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E-waste consciousness and disposal practices among residents of Pune city

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Abstract

The authors attempted to study and comprehend the e-waste awareness and disposal practices among residents of Pune city. It was revealed through survey data and the analysis that in general, the consumer awareness in Pune city is very good, but at the superficial level; however, when it comes to the disposal practices the residents are not aware of the collection centres, the E-waste rules, and correct disposal practices. Residents therefore mix-up the E-waste generated along with municipal solid waste thereby leading to unsustainable way of disposal practices. Ministry of Environment and Forests (MoEF) has played a key role by formulating the E-waste policy and it is the high time for consumers to shoulder the responsibility in management of E-waste. Also there is an urgent need to explore unlimited business opportunities and scope for developing sustainable models for E-waste management.

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1. Introduction

The role of the Information and Communication Technology (ICT) in today's web based is a necessity and not a luxury. It facilitates the participation of the developed and developing nations to be a part of the global village and also acts as a fuel for the development and economic growth. The use of ICT in almost all of the sectors is a reality

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and very popular among the masses as it keeps them abreast in the knowledge revolution. ICT acts as a gateway for knowledge sharing, connectivity, access to remote resources with the help of the newer technologies in the form of mobiles, internet, i-pads, laptops, etc. The common public is immensely benefitted by the technology aided household electronic products like television, refrigerators, washing machines, microwaves, etc. which play a considerable role in making the daily routines comfortable and smooth. In general, it is being experienced that ownership of these electronic products are not affected by diversity in income, education and locality; however they all equally contribute to the piles of a new stream of waste from the used electronic devices known as E-waste and is one of the most rapidly expanding waste streams in the world. Increasing demand for the newer electronic appliances due to change in incomes, life style, fashion etc. both in developed and developing countries is further resulting into high volumes of the e-waste mountains being built in developing nations

E-waste, also known as WEEE (Waste Electrical and Electronic Equipment) or EOL (End of Life) electronics are the electronic appliances such as computers, laptops, televisions, DVD players, mobile phones, etc. including their assembly, subassembly, components and consumables, which have been disposed of or unwanted by their original users (Wath et al., 2010). E-waste is a generic term encompassing various forms of electrical and electronic equipment (EEE) that are old, end-of-life electronic appliances and have ceased to be of any value to their owners” (UNEP Report, 2007). As per the Ministry of Environment and Forests, Govt. of India’s E-waste (Management & Handling Rules), 2011, E-waste means waste electrical and electronic equipment, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded.

It is well known that the composition of E-waste is diverse and differs in products across different categories (Hidy et al. 2011). It consists of more than one thousand different substances, which fall under ‘hazardous’ and ‘non-hazardous’ categories (Wath et.al, 2010). Annually, generation of E-waste is to the tune of 40 million tons (Schluep et al., 2009). Around 3.3 hundred thousand tonnes of E-waste is generated annually in India (Chaturvedi et.al, 2010). In developing countries, E-waste constitutes to 1-2% of total solid waste generation and expected to grow to 2% by 2010 (UNEP Report, 2007).

E-waste contains highly valuable and toxic non-renewable materials (Bhat et al. 2012) capable of getting recovered and recycled thereby creating a lucrative business opportunities. Several developed nations follow easy route and frequently move WEEE to the developing countries for processing. Countries like China, India and Nigeria with a large unemployed illiterate population and have no strong regulatory framework offer an excellent readymade ground for import of the e-waste for processing. The treatment to these wastes is carried out in an unregulated manner and manually by women, children who are unaware of the aftereffects of these processes on their lives. The high toxicity of the component materials in WEEE especially when burned or recycled in an uncontrolled manner leads to many socio economic problems. Haphazard disposal of E-waste may lead to the deterioration of ecological and human systems (Grant et al, 2013). Managing E-waste in a formal, systematic and eco-friendly manner by way of removing/recycling the precious metals from waste streams is an urgent need and hence there is an unlimited business opportunity and scope for academicians in developing sustainable models (Bhat et.al, 2012). Several studies are being conducted world across for the removal and recovery of non-renewable resources from waste (Gaddi and Patil, 2011; Itankar et al., 2013; Patil, 2012).

Individual consumer’s awareness is one of the major challenges in the e-waste management as it is not only sufficient to frame and implement the regulatory framework which defines clearly the roles of various stakeholders. Individual consumers, the sources of E-waste generation, lack in awareness and basic civic sense among the city residents a pose hurdle to manage E-waste. Consumer awareness plays a major role to route E-waste to the authorized collection centres and authorized recyclers for safe disposal. Majority of the population using e-goods are innocent and ignorant about the consequences of the e-wastes generated and disposed irrationally on the environment, ecology and health of current and future generation. In India, Maharashtra state tops the rank among 10 states in E-waste generation and the city of Pune ranks 8th. Pune is the developing hub for Information and Technology sector and also the cultural capital of Maharashtra. It is also known as the “Oxford of the East”. Pune citizens and the corporation is contributing significantly in achieving the zero garbage status in terms of solid waste management with state-of-the-art waste management processes and systems. However, Pune lacks the functional elements of E-waste transit systems and processes to handle the e-waste. The present paper attempts to understand the E-waste consciousness and disposal practices among residents of Pune City with reference to the E-waste (Management & Handling) Rules 2011, implemented from May 2012.

2. Methodology

In order to understand the consumer behaviour and awareness about E-waste and/or E-waste Rules, 2011, disposal practices, environment and health impacts, etc. a preliminary study was conducted through a survey of households of Pune city. The data was collected using random sampling method with a sample size of 200 which comprised of different income groups, age groups, diverse education streams and also variable family size. In all, 100 responses were received. The structured questionnaire with questions related to personal information, general awareness about e-waste, e-waste policy, and contents of e-waste and disposal practices of unused electronic products was administered through online and offline mode. The sample size considered was 200 Pune households spread across different areas and.

The survey data was analysed by looking at the overall responses for each question and then comparing the demographic information, such as income, age, educational background, family size. Due to the diversity among the demographics of households, the comparisons were done using percentages. The data collected from the survey is meant to be used just as a tool to support the qualitative information.

3. Results and discussion

3.1. Overall awareness knowledge

The survey was administered in households and was responded mainly by the elder member of the family. The respondents were asked to respond to the questions of general awareness about what is e-waste and whether they were aware of the Government of India's E-waste policy. Overall, 90% of respondents reported being familiar with the term E-waste and 10% reported that they are unaware of what e-waste is. 17% of respondents knew that there is a Government of India's Policy for E-Waste Management, 48% were not aware of the policy and 35% did not have any idea of what the policy is all about (Fig. 1 and 2).



Fig. 1: E-Waste general awareness

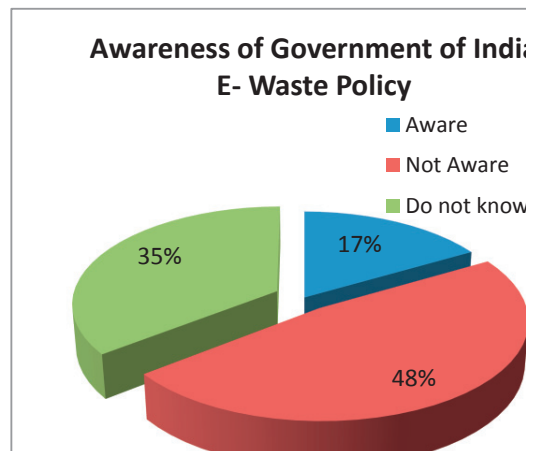


Fig. 2: E-waste policy awareness

3.2. Awareness/Knowledge by education and Income

The survey indicated that the awareness level is more in post graduates (94%) and undergraduates (95%) and surprisingly less in graduates (86%). As regards to family income, it played a positive role in awareness indicating that as the income level rises concomitantly with the awareness and stabilizes after one lakh (Fig. 3 and 4).

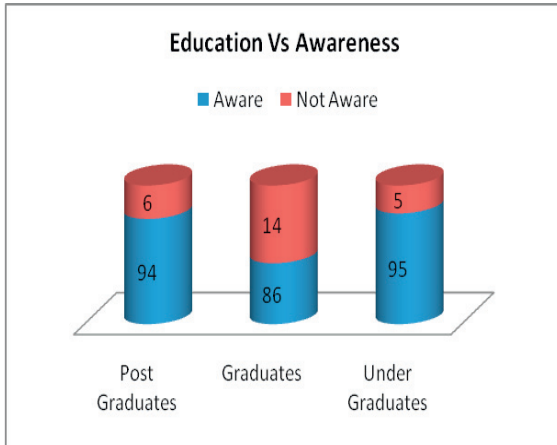


Fig. 3: Awareness as a function of education

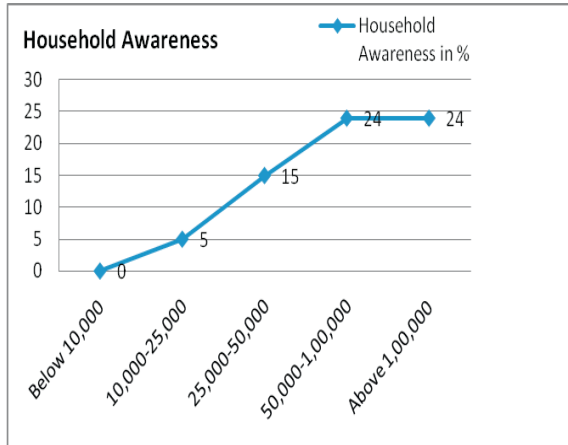


Fig. 4: Household awareness as a function of income

3.3. E-waste as a health and environmental hazard

When respondents were required to share their knowledge about the hazardous nature of e-waste, 80% responded that they believe it as hazard, while 20% did not. When the respondents were questioned about the impact of E-waste on human health and ecology, 67% of the respondents said yes it does, 30% said it does not, while 3% said they don't know (Fig. 5 and 6).



Fig. 5: Consumer awareness about E-waste as a Hazard

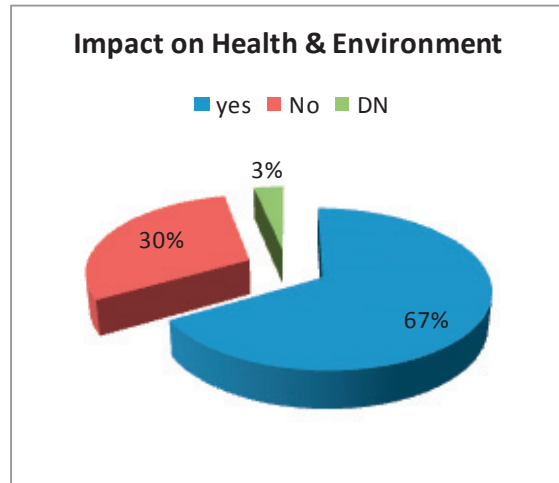


Fig. 6: Household's awareness of E-waste Impact on health and Environment

3.4. E-waste disposal practices and channels

The household members were probed on how they dispose of their unused electronic products. 57% households use the regular waste collection facility to dispose them off by mixing them with solid waste and 43% households do not mix it with solid waste for disposal. The household's disposal channels were also analysed and the survey supported the data with 32% of households exchanging their old non-working products while buying the new ones. 6% donate, 7% sell it to the second hand dealers, 17% sell it to scrap dealers, 18% store it as waste in home, 13% dispose with solid waste and 7% said they use other channel of disposal. The higher % of exchanges indicates that the old products reach the dealers or manufacturers which may help in the EPR policy implementation (Fig. 7 and 8).

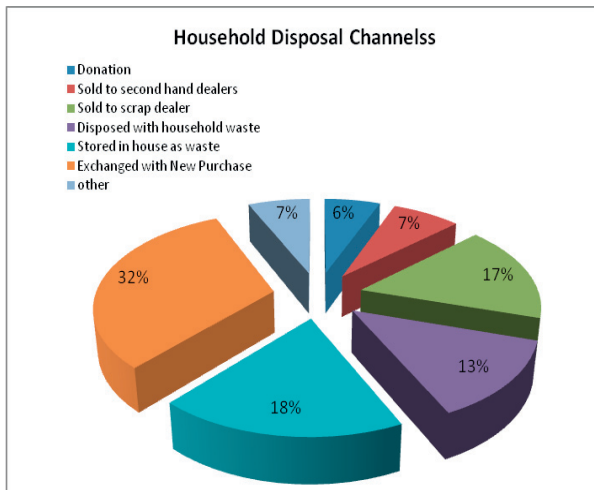


Fig. 7: Disposal channels for e-waste

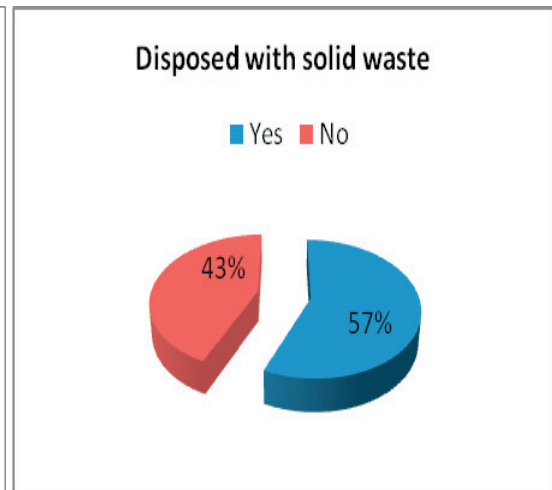


Fig. 8: E-waste disposal practices

3.5. Waste collection Services

To analyse and suggest various capacity building measures for waste collection in general and e-waste particular, the respondents responded to the question “Do have waste collection service in your area?” and “Are you aware of e-waste collection facility in your area?” 80% respondents responded to have waste collectors providing service in their area and 20% respondents do not have the service. Further probed to know about the e-waste collector facilities/ services, only 3% responded to have service providers to collect e-waste, 61% do not have and 36% were not aware of such special services in their area (Fig. 9 and 10). This supports the fact that Pune City has one of the best waste collection systems in place but for treating e-waste, the capacity is still to be built and also the awareness needs to be increased.

3.6. E-waste as source of treasure

When the respondents were questioned about treating e-waste as a treasure to recover the precious metals in it, 80% were aware of the precious metals presence and 46% felt special treatment to recover these metals from e-waste. 20% were not aware of the fact that e-waste has precious metals, 19% felt it can be treated like any other waste and 35% were not aware about how to recover it (Fig. 11 and 12). The survey data also recommends in creating awareness about e-waste composition and hence develop the responsible disposal behaviour for formal treatment to recover precious metals.

E-waste management is a menace and poses a great challenge to many authorities (Oteng-Ababio, 2010). Motivation to address the menace associated with e-waste not only includes the rapidly growing waste streams, but also concerns over the fate of heavy metals and other substances. A major concern also relates to the impacts of informal recycling. Managing such waste calls for a policy response using a comprehensive strategy which includes reviewing the available local infrastructure. It also entails acknowledging the diverse interest of the various stakeholders including the city authorities, manufacturers, beneficiaries (consumers), collectors and recyclers. The e-waste problem has been dealt seriously both at international and national levels by framing rules, action networks, collaborations, sponsored pilot projects to enable the countries for a feasible solution which should be inclusive in nature for both formal and informal sectors. Initiatives like Step, Basel Action Network, OECD and rules / policy are introduced and implemented with guidelines to help all the stakeholders: manufacturers, consumers, recyclers, collectors for management of e-waste.

Both the developing and developed countries are taking serious note of the issue and are actively involved in policy framing, awareness creation, and capacity building exercises. The management in developing countries is more serious as some of these countries unaware of the ill effects and importing the waste from developed countries.

India and China are one among the developing countries where the problem is aggravated due to illegal imports and large domestic e-waste generation. As far education is concerned, in the post liberalization era, most of Indian Business Schools and Universities have started focusing on sustainable development aspects in their curriculum and E-waste management is an integral part of it (Rao et al. 2013).



Fig. 9: Waste collection services

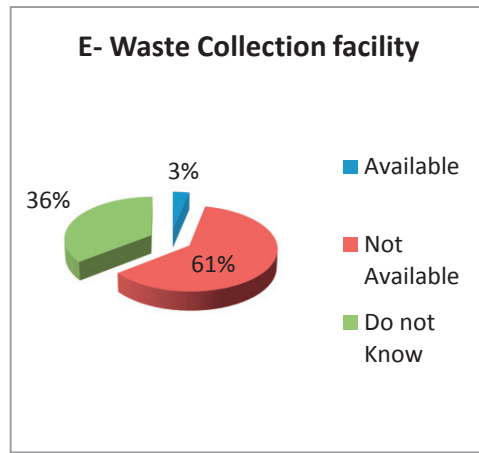


Fig. 10: E-waste collection services

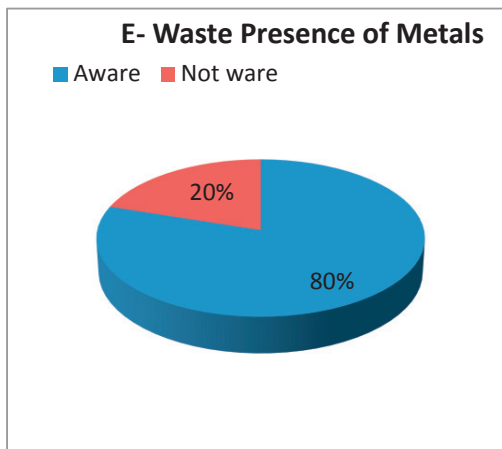


Fig. 11: E-waste as a treasure

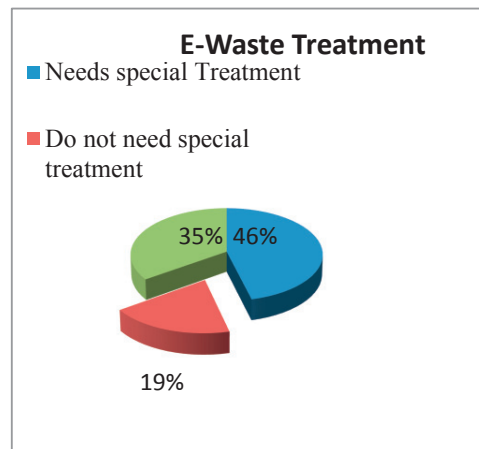


Fig. 12: E-waste treatment

In India E-waste generated is 380,000 tonnes with a growth rate of 15% annually (Greenpeace Report 2008) and is expected to cross 800,000 tons by 2012(UNEP report, 2005 and there will be 500% increase in e-waste by 2020 (UNEP Report,2010). According to the 2012 report by Times of India dated 3rd April 2012, E-waste Output jumps 8 times in 7 years – 8 lakh tons and also states that 50,000 tonnes of e-waste illegally imported from developed countries (Times Of India Report, 3rd April 2012).

In India, several initiatives have been taken by the Government as regulatory/legislative majors to support and safeguard the environmental and as regulators for various trades which directly or indirectly effects the environment and general health (Bandyopadhyay, 2008). Governmental Bodies like Ministry of Environment and Forest (MoEF) and Central Pollution Control Board and state Pollution Control Boards, NGO’s like Toxics Links, Saahas, Industry Associations like NASSCOM, MAIT have been active in finding out solutions to solve the e-waste problem. The first major policy initiative came in as Guidelines for Environmentally Sound Management of E-Waste (MOEF Letter No. 23-23/2007-Hsmd Dt. March 12, 2008). These draft rules were modified based on the feedback and responses from various stakeholders and in 2011, the E-Waste (Management & Handling) Rules 2011 were notified.

3.7. E-Waste (Management and Handling) Rules, 2011

On 12 May 2011, the Government of India notified the E-waste (Management and Handling) Rules 2011 and has been implemented effectively from 1 May 2012 (Government of India, E-Waste (Management and Handling) Rules 2011, II,4 (1)). The new legislation applies the principle of Extended Producer Responsibility holding the producers of electric and electronic equipment responsible for: (i) Collection and channelization to a registered dismantler or recycler, (ii) E-waste generated during the manufacturing processes, and (iii) E-waste generated “from the ‘end of life’ of their products.” [Government of India. E-Waste (Management and Handling) Rules 2011, II, 4 (1)].

The rules have a detailed the roles for each stakeholders involved in the entire supply chain of the Electronic Waste. Extended Producer Responsibility (EPR), the onus on the manufacturers mandates producers to shoulder the responsibility of the products starting from the manufacturing stage, during their useful lifetime but also post-consumer stage of the product’s life cycle, including its final disposal. Consumers play a vital role in the EPR as their decision about the product purchases (choosing environmentally friendly products), building the repair and maintenance attitude, reuse of the product till it reaches its EOL and most importantly disposal in a manner that it helps in 4R (Reuse, Repair, Recycle, Refurbish) approach.

Despite the fact that the E-Waste (Management & Handling) Rules are effective from 2012, there are many challenges for environmentally Sound Management of e-waste in India. There are several reasons for this including Government Apathy to implement rules, lack of authorized e-waste Recyclers, lack of awareness and inadequate implementation initiative. One of the major roadblocks in implementation legislation effectively is the consumer (both bulk and individual) awareness. Bulk consumers under the legislation are compelled to manage e-waste but the individual consumers are completely neglected.

4. Conclusion

The survey data and the analysis gives a broad picture that general consumer awareness is very good but when it comes to the disposal practices they are not aware of the collection centres, the rules, correct disposal practices and hence result in mixing it up with the solid waste and fail to dispose it an environmental friendly way. In the entire supply chain of E-waste the awareness of the consumer is of most importance as it helps in developing a mind-set of reuse, repair and recycle which will help proper e-waste management to protect the livelihood, health, environment and sustainable development. The study is based on a random sampling and hence has limitations but the sample size considered indicates the fact that there is a urgent requirement to handle the e-waste and hence control it’s source of generation. This can be done by making the consumer aware of its ill effects, benefits of reuse and recover approach. The consumer needs to develop an attitude of looking beyond electronic products as just luxury items but also as a source of precious metals and also an environmental and health hazard. This is the responsibility of all the stakeholders involved and hence the Cradle to Grave concept is to be understood. The Government has played its role as a regulator by framing and implementing the rules and it is time for the consumers to shoulder the responsibility to manage the E-waste.

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