

# Understanding India's Informal E-Waste Management Sector

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**Abstract:** *Lack of technical expertise, subpar infrastructure, insufficient funding, and passive community involvement all contribute to difficulties in managing electronic trash (E-waste). This article offers a thorough overview of attempts to address these issues concerning inadequate recycling practices for e-waste and their harmful impacts on the environment and human health. It also shows informal sectors in e-waste management in developing countries (India) follows a cradle-to-grave approach. The appropriate management of E-waste requires the establishment of an inventory of obsolete electronic items, which can be done by setting up an eco-friendly legal framework for recycling. E-waste management policies implemented systematically in developing nations and best practices are anticipated to reduce negative effects while preserving a resilient and sustainable ecosystem.*

**Keywords:** E-waste, recycling, environment, pollution

## 1. Introduction

One of the fastest-growing waste streams in the world today is electronic waste (e-waste), or waste resulting from end-of-life electronic equipment like computers and cell phones. India produces 2 million tons of electronic waste annually, placing it among the top five producers worldwide. According to estimates, the informal sector dominates India's e-waste disposal, with over 90% of the waste being treated there, like in certain poor nations.

Millions of individuals, many of whom are members of the most disadvantaged groups, earn a living in the informal e-waste industry. On the other hand, the industry's waste management techniques seriously endanger the environment and the health of both the workers and the general public.

The long-term effectiveness of any e-waste management system will depend on our capacity to address this moral conundrum, raising public policy questions.

How to integrate this large group of people into an effective e-waste management system that will protect (and improve) their standard of living while also reducing the costs incurred by processing and disposing of e-waste externally.

## 2. Methodology

The study is based on both primary and secondary data.

Secondary data sources include published data from Environmental Science and Pollution Research, Science of the Total Environment, ScienceDirect, Recovery of Materials and Energy for Resource Efficiency, and The Journal for Decision Makers by IIM-A.

However, primary data was collected using semi-structured interviews with experts and professionals in the field of environmental engineering, NASSCOM, Central Pollution Control Board, and Public works Department in India (Region –Kerala)

Research question: How to utilize the existing informal sector without affecting the environment?

## 3. Literature Review

**Assessing enablers of e-waste management in the circular economy using DEMATEL method: An Indian perspective-Manu Sharma et al.**

Objective: Thus, this study aims to address these gaps to help stakeholders and policymakers to identify the causing factors, which are influencing the e-waste ecosystem adversely

Collaboration with environmental partners (EN1), Subsidies benefits (EN2), Recovery of precious material (EN3), Deposit refund scheme (EN4), Employee health schemes, Training programs for environmental consciousness (EN5), Green image (EN6), Reduction in landfill practices (EN7), Environmental management systems (EMS) (EN8), Environmental legislation (EN9), Reduction of hazardous and toxic substances in environment (EN10).

**E-waste management and its effects on the environment and human health-R. [5]**

Objective: This study seeks to investigate the detrimental impact of E-waste on both human health and the environment, analyze the worldwide distribution of e-waste, and explore strategies for formalizing the informal sector to enhance effective E-waste management.

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Findings: Various effects on human health were investigated in the study, alongside the global distribution of e-waste. Additionally, a cradle-to-cradle model was proposed as an effective approach for managing e-waste.

#### **The “Green e-Waste Channel” as an environmentally friendly and socially responsible concept to manage e-waste in emerging economies –[1]**

Objective: The study identified existing issues and unfavourable practices within the current situation, which were then translated into objectives for the implementation of the Green e-Waste Channel. These objectives align with the three pillars of sustainable development, focusing on environmental friendliness, economic sustainability, and social responsibility.

Findings: A long-term Green e-Waste Channel model was developed, incorporating a SWOT analysis. The model is designed to address the challenges and opportunities in e-waste management

#### **E-Waste Management in India: Issues and Strategies-[6]**

Objective: The objective of this study is to assess the current state of the e-waste management ecosystem by identifying the diverse challenges faced by the sector and exploring potential avenues for improvement. The focus is on creating a robust e-waste management system that integrates a strong network of individuals, ensuring the preservation and enhancement of their livelihoods. Simultaneously, the aim is to mitigate the external costs linked to e-waste processing and disposal.

Findings: The study identified several challenges and examined both current and future drivers influencing the business response to e-waste management in India. Additionally, the study proposed the establishment of informal-formal partnerships as a potential solution.

#### **Circular Economy: Overview of Barriers-[2]**

Objective: Through content analysis, the study identified and categorized several barriers.

Findings: main barriers identified in the literature were: (i) technological, (ii) policy and regulatory, (iii) financial and economic, (iv) managerial, (v) performance indicators, (vi) customer, and (vii) Social

Cradle to cradle: remaking the way we make things [9]

Cradle-to-cradle design, also referred to as 2CC2, C2C, cradle 2 cradle, or regenerative design, adopts a biomimetic approach to product and system design. It emulates natural processes where materials are viewed as nutrients, flowing through healthy and safe metabolisms. The term "cradle-to-cradle" is a deliberate twist on the corporate saying "cradle to grave," signifying that the C2C model prioritizes sustainability and takes into account the well-being of life and future generations. It focuses on the continuous cycle from the birth, or "cradle," of one generation to the next

rather than the linear trajectory from birth to death, or "grave," within the same generation.

#### **4. Informal sector**

The e-waste management sector in India is primarily handled by local scrap vendors who collect electronic waste. Subsequently, the recycling process involves crude techniques such as disassembling electronic equipment, manual dismantling of printed circuit boards, recovering metals through unsafe methods like opening or cutting cables, and breaking or melting plastics. Additionally, they use open acid leaching for metals recovery from e-waste. Unfortunately, many of these scrap vendors and their workers lack proper education and skills. [7]

Furthermore, they engage in the repair and refurbishment of old products for resale in the second-hand market, employing traditional and illegal methods like burning the products to extract metals, often unaware of the associated health risks. This extraction process releases toxic elements into the air, leading to air pollution, while the disposal and smudging of e-waste contaminate water sources. The remaining waste is often illegally landfilled.

Moreover, the workers labor under hazardous conditions without proper ventilation or personal protective equipment, resulting in direct exposure to these harmful elements, causing various chronic diseases.[3] Despite these concerns, the sector continues to expand, as the larger society has not taken adequate action.

Although the e-waste sector provides livelihoods to a substantial number of people, many of whom belong to marginalized sections of society, their practices are unscientific and unsafe, endangering their own health and potentially imposing environmental and health costs on the broader community.

#### **5. Formal System**

In India, a significant portion of e-waste is currently managed through non-regulatory methods, necessitating the implementation of policies to establish regulation. The formal e-waste management sector adopts an environmentally friendly approach, utilizing the latest available technologies for resource recovery. [7]. However, maintaining these measures requires substantial investment, creating challenges for formal recyclers who face competition from the informal sector.

In the formal e-waste system, electronic equipment is collected and sorted based on its intended use. The categorized equipment is then either refurbished or subjected to the dismantling process as needed. Reusable components obtained from refurbishment are sold in the market, while the remaining materials undergo proper dismantling to ensure environmentally friendly disposal of residues. During this process, various items are carefully separated and categorized to recover valuable materials for market use. The number of cycles required for these procedures may vary depending on the specific circumstances.

Global distribution of E-waste export (source) and import (destination) countries

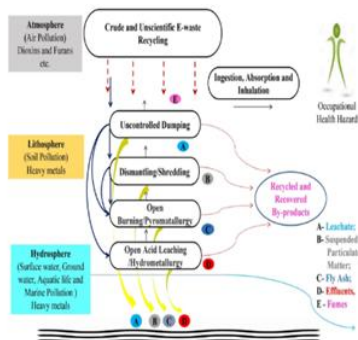


**Figure 1:** Source (E-waste management and its effects on the environment and human health)

The most significant challenge lies in the existence of the informal sector and its exclusion from the current regulatory framework. Despite playing a crucial role in managing the e-waste stream, the informal sector has not been recognized or acknowledged. On the other hand, the producers, identified as the key stakeholders in the regulations, have often used the presence of the informal sector as an excuse to avoid fulfilling their mandated Extended Producer Responsibility (EPR) obligations [8]. As a result, the current situation reflects a competitive scenario between the formal and informal sectors on multiple fronts. Access to waste, centred around value extraction at multiple levels of the waste trade, poses a serious challenge to EPR compliance [6]

In the presence of an informal sector with strengths in collection logistics, meeting the target capacity of the formal system is not ideal.

Routes of pollutants threatening the environment and human health due to informal E-waste recycling adapted from.



**Figure 2:** Source- pollutants threatening the environment and human health

### 6. Current e-waste management system in India

The primary concerns and challenges of E-waste management revolve around the lack of awareness among consumers and manufacturers regarding proper disposal methods. The generation and recycling of E-waste lack adequate monitoring. The informal sector, which handles a significant portion of E-waste processing, employs outdated techniques that lead to environmental pollution. Workers in the informal sector are often unaware of the toxic substances

and health hazards associated with E-waste, and the lack of modern technologies hampers efficient resource extraction. The absence of well-defined and enforced regulations for handling E-waste contributes to the problem. In developing countries, E-waste is viewed as a valuable commodity, and customers are paid by collectors. Conversely, developed countries have implemented strict regulations to prevent the flow of E-waste through illegal channels and ban illegal dumping.

Identifying the various flows of E-waste, both visible and illicit, is a crucial area of investigation for all countries. This investigation is essential for resource conservation, managing transboundary movement, and safeguarding human health.

### 7. Schematic Representation of India's existing e-waste management system



**Figure 3:** Source (author) India's existing e-waste recycling status

The schematic diagram makes it crystal obvious that the informal sector uses a cradle-to-grave approach and it follows the linear economy and is harmful to the environment. The cradle-to-grave approach is linear and typically does not take into account the environmental and sustainability considerations involved in product design and waste management. It often results in the depletion of natural resources, pollution, and waste generation, contributing to environmental issues such as climate change and ecosystem degradation. The discarded product is then usually sent to landfills, incinerated, or disposed of through other waste management methods. Nonetheless, a substantial number of marginal people depend on the informal sector for their living due to its extensive logistics. Hence, rather than outlawing the informal sector, the author proposes a formal-informal cooperation that would benefit both the environment and those who rely on it. In contrast, the cradle-to-cradle approach aims to promote sustainability and a circular economy. It advocates for designing products with the intent of recycling and reusing their materials at the end of their useful life, thereby minimizing waste and environmental impacts.

### 8. Conclusion

In many developing countries, e-waste is treated and managed informally and unlawfully. Due to a lack of enforcement of current legislation, large people in developing nations continue to be unaware of E-waste, applicable policies, rules, and regulations, and its

management. A viable pathway to a successful E-waste management system can be customized to bridge current gaps between the formal and informal recycling sectors, create sustainable and resilient environments, improve worker health and safety, and boost business and job prospects. The schematic representation clearly shows that the informal sector takes a cradle-to-grave approach that is linear and does not take environmental and sustainability considerations into account in product design and waste management. Thus, the author suggests a cradle-to-cradle approach in our e-waste management system to reduce the environmental impact.

Engineering at AISAT. Currently, he is at research at the Faculty of Economics and Business, University of Latvia, where he is engaged in groundbreaking research focusing on the management of electronic waste (e-waste) systems in developing countries.

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## Author Profile

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