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Electronic Waste Management Approaches - A Pilot Study in Northern Indian States

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Abstract

The electronics industry is the one of the world's largest and fastest growing manufacturing industry. Discarded electronic and electrical equipment with all of their peripherals at the end of its useful life is termed as E-waste. But nowadays the main problem with the electronics products is that we generally don't consider the lifespan of it, mainly in case of mobile phones, laptops/PC, we frequently buys new products ultimately leading to an increased E-waste. Also, we don't know what to do with the discarded electronics items. We generally store them in our home as we are not aware of the hazardous effect of these E-devices on human health as well as on the environment. This paper projects a pilot study conducted in northern Indian states to find out the awareness level among the Consumer (Individual and Organizational) and recycler about the hazardous effect of E-waste. Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Delhi, Chandigarh are selected for the pilot study.

Keywords E-waste; Awareness level; Northern Indian states; WEEE; E-devices

Introduction

First, it is very important to study the following terms to know more about the E-waste.

What is E-waste?

E-waste means the waste generated from used electronic devices which are not fit for their original use. It is also termed as WEEE which means waste electrical and electronics equipment. Life is the main factor to be considered while discarding any of the products, but in case of the electronics items, it is mostly neglected. This is due to the latest and newer inventions in this industry. More functional and features products are introduced in the market day by day. That's why everybody is looking for the latest and more featured electronics items like mobile phones, laptops etc. Further, we consider that computers do not wear out; they become obsolete as user desire technological advanced products with lower cost. Hence computers tend to have a very short lifespan.

What product comes under the category of E-waste?

The field is very vast. Electronics items under this category are a wide range of mobile phones, laptops/PC, refrigerators, televisions, washing machines, printers etc. India generated 380,000 tons of E-waste in 2007 as per MAIT.

What is the need for proper E-waste management?

The majority of E-waste components are led to landfills. It is very shocking to know that in India, only 3%-5% of the total E-waste generated is recycled by the authorized recycler. Rest or most of the (95%-97%) E-waste generated is managed by unauthorized channel. The Electronics industry is not a clean industry as assumed initially; electronics devices have both hazardous and valuable materials. To segregate the hazardous materials from the valuable materials, special treatments are needed while disposing of the E-devices. The disposal/management of E-waste is directly or indirectly related to human health. As hazardous materials are very harmful to both human health and for the environment, this is also related to the health of the living being. Hazardous materials even cause cancer, kidney failure, and various life-threatening diseases. E-waste also consists of the valuable materials like gold, copper, iron etc. These materials also need special attention to be recovered. Also, the components which are in working condition need to be recovered from the discarded E-waste. These types of components are used as a resource in the second-hand market. So we can say that e-products are destined for recycling or disposal and part recovery. So recycling is the process of recovery of reusable materials, components, and products for reuse in the forward production channel, from the raw material stage to the final product stage.

What is the source of E-waste?

The research unit of Rajya Sabha Secretariat, India, explains the main sources of electronic waste in India are the government, public and private (industrial) sectors, which accounts for almost 70 percent of total waste generation. The contribution of individual households is relatively small at about 15 percent; the rest being contributed by manufacturers. Moreover, we in India discard our personal electronic items but the developed countries like the USA, Japan etc. also dump their discarded electronic products in India, which only worsens the condition. As we step towards the modernization we also step towards the more and more E-waste generation.

Aim of the study

The study was conducted in the northern Indian states. This is only a pilot study amongst the consumers (Individuals and Organizational)

and the recyclers to check their awareness level regarding the hazardous effects of the discarded electronics products.

This study was carried out to get a direction for the future work in the field of E-waste management. The future work is to conduct a detailed survey on individuals, organizations and recyclers based on Likert scale to their awareness level.

Literature Review

The waste electrical and electronic equipment (WEEE or E-waste) are the globally recognized hazardous material, though containing a full spectrum of valuable and critical metals. India, being the fifth largest generator of WEEE, is facing a great challenge in the sustainable management of such waste. Therefore since the past few years, Government of India has been trying to establish a proper institutional and legislative framework to implement the sustainable management of WEEE in the country [1,2]. These suggest how the government can carry out Extended Producer Responsibility (EPR) system. The legislation, customer demand, strategic cost/benefits, environmental concerns, volume and quality, incentive, resources, and coordination are the factors which affect RSCM [3]. Although many view disposal of solid waste in landfills as the least desired management method from a sustainability and environmental standpoint, landfills remain the predominant method of solid waste disposal in many parts of the world because of the current lower cost of this technology [4]. Li Jian and Zhang Shanshan in 2010 study that, the E-waste management system based on EPR, to reduce electronic pollutants. They conducted their study in China. E-waste contains both dangerous and valuable materials. These materials require special treatment and recycling practices to avoid harmful impact on human health and environment. Retrieving the valuable and base metals is only possible by recycling of E-waste. Through recycling, 95% of a computer's useful materials and 45% of cathode ray tubes materials can be retrieved [5].

David Thiel, 2008 described that global warming, greenhouse gas emissions and E-waste are all major issues worldwide. Antennas are now a very common component in most consumer electronic devices (e.g., computers, telephones, toys, etc) in addition to wireless sensor networks and RFID systems used for product management and animal husbandry [6]. In moving to RoHS and WEEE compliant systems, antenna engineers must consider new design methods and materials in antenna mass-manufacturing. Initially, it was believed that electronic industry was a clean industry which is free from various pollutants. But with the expansion of the industry, it became clear that this industry is not a pollution-free industry [7].

Anthony Hume, Susan Grimes, Tim Jackson and Joy Boyce (2002) illustrated the strategic and environmental issues related to the implementation of producer responsibility for business to business operations within an IT systems and service company. They also explained the responsibilities of the producer and environmental benefits of E-waste management [8].

Susan Landry and Raymond Dawson (2002) focused on the life cycle environment effect of ever growing and constantly changing the world of EEE. This market continues to grow particularly with improvement in technology [9,10]. They further stated about the fire safety aspects for EEE for the protection of life, protection of the environment. Flame retardants are used to reduce the fire risk. John Bullock presented that the electronics industry faces a challenge, perhaps a legal responsibility along with the take-back system. Further, he considered that computers do not wear out; they become obsolete as user desire technological advanced products with lower cost. Computers have a very short lifespan. He also explained the elements of hierarchy which are direct reuse of complete computers, direct reuse of working components, recovery and reuse of microelectronics components, reclamation of the raw materials and disposal [11,12].

Problem Formulation

As it is clear from the literature that E-waste needs special treatment for their proper disposal. In India, the formal management of E-waste is very less in quantity. Further awareness regarding the hazardous effect of the E-waste is one of the main obstacles to the formal disposal of any electronic devices. In this paper, we discuss the awareness level of the consumers and recyclers regarding the dangerous effect of the E-waste on the human health and on the environment.

Objective of the study

The objective of the study is to check level of awareness of consumers (Individuals and Organizations) along with recyclers about the E-waste hazardous effect on human health. For the achievement of the objective, a pilot study was conducted among the consumers and recyclers.

Research Methodology

This study is based on the northern Indian states i.e., Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Delhi and Chandigarh. A pilot survey was conducted in these states to check the awareness level. We consider three different pillars. These pillars are individual consumers and organizational consumers which play a very vital role in the generation of E-waste; another pillar is recycler which plays a very important role in the proper disposal of E-waste. We conducted a survey on all these three pillars to check the awareness level regarding the hazardous effects of the E-waste. The Questionnaires was designed for these pillars to conduct a pilot study. We conducted the pilot survey among 35 individual consumers, 25 organizational consumers and 10 recyclers.

Result and Discussion

This chapter includes the outcome of the pilot study. We discuss the outcome of all three pillars individually.

Individual consumer

Individual consumer is one of the main pillars which are directly related to the E-waste generation. So the pilot study was conducted amongst the individuals from the different northern Indian states. Total seven questions were asked to them. On the behalf of the response given by them, we come to the result that most of the individuals have more than 2 electronic items in their house like mobile phone, personal computer/Laptop and television/LED. Few of them have more than one mobile phone and also have more than one TV/LED at their home. When we asked them about their knowledge of hazardous fraction in E-waste, the response of most of the consumer was negative. They think these are very clean products and do not have any negative effect on health. They do not have any knowledge about the hazardous fraction in E-waste. Even they are totally unaware of the term E-waste. The consumers also do not have any knowledge that some fraction of E-waste needs special treatment for their safe disposal. No one comes to their doorstep to pick the E-waste for the

formal disposal. Then we decided to check their knowledge about the legislation of the E-waste in our country. Here again, we got the shocking response from their side as most of them did not have any knowledge of legislation.

The Last question is that what they did with their rejected/obsolete rejected/obsolete electronic devices? Here rejected devices mean the devices which did not complete their intended useful life but currently not in use. This is due to the advanced technology, new features, social esteem etc. On the other hand, obsolete devices mean the devices which may or may not complete their useful lifespan but currently not in use due to obsolescence. Some obsolete electronic devices are CDMA mobile phones from Reliance, black and white TV.

For the rejected devices about 70% answered that they sold it to anyone, about 20% responded that they exchanged their old products with the new one, rest 10% sold their electronic items to the scrap dealer. When we asked about the obsolete devices, the scenario was totally different. In this case, about 60% of the consumers sold their obsolete E-devices to the scrap dealer. About 30% of the consumers keep these devices stored at their home and only 10% go for the product exchange as shown in the graph below (Figure 1).

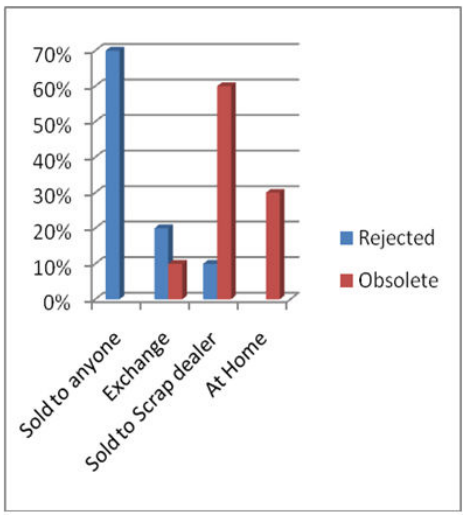

Figure 1: How the individual discard E-waste in case of rejected and obsolete devices.

Organizational consumers

Organizational consumers are various BPOs, institutions/colleges, govt. offices etc. An organizational consumer is the most important pillar of the E-waste generation as the majority of E-waste is generated by the organizational consumers. They have a penalty of E-devices in their use. They also replace them by considering the lifespan of the product and by considering any other factor like advanced technology, latest features, data security etc. So they contribute to the large extent to the E-waste generation. To check the awareness level we asked seven questions. As a result of the pilot study, we come to the conclusions that about 70% -75% of the consumer has no knowledge about the dangerous effect of E-waste on human health and on the environment. Rest 25% to 30% is aware of these effects as shown in the figure 2 below.

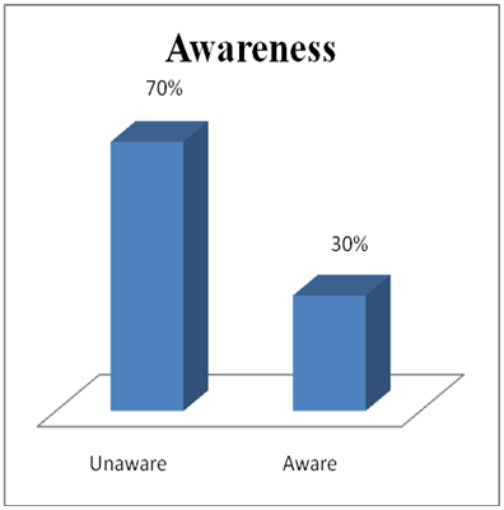

Figure 2: Awareness level among the organizational consumers.

Secondly, most of them also have no knowledge that E-waste management needs special treatment for the proper or safe disposal. This is mainly because of their lack of knowledge about the hazardous effect of E-waste on human health and environment. Even they do not have any idea that recycling of E-devices is profitable as it acts as a resource for the second-hand market and also the raw material is recovered from them. Almost all organizations have no policy or strategy for the formal disposal of the E-waste generated by them. They are even not aware of the rules and regulations of E-waste management decided by Govt. of India. Almost every organization keeps inventories of WEEE in their store. About 50% of the total organizational consumers think that their discarded products are reused as it is in the second-hand market. Only 25% of the consumer responded that E-waste is segregated for valuable and non-valuable products. Valuable products are recovered are again sell to the 2nd hand market which acts as a resource. About 15% of the consumers think that their e-devices are recycled properly. Rest 10% leaves their product for landfilling. Now a question arises that what are the possible hurdles in the formal disposal of the E-waste according to the perception of organizational consumers.

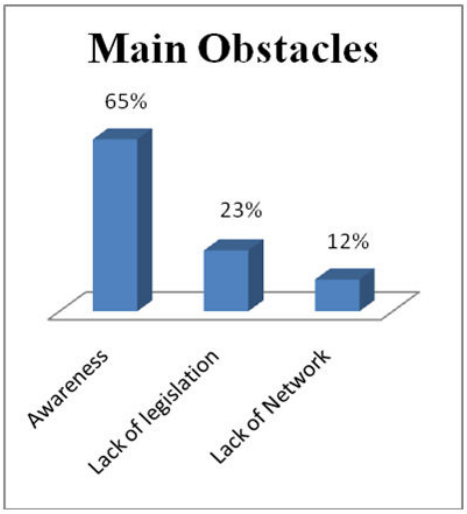

Figure 3: Main obstacle considered by the organizational consumers for proper E-waste management.

As it is clear from the diagram, approximately 65% think that awareness is the main obstacle. They consider it as the main obstacle for the formal disposal. Only 23% considered that lack of legislation and proper implementation of the legislation is not in India. While 12% consider that there is lack of the network of the collection centers so that they may dump their E-waste at the collection point (Figure 3).

Recycler

The two pillars as discussed are responsible for the generation of the E-waste. The third pillar is responsible for the proper disposal of the E-waste. The first question is about the awareness level of hazardous effects of E-waste. Almost 75% of the recyclers are aware of the hazardous effect of E-waste during its management. Rest 25% is totally unaware of the concept (Figure 4).

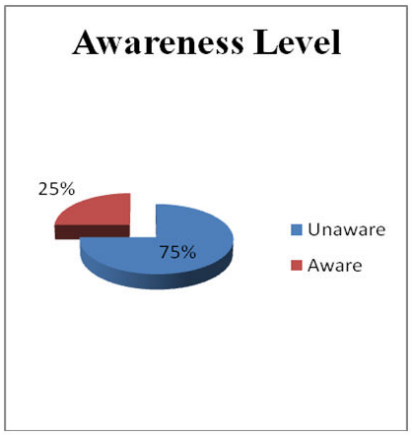

Figure 4: Level of awareness among the recycler.

About 80% of the recyclers collect the E-waste from the manufacturer and collection centers, only 20% buy the E-waste from the scrap dealer. They also consider the manufacturer and collection points are the most important channels to collect the E-waste for the formal sector. About 85% of the recyclers think that lack of legislation or their improper/non-strictness in the implementation of the legislation is the main obstacle in the formal E-waste management. 15% think that there exists no proper channel for the formal disposal of E-waste (Figure 5).

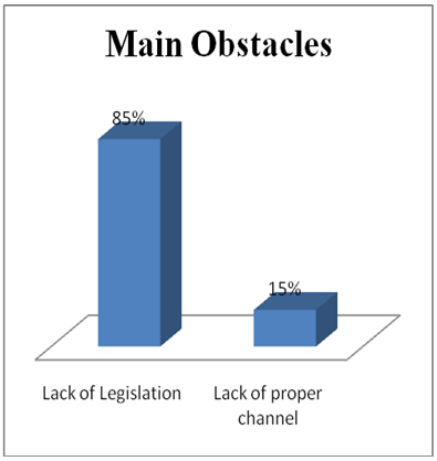

Figure 5: Main obstacle in the proper management of E-waste management as considered by the recycle.

Response to the next question is that almost 85% of the recyclers dismantle the E-waste manually and then just put it into the furnace to recover the plastics, iron, copper etc. They do not have the proper technical facilities for the segregation of the E-waste. They are totally unaware of the fact that residual left after E-waste recycling needs special treatment to be disposed of. They are not using safety instruments during the E-waste recycling. Almost every recycler keeps the inventory of the WEEE in their possession. They start working on it after they have some specified quantity of inventory. This specified quantity of inventory various from recycler to recycler, it also depends on the processing capacity of the recycling unit.

Conclusion

It is clear from the pilot study:

- Individual consumers and the organizational consumers are not aware of the hazardous effect of the E-waste on human health and the environment.
- Their knowledge about the legislation is also inadequate. It comes out to be the main obstacle for the formal disposal of the E-waste.
- No one comes to their doorstep to pick the E-waste. In case of organizational consumers, they do not have any disposal policy for the safe disposal of the E-waste.
- There is no proper channel for the collection of the E-waste in India.
- Recyclers are aware of the hazardous effects of the E-waste on human health and on the environment but even then they do not use the proper techniques for the disposal of the E-waste. They collect the E-waste from the manufacturer or from various collection centers and also recommend it as the best-suited method as they buy in bulk from there.

So the govt. should take the initiative to aware the consumers about the hazardous effects of the E-waste through advertisement, legislation and by extended producer's responsibility (EPR). The lifespan of any electronics devices should be clearly predefined and should be mentioned on the box of the device, so that consumers get aware of the lifespan of his electronics devices.

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