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Refurbishing and Recycling as an Effective Way to Solve the E-Waste Problem

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Abstract: ***E-waste has become the most significant problem since the 1980s, and awareness is growing among the general public and institutions worldwide about the e-waste problem and its harmful effects. Although European countries and developed countries see it as a threat, in many countries such as India, China, and Southeast Asia, there is little concern about it. Even in West Bengal, there needs to be more awareness about it. There are many registered e-waste dismantlers/recyclers in India, but very few are from West Bengal. The primary motivation of the work is to understand the treatment associated with electronic waste and to study the initiatives taken by different governmental and non-governmental organizations to find the solution to the imminent threat of electronic waste. One of the possible solutions to the problem is recycling and recovery. Also, society should opt for longer life spans and repairable products over cheap, non-repairable ones. We should avoid disposing of e-waste but give it to merchants associated with recycling. In the future, we need more E-Waste Dismantling/Recycler-associated organizations in West Bengal. Our study indicates that compared to countries like the United Kingdom, and the United States of America. In India, the percentage of "formally collected electronic waste" is very small, although currently, the "Kg of E.E.E. placed on the market per capita" is very low. in countries like the U.K. and U.S.A. But, in the future, there will be a drastic increase in the same in India. Our study also indicates that the installed capacity of e-waste Dismantler/Recyclers in West Bengal is minimal, almost 0.24% compared to the rest of India. The same needs to be improved to deal with the imminent threat of e-waste.***

Keywords: E-waste awareness, harmful effects, limited lifespan, reuse-initiatives, advanced recycling fee

1. Introduction

Electronic waste, commonly known as e-waste, refers to discarded electronic devices or equipment that have reached the end of their useful life or are no longer wanted or needed. E-waste encompasses many electronic devices, including computers, laptops, mobile phones, televisions, refrigerators, washing machines, digital cameras, printers, and more. These electronic devices often contain hazardous substances and materials like brominated flame retardants, lead, mercury, cadmium, and various toxic chemicals. When e-waste is improperly disposed of or managed, these substances can have profound environmental and health implications.

E-waste is a global issue that is getting more attention because of how quickly technology is developing and how many electronic gadgets are being used. Due to intentional obsolescence or regular upgrades, A large number of electronic equipment have a relatively limited lifespan, which results in a sizeable amount of electronic trash being produced globally. Proper management of e-waste involves recycling and disposal methods that minimize environmental and health risks. Recycling e-waste helps recover valuable materials and reduces the demand for new resources, while ensuring hazardous substances are safely handled and disposed of. Additionally, refurbishing and extending the lifespan of electronic devices through repair and reuse initiatives can also help reduce e-waste.

India as producer of e-Waste:
India is the fifth largest producer [1] of the e-waste [2]. The largest e-waste dismantling facility in India is located in Seelampur [3], Delhi. Children and adults spend 8 to 10 hours every day removing functional parts, copper, gold, and other valuable metals from the devices. In Table 1 and Table 2 , the e-waste generation report and chronological development of e-waste rules in India is stated, respectively. In Table 1 and Table 2 , the e-waste generation report [4] and chronological development of e-waste rules in India is stated, respectively.

Table 1: E-waste generated per category (kt) in India (Global E-waste Statistics Partnership, 2022)[1]

Year	E-waste generated (kt)	EEE Put on Market (kt)	E-waste formally collected (kt)	E-waste generated Kg Per capita	EEE Put on Market Kg Per capita	Population
2015	1973	4506	30	1.5	3.5	1,282,920,000
2016	2225	5636	30	1.7	4.3	1,299,800,000
2017	2529	6799	30	1.9	5.2	1,316,900,000
2018	2863	7155	30	2.1	5.4	1,334,220,000
2019	3230	7783	30	2.4	5.8	1,351,770,000
2020	3617	8295	30	2.6	6.1	1,369,560,000
2021	4013	8594	30	2.9	6.2	1,387,580,000
2022	4413	8912	30	3.1	6.3	1,405,830,000

[1]India - 2022 - E-waste statistics (globalewaste.org)

"EEE PUT ON MARKET [https://globalewaste.org/country-sheets] *IS* DEFINED AS ANY SUPPLY OF A PRODUCT FOR DISTRIBUTION, CONSUMPTION OR USE ON THE MARKET IN THE COURSE OF A COMMERCIAL ACTIVITY, WHETHER IN RETURN FOR PAYMENT OR FREE OF CHARGE."
"E-WASTE GENERATED IS DEFINED AS THE AMOUNT OF DISCARDED ELECTRICAL OR ELECTRONIC PRODUCTS (E-WASTE) DUE TO CONSUMPTION WITHIN NATIONAL TERRITORY IN A GIVEN REPORTING YEAR, PRIOR TO ANY COLLECTION, REUSE, TREATMENT, OR EXPORT."
"E-WASTE FORMALLY COLLECTED REPRESENTS THE E-WASTE COLLECTED AS E-WASTE AND REGULATED BY ENVIRONMENTAL PROTECTION LAWS SPECIFICALLY DESIGNED FOR E-WASTE. THIS INCLUDES E-WASTE THAT IS COLLECTED AND LATER EXPORTED, AND TREATED ACCORDING TO NATIONAL STANDARDS IN ANOTHER COUNTRY."

Table 2: Chronology of development of E-Waste management rules in India (http://www.iisrr.in/mainsite/wp-content/uploads/2021/09/14.-Dr-Tamal-Sarkar-E-Waste-threat-and-solution-to-the-impending-e-waste-threat-in-India-with-specific.pdf)

Year	Act/Rule/Reports
1986	In order to safeguard and improve the quality of the environment and to prevent, control, and mitigate environmental pollution, the Environmental Production Act (EPA) provides required or expedient measures.
1989	Hazardous Waste Management and Handling Rules to to have a dividing line between waste and by product streams
2003	The Hazardous Wastes Management and Handling Rules
2008	The management of e-waste was covered under the Environment and Forests Hazardous Wastes (Management and Handling) Rules 2008
2009	Department-related Parliamentary Standing Committee on Science & Technology, Environment & Forests in its 192nd Report on the Functioning of the Central Pollution Control Board (CPCB), has concluded that e-waste is going to be a big problem. The Committee has suggested a more proactive role for the CPCB
2011	An exclusive notification on E-waste (Management and Handling) Rules, 2010 under the Environment (Protection) Act, 1986 has been notified on 12th May 2011 to address the safe and environment friendly handing, transporting, storing, and recycling of e-waste and also to reduce the use of hazardous substances during manufacturing of EEE
2016	Implementation of Extended Producer Responsibility (EPR) by producers and to increase their role, in effective management of E-Waste, MoEF & CC, GoI has notified the E-Waste (Management) Rules, 2016 vide G.S.R. 338(E) dated 23.03.2016

Steps for proper handling of e-waste:
Handling e-waste and recycling it involves a series of processes to ensure the proper management of electronic devices and the recovery of valuable materials. Here are the general steps involved in handling and recycling e-waste:

Collection: E-waste collection is the initial step in the recycling process. Various stakeholders, including individuals, businesses, and organizations, participate in collecting and consolidating e-waste. Collection points can be established at designated recycling centres, drop-off locations, or through specialized e-waste collection events.

Sorting and Categorization: Once collected, the e-waste is sorted and categorized based on different criteria such as device type, material composition, and potential for recycling. This step helps identify which devices can be refurbished or reused and which ones need to be processed for recycling.

Testing and Repair: Devices that are suitable for refurbishment undergo testing and repair. Skilled technicians assess the functionality of the devices, identify any defects or issues, and perform repairs to restore them to working condition. This process includes replacing faulty components, upgrading software, and conducting quality checks.

Data Erasure: Before refurbishing or recycling, it is crucial to ensure the secure erasure of any personal or sensitive data present on the devices. Data wiping techniques, such as overwriting or degaussing, are used to remove all traces of information, protecting privacy and preventing unauthorized access.

Refurbishment and Reuse: Refurbished devices that have been repaired and tested successfully are made available for reuse. They can be sold or given away to people, groups, or communities that would benefit from receiving inexpensive and useful electronics. This extends the lifespan of the devices and reduces the need for new production.

Recycling: Devices that are not suitable for refurbishment or reuse are processed for recycling. The recycling process involves disassembling the devices into their constituent parts and separating the different materials, such as metals, plastics, glass, and circuit boards. These materials are then sent for further processing and recycling.

Material Recovery: During the recycling process, various valuable and hazardous materials are recovered from the e-waste.The extraction of rich resources, including copper, silver, gold, and other precious metals, is done for recycling. Lead and other hazardous materials are handled carefully and disposed of in accordance with legal standards.

Proper Disposal of Residual Waste: After the recycling process, any remaining non-recyclable or hazardous waste is appropriately disposed of in compliance with environmental regulations. This guarantees that the leftover garbage won't endanger the environment or people's health.

Suggested solution to the impending problem of e-waste:
Refurbishing and extending the lifespan of electronic devices through repair and reuse initiatives is an important strategy to reduce e-waste and promote sustainability.

Here are some crucial details emphasizing the advantages of this strategy:

Environmental Impact Reduction: We can greatly lessen the environmental impact resulting from the production and disposal of new electronic equipment by fixing and reusing them. By extending a device's lifespan, fewer resources are required to create new ones, which results in energy savings and lower greenhouse gas emissions.

Conservation of Resources: Electronic devices contain valuable resources such as rare metals, precious metals, and plastics. By refurbishing and reusing these devices, we conserve these resources and reduce the need for extracting and processing new raw materials. This lessens the ecological impact of producing electronics and protects natural resources.

Waste Minimization: Repairing and reusing electronic devices reduces the amount of e-waste generated. Instead of being discarded and ending up in landfills or incinerators, functional devices can find new owners or be used in other applications, extending their useful life. This minimizes the environmental and health risks associated with the improper disposal of e-waste.

Cost Savings: Refurbishing and repairing electronic devices can be more cost-effective compared to purchasing new ones. It offers a cost-effective way for people and businesses to use technology while easing the financial load brought on by frequent updates or replacements.

Digital Inclusion: Reusing and distributing refurbished devices can help bridge the digital divide, making technology more accessible to underserved communities and individuals who may not have the means to purchase new devices. This promotes digital inclusion and enables broader access to educational, economic, and social opportunities.

To support refurbishing and extending the lifespan of electronic devices, initiatives like repair programs, trade-in programs, and community-based refurbishment centres can be established. Additionally, consumer awareness and education about the benefits of repair and reuse can encourage individuals to choose these options over buying new devices.

2. Conclusion

Though, the Government has put forward the policy instrument under the EPR, which put the mandatory responsibility of the producer to take back. According to Sinha [5], the Ministry of Environment, Forest and Climate Change (MoEFCC) should update the current regulation to more explicitly highlight the part the informal sector plays in the management of e-waste. Such decision may play a crucial role to cover a vast geographical area due to ability of informal sector to collect and aggregate strength and also help the urban poor.But, in the presence of an informal sector with strength in collection logistics, a mandatory take back targets might not be good idea as suggested by Turaga[6] rather the economic instrument like advanced recycling fee (ARF) or advanced disposal fee (ADF) on every unit of the product sold in the market would relieve the producers of the physical responsibility of collection and the generated revenue of this way may be used for market developments of the end-of-the-life products through various means such as funding the recyclers, assist informal sector workers through training/skill development or provide social security to the workers in informal sector[7]. Further, there should be incentives for design environmentally friendly products.

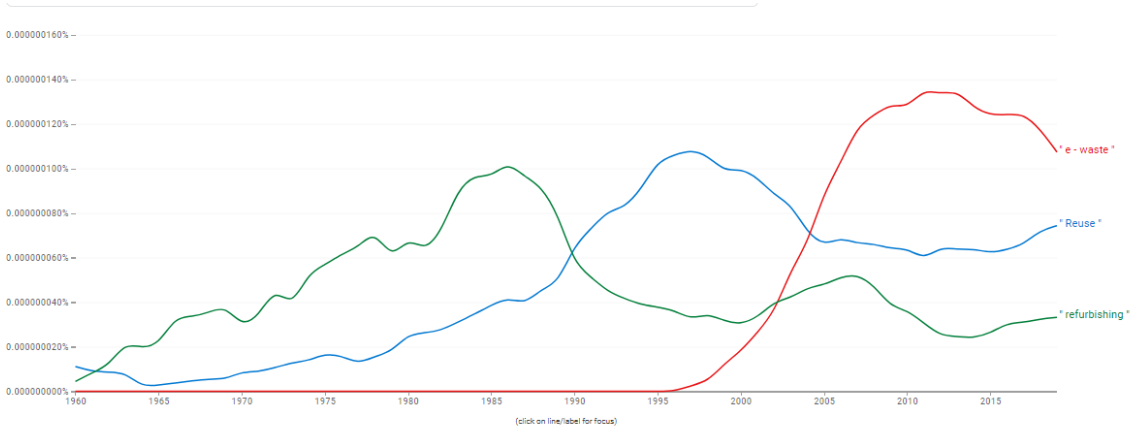

Figure 1: ngram comparative analysis between "e-waste" vs "refurbishing"and “reuse”

Further, the ngram analysis is also suggesting that the refurbishing and re-use is helping in controlling the e-waste.

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