KNOWLEDGE AND PRACTICE OF E-WASTE MANAGEMNT AMONG COLLEGE STUDENTS IN WEST BENGAL, INDIA

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ABSTRACT

The present investigation was aimed to understand the knowledge of the college students towards e-waste, and their active participation in sustainable use and management of e-waste. In modern world, every day a varieties of electronic goods are advancing with advancement of technologies. The older versions become obsolete, old fashioned, broken and thus surplus or of no use. This causes an increase burden of electronic wastes, a burning problem for disposal of electronic waste or e-waste throughout the world. The environment and human health are most vulnerable part, which are highly affected by the growing size of e-waste. The objective of the study is to encourage the students in recycling, reduce of excessive use and practice of sustainability of e-waste for effective management of e-waste. For this, a survey was conducted, with both under-graduate and post-graduate students of different colleges of West Bengal, India. The information of knowledge included knowledge on the types of e-waste, effect of e-waste on environment and health, and knowledge on the types of management strategies. For the information of practice of e-waste management, the data collected were participation of respondents in awareness programs of e-waste management, involvement of the participants in recycling of e-waste, training on the e-waste management. In this study it was found that though majority of the respondents had very good- good- average knowledge on the types of e-waste and their effect on the environment, but they lack knowledge on the effect of e-waste on health. In case of health perspective, the respondents had poor-very poor knowledge on health hazards caused by the e-waste. Further, the majority of the respondents had poor-very poor knowledge on the management strategies needed for e-waste. Majority of the respondents participated in the awareness programs for e-waste managements few times in life or never participated in such events. Very few participants were directly involved in the recycling of the e-waste in the way of recycling of their mobile phones, pagers, i-pods, computers, and computer related parts, home appliances, etc. As very few of the respondents had proper practical training on the e-waste management, the research was aimed to study their subjective knowledge or theoretical knowledge on the e-waste management in this respect. Data revealed that among the untrained respondents, majority of the respondents had no subjective knowledge also, followed by poor knowledge on the training on E-waste management programs in this regard. The citizens of India more specifically students are the main segment for e-waste management. They can mobilize the whole society by awareness generation in any new ideas. For this, such type of research is very important to motivate the students. This study was also an effort in this direction.

KEYWORDS: E-waste, awareness, management, recycling, environment, health.

INTRODUCTION

In modern world, every day a varieties of electronic goods are advancing with advancement of technologies. The older versions become obsolete, old fashioned, broken and thus surplus or of no use. This causes an increase burden of electronic wastes, a burning problem for disposal of electronic waste or e-waste throughout the world (Hicks *et al.,* 2005). Further, under developed or developing countries become the dumping ground of such old models of electronic goods of developed countries (Widmer *et al.,* 2004).

E-waste can be of different types. The huge number of e-waste now-a-days gathered from cellular phones, pagers, iPods and trans-receivers. E-waste produced from computers, including servers, monitors, mainframes, compact discs (CDs), scanners, printers, etc (Agarwal *et al.,* 2003). The household domestic e-waste includes TVs, refrigerators, kitchen appliances, washing machines, air conditioners, etc. Business e-waste includes Xerox machines, copiers, fax machines, calculators, battery cells, CCTV, medical apparatus, etc.

The use of electronic goods used for household domestic purpose has been increase 76.8% from 2014-2019 in India. In case of personal computers, every year 1.38 million become obsolete in India.

The environment and human health are most vulnerable part, which are highly affected by the growing size of e-waste. The health hazards are also prevalent in all forms of living organisms like plants, animals, as well as non-living things. So they are a huge threat for the ecosystem of this earth. The toxic substances and heavy metals present in the E-waste are the main culprit. These includes the most dangerous and hazardous elements like lead, mercury, barium, beryllium, cadmium, selenium, copper, cobalt, arsenic, chrome, nickel, lithium, polychlorinated biphenyls (PCBs), liquid crystal, brominated flame retardants, etc. They pose threat to environment and health if present even in a very minute quantity (Hashmi and Varma, 2019).

Consumers are the main sector for management of the e-waste. Awareness towards Reduce, Reuse, Recycle (3Rs) is very important. Further, initiatives can be taken to encourage the consumers for correctly dispose their e-waste, with increased reuse and recycling rates, reduce the unnecessary buying just for change and adopt sustainable consumer habits (Chatterjee, 2019).

In India, the problem of management of e-waste is a thrust area (Ghosh, 2019). In 2012, the broken or obsolete electrical or electronic equipment was 8 lakh tonnes, and it is expected to over 19 lakh tones in 2021. In 2007, only 3% of the e-waste had recycling facilities in India, as per Greenpeace Report.

The present investigation was aimed to understand the knowledge of the college students towards E-waste, and their active participation in sustainable use and management of E-waste. For this, a survey was conducted, with both under-graduate and post-graduate students of different colleges of West Bengal, India.

METHOD

The data were collected from 1156 college students (under-graduate and post-graduate). Respondents were between 17 and 24 years of age. The questionnaires elicited information about knowledge and practice of e-waste management among them.

The information of knowledge included:
  a) knowledge on the types of e-waste,
  b) knowledge on the effect of e-waste on environment,
  c) knowledge on the effect of e-waste on health.
  d) knowledge on the types of management strategies.

For gathering information on the knowledge on e-waste and the knowledge of the participants on environment and health hazards by e-waste, 20 sets of multiple-choice questions were given from each sections. Among the successful respondents, 75% right answer were given 'very good' score, 60% right answer were given 'good' score, 45% right answer were given 'average' score, and 30% and 15% right answer were given 'poor' and 'very poor' score respectively.

For the information of practice of e-waste management, the data collected were:
  e) participation of respondents in awareness programs of e-waste management,
  f) involvement of the participants in recycling of e-waste,
  g) training on the e-waste management.

The active participation of the respondents in awareness program were judged by different questionnaires. Here a 5-point Likert scale was used, having 'always', 'very often', 'occasionally', 'few times in life' and 'never' variables. To understand the involvement of the respondents in the e-waste management, the study used a 5-point Likert scale to ask respondent about how often they recycled the E-waste like the mobiles or computer related parts in the past year (1 = never; 5 = always). Recycling is a continuous variable, ranging from 1 to 5.

Data was also collected from participants regarding their proper training on the e-waste management programs. The participants were divided into 'trained', 'semi-trained', and 'untrained'. The untrained respondents were further divided into 'untrained with well knowledge', 'untrained with poor knowledge' and 'untrained with no knowledge'.

Further, data was also collected on the social demographics, living styles, social networks, personal cognitive ability, and behaviors and knowledge of the participants.

RESULT

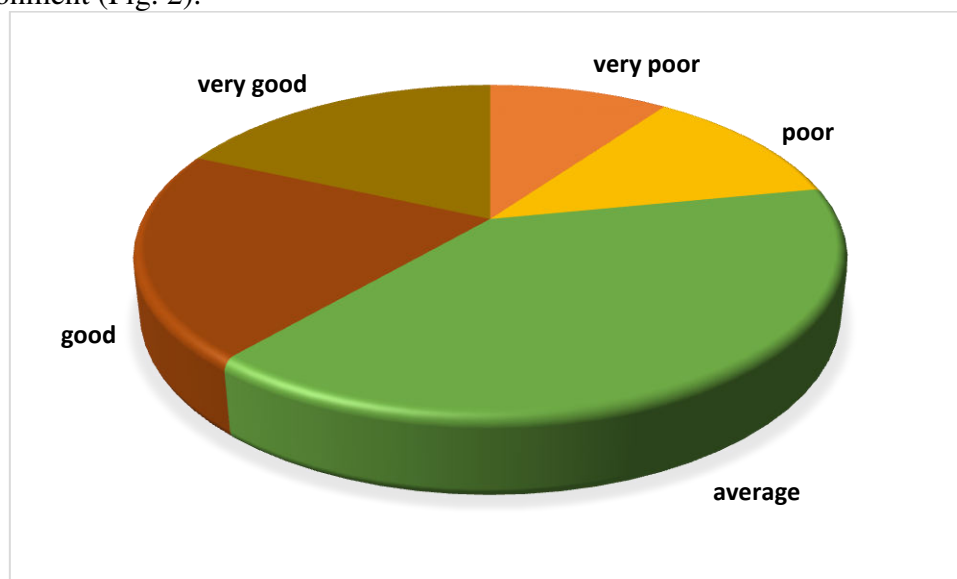**a) Knowledge on the types of e-waste**

In the present study, it was found that among the 1156 participants, 333 and 204 respondents had good and very good knowledge on types of e-waste, respectively. Majority of the respondents had average knowledge (238 respondents), whereas 217 and 164 respondents had poor and very poor knowledge on types of e-waste, respectively (Fig.1).
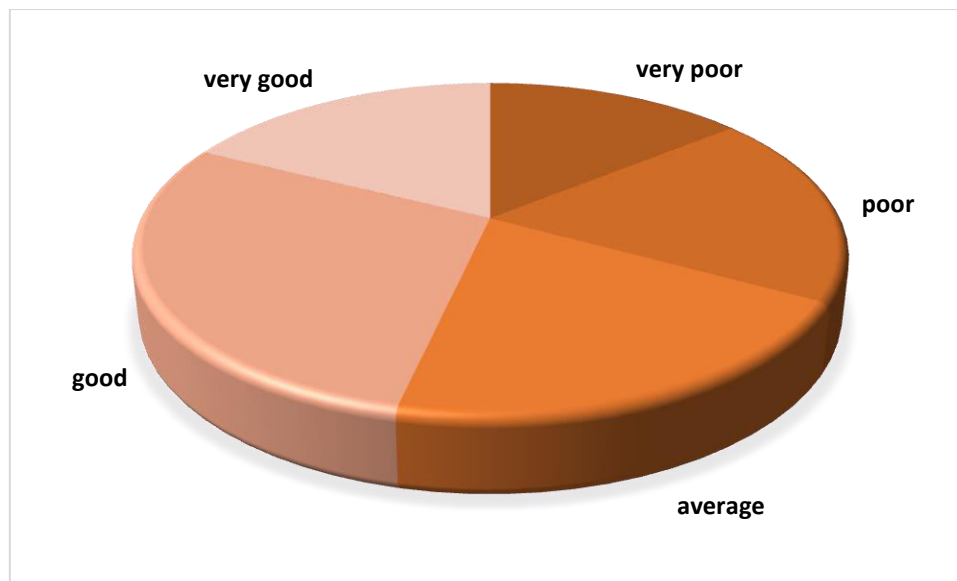
Fig. 1: Knowledge of the respondents on the types of e-waste.

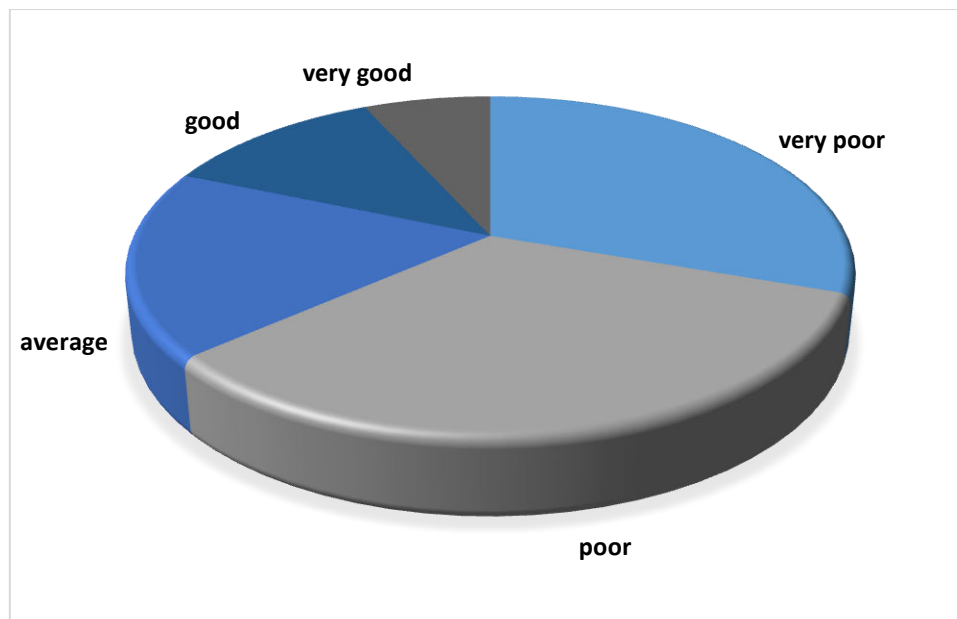**b) Knowledge on the effect of e-waste on environment**

Among the 1156 college students (under-graduate and post-graduate students), 211 and 236 respondents have very good and good knowledge on the effect of e-waste on environment respectively, whereas 114 and 139 respondents have very poor and poor knowledge on environment respectively, 456 respondents have average knowledge on the effect of e-waste on environment (Fig. 2).

Fig. 2: Knowledge of the respondents on the effect of e-waste on environment.

**c) Knowledge on the effect of e-waste on health**

Results revealed that 78 and 137 respondents have respectively very good and good knowledge on the effect of e-waste on health. Average knowledge was present in 206 respondents, whereas 384 respondents showed poor knowledge in this direction. But 351 respondents showed very poor knowledge on the effect of e-waste on health (Fig. 3).

Fig. 3: Knowledge of the respondents on the effect of e-waste on health.

d) Knowledge on the types of e-waste management strategies

In the present study, 322 and 327 respondents showed very poor and poor, respectively, knowledge on the types of e-waste management strategies. Average knowledge was present in 213 respondents. Only 192 and 102 respondents had good and very good knowledge on the types of e-waste management strategies, respectively (Fig. 4).
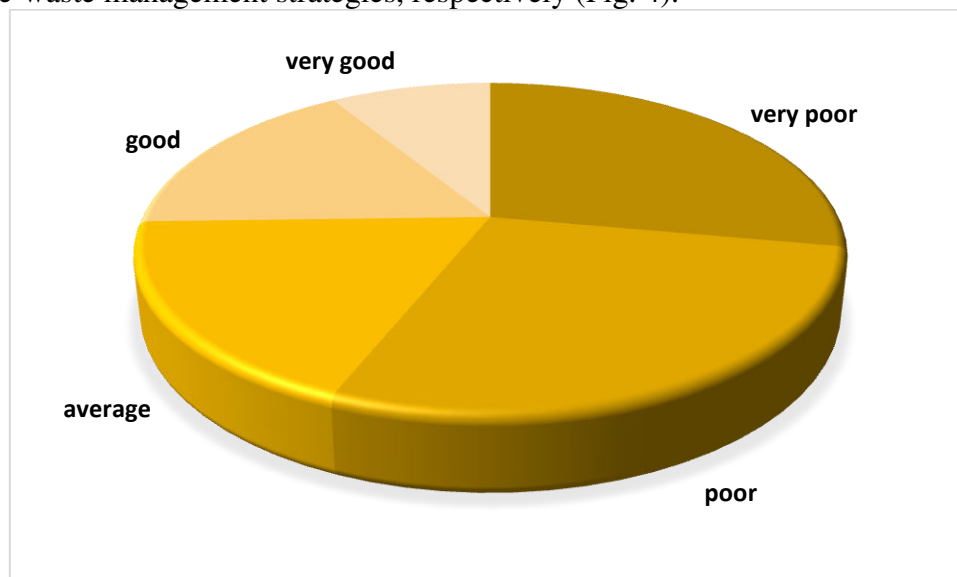
Fig. 4: Knowledge on the types of e-waste management strategies.

e) Participation of respondents in awareness programs of e-waste management

Results revealed that 41 respondents were always actively participated in awareness program of e-waste management. Among the 1156 participants, 85 and 286 respondents were very often and occasionally participated in awareness program with efforts. Further, 328 respondents never participated, and 416 respondents participated few times in life in such events (Fig. 6).
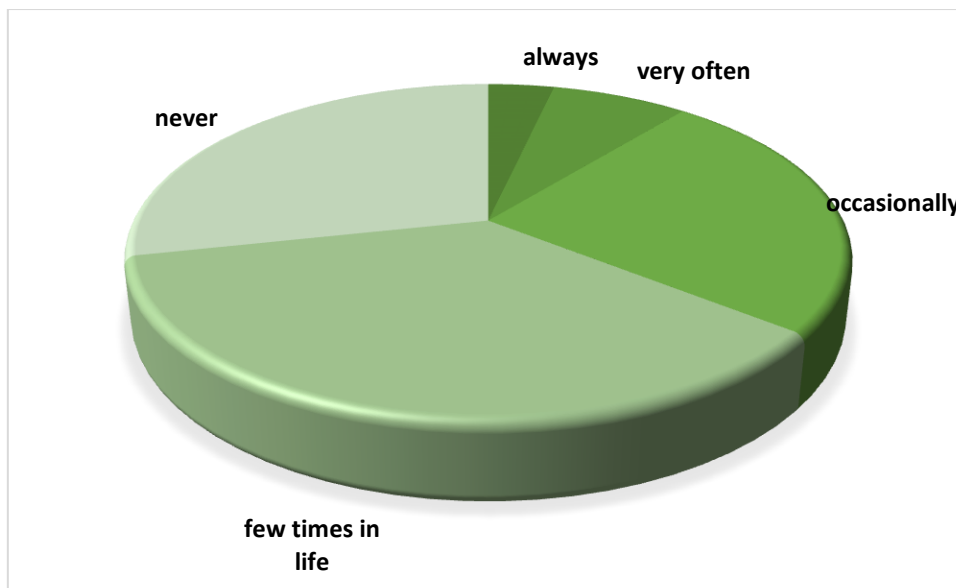
Fig. 6: Participation of respondents in awareness programs of e-waste management.

f) Involvement of the participants in recycling of e-waste

The result showed that recycling has a positive correlation with e-waste management. The 312 respondents never participated in recycling of e-waste, 296 respondents occasionally did so, 326 respondents did so few times in life, 126 respondents very often and 96 respondents always participated in recycling of e-waste (Fig. 5).
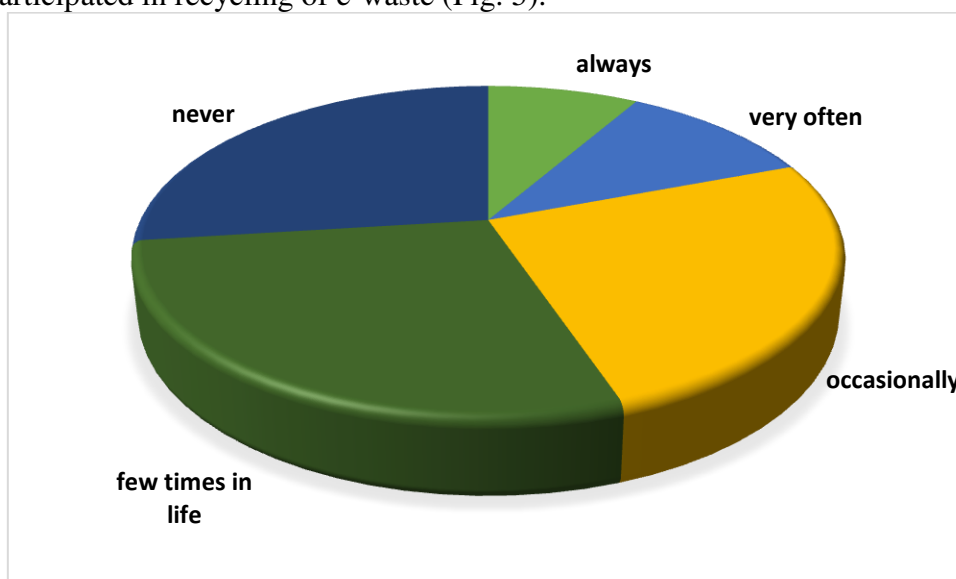

Fig. 5: Involvement of the participants in recycling of e-waste.

g) Training of the respondents on the e-waste management

Among all the participants, only 24 respondents were well-trained and 84 respondents were semi-trained how to manage e-waste. Majority of the participants had no knowledge on the training on e-waste management programs. Further, among the untrained respondents, 496

respondents had no knowledge on the proper training. But 246 respondents had well knowledge on the training program, and 306 respondents had poor knowledge on the training on e-waste management programs (Fig. 7).
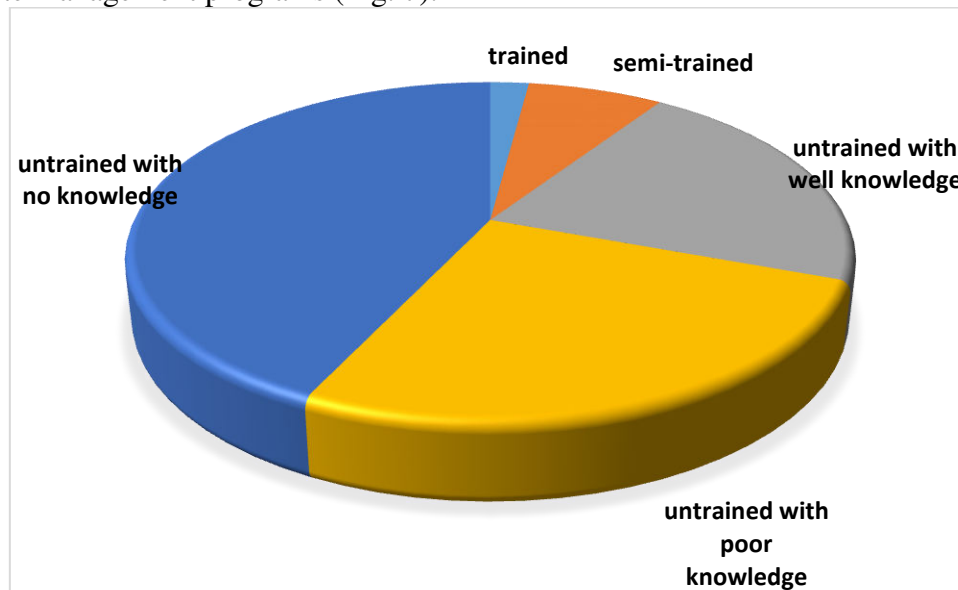
Fig. 7: Training of the respondents on the e-waste management.

DISCUSSION

E-waste managements are a serious problem in recent days. Many media (print media as well as visual media) and virtual worlds have started shouting in this direction. The virtual world are also coming forward for sustainable use of e-waste. Many campaigns are going on in this regard to aware people for motivating them in recycling and proper training in e-waste management. Attempts are also focusing to aware people on the effect of e-waste on environment and public health hazards (Ghosh, 2019). Now-a-days different social media circulate many environmental conservation programs and save nature events. This causes awareness generation among this generation students. The present study also proved these positive effects of e-waste management among the respondents.

In this study it was found that though majority of the respondents had very good- good-average knowledge on the types of e-waste and their effect on the environment, but they lack knowledge on the effect of e-waste on health. In case of health perspective, the respondents had poor-very poor knowledge on health hazards caused by the e-waste. Further, the majority of the respondents had poor-very poor knowledge on the management strategies needed for e-waste.

Majority of the respondents participated in the awareness programs for e-waste managements few times in life or never participated in such events. Very few participants were directly involved in the recycling of the e-waste in the way of recycling of their mobile phones, pagers, i-pods, computers, and computer related parts, home appliances, etc.

As very few of the respondents had proper practical training on the e-waste management, the research was aimed to study their subjective knowledge or theoretical knowledge on the e-waste management in this respect. Data revealed that among the untrained respondents,

majority of the respondents had no subjective knowledge also, followed by poor knowledge on the training on e-waste management programs in this regard.

E-waste are made up of plastics, cathode ray tubes (CRTs), printed circuit boards, cables and valuable metals like platinum, gold, copper and silver, and those can be recovered with special efforts from E-waste. But for that recovery scientific and systematic process should be employed (Jang and Townsend, 2003).

Waste Electrical and Electronic Equipment management (E-waste or WEEE) is the burning section for the solid waste management areas throughout the world (Baud *et al.,* 2001). It interconnects the globe in well-developed, developing and under-developed countries. Among the 180 countries, India is in 177 position as reported in Environmental Performance Index 2018, and it ranks the bottom 5 among all the countries, which is the matter of concern. This may due to the poor environmental health policy in case of air pollution. India ranked after USA, China, Japan, and Germany, and is in the 5th position world-wide for e-waste production (Baud *et al.,* 2001). Further, less than 2% of the total e-waste are recycled annually in India, which adds problem in different areas such as environment and human health (Hicks *et al.,* 2005). India generated more than two million tonnes of e-waste since 2018, which is very alarming and dangerous for human being and environment (Pandve, 2007).

This situation can be altered by awareness generations among publics, and improvements of the recycle infrastructure. Reuse of electronics through repair shops and/or used product dealers can also help in this direction. The discarded electronics can be collected by e-commerce portal vendors, and then they can be reuse and recycle the components.

In 2016, the Ministry of Environment, Forest and Climate Change (MoEFCC) released the updated E-waste (Management) Rules, and in India this rule supersession the e-waste. According to these rules, the producers are liable to collect 30-70% e-waste of their products over seven years. The rules are finalising by the CPCB India, and they issued a guidelines of handling and disposal of the e-waste or electronic waste which is eco-friendly (CPCB, 2008). Department of Information Technology (DIT), Ministry of Communication and Information Technology, also issued guidelines on "Environmental Management for Information Technology Industry in India" (DIT, 2003).

Many electronic companies like Apple, Samsung, Dell, HP have already started various recycling schemes. Nokia India also started "recycling campaign" to make the users aware of the recycling of e-waste. The program (irrespective of the brand) encouraged mobile phone users to dispose of their old handsets, cell phones, mobiles, accessories at any of the 1,300 green recycling bins, which are installed in the priority dealers and care centres. The Department of Environment, Delhi government, decided to motivate and involve ragpickers in the waste management program. The department involved over 1,600 government and private schools in Delhi as 'eco-clubs' to interact with the ragpickers.

CONCLUSION

The citizens of India are the main segment for e-waste management. Generally, people throw small gadgets casually or burn accumulated waste in open areas. This cause accumulation of dioxins and furans and other hazardous substances which are remarkable air pollutants and proved chemicals of fatal diseases (Jain and Saxena, 2019). It also hampers our ecosystem

and cause environmental damage (Hashmi and Varma, 2019). Thus such practice should be stopped with care. In practice, some of the very progressive Resident Welfare Associations (RWAs) have already taken few steps to solve the problem. Separate bins of different colours have been installed for collection of e-wastes. This type of practice should be lengthened in the society for e-waste management. Students are the future of any generations. They can mobilize the whole society by awareness generation in any new ideas. For this, such type of research is very important to motivate the students. This study was also an effort in this direction.

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