recent years, the concept of an aggregator-style model has gained prominence in various industries, revolutionizing the way services are provided. Just as Uber transformed the taxi industry and Zomato revolutionized food delivery, a similar model has the potential to bring significant change to e-waste collection services in India.

The current e-waste management landscape in India largely relies on informal micro-entrepreneurs who collect and process the majority of the country's e-waste. However, this informal sector faces numerous challenges, including limited resources, lack of access to technology, and inadequate training on safe handling and disposal practices. These issues hinder the efficient and sustainable management of e-waste.

Such models have gained prominence in various industries and has the potential to revolutionize e-waste collection services in India.

An aggregator platform can connect e-waste generators, informal collectors, and authorized recyclers, serving as a centralized hub for requesting pickups and connecting with verified collectors.

The model would support the growth and professional development of informal collectors through training, knowledge sharing and promote transparency, efficiency, and sustainability in e-waste management, empowers informal collectors, and encourages responsible disposal by e-waste generators.

An aggregator-style model for e-waste collection services can address these challenges by leveraging technology and creating a platform that connects e-waste generators, informal collectors, and authorized recyclers. The aggregator platform can serve as a centralized hub where individuals and businesses can request e-waste pickups and connect with verified collectors in their vicinity.

The process could begin with e-waste generators using a mobile application or website to schedule a pickup for their electronic waste. This could be done by providing details such as location, quantity, and type of e-waste. The aggregator platform would then match the request with nearby registered collectors from the informal sector who have the capacity and resources to handle the specific type of e-waste.

Once a suitable collector is identified, they would receive a notification about the pickup request and accept it based on their availability. The collector would then visit the designated location to collect the e-waste from the generator.

The aggregator platform could provide real-time tracking of the collection process, ensuring transparency and accountability. The model can also incorporate features such as rating and feedback systems to promote quality service and build trust between collectors and e-waste generators. This would enable users to provide feedback on the collection experience, helping to improve the overall efficiency and professionalism of the sector.

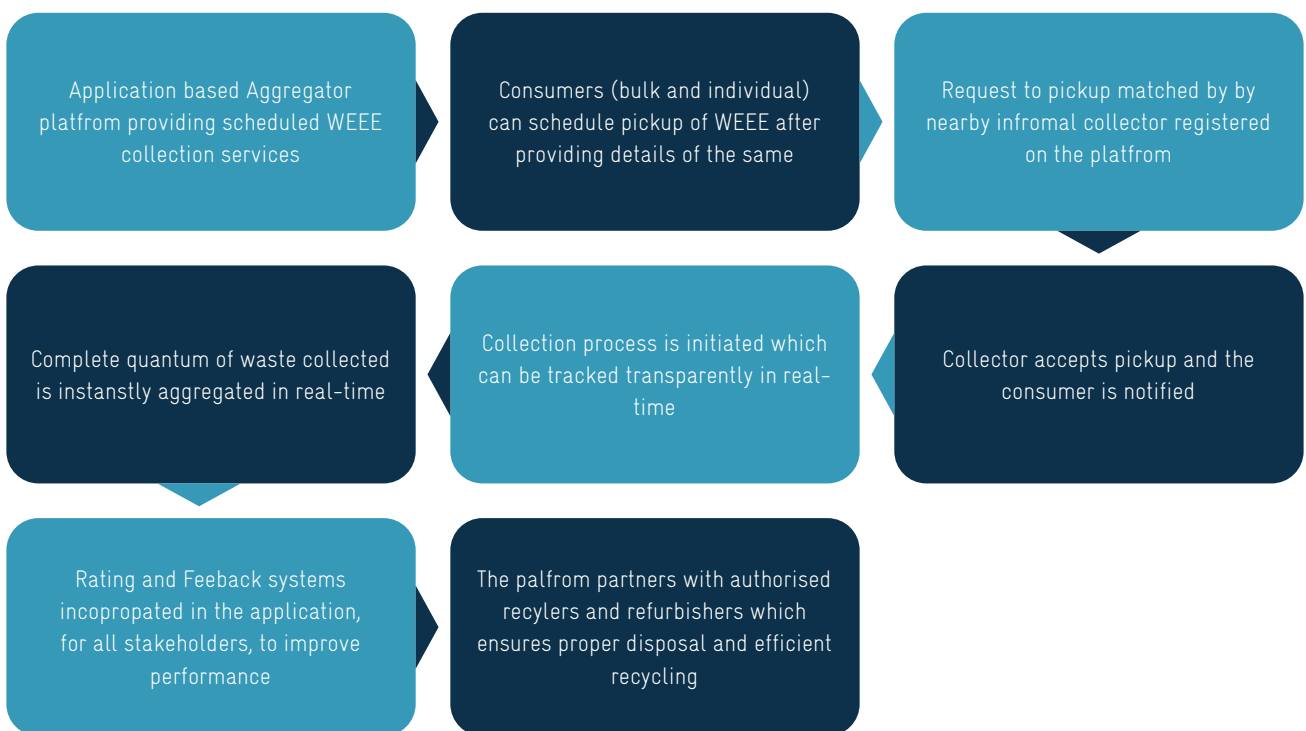
Furthermore, the aggregator platform could play a crucial role in facilitating the proper disposal and recycling of e-waste. It could establish partnerships with authorized recyclers who adhere to environmentally sound practices. The collected e-waste could be channelled to these recyclers, ensuring that it is treated in a responsible manner and valuable resources are recovered.

In addition to streamlining the collection and disposal process, the aggregator model can also support the growth and professional development of informal collectors. By providing access to training programs, knowledge sharing, and capacity-building initiatives, the aggregator platform can enhance the skills and capabilities of collectors. This, in turn, can lead to improved livelihoods and upgradation of the sector.

The benefits of an aggregator-style model for e-waste collection services in India are significant. It can promote transparency, efficiency, and sustainability in the management of e-waste. It can empower informal collectors by providing them with technological tools, training, and access to a broader customer base. Additionally, it can encourage e-waste generators to responsibly dispose of their electronic devices by offering a convenient and reliable pickup service.

As India continues to grapple with the challenges of e-waste management, embracing an aggregator-style model could be a game-changer. By harnessing the power of technology and connectivity, this innovative approach has the potential to transform the e-waste sector, ensuring a cleaner environment, promoting circular economy principles, and creating new economic opportunities for informal collectors.

**FIGURE 5: PROCESS FLOW FOR AN APP-BASED AGGREGATOR PLATFORM FOR E-WASTE, INFORMAL COLLECTORS AND AUTHORISED RECYCLERS.**



**Corporate Social Responsibility (CSR) based skill enhancement campaigns**—In the realm of e-waste management, the mandates of Corporate Social Responsibility (CSR) can also be used as a tool for upgradation of informal workers by encouraging producer company to design and implement CSR campaigns and initiatives that focus on skill enhancement of informal actors.

CSR can be used as a measure to upgrade informal workers in e-waste management by designing and implementing campaigns and initiatives that focus on skill enhancement.

Training programs can focus on e-waste types, hazards, and best practices for collection, segregation, and disposal to handle e-waste effectively and safely.

Such campaigns can also provide broader skill sets including entrepreneurship, financial literacy, and business management, enabling informal actors to establish and sustain their own enterprises.

Informal actors, such as waste pickers and recyclers, play a crucial role in the collection and processing of e-waste in many countries, including India. However, they face numerous challenges, including limited access to resources, inadequate training, and a lack of recognition for their contributions.

A model based on CSR funded skill enhancement campaigns can bridge these gaps and bring about significant positive change in the e-waste management ecosystem. Such campaigns can be designed to provide formal training, education, and capacity-building opportunities for informal actors, empowering them with the skills and knowledge needed to perform their tasks safely, efficiently, and in line with environmental regulations. One of the key objectives of these campaigns would be to enhance the technical expertise of informal actors in e-waste management.

Training programs could focus on teaching them about the different types of e-waste, their potential hazards, and the best practices for collection, and segregation. By equipping them with this knowledge, they can handle e-waste more effectively, reducing the risk of harm to themselves and the environment.

Moreover, these campaigns can offer vocational training to informal actors, enabling them to acquire specialized skills related to e-waste recycling and processing. This could include training in dismantling electronic devices, extracting valuable components. By upgrading their skills, informal actors can enhance the efficiency of their operations and potentially increase their income.

In addition to technical and vocational training, CSR-based skill enhancement campaigns can provide informal actors with broader skill sets necessary for their professional development. This could include training in entrepreneurship, financial literacy, and business management, empowering them to establish and sustain their own enterprises. By fostering an entrepreneurial mind-set, informal actors can explore new opportunities, create job opportunities for others, and contribute to the upgradation of the e-waste sector.

The need for such skill enhancement campaigns arises from the inherent challenges faced by informal actors in e-waste management. These individuals often operate in marginalized and vulnerable conditions, lacking access to basic amenities and facing social stigmatization. They often work without adequate protective gear, putting their health at risk. By addressing these challenges through CSR initiatives, companies can actively contribute to the well-being and empowerment of these informal actors.

Furthermore, these campaigns are essential for building a sustainable and responsible e-waste management system. By investing in their skills and capacities, companies can support the development of an inclusive and efficient e-waste management ecosystem, where informal actors are recognized, protected, and provided with opportunities for growth.

CSR-based skill enhancement campaigns for informal actors in e-waste management align with the principles of sustainable development, social responsibility and circular economy. They promote environmental stewardship,

economic empowerment, and social inclusion. Through these initiatives, companies can demonstrate their commitment to sustainable business practices, community engagement, and the well-being of society at large.

Finally, the need for a model for CSR-based skill enhancement campaigns for informal actors in WEEE management is evident. By investing in the training, education, and capacity-building of these individuals, companies can empower them to operate safely, efficiently, and with dignity.



## VI. CONCLUSION AND SUGGESTIONS

This paper gives detailed account about the contributions and key characteristics of informal sector workers in managing WEEE and the challenges and implications of their involvement in WEEE management.

It also provides descriptions of the various models that have been used to assist the upgradation of informal sector actors along with their constraints which hampered replicability and scalability. The final section of the paper elaborates on three different approaches / models which have been developed taking into consideration some drawbacks of the earlier models and the unique realities of the e-waste landscape in India.

We believe that these models have potential to transform e-waste management in the country while taking on board the skill set of the informal sector, ensuring their upgradation and integration into the recycling value chain. Government support, encouragement and incubation of these models will indeed bring about lasting gains for the entire sector.

Apart from these models the adoption of some key recommendations by the dispensation can also lead to fulfilment of certain key objectives which currently impede the upgradation of informal sector workers. These recommendations include;

- **Defining the role of informal workers in all regulations and ensuring recognition:** There is a need to reconcile the contradictory and cross cutting regulatory and legislative frameworks which lead to ambiguity about the legal status of the work performed by informal workers in e-waste sector. This can be achieved by clearly defining their role, contribution and their forms of operations under current legislations, addressing aspects such as e-waste collection and trade of e-waste.
- **Simplified Licensing and Taxation Policy:** The need for introducing a simple licensing process, with separate licensing category tailored to the informal actors' scale of operations, is paramount. As currently, the collection of e-waste by informal workers is not authorised under any statute, albeit, the buying, selling or trade in e-waste by informal sector does qualify as a commercial activity and attracts progressive taxation under the GST ambit.
- **Authorising collection by informal workers:** Authorising collection by the informal sector would not only benefit informal e-waste workers, but would also get rid of many bureaucratic pitfalls. Such authorisation can be provided by defining the act of e-waste 'collection' under the latest e-waste rules separately and recognising the role of informal workers in the same.
- **Facilitating market linkages:** Platforms or networks, like the first two prototypes for upgradation suggested above, will foster and facilitate market linkages for informal sector workers by connecting them with formal recyclers, manufacturers, and e-waste generators that enable direct transactions and transparency while ensuring fair prices



for the services of informal e-waste workers. These need to be encouraged by the government by assisting their piloting and scaling.

- **CSR based skill enhancement and assistance:** The producers of EEE devices can be mandated by the government to allocate a certain proportion of their CSR funds (say 10 per cent) exclusively for skill enhancement campaigns designed to assist the upgradation of informal sector workers.
- **Financial assistance, Incentives and Subsidies:** Incentives and subsidies can be introduced to encourage adoption of sustainable e-waste management practices. This could include tax benefits, financial support for infrastructure development, access to low interest loans and affordable technologies for safer dismantling.

By implementing these recommendations, India can enhance the capacity and well-being of informal sector workers involved in e-waste management, while promoting sustainable practices and circular economy principles and achieving environmental and social goals.

# ANNEXURE 1

## Informal sector upgradation

Identifying measures to support and facilitate the upgradation of the informal workers in the value chain, keeping in mind their skills

\* This form will record your name, please fill your name.

**1. What models can Producers/brands and Recyclers use to upgrade or integrate the informal sector?**

- Any of the existing models discussed
- One of the proposed models
- Other

**2. Have you worked with informal actors before?**

- Yes
- No

**3. If yes, then what was (is) the model/structure of engagement? (answer in a few words)**

**4. What are the major challenges that arise while working with informal actors? (answer in a few words)**

**5. Do you currently have any CSR campaigns or are you willing to spend CSR funds, for the skill enhancement of informal sector actors in the E-waste economy (for manufacturers / producers)**

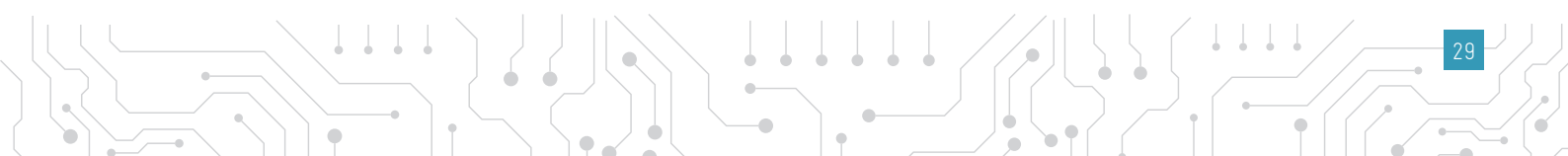
- Yes
- No



# REFERENCES

- Gollakota, A. R., Gautam, S., & Shu, C. M. (2020). Inconsistencies of e-waste management in developing nations—Facts and plausible solutions. *Journal of environmental management*, 261, 110234.
- Forti, V., Baldé, C. P., Kuehr, R., & Bel, G. (2020). *The global e-waste monitor 2020*. United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Rotterdam, 120.
- Baldé, C. P., D'Angelo, E., Luda, V., Deubzer, O., & Kuehr, R. (2022). *Global Transboundary E-Waste Flows Monitor—2022*. International Telecommunication Union: Bonn, Germany.
- Henzler, M. (2017). *Building the Link: Leveraging Formal–Informal Partnerships in the Indian E-Waste Sector*. GIZ.
- International Labour Organisation. (n.d). *Informal economy in South Asia*. Available at: <https://www.ilo.org/newdelhi/areasofwork/informal-economy/lang--en/index.htm>
- Ministry of Environment, Forest and Climate Change (2016) *Solid Waste Management Rules, 2016*. Available at: [https://cpcb.nic.in/uploads/MSW/SWM\\_2016.pdf](https://cpcb.nic.in/uploads/MSW/SWM_2016.pdf)
- Ministry of Environment, Forest and Climate Change (2022) *E-Waste (Management) Rules, 2022*. Available at: [https://cpcb.nic.in/uploads/Projects/E-Waste/e-waste\\_rules\\_2022.pdf](https://cpcb.nic.in/uploads/Projects/E-Waste/e-waste_rules_2022.pdf)
- Magalini, F., Kuehr, R., & Balde, C. P. (2015). *eWaste in Latin America: Statistical analysis and policy recommendations*. [https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee\\_en](https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en)
- Baldé, C. P., D'Angelo, E., Luda, V., Deubzer, O., & Kuehr, R. (2022). *Global Transboundary E-Waste Flows Monitor—2022*. International Telecommunication Union: Bonn, Germany.
- Turaga, R. M. R., Bhaskar, K., Sinha, S., Hinchliffe, D., Hemkhaus, M., Arora, R., ... & Sharma, H. (2019). E-waste management in India: issues and strategies. *Vikalpa*, 44(3), 127–162.
- Awasthi, A. K., Zeng, X., & Li, J. (2016). Environmental pollution of electronic waste recycling in India: A critical review. *Environmental pollution*, 211, 259–270.
- Turaga, R. M. R., Bhaskar, K., Sinha, S., Hinchliffe, D., Hemkhaus, M., Arora, R., ... & Sharma, H. (2019). E-waste management in India: issues and strategies. *Vikalpa*, 44(3), 127–162.
- Ibid.
- Toxics Link (2019). *Informal e-waste recycling in Delhi*.
- Baldé, C. P., D'Angelo, E., Luda, V., Deubzer, O., & Kuehr, R. (2022). *Global Transboundary E-Waste Flows Monitor—2022*. International Telecommunication Union: Bonn, Germany.

- Sengupta, D., Ilankoon, I. M. S. K., Kang, K. D., & Chong, M. N. (2022). Circular economy and household e-waste management in India: Integration of formal and informal sectors. *Minerals Engineering*, 184, 107661.
- Ibid.
- Ghosh, S. K., Debnath, B., Baidya, R., De, D., Li, J., Ghosh, S. K., ... & Tavares, A. N. (2016). Waste electrical and electronic equipment management and Basel Convention compliance in Brazil, Russia, India, China and South Africa (BRICS) nations. *Waste Management & Research*, 34(8), 693-707.
- Turaga, R. M. R., Bhaskar, K., Sinha, S., Hinchliffe, D., Hemkhaus, M., Arora, R., ... & Sharma, H. (2019). E-waste management in India: issues and strategies. *Vikalpa*, 44(3), 127-162.
- Awasthi, A. K., Zeng, X., & Li, J. (2016). Environmental pollution of electronic waste recycling in India: A critical review. *Environmental pollution*, 211, 259-270.
- Turaga, R. M. R., Bhaskar, K., Sinha, S., Hinchliffe, D., Hemkhaus, M., Arora, R., ... & Sharma, H. (2019). E-waste management in India: issues and strategies. *Vikalpa*, 44(3), 127-162.
- Henzler, M. (2017). Building the Link: Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector. GIZ
- Ghosh, S. K., Debnath, B., Baidya, R., De, D., Li, J., Ghosh, S. K., ... & Tavares, A. N. (2016). Waste electrical and electronic equipment management and Basel Convention compliance in Brazil, Russia, India, China and South Africa (BRICS) nations. *Waste Management & Research*, 34(8), 693-707.
- Henzler, M. (2017). Building the Link: Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector. GIZ.
- Arya, S., & Kumar, S. (2020). E-waste in India at a glance: Current trends, regulations, challenges and management strategies. *Journal of Cleaner Production*, 271, 122707.
- Henzler, M. (2017). Building the Link: Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector. GIZ.
- Ahirwar, R., & Tripathi, A. K. (2021). E-waste management: A review of recycling process, environmental and occupational health hazards, and potential solutions. *Environmental Nanotechnology, Monitoring & Management*, 15, 100409.
- Henzler, M. (2017). Building the Link: Leveraging Formal-Informal Partnerships in the Indian E-Waste Sector. GIZ.
- Arya, S., & Kumar, S. (2020). E-waste in India at a glance: Current trends, regulations, challenges and management strategies. *Journal of Cleaner Production*, 271, 122707.
- How Karo Sambhav, an Indian startup part of Microsoft ScaleUp, is solving e-waste problems (2021, March 17) The Economic Times. Available at: <https://economictimes.indiatimes.com/industry/miscellaneous/how-karo-sambhav-an-indian-startup-part-of-microsoft-scaleup-is-solving-e-waste-problems/fighting-e-waste/slideshow/81549561.cms>
- Singh, Y. P., & Amin, N. (2018). Assessing the challenges and issues of electronic waste management for cities in developing countries. *Int Res J Eng Tech*, 5, 1305-15.
- <https://www.isc3.org/page/ecowork-enabling-safer-sound-and-inclusive-e-waste-management>



**European Resource Efficiency Initiative**

B5/2, Safdarjung Enclave

New Delhi – 110029

T: 011 49495353

E: [rachna.arora@giz.de](mailto:rachna.arora@giz.de)

E: [reva.prakash@giz.de](mailto:reva.prakash@giz.de)

I: [www.eu-rei.com](http://www.eu-rei.com)