

Inventorization of electronic waste management, engaging with consumption: A Survey in Bhopal

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ABSTRACT

The existing practices of electronic waste in India suffer many problems like the difficulty in inventorization, legislation, poor awareness of electronic waste management and unhealthy conditions of informal recycling. The study was focused on inventories of e-waste in Bhopal city which is in the capital of the state and generates a database for the future plan and provide statistical data affecting the generation of E-Waste in Bhopal as well as prepare an inventory of electronic waste. This can help to prepare an action plan for Waste Electrical and Electronic Equipment which can be formulated and give a quantitative and qualitative analysis of WEEE generation in Bhopal City. The main objective of the study inventorization of seven electronic sub-sectors like refrigerators, mobile phones, television computers, air conditioners, washing machines and waste batteries in Bhopal city of the state. The present practices of electronic and electrical waste of management having many drawbacks like unhealthy conditions of informal recycling, the difficulty in inventorization, poor awareness inadequate legislation, these are the critical issues, during the site visit interviews total 120 questionnaires were collected, 50 questionnaires business entities and 70 from household and collect 432MT e-waste during the survey.

KEY WORDS: E-WASTE, RECYCLE, INVENTORIZATION, REUSE, DISPOSAL

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INTRODUCTION

Electronic waste management becomes burning issue all over the world, because growth in demand and consumption of electronic goods had led huge amount of waste and this waste become a new type of waste called electronic waste. So there is dire need to adopt sustainable practices so that we can handle a waste, (Schwarzer 2005). Electronic Waste, as the name represent, comprises of electronic and electrical equipment such as computers, cell phones and other electrical devices which are destined for recycling or disposal, (Robinson 2009). The amount of electronic dump generated globally has been estimated to reach about 72 billion tons annually by 2017, (Bisschop 2014).

E-waste informal processing sites can be located near agricultural fields and other cropland where heavy metals and other contaminate can penetrate into the soil where food is grown, (Song and Li 2014). Human exposure to halogenated flame retardants (HFR) over dermal adsorption by skin wipe. Dermal absorption would be an important exposure route for HFR. Liu et al. (2017).

Developing countries leading the pack in accepting electronic waste since the developed world today include China, India, Pakistan, and Nigeria, (Garlapati 2016).

The electrical and electronic equipment's are largely classified into three parts as:- comprising of household usages like air conditioners, refrigerators and dishwashers, washing machines are 'white goods,' computers, printers, fax machines, scanners, etc are'; 'grey goods,' comprising of TVs, camcorders, cameras are 'brown goods, Sinha (2007). PCBs, dioxins, and heavy metals in their essential forms, Lead, Nickel, Cadmium and Lithium are found in used batteries, abundant the ones being mass produced in electric vehicles. Organophosphate flame retardants and plasticizers in urine example of the people living in an e-waste dismantling site (Lin et al., (2017).

Despite the risk of many developing countries do not have proper regulations and policies in place to protect the local people and environment. Example, in Nigeria exquisite metals are removed from circuit boards by using acid, and then dumping them onto the ground or into streams, (Kiddee et al., 2013).

The University of the Negev researchers used cathode ray tube exhibit the financial incentive system. The proper recycling facilities would offer a higher price for the CRTs that could be earned thru the informal recyclers manually dismantling them. This would provide motivation for the informal recyclers to take the collected CRTs to the formal sector to go through recycling. These material incentives encourage a relationship between their informal and formal sectors, (Davis and Garb, 2015).

'Meeting the needs of the present generations without compromising the capacity of upcoming generations

to meet their own needs by Hester et al., (2012). Faster obsolescence and subsequent up-gradation of electronics product, are forcing consumers to discard old products, which in turn accumulate huge e-waste to the solid waste stream, (Bhat and Patil, 2014).

Informal recycling practices: preferably, all electronic waste should be recycled in informal recycling facilities. However, because of the formal electronic waste facilities are costly to operate construct as well as, especially in less developed countries, informal recycling sites are prevalent. The informal e-waste sector consists of sites that excerpt the valuable parts of the electronics and electrical equipment using crude recycling and disposal methods usually without any kind of shelter equipment such as goggles or gloves or the assistance of technology, (An et al. 2015).

Technological innovations and intense marketing engender a rapid replacement process, the Basel Convention, which is reduction of Tran's boundary movements of hazardous and other wastes including the minimization and prevention of their generation, the environmentally sound management of such wastes and transfer as well as use of technologies. Sthiannopkao and Wong (2013).

A Draft Strategic Plan has been proposed for the implementation of the Basel Convention, The Draft Strategic Plan takes into account existing regional plans, strategies or programs, the decisions of the Conference of the Parties and its subsidiary bodies, ongoing project activities and process of international environmental governance and sustainable development and also calls the management and effective involvement by all concerned stakeholders essential for the aims of the Basel Declaration within the approach. Of interrelated and equally support strategies are proposed to support the concrete implementation of the activities as indicated 1989 in the website (<http://www.basel.int/>).

MATERIAL AND METHODS

SITE SELECTION

The study of electronic waste was conducted in Bhopal cities which is one of the biggest city, located in Madhya Pradesh. The electronic waste generators and business entities, household, institutions are the consumers of the electronic and electrical equipment's they were targeted in this study the survey location is based on the socio-economic status of the area as well as population density of Bhopal. The population of Bhopal metropolitan area that extends beyond Bhopal city was 1,886,100. The total effective literacy rate was 85.24%, with male and female literacy respectively at 89.2% and 80.1% according to Census in 2011 next will be held on 2021.



FIGURE 1. Map of Bhopal city

STUDIES AND DATA COLLECTION

Field data were collected through the questionnaire-based survey; paper studies of their official sites give a better result than mail survey. The study was targeted following categories of electronic and electrical equipment such as televisions, mobile phones, personal computers air conditioners, refrigerators, washing machines for quantifications and estimations of e-waste produced, we collected data from the government office, household private sectors second-hand shops.

EMAILING QUESTIONNAIRE

E-mail is the most useful method for collecting data a standardized e-mail was attached to the questionnaire so that it would attract the recipient to read the email and participate in answering the questionnaire.

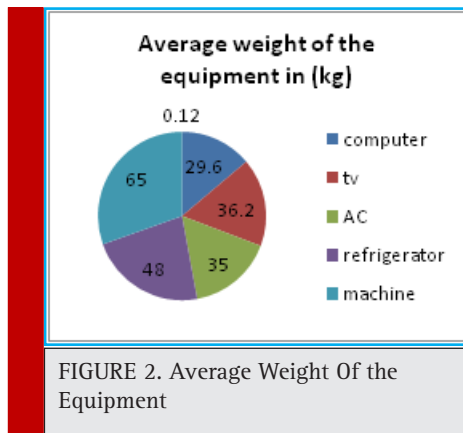


FIGURE 2. Average Weight Of the Equipment

RESULTS AND DISCUSSION

COMPUTERS

A Computer is an electronic device which contains many toxic components such as mercury PCBs, CRT chromium, and cadmium. A Monitor having 6% lead which is dangerous for our health as well as affects our environment generally, electrical and electronic equipment is sent to



FIGURE 3. Discarded E-Waste

the landfilling, which produces toxic element, like cadmium lead mercury into the atmosphere ground and soil releases negative impact.

TELEVISION SETS

The average weight of the television is 36.2 kg, during the survey, find that total around 8952 televisions were used, since last 5 years the generation of electronic waste is approximate 2173 kg so the yearly generation 1644 kg/year.

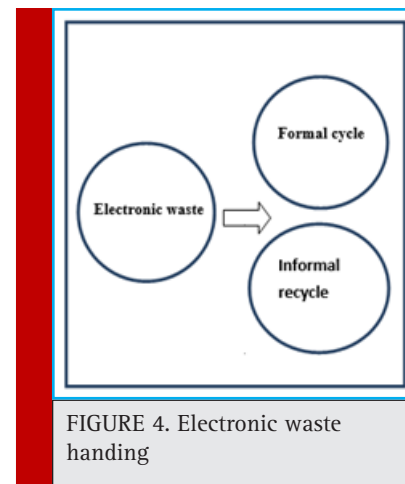


FIGURE 4. Electronic waste handing

REFRIGERATORS

Total of 9374 refrigerators are in use, and according to respondents most of the refrigerators have an average lifespan of 10-12 years. Maximum discarded refrigerators are used for exchange purposes to buy new refrigerator so the yearly generation is 13256.77 kg/year.

AIR CONDITIONERS

On an average it is found that in every two household, one number of AC is being possessed by the respondent, brand new air conditioners were found to be used for a long time. Maximum respondents have discarded their air conditioner by exchange offer only and few respondents have given to scraping dealer, total 1123 air conditioners are used so the e-waste yearly generation is 14.23kg/year.

WASHING MACHINES

Total 7543 washing machines are used on an average and it is found that each household respondent possessed one number of washing machines. Brand new washing machines were found to be used for a long time. Many respondents have discarded their washing machine either by exchange offers or by giving to scrap dealer so the e-waste yearly generation is 5389kg/year.

Home	Hospital	Government sectors	Private sectors
Pc	pc	Fax machine	Boiler
Fan	ECG device	Xerox machine	Mixture
Fridge	Microscope	Scanner	Incubator
Washing machine	Incubator	Fan	Fan
Refrigerator	fan	Tube lights	etc.
CD player	etc.	Air conditioner	

FIGURE 5. Source of electronic waste

COMPUTATION OF ELECTRONIC WASTE GENERATION IN LAST YEAR FROM DATA COLLECTED

Reduction of volume

Method which subtract the hazardous parts of waste materials from non-hazardous parts, includes in volume reduction these methods are basically used for capacity reduction also price of disposing of e-waste also reduce waste steam capacity and divided into two parts:-

- Waste concentration
- Source segregation

The technique for waste reduction can be simple and economical by segregation of wastes. Different types of metal are present in a waste material can be treated simply which can improve the metal value of sludge. Waste can be recycled by the technique of vacuum filtration also gravity or inverse osmosis or ultra-filtration etc.

S. No	Total Generation of Batteries	Quantity
1	Average Weight	30 kg
2	Total Usage of Batteries in no.	3845
3	E-Waste of Batteries in Last 5 years in no.	4784
4	Yearly Batteries Generation in KG	8942kg/year
5	Batteries generation in MT	8.94 mt/year

S. No.	Total Generation of AC	Quantity
1	Average Weight in 1 AC	35 kg
2	Total usage of AC in no	1123
3	E-Waste of AC in Last 5 years in no.	1565
4	Yearly AC Generation in KG	14.23 kg
5	AC generation in MT	14.22 mt/year

S. No	Total Generation of Refrigerator	Quantity
1	Average Weight in 1 Fridge	48 kg
2	Total Usage of Refrigerator in no	9374
3	E-Waste of Fridge in Last 5 years in no	2045
4	Yearly Fridge Generation in KG	13256.77 kg/year
5	Refrigerator generation in MT	13.25 mt/year

Reuse and recycle

In this method, we can reduce the price of waste removal and raw materials also deliver profitable waste income. Repair facility of waste materials can be provided onsite as well as off-site. Reverse osmosis, condensation, electrolytic repair, filtration are the physical and chemical method which is used to recover and reuse the waste material

S. No.	Total Generation of TV	Quantity
1	Average Weight in 1 T.V.	36.2 kg
2	Total usage of TV in no.	8952
3	E-Waste of T.V. in Last years in no	2173
4	Yearly T.V. Generation in KG	1644.25 kg/year
5	Yearly T.V. Generation in MT	16.44 mt/year

S. No	Total Generation of Washing Machine	Quantity
1	Average Weight	65 kg
2	Total Usage of Washing Machine in no.	7543
3	E-Waste of WM in Last 5 years in no	3687
4	Yearly WM Generation in KG	5389 kg/year
5	Washing Machine generation in MT	53.89 mt/year

Sustainable product design

- **Redesign the product:-** use less amount of hazardous materials, to design the product example redesign the new computer which has flatter lighter and integrated materials
- **Use of renewable materials and energy:-** plant-based chemical are used to make bio-based plastics.
- **Use non-toxic and non-renewable materials:-** material which are non-renewable use such that they can recycle and reuse. Example some parts of processor product as dell and Gateway lease.

CONCLUSION

Electronic waste has suffered major concern in maximum countries in the world, mainly those countries where electronics and electrical waste is imported as well as unregulated function processed and generating significant opposing environmental effect the evaluation of the study indicates that in 2016, electronic and equipment waste is calculated and the total collection of e waste is estimated in around 432 MT in Bhopal city which is in the Madhya Pradesh and increases year by years. According to the report, 16 registered recycle they collect the electronic and electrical waste and process the electronic and electrical equipment waste in India. Reuse and recycle system were implemented in India it is very important issue for sustainability, globally and domestically both.

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