E-Waste: Challenges and its Management

N.Tyagi[1], S.K. Baberwal[2], N. Passi[3]

[1]Associate Professor, Deen Dayal Upadhyaya College, D.U., Delhi, India

[2,3]Assistant Professor, Keshav Mahavidyalaya , D .U., Delhi, India

ABSTRACT

The obsolete materials from electrical and electronic goods are known as e–waste. Managing e-waste has become a general problem in many countries. Even if people are aware about it, its implementation has not been in a systematic and environment friendly approach. The e-waste if recycled has a great economic value, but unfortunately it's not recycled as per the different categories of waste. Most of it is recycled in the basic informal way which not only reduces its price worth but also induces toxic chemicals for the environment and people around them. Our Paper is an effort towards understanding the different methods being adopted for e-waste management and how our country may do better in that. A study of the e waste disposal method of Delhi University has been taken to understand the measures and steps that different bodies may also follow.

Keywords: Delhi University, e-waste, e-waste management, informal way, recycle.

INTRODUCTION

Electronic industry is the fastest growing industry. It contributes a lot in the economy of a country and fuels the market with new and latest products. But with growing number of innovations, number of old and unused devices has also increased, hence contributing towards e-waste. It is growing at a much higher rate compared to the normal municipal waste. According to a report, by the end of 2016, 93.5 million tons of e-waste will be generated globally which was 41.5 million tons in 2011. With a compound annual growth of almost 18% it is becoming one of the biggest challenges to handle (4). With the expeditious advances and innovation in the technology, electronic devices are now available at a reasonable and affordable price, hence increasing the buying power of consumers. Now consumers may replace their devices to be tech updated and somehow these days it has also become a status symbol to use latest electronic products. But the important point is how to handle the generated e-waste and how to recycle. If it is not managed properly the unregulated accumulation and recycling can affect the environment and human health.

E-Waste Generation and its Effects

Electronic devices are helping hand for humans, the help in doing many tasks effortlessly with speed and accuracy. Today's competitive market gave birth to so many new editions of products, making the old systems outdated and obsolete. E-waste is defined as the obsolete,

unused, broken electronic or electrical equipments that are no longer in use or have reached end of life. Major sources of E-waste generation are Computers, Cell phones, household appliances, electronic tools (motors, drilling machine), DVD players, printers, batteries etc. All these products contain some precious elements like copper, zinc, gold, nickel, aluminium, tin etc. These non-renewable resources can be recycled easily, but how? The above mentioned devices are made up of plastic, rubber cables. So in order to extract the metals, systematic disposal and recycling is required because just by burning or by some unsafe extraction methods, hazardous materials including mercury, lead, lithium and cadmium which are very harmful for the environment and hence for the human health are produced. Lead, Cadmium affects the nervous system, functioning of kidney, liver, and heart. Mercury results in brain damage and beryllium affects the lungs and causes skin diseases. The immune system is affected by PVC (cable coating).

Why recycling of e-waste is important?
As mentioned, the basic purpose of recycling is to manage the generated volume and to extract the non-renewable heavy materials.

E-Waste management

E-waste management includes the collection, sorting and recycling of electronic products. In India most of the people are not aware about how to dispose their old equipments, so they just sell out the things to the local scrap man roaming in the streets (known as Informal system). They are only bothered about the cost of their products. After that what that vendor will do with those things are none of their business. But now it's high time to understand about the systematic disposal of e-waste and spread awareness about it among people. Major e-waste collected is not recycled. Recycling is important but how the recycling would be done is the major concern. Management of e-waste is done by:

Informal System

This sector is managing the major e-waste in India. The collection has been done by the local scrap vendors. After collection, recycling process involves segregation and dismantling the products. Primitive techniques are used in this process. Which may include (i) disassembling of electronic equipment ; (ii) heating or manual dismantling of printed circuit boards; (iii) recovering metals by opening or cutting cables; (iv) breaking or melting plastics; (v) toner sweeping ; (vi) metals recovery by open acid leaching of e-waste (13). Most of the scrap vendors are not much educated; moreover, the people working under them are also not skilful and educated. They also do the repair and refurbishment of old products, which will be sold in second hand market. They just use their older and traditional illegal methods of burning the products to extract the metals – in many cases they are not aware about the risk/health risks involved. Extraction process emits various toxic elements polluting the air and the disposal/ smudges of e-waste contaminating the water. The remaining waste is then land filled somewhere illegally. Additionally, workers work in an environment with no ventilation, or personal protection equipments, leading them to a direct exposure with these hazardous elements causing many chronic diseases. As our society is not doing anything, this sector is growing day by day.

Formal System

As most of the e-waste in India is handled in a non-regulatory method, some polices need to be implemented to make it regulated. Formal system is a sector where e-waste is managed in

an environment friendly manner. Latest available technologies are used to manage and recover the resources. But a lot more cost investment is required to maintain the measures, making the road tough for the formal recyclers, as they have to face a competition from the informal sector.

Figure-I depicts effective steps for safe restoration or disposal of e-waste. Electronic equipments are collected and segregated on the basis of their use. Categorized equipments are sent for refurbishment or dismantling process, as required. After processing, the reusable components from refurbishment are sent to the market and the rest may be sent for dismantling. During dismantling, proper procedure is taken to ensure environment friendly disposal of residues. Various items are separated and categorized to recover important materials for market. The number of cycles the process takes may vary.
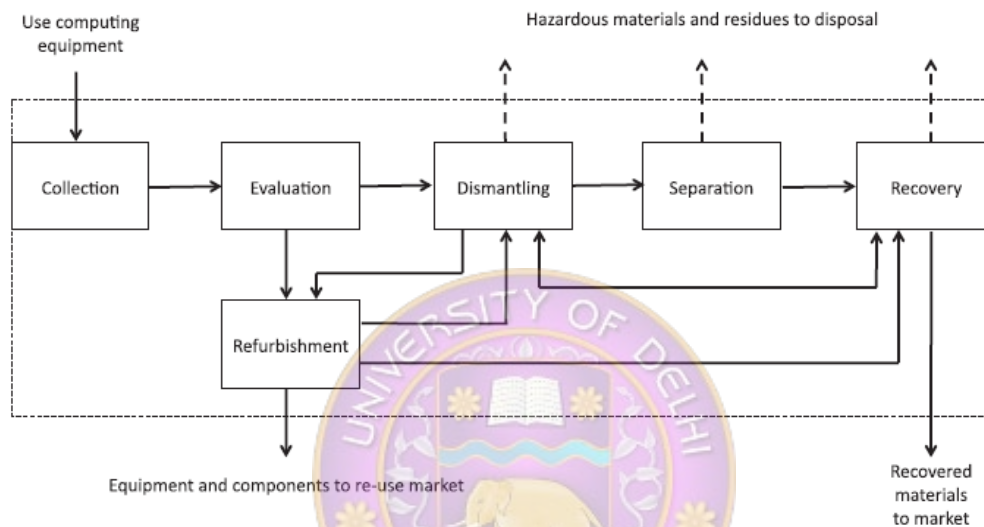

Figure I: (Source (2) A general flow diagram for recycling facility

CONCERNS & CHALLENGES

- Consumers and manufacturers are not aware about the correct disposal of e-waste.
- No check on the e-waste generation and recycling.
- E-waste is majorly processed by the informal sector, which use old techniques resulting in polluting the environment.
- Workers working in informal sector are not aware about the generated toxics and health hazards.
- Not using the latest technologies, resulting in the partial extraction of the resources.
- No specific rules defined and imposed to handle e-waste.
- Partial dismantled products are land filled.
- Women and child labour at e-waste sites.

HOW INDIA IS HANDLING THIS PROBLEM

In India the formalisation process of handling the e-waste is in transition. Current scenario is that India is capable of handling only 4% of the generated e-waste (20). The Ministry of Environment and Forests with Central Pollution Control Board (CPCB) is the concerned legislation for environment. Right now 138 formal recyclers are registered under CPCB.

Table- I shows the number of registered recyclers with their capacity to handle e-waste in the corresponding states.

Table- I: (Source (14) Number of registered recyclers in India (Till 2014)

State	Number of Registered Recyclers	Capacity in MTA(metric ton per annum)
Andhra Pradesh	2 unit	11,800
Chhattisgarh	1 unit	900 (operation of 300 days/ year)
Gujarat	7 unit	20,849.12
Haryana	13 unit	47,225
Karnataka	52 unit	50,318.5
Maharashtra	22 unit	32,180
Madhya Pradesh	2 unit	6585
Rajasthan	9 unit	67,470
Tamil Nadu	14 unit	38,627
Uttar Pradesh	11 unit	43,150
Uttarakhand	4 unit	28,150
West Bengal	1 unit	600

Apart from the registered recyclers, Ministry has collaborated with many international/national companies and NGO's to handle the problem of e-waste. Some of them are:

• **National Solid Waste Association of India (NSWAI):** organization working in the field of waste (waste, bio-medical waste, e-waste etc.) management. It was formed in 1996. Their objective is to implement good practices in handling the waste, creating awareness and community involvement (8).

• **Toxics Link**: NGO working to make people aware about the toxics and harmful effects. They use reports, articles, and news bulletins to involve the people/community. Their main aim is to work for environmental justice and freedom from toxics (21).

• **Waste Electrical and Electronic Equipment (WEEE) Recycle:** The company works to involve producers and recyclers (formal and informal) to work together**.** Their main aim is to improve the living standards (in terms of health) and to reduce e-waste pollution (23).

• **Attero**: This is India's only company that uses NASA recognized innovator technology to handle e-waste. Globally there are only seven companies which are capable of extracting the metals in pure form from the e-waste in eco-friendly manner and Attero is one of them. With various training programs and awareness events, it provides a platform to educate the consumers and helps the informal sector to integrate their work or to follow proper handling procedure of e-waste. Use of ground breaking distruptive technology allows Attero to provide low cost, eco-friendly recycling plants to process and recover the resources from dead devices. This company has also started an initiative to collect the e-waste from the consumer's house. By dialling and providing the details on this 1800 - 419 – 3283 toll free number, their employees will collect the e-waste (1).

Clean India, Indian Environmental Society, India Habitat Centre are some other examples.

DELHI UNIVERSITY INITIATIVES FOR WASTE DISPOSAL

Delhi University has signed an MoU with Metal Scrap Trade Corporation Ltd. (MSTC) which is a Govt. owned PSU for the disposal of waste materials in the University. MSTC is the Govt of India Mini Ratna Company majorly dealing with Govt organisations, renders services in managing any type of disposal through e-auctions/procurement. They work on the guidelines and notifications given by the Ministry of Environment and Forests (MoEF) and Central Pollution Control Board (CPCB).

Different departments of Delhi University first identify the items to be disposed off under separate heads like wooden scrap, iron scrap, electrical items, Library Books/Magazines, E-waste and Hazardous Waste and Non Working /Non repairable scientific equipments. A list is prepared for the same with Reserve prices for different items based on their original cost depreciated over time. This list is then sent to the University. The University after verification of the items in list sends it to the MSTC which then takes steps to e-auction the materials. The identification of hazardous or radioactive material, if any, is done with the help of trained Radiological Safety Officer (RSO) who is deputed for this purpose by the University. The Internal Audit Office (IAO) of the University facilitates the bidding process for these waste materials. The main role of MSTC is to sell the old/obsolete products on behalf of Govt. Departments, PSU's, and Ministries etc. through e-auction. Vendors need to register themselves with proper documents to participate in e-auction. The vendor who proposes maximum bidding is identified as buyer. He visits the respective department and hence the site is cleared off. MSTC ensures the validity and responsibility of buyers in disposing off the e-waste (16).

Figure- II: Delhi University Waste Management Process Flow Chart

SUGGESTIONS

Following areas have a scope of improvement in the Indian e-waste rules:

• 3R's Initiative - RECYCLE, REUSE AND REDUCE: Recycling of E-waste as a resource for new products, use of whole product or a few usable parts and also reducing the use of resources by taking responsible choices whether an alternative may work or not .

• The products could be categorised so that appropriate measures for the same may be applied and as many as possible products this way may be collected. Ex- plastic waste, paper waste, electronic waste, consumable waste, toxic waste etc.

• Responsibilities of the producers, dismantlers and recyclers must be mentioned clearly in the legislations.

• The finances at each step as for collection, recycling and transport must be clarified and standardized.

• The e-waste collected must adhere to a minimum recycling rate.

• Many electronic equipments contains hazardous substances which requires under expert's supervision specialized treatment. Treatment of such articles without rules fulfilment must be prohibited.

• Strict penalties may be imposed to discourage rules violation.

CONCLUSION

Various measures of e-waste management are available but their scrutinization at different levels is not properly formulated. It may start with the citizens first. The awareness amongst the users regarding the recycle, reuse and reduce is important as it may help in managing the balance of health and sustainable environment. More awareness campaigns and educating the students may help in improving knowledge regarding treatment of scraps. A study of the e-waste disposal at different economic class may help in predicting and formulating a better solution. Cooperation amongst the informal and formal sectors is required along with motivation to contribute to the system rather than personal sustenance. Further, tackling of different challenges for human welfare are essential in creating a green environment with superlative solutions for the citizens.

ACKNOWLEDGEMENT

REFERENCES

1.   Attero: Electronics asset management company. Retrieved from http://www.attero.in/
2.   Devin N. Perkins, M.-N. B. E-Waste: A Global Hazard. ScienceDirect .
3.   EPA, Q. (2006). The state ofwaste and recycling in Queensland in 2004. Queensland Environmental Protection Act 1994 .
4.   E-waste generation figure. Retrieved from http://www.environmentalleader.com/2014/02/24/e-waste-to-exceed-93-5-million-tons-annually
5.   Filippo Corsini, M. F. (2012). Recent trends in E-waste research. IEEE .
6.   Gibson K, T. J. Electronic waste management and disposal issues and alternatives. Environmental Claims Journal 2006 , 18 (4), pp(321–32).
7.   Harrington JM, A. T. (2003). Occupational and environmental health and safety. Oxford Textbook of Medicine ,pp(956–60).
8.   Information of National Solid Waste Association of India . (n.d.). Retrieved from http://nswai.com
9.   Jain, A. Developments and Evaluation of Existing Policies and Regulations for E-waste in India. ieee explore .
10.   K.K., W. (15/01/2005). Britain's Environment Agency confirms huge e-waste outflow to India. Toxics Link .
11.   Kelsea A. Schumacher, T. S. (2014). Waste Management:Quantification and probabilistic modeling of CRT obsolescence for the State of Delaware. ScienceDirect.
12.   Lim Fung Chen, H. W. (November 2011). E-waste Management:Are we ready for it? ieee .
13.   Lin Weia, Y. L. Present status of e-waste disposal and recycling in China. SciVerse Science Direct .
14.   List of Registered E-Waste Dismantler(2014)Recycler in the country.
15.   Manmohit Singh, M. K. (2013). E-waste: Challenges and Opportunities in India. IEEE .
16.   MSTC . Retrieved from http://www.mstcecommerce.com/

17.   Ramesh Babu B, P. A. Electrical and electronic waste: A global environmental problem. Waste Manag Res. 2007 , 307–18.

18.   Reddy, R. N. Producing abjection: E-waste improvement schemes and informal. ScienceDirect .

19.   S., S. (28/12/2007). Downside of the Digital Revolution. Toxics Link .

20.   The Associated Chambers of Commerce and Industry of India. Retrieved from http://www.assocham.org/

21.   Toxics Link - for a toxic free world. Retrieved from www.toxicslink.org

22.   Viraja Bhat, Y. P. E-waste consciousness and disposal practices among residents of. ScienceDirect .

23.   WEEE recycle. Retrieved from http://weeerecycle.in/