E-Waste Management: Not a Hurdle, But an Opportunity for the Indian Market

ANKIT DIXIT

PRAVIN WARARKAR

PRAKHAR MITTAL

Abstract

Around the world, developing countries like India and China are becoming the favourite dumping destinations of Waste from Electrical and Electronics Equipment (WEEE) or E-waste because of their poor laws and regulations. India's capital, Delhi - NCR region, is turning into the world's dumping yard for electronic waste and could collectively generate more than 95,000 metric tons (MT) per annum by 2017. While there is no organized sector handling this waste generated, the paper discusses various aspects to set up recycling plants which will have facilities to dismantle, segregate and recycle this e-waste. All the Electronics waste contains some amount of precious material like gold, silver, etc. Collecting this material and refurbishing the waste into usable material is an opportunity for the Indian market. This paper discusses the possibility of a partnership between an electronics company and the customer to tackle the issue of electronic waste by recycling electronic components. Recycling electronic items at a mass level will not only solve the problem of e-waste but also provide employment to the skilled and semi-skilled youth of the country.

Key Terms: Electrical and Electronics Equipment (EEE), E-Waste Management, Refurbishment, Recycling

Introduction

Waste Electrical and Electronic Equipment (WEEE) includes a wide variety of domestic and commercial products like refrigerators, air conditioners, televisions, laptops, desktops, smart phones, computing machines, robots in industry, etc. which are rejected by the consumer or industry[1]. These devices contain lots of toxic materials like mercury, chromium, arsenic, lead, cadmium and plastics, which should be treated well before disposing the waste [2].

StEP, a collaborative organization of solving the e-waste problem states, "E-waste is a general term; it can be considered to cover TVs, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers etc.), home entertainment and stereo systems, toys, toasters, kettles – almost any household or business item with circuitry or electrical components with power or battery supply." [3]

Currently, e-waste recycling is a highly unorganized sector in India, where any e-waste product is generally dumped. At most, the product is repaired or the valuables are mined from the gadget and the rest is dumped. The uniqueness of the proposed idea is to ensure that each and every discarded electronic item can be recycled by defining the responsibility at the individual level. We also tend to retain and reuse things which are useable. The reused items contribute to very low cost "Refurbished" gadgets. Any recycling should be done using non-toxic methods and outputs. The non-recyclable material will be fed to incinerators and treated.

The idea is to recycle this e-waste, including metal burning, silicon recycling, plastics and other materials, all in one place without exception. So, if a gadget is to be discarded, the user will simply contact the nearest dump centre or collection centre of the company to which the product belongs. In return, the user will get an acceptable price after an evaluation of the product. The product will be recycled and the toxic waste will be disposed of safely. The recycling of waste from scrap dealers and companies will be done at par with international standards.

The major driver will be the cost of recycling, recovery and disposal, which is much cheaper in India when compared to that in developed countries.

Component of E-Waste Management

The major components of e-waste management are:
1. e-waste collection, sorting and transportation
2. e-waste recycling; it involves dismantling, recovery of valuable resources, sale of dismantled parts and export of processed waste for precious metal recovery.

The first component i.e. collection of the e-waste plays an important role to resolve this issue. In India, currently the informal sector (including individuals) manages e-waste. For managing e-waste efficiently, it's important to change this into a formal business sector.

The stakeholders, i.e., the people who can help in overcoming the challenges posed by e-waste, are:
1. Manufacturers
2. Users
3. Recyclers
4. Policy makers

All these four stakeholders have individual responsibility in this management process. Presently in India, there is lack of government policies which define the collection, sorting and recycling of e-waste at every level of the process. The literature survey done by the authors indicates that e-waste generated in previous years increases rapidly and needs to be dealt with in time.

Literature Survey

With rapidly evolving technology, electronic gadgets become obsolete within a year, i.e. they have a short life span. These products, including mobiles, laptops, refrigerators, air conditioners, etc. may still be usable. Unfortunately, they are discarded. In 2009, India was producing 3,82,000 tons of e-waste which had doubled since 2005, with 65 cities contributing to more than 60% of this e-waste. The main contributor of e-waste in India is the US, which ships about 42 per cent of its e-waste into the country, followed by China and the European Union, who dump nearly 30 per cent and 18 per cent e-wastage in Delhi-NCR respectively [4].

According to Enterprise Innovation, a paper by the Associated Chambers of Commerce of India (ASSOCHAM) says e-waste in India is projected to grow at a compound annual growth rate (CAGR) of 25 per cent from today's 55,000 MT per annum [5]. The Supreme Court of India ruled on 14 October 2003 that import of e-waste into India is illegal and amendments should be made in the policy [6].

Table I gives an overview of e-waste related information for India including how much EEE (Electrical and Electronics Equipment) was put in the market in the year 2012 and e-waste generated in the year 2014 [7]. The data shows that over 50% of electronics products have been discarded by the consumer in the span of 2 years. The main issues with WEEE (Waste from Electrical and Electronics Equipment) are lack of common protocol of e-waste recycling, people not being aware about what to do with e-waste scrap and poor e-waste collection efficiency [8].

Subject	Unit	Year	Amount	Source
EEE put in the market	(kg per inhabitant)	2012	2.5	UNU-IAS SCYCLE (2015)
	(total in metric kilotonnes)	2012	3,026	UNU-IAS SCYCLE (2015)
E-waste Generated	(kg per inhabitant)	2014	1.3	UNU-IAS SCYCLE (2015)
	(total in metric kilotonnes)	2014	1,641	UNU-IAS SCYCLE (2015)

TABLE I: Overview of e-waste related information [7]

Proposed Methodology

Today, only 10% of the total e-waste produced is recycled in the formal sector. E-waste recycling by the formal sector has a three-level hierarchy. 1. Preliminary e-waste generators, 2. Secondary e-waste generators and 3. Tertiary e-waste generators [9]. The major stakeholders are scrap dealers who purchase e-waste at the first level in bulk. The market between the first and second levels is partly formal but is completely informal between the second and third levels. The major stakeholders between the second and third levels are metal extractors, plastic extractors, electronic item extractors, etc. The conventional method is a bit complex in nature and is not efficient - most of the scrap is only dumped.

If we define the responsibility at the individual level, then it would be easier to face the problem of electronic waste. The author proposes that every electronic item, which is sold by a company, should include the recycling cost of the product. The amount should be refundable in nature. The deposited amount should be used by the company to set up recycling plants for their own products. The consumer will discard the products by returning them to the nearest E-waste collection centre of the company and the deposited amount will be refunded to the customer with interest. Figure 1 shows the lifecycle of the product from the manufacturing level to the recycling level.

The proposed methodology will not only help to organize this recycling process at the individual level i.e. customer to company level, but it is proposed that profits earned on recycling should be shared by all stakeholders. The customer gets his deposited amount with interest and the company always has the option to refurbish the product or use the valuable material like antimony, gold, silver, chromium, zinc, lead, tin and copper to manufacture new electronic gadgets.
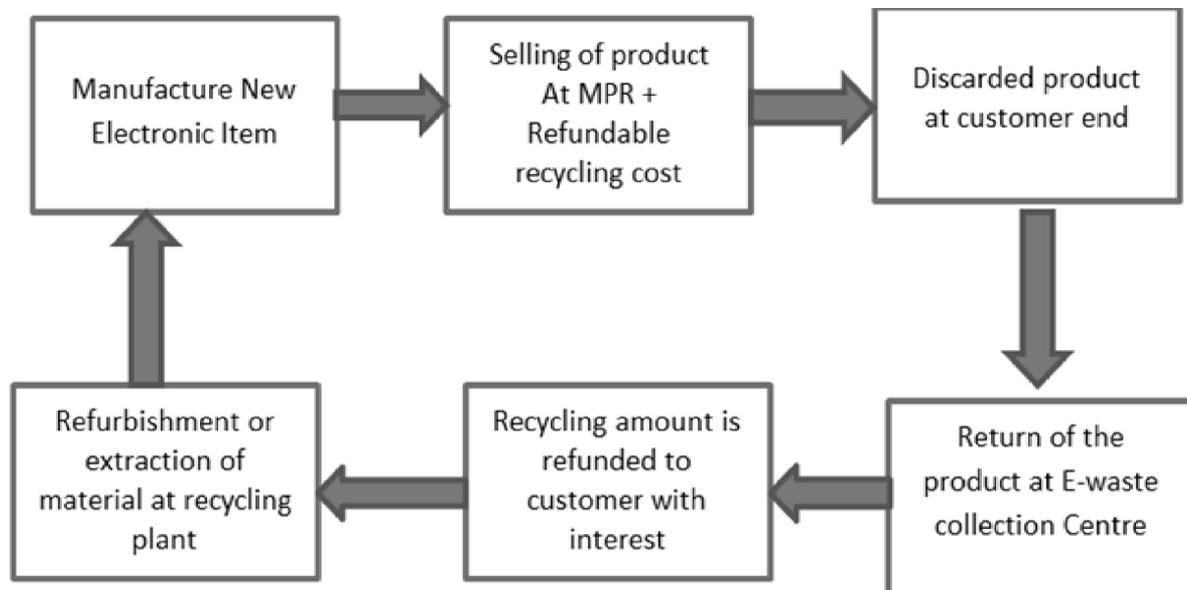
Figure1: Life cycle of product manufacturing to recycling

Future Scope

The authors have discussed the idea of e-waste management and suggest formalizing this sector like other industries. There is also need for a proper regulatory body that will not only design guidelines for the industry but also for the customer who purchases any electronic product. There is scope for further study in the following sections of industry with respect to e-waste management:

1. Inventory management,
2. Production-process modification,
3. Volume reduction,
4. Recovery and reuse.

Conclusion

The new 'Make in India' initiative of the Government of India (GoI) will encourage new electronics companies to enter the Indian markets. The implementation of the proposed technique at the initial stage will go a long way to help manage e-waste efficiently. India, with its low labour costs and availability of skilled and semiskilled people, places the country in an advantageous position to set up e-recycling plants for multinational companies. This, in turn, will provide employment opportunities for the Indian youth. It will also make India a recycling hub of e-waste in the world.

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References

[1]   J. Puckett, M. Ryan, B. Zude, S. Simpson, T. Hedenrick, and B. A.Network, Exporting harm: the high-tech trashing of Asia. Basel Action Network, 2002.

[2]   M. Wong, S. Wu, W. Deng, X. Yu, Q. Luo, A. Leung, C. Wong, W. Luksemburg, and A. Wong, "Export of toxic chemicals–a review of the case of uncontrolled electronic-waste recycling," Environmental Pollution, vol. 149, no. 2, pp. 131–140, 2007.

[3]   StEP Initiative - solving the e-waste problem. [Online]. Available:

www.step-initiative.org

[4]   Central Pollution Control Board (CPCB). Guidelines for Environmentally Sound Management of E-Waste. PCB, Ministry of Environment & Forests, Delhi, India, 2008.

[5]   Business Standard, "India's capital becoming world's e-waste dumping yard" [Online]. Available:http://www.business-standard.com/article/newsani/india-s-capital-becoming-world-s-e-waste-dumping-yard-says-report-1140811007721:html

[6]   Amit Jain, "Development and evaluation of existing policy and regulation for E-waste in India", Sustainable Systems and Technology, IEEE International Symposium 2009.

[7]   StEP: Overview of e-waste related information. [Online]. Available: http://www.step-initiative.org/OverviewIndia:html

[8]   Jaiswal, Anand, et al. "Go Green with WEEE: Eco-friendly Approach for Handling E-waste" Procedia Computer Science 46: 1317-1324,2015.

[9]   Amit Jain, "Perspective of Electronic Waste on South Asia: Current status, Issues and Application of 3Rs", Promoting Reduce, Reuse and Recycle in South Asia, Synthesis Report of 3R South Asia Expert Workshop, Kathmandu Nepal, ADB, IGES, UNEP, 30August-1September 2006.

Ankit Dixit, Assistant Professor in Department of Electronics and Telecommunication Engineering at NMIMS (Deemed-to-be-University), Mumbai, India, received his Bachelor of Engineering degree in Electronics and Telecommunication from the SGSITS, Indore in 2009 and Master of Technology degree in Electronics and Communication Engineering from IIIT, Jabalpur in 2014. He has completed International Engineering Educator Certification Program (IEECP) offered by IUCEE and Microsoft Certified Educator (MCE). He is a life member of Indian Society for Technical Education (ISTE), India and Associate Member of the Institution of Engineers (IEI), India. His interest research areas are Microelectronic devices, Communication engineering and Green energy. He can be reached at ankitdxt@gmail.com

Pravin Wararkar, Assistant Professor in Department of Electronics & Telecommunication Engineering at NMIMS (Deemed-to-be-University), Mumbai, India, received his Bachelor of Engineering degree in Electronics & Telecommunication Engineering, Master of Technology degree in VLSI and is pursuing Doctoral Degree from Nagpur University, India. He has also completed various PG Diplomas in the Management domain from Nagpur University. With over 6.5 years of experience in industry and academics, his expertise lies in Electronics engineering & designing of HR Management Policy. He has authored several books on Engineering & Management. He has also authored over 50 papers in journals and conferences of international repute and has to his credit about 35 citations, h-index: 4, i10-index: 1 (Google Scholar). He acts as a regular reviewer for reputed journals like "Elsevier, Springer, Taylor & Francis" and IEEE Conferences. He is a Session Chair for Various Technical Events, Seminars & Workshops. He is a member of various professional societies like IEI, ISTE,IETE. He can be reached at pwararkar@gmail.com

Mr. Prakhar Mittal completed his engineering (B.Tech) from Department of Electronics & Telecommunication Engineering at NMIMS(Deemed-to-be-University), Mumbai, India. He is the current Vice Chairman at the Mittal Group of Institutes, Bhopal, Madhya Pradesh, managing the institute of Technology, Pharmacy, Education, Management and ITI. He is the former Chairperson of the ACM student chapter NMIMS. He is keen to explore and learn with interest in the green energy management and human resource management. With a vision of imparting quality education and making students industry ready, he is running the Institutes. He can be reached at prakhar11@gmail.com