4

E-waste Challenges, Impacts Over Health and Job Opportunities in India

Bharat Raj Singh*, Dharmendra Singh and **Anoop Kumar Singh**

School of Management Sciences, Lucknow, 226 501, Uttar Pradesh, India.

*Corresponding author E-mail: brsinghlko@yahoo.com; Mobile: +91-9415025825

Abstract

The development of the global information technology and communication sector has led to a rapid increase in the use of electronic gadgets and devices. The main reason for discarding old electronic devices and gadgets is their rapid upgrades and this is forcing consumers to replace them at a faster rate, resulting in piling up of electronic (E-waste), in turn, increasing the solid waste sector. The volume of E-waste increased by 21% in the five years upto 2019, when 53.6 million metric tonnes (Mt) of E-waste was generated. For perspective, last year's E-waste can be weighing as much as 350 cruise ships was put up until the end to build a 125 km-long line. This enhancement is projected to continue as the use of computers, mobile phones, and other electronics continues to expand, with their rapid obsolescence. It is also observed that only 17.4% of the E-waste produced is reaching formal management or recycling facilities. India is the "3rd largest E-waste producer in the world"; about 3.5 Mt of E-waste has generated annually, of which about 70% is generated in computer equipment, 12% from the telecommunications sector, 8% from medical equipment, and 7% from electrical equipment (Parks, 2019). Governments, public sector companies, and private sector companies generate about 75% of electronic waste, with the individual household contributing only 16%. This growing issue of E-waste invites more work on recycling and good management of electronic waste. On the other as E-waste is rising, its hazardous implications rising health issues. Thus, opening the doors for better management, researchers, and mechanized systems on its recycling, refurbishment, and reuse in India is to manage the growing millions of tones of E-waste as India is the third-largest producer. This chapter covers the type of challenges, implications on health issues as well as on fertile soil, and a new area for research towards mechanization and job opportunities about managing E-waste in India.

Keywords: ITC, electronic gadgets, solid waste, mechanization, job opportunities

E-waste in India: Management, Challenges & Opportunities (Vol-II)
Editor: Suresh Kumar

First Published in 2022 by Authorspress
ISBN 978-93-5529-322-0

Introduction

Growth in the information technology and communication (ITC) sectors has led to a rapid increase in the use of electronic equipment. The rapid upgrades of electronic products are forcing users to discard old electronic products very fast, which, in turn, add E-waste to the solid waste stream. The growing E-waste problem demands greater emphasis on E-waste recycling and better E-waste management. Electronic waste or E-waste is generated when electronic and electrical equipment becomes unfit for its original use or exceeds the expiration date (WEEE, 2019). Examples of E-waste (when unfit for use) are computers, servers, mainframes, monitors, compact discs (CDs), printers, scanners, copiers, calculators, fax machines, battery cells, cellular phones, transceivers, TVs, iPods, medical devices, washing machines, refrigerators, and air conditioners. These electronic components are increasingly replaced with new models due to rapid technological advancement and the production of new electronic components. This has led to a rapid increase in E-waste production (Figure 1). People turn to newer models and the life of the products has also become shorter.

E-waste usually consists of metals, plastics, cathode ray tubes (CRTs), printed circuit boards, cables, etc. Valuable metals such as copper, silver, gold, and platinum can be recovered from E-waste if they are processed scientifically. The presence of toxic substances such as liquid crystals, lithium, mercury, nickel, polychlorinated biphenyls (PCBs), selenium, arsenic, barium, brominated flame retardants, cadmium, chrome, cobalt, copper, and lead makes it very dangerous if E-waste is treated destroyed and processed in a crude manner by primary techniques. E-waste is a huge threat to humans, animals, and the environment. The presence of heavy metals and highly toxic substances such as mercury, lead, beryllium, and cadmium pose a significant threat to the environment, even in very small amounts.

Figure 1 E-waste Generated After Obsoleting

(source: CONS200/ The story of Canada's digital dumping ground)

Consumers are the key to better management of E-waste. Initiatives like Extended Producer Responsibility (EPR); Design for the Environment (DFE); Reduce, Reuse, Recycle (3Rs), a technology platform to connect markets to facilitate

a circular economy, aims to encourage consumers to dispose of their E-waste correctly, increase reuse and recycling rates, and adopt sustainable consumer habits. In developed countries, high priority is given to E-waste management, while in developing countries it is difficult to fully adopt or replicate E-waste management of developed countries and many related problems including lack of investment and technically skilled human resources. In addition, there is a lack of infrastructure and appropriate laws specifically to deal with E-waste. Also, there is an inadequate description of the roles and responsibilities of the stakeholders and institutions involved in E-waste management etc. In 2016, the Ministry of Environment, Forest and Climate Change (MoEFCC) issued updated E-waste (management) rules, which came into the siege of E-waste in India.

Challenges in India About E-waste Management and Recycling

E-waste, as important a task as it sounds, is not easy. This is something that has started in India in past decades and for a vast country like India, it is understandable for India to face certain challenges for the purpose of e-recycling. Challenges that include,

a) Volume of E-waste Generated

The production of E-waste at about 1.7 lakh tons per year ranked India and stood fifth. But in the year 2019, India accounted for the third-highest E-waste producer after China and U.S.A.

b) Participation of child Employment

In India, around 4.5 lakh working children between the ages of 10 and 14 are believed to be involved in various E-waste activities and without adequate protection in various campuses and rehabilitated workplaces. Therefore, there is an urgent need to bring effective legislation to prevent the entry of children in the E-waste market – its collection, classification, and distribution.

c) Unemployment Law

There is no public information on the Pollution Control Committee (PCC) in the case of most of the State Pollution Control Boards (SPCBs) or Union Territory websites for the State. Approximately 15 out of the 35 PCBs/35 PCCs do not have E-waste related information on their websites, their point being a visible public connector. The basic E-waste Rules and guidelines are also needed to be uploaded. If there is no information on their website, especially the details of recycling personnel and E-waste collectors, residents, and waste producers who are losing their garbage and do not know how to fulfill their responsibility. Therefore, e-management is a failure ineffective implementation of the Waste Management Regulations.

d) Lack of Infrastructure

There is a big difference between the current renovation and the collection of sites and the amount of E-waste that is generated. There is no collection and retrieval of items available. Recycling facilities are also lacking.

e) Health Risks

E-waste contains more than 1,000 toxic substances, which pollute the soil and groundwater. Exposure can cause headaches, irritability, nausea, vomiting, and eye pain. Recyclers can suffer from kidney and emotional problems. Out of ignorance, they risked their lives and their environment (E-waste is releasing toxic, 2018).

f) Lack of Incentive Programs

No clear guidelines exist for the management of E-waste for the informal sector. And there is no incentive to entice those involved in the legal process of E-waste management. The conditions in the informal reform sector are much worse than in the formal sector. There are no plans to encourage producers to do something to manage E-waste.

g) Negative Awareness and Empathy

Limited access and notification regarding disposal after setting an expiration date. And only 2% of people think about the impact on the environment when discarding their old electrical and electronic equipment.

h) Importation of E-waste

Import of waste equipment arriving in India – In developed countries, 80% of E-waste is exported to developing countries like India, China, Ghana, and Nigeria for recycling.

i) Decentralisation Involved

The lack of cooperation between the various authorities responsible for the management and disposal of such waste includes non-municipal participation.

j) Security Results

Lifelong computers often contain sensitive personal information and bank account information, which, if not removed, leaves room for fraud.

k) High Cost of Setting up Re-uses Space

Furthermore, the study also noted that renewable technology projects (including steel and non-ferrous metal refining) are at a major economic disadvantage compared to basic process activities and are generally not economically viable. Legal recycling

companies in India are limited to pre-processing E-waste material among others, where the crushed waste is exported to mines outside India. The formal sectors in India will still need to be utilized to use state-of-the-art waste recycling technology due to garbage collection problems and in part because of the difficulty of making a profit with high investment in high-tech and expensive technology.

l) Lack of Research

The government should encourage research into hazardous waste management, environmental monitoring, and the development of hazardous waste management and standards.

The Minister of State for Electronics and IT, Shri Rajiv Chandrasekhar informed the Parliament (Lok Sabha) on Dec. 08, 2021, that more than 3.54 Mt of E-waste was collected and processed in the financial year 2020-21, up from the previous 2.24 lakh tonnes, was excessive. In the previous year (Fig. 2). Based on the annual reports submitted by 35 State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs) to the Central Pollution Control Board (CPCB), 22,700.33 tonnes of E-waste was collected and processed in the financial year 2016-17, 69,413.619 tonnes in the financial year 2017-18, 1,64,662.993 tonnes in the financial year 2018-19, 2,24,041 tonnes in the financial year 2019-20 and 3,54,540.7 tonnes in the financial year 2020-21.

Figure 2 Over 3.54 Lakh Tonnes of E-waste Collected and Processed in FY21 in India

End of the E-waste Generation

Electronic waste generation can't be ended as such there is no method developed for this issue so far. It can however be recycled by adapting more convenient ways and its challenges and opportunities can go hand in hand like rights and duties. Most of the time, it is noticed that whenever a challenge for the country at large develops that becomes an area of opportunity provided proper solutions are laid down for such

challenge. There is no doubt that E-waste has increased in the past decades and these numbers will go on increasing in the coming times, which opens up a huge area of opportunities for the recyclers of E-waste. Electronic and equipments are designed in such a way that they would be used for 3-4 years only and then will have to be re-cycled and the statics themselves shows that India is the 3rd largest country that generates 3.2 Mt (India, 2019) and this would increase in the coming times (Park, 2019). Some suggested solutions to the existing problems related to E-waste are:

(i) *Trained managers*: Employees want that a reputable labor team supplier shall briefly explain the expectation of the job and shall then manage the workers. This would make the employees happy so that they do a good job and keep their job. This would help to a large extent in the problem of employee retention as well.

(ii) *Domestic legal framework*: To address the deficiencies in the import of E-waste and ensure that the framework addresses the issue of importing E-waste for recycling and reuse. There is also a definite need to address the safe disposal of household waste.

- Recycling shall be tied up with take-back products.
- Investments that shall attract the re-cycling sector.
- Linking of activities of the informal sector with formal sector activities.
- Promotion of technologies for recycling, like adequate ESM technology and incorporation of precautionary principles.

(iii) *Collection depots*: As in the example of British Columbia, the actual influx of used electronic items begins at authorized collection depots. Enter contracts in over 100 locations in B.C., receiving authorized items, where they are usually tiled and folded in type (computer, television, etc.), are sent to the assembly center. Most of the B.C. Collection centers also serve as bottles and beverages that can be brought back to the centers while generating more business than the e-scrap side of the work.

(iv) *Consolidation points*: Consolidation points are a common practice in the logistics world. They allow less than load (LTL) to be integrated into full load to provide efficient transportation efficiency. In the BC model, the next step behind the collection center is the assembly center. For a company interested in this type of business integration, port departments to facilitate loading and unloading of truck handling equipment and a secure storage area for bulk products are needed. For some authorities, integration opportunities are also available.

(v) *Basic recycling*: In recycling materials, a recycling 25,000-square-foot facility with more than 100 employees, incoming debris is removed from pallets and recycled by equipment operators in the workplace and the appropriate pallet bin is packed in including areas such as circuit boards, metal, plastic, and glass. For larger companies, the need to protect reputation and credit as well as corporate confidential information is considered.

(vi) *Secondary process*: Clean items are sent to other tasks for further processing. Some of these materials, such as copper, may generate revenue for recycling raw materials, while other materials, such as glass, that will be reused will

pay for better processing. Another way to continue the release of material is the use of cutting machines, which separate the electrical debris to facilitate the release of the material. The extraction is aided by a number of filtering technologies including magnets, vibrations, optical devices, and eddy currents.

E-waste recycling is an important issue and must be dealt with caution and on an urgent basis. The government of the country shall provide the recyclers with adequate technologies and solutions to the challenges faced by them in the process of recycling.

Impact of E-waste on Human Health

Workers aiming to recover valuable materials such as copper and gold are at risk of exposure to more than 1,000 harmful substances, including lead, mercury, nickel, brominated flame retardants, and polycyclic aromatic hydrocarbons (PAHs). For an expectant mother, exposure to toxic E-waste can affect the health and development of her unborn child for the rest of her life (Brun, 2013). Potential adverse health effects include negative birth outcomes, such as stillbirth and premature birth, as well as low birth weight and height. Exposure to lead from E-waste recycling activities significantly decreased neonatal behavioral neurological assessment scores, attention-deficit/hyperactivity disorder (ADHD), behavioral problems, changes in child disposition, sensory integration difficulties, is associated with and reduced cognitive and language score. Other adverse child health effects associated with E-waste include changes in lung function, respiratory and respiratory effects, DNA damage, impaired thyroid function, and an increased risk of certain chronic diseases later in life, such as cancer and heart disease.

"Marie-NolBrune Dries, the WHO's lead author on the report, said: "A child who ate just one chicken egg from Agbogbloshi, a waste site in Ghana, was consuming 220 times the European food safety authority, last year's E-waste – weighing as much as 350 cruise ships, kept till the end to make a line 125 km long. This growth is projected to continue as the use of computers, mobile phones and other electronics continues to expand along with their rapid obsolescence. Only 17.4% of the E-waste produced in 2019 reached formal management or recycling facilities, according to the most recent GESP estimates, with the rest illegally dumped in low – or middle-income countries, where it is recycled by informal workers. Appropriate collection and recycling of E-waste are important to protect the environment and reduce climate emissions.

In 2019, daily limit of chlorinated dioxins – "Improper E-waste management is the reason. It is a growing issue that many countries do not yet recognize as a health problem (Grant, 2013). If they do not act now, its effects will have devastating health impacts on children and will put a heavy burden on the health sector in the years to come".

Figure 3 Worker's Dismantling E-waste

A Rapidly Escalating Problem

The amount of E-waste is increasing globally. According to the global e-waste statistics partnership (GESP), they grew by 21% in the five years to 2019, when 53.6 million metric tons of E-waste was generated (Figure 3). For perspective GESP found that 17.4% of E-waste that was collected and recycled appropriately prevented the release of 15 million tons of carbon dioxide equivalents into the environment.

Children and Digital Dumpsites

It calls for effective and binding action by exporters, importers, and governments to ensure environmentally fair disposal of E-waste and the health and safety of workers, their families, and communities; monitoring E-waste exposure and health outcomes; to facilitate better reuse of materials and to encourage the manufacture of more durable electronic and electrical equipment. It also calls on the health community to take action to reduce adverse health effects from E-waste, by building the capacity of the health sector to diagnose, monitor, and prevent toxic exposure among children and women, more raising awareness of the potential co-benefits of more responsible recycling, working with affected communities and advocating for better data and health research on the health risks faced by informal E-waste workers.

"Children and adolescents have the right to grow and learn in a healthy environment, and exposure to electrical and electronic waste and its many toxic components unquestionably impacts that right," said Dr. Maria Neira, Director, Department of Environment, Climate Change and Health, at the WHO. The health sector can demand that health concerns be central to E-waste policies by providing leadership and advocacy, conducting research, influencing policy-makers, involving communities, and reaching out to other sectors (Joon, 2019).

A significant proportion of the E-waste produced each year is exported from high-income countries to low- and middle-income countries, where regulation may be lacking, or where regulation exists, may be poorly implemented. Here, E-waste is dismantled, recycled, and refurbished in an environment where infrastructure, training, and environmental and health safeguards may not exist or are poorly followed. This puts E-waste workers, their families, and communities at greater risk of adverse health effects from recycling E-waste (Monica, 2010).

E-waste presents a unique exposure scenario as people are exposed to complex mixtures of chemicals from multiple sources and through multiple exposure routes. William A. Suk, Ph.D., Branch Chief of the NIEHS Hazardous Substances Research Branch said "We know the toxicities and health implications of the individual components that make up E-waste, but we need to understand how these components potentially interact to affect human health".

E-waste is often exported to developing countries where workers use primitive recycling techniques such as acid leaching and cable burning to recover gold, silver, copper, and other valuable metals. Workers at so-called informal recycling centers are directly exposed to contaminants as they destroy discarded equipment. In addition, primitive recycling practices release polyaromatic hydrocarbons, dioxins, and other hazardous byproducts into the environment. This environmental pollution exposes neighboring communities to pollutants.

The review shows that exposure to E-waste is always harmful to human health; especially in children and pregnant women. WHO, in collaboration with NIEHS and other partners, recently launched an initiative to raise awareness and advance research on this emerging health threat as to how E-waste affects children's health?

Three Scary Effects of E-waste

1) E-waste Negatively Impacts the Soil

First, E-waste can have a detrimental effect on the soil of an area. As E-waste breaks down, it releases toxic heavy metals. Such heavy metals include lead, arsenic, and cadmium. When these toxins get into the soil, they affect the plants and trees growing from this soil. Thus, these toxins can enter the human food supply, causing birth defects. As well as many other health complications (Chennai soil, 2019).

2) E-waste Negatively Impacts the Water

E-waste that is improperly disposed of by residents or businesses also leads to toxins in groundwater. It is groundwater that is at the bottom of many surface streams, ponds, and lakes. Many animals depend on these channels of water for nutrition. Thus, these toxins can make these animals sick and cause imbalances in the

planetary ecosystem. E-waste can also affect humans who depend on this water. Toxins such as lead, barium, mercury, and lithium are also known to be carcinogenic (E-waste Contaminants, 2019).

3) E-waste Negatively Impacts the Air

When E-waste is disposed of in a landfill, it is usually burned by incinerators on site. This process can release hydrocarbons into the atmosphere, which pollute the air that many animals and humans rely on. In addition, these hydrocarbons can contribute to a greenhouse gas effect, which many scientists consider to be a major contributor to global warming. In some parts of the world, desperate people sift through landfills to salvage E-waste for money. Nevertheless, some of these people burn unwanted parts such as wires to remove the copper, which can also cause air pollution (Maria, 2019).

Even though the long-term effects of E-waste are still unknown, it certainly has some negative effects on soil, water, and air quality. All these are essential parts of a healthy planet. A green E-waste recycling center can provide a disposal drop-off location for residents and pick-up service for businesses. Such centers and many others that have advanced technology and specialized technicians can do a great job of proper recycling of E-waste. These exercises will help bring the planet back to a state of equilibrium.

E-waste Job Opportunities in India

In many Southeast Asian countries, garbage collection has increasingly become a private initiative. This has accelerated waste management. In India, it is still in the hands of corporations that are slow to implement the changes. But there is immense potential for development as far as engineering of the sites; organized methods of trapping and recycling methane are concerned.

Career Prospects

E-waste management is a niche area in the West. There are many organizations that have done well by specializing in this field. Professor Anjan Raychaudhuri, Center for Entrepreneurship Development, IIM Calcutta says, "Environmental management and engineering is a well-established stream in the West. It is far less developed in India and the main thrust comes from NGOs and individuals concerned about the environment. The government seems rather slow in legislation and taking concrete steps. The young are, however, conscious of this emerging career prospect and are thinking closely on these issues. We have had a student who successfully runs an organisation that reduces energy waste while various groups have made plans for setting up ventures in the recycling of urban waste".

Courses on Offer

While there are no formal courses available specifically on E-waste management, there are diploma courses in waste management that cater to this area of specialisation as well. At IIMC, many elective courses touch the field. Center for Environmental Studies has a very interesting syllabus on "Environmental Challenges in India' that covers all the aspects of dealing with waste. The public policy group also offers a course on urban management. There are also courses on entrepreneurship in NGOs, which cover initiatives in this area," says Raichaudhuri.

UNESCO has an academic program in this area, while many universities in the UK and US offer specialisations. Those with technical degrees like BE/B.Tech or ME and M.Tech can also pursue a course on environmental engineering or environmental management. Others can consider a BSc in Environmental Science or a Doctorate of Philosophy in Eco-Sustainability and Hazardous Waste Management. An added advantage would be a course on entrepreneurship if one is interested in going in for their own venture/NGO. A fresher wanting to join the industry can expect a minimum salary of Rs 15,000 and above. Those working on their own can also hope to earn something between Rs 20,000 and Rs 35,000 per month, while those with technical degrees can look at anything between Rs 30,000 and Rs 50,000.

In making the E-waste management industry, it can tackle environmental issues while generating employment and revenue. Therefore, everyone who falls in the GenY category can think beyond the white-collar job; and do their bit to make the environment better. They can do this not only by participating or deliberating at conferences and speech competitions but by taking initiatives to challenge carbon footprints. After all, managing a career and pursuing your passion can be the right combination.

Half Million Jobs in India by 2025

The E-waste sector will generate 4.5 lakh direct jobs by 2025 and 1.8 lakh jobs in the allied sectors of transportation and manufacturing, according to the International Finance Corporation (IFC), a member of the World Bank Group. IFC, which has been working in the E-waste sector since 2012, under a program launched by it in 2017, has collected over 4,000 metric tonnes of E-waste from citizens and corporations and recycled responsibly under the program is gone (Figure 4).

Environment Ministry official Sonu Singh while praising IFC at the conference on 'E-waste Management in India: The Way Forward' said that the government is happy to see IFC's commitment in developing the sector in a responsible manner (Singh, 2017).

Figure 4 Need of E-waste Management

- The E-waste sector has significant potential to contribute to the country's economy and generate employment. The power and electronics industry is collaborating with the government and has taken a lot of initiatives to handle E-waste responsibly.
- If the responsibility is shared between the government, producers, and consumers of E-waste, efficient management of E-waste can be successfully achieved in India. "We are delighted to see IFC's commitment to helping this sector grow in a responsible manner," said Singh, Joint Director, Hazardous Substances Management Division, Ministry of Environment.

Electronic waste or E-waste is thrown to electrical or electronic equipment. Used electronics destined for reuse, resale, disposal, recycling, or disposal are also considered E-waste.

Conclusion

From the study of the above chapter, we can find that E-waste has three scary effects:

1) Affects the soil because of its harmful effect on the soil of an area. When E-waste breaks down, it releases toxic heavy metals.
2) Affects water when E-waste is not properly disposed of by residents or businesses, allowing toxins to enter groundwater.
3) Affects the air, when E-waste is disposed of in a landfill, it is usually incinerated by incinerators on site.

Soil, water, and air are the basic needs of survival of life. It should be addressed properly on the one hand and on the other hand, E-waste recycling should be handled scientifically and systematically so that the process generates employment

opportunities for the development of the nation. It is very likely that the electronic waste sector in India will generate 4.5 lakh direct jobs and another 1.8 lakh jobs by 2025 in allied sectors of transport and manufacturing.

References

"E-waste is releasing toxic chemicals into soil in India's metros, says study (2018)." *Hindustan Times*. 2018-02-27. Retrieved 2019-03-28.

"India's 80%-surface water may be polluted, report by international body says –TOI," (2019). *The Times of India*. Retrieved 2019-03-28.

Brigden, K. (2019). *Recycling of electronic wastes in China and India: workplace and environmental contamination – Greenpeace*. Retrieved 28 March 2019.

Brune, M.N., Goldizen, F.C., Neira, M., Van den Berg, M., Lewis, N., King, M., Suk, W.A., Carpenter, D.O., Arnold, R.G. & Sly, P.D., (2013). *Health effects of exposure to E-waste*. Lancet Global Health 1:e70.

Chennai's soil, *Delhi's air most contaminated due to high PCB concentration: study* (2019), downtoearth.org.in. Retrieved 2019-03-28.

Chatterjee, S., Kumari, A., & Jha, M.K. (2016). "Chapter "Sustainable recycling technology for electronic waste", in Sustainability in the Mineral and Energy Sectors." CRC Press, Taylor & Francis, London. https://www.taylorfrancis.com/chapters/edit/10.1201/9781315369853-11/ sustainable-recycling-technology-electronic-waste-sandip-chatterjee-archana-kumari-manis-kumar-jha

E-waste contaminating Delhi's groundwater and soil, (2019). Downtoearth.org. 23 March 2019.

Grant, K., (2013). "Health consequences of exposure to E-waste: a systematic review, The Lancet. *Global Health*. 1 (6): e350-61. doi:10.1016/S2214-109X (13)70101-3. PMID 25104600. Retrieved 2019-03-27.

Grant, K., Goldizen, F.C., Sly, P.D., Brune, M.N., Neira, M., Van den Berg, M. & Norman, R.E., (2013). *Health consequences of exposure to E-waste: a systematic review*. Lancet Global Health 1: e350-e361.

India to generate over 5 million tonnes of E-waste next year, (2019), *ASSOCHAM-EY study-The Asian Age.* 2019-03-03. Retrieved 2019-03-26.

Joon, V., Shahrawat, R., & Kapahi, M., (2017). "The Emerging Environmental and Public Health Problem of Electronic Waste in India". *Journal of Health and Pollution*. 7 (15): 1–7. doi:10.5696/2156-9614-7.15.1. ISSN 2156-9614. PMC 6236536. PMID 30524825.

Maria, A.H. & Hari, K. (2019). "India finally has the plan to fight air pollution". *Environmentalists Are Wary*, The New York Times. ISSN 0362-4331. Retrieved 2019-03-28.

Monika, J. (2010). "E-waste management: As a challenge to public health in India". *Indian Journal of Community Medicine*. 35 (3): 382–5. doi:10.4103/0970-0218.69251. PMC 2963874. PMID 21031101.

Pandit, V. (2016). "India likely to generate 5.2 million tonnes of E-waste by 2020: Study – Business Line," *The Hindu Business Line*. Archived from the original on 12 July 2018.

Park, M. (2019). "India's two-million-tonne E-waste problem has deadly consequences". *Quartz India*. Retrieved 28 March 2019.

Singh, S. (2017). *IFC Conference on 'E-waste Management in Indian*, Ministry of Environment.

Toxic foam pollutes India's sacred Yamuna River, (2018) ABC7 Chicago. 2018-09-27. Retrieved 2019-03-28.

WEEE: Impact of Waste Electrical and Electronic Equipment, (2019), Retrieved 2019-03-28.