Electronic Waste and Sustainability- Perspective on the Rise of a Global threat

Swahili Rai [1], Himanshu Prasad [1]

[1]*Student, Marketing, Universal Business School, Karjat, Maharashtra, India.*

Corresponding Author: himanshu.asd@gmail.com

Abstract: Electronic waste is a growing worldwide danger to long-term development. The researchers examine the issues of electronic waste management, as well as the harm it does to the environment, human health. The goal of this research is to show that current global e-waste scenarios and health risks could delay the fulfilment of sustainable development goals. This study depicts scenarios from various perspectives, raises concerns about e-waste, identifies information gaps, and lays the groundwork for knowledge and awareness building, as well as technological advancement, to assist the world in achieving long-term sustainability. The researchers have put their observations, conducted interviews of the focus group (colleagues) and surveys. The research also discusses how comprehensive global e-waste management and legislation can help to mitigate e-waste risks and are the most effective way to achieve sustainable development.

Key Words: —*Electronic Waste; Health Risks; E-Waste Management.*

I. INTRODUCTION

Electronic Waste: E-Waste encompasses waste from all electronic and electrical appliances, including computers, mobile phones, digital music recorders/players, refrigerators, washing machines, televisions, and a variety of other household consumer items. This includes used electronics that will be reused, resold, salvaged, recycled, or disposed of.

Health Risks: E-waste also contains hazardous materials such as lead, mercury, cadmium, hexavalent chromium, and others that can harm the human reproductive, renal, and respiratory systems. Unscientific urban mining of E-waste causes health risks, soil and water contamination, and air pollution, affecting many people. As a result, determining the level of awareness about e-waste management and public concern for the environment is critical.

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E-Waste Management: A smart e-waste management system for developing countries must assess the e-waste situation, recognise that e-wastes are a complex mixture of hazardous and non-hazardous substances and materials, and define an integrated e-waste management system can takes into account EEE market penetration, the life cycle of ICT equipment, financing mechanisms, and so on.

1.1 Objective

- The goal of this research is to show that current global e-waste scenarios and health risks could delay the fulfilment of sustainable development goals.
- This study depicts scenarios from several viewpoints, raises concerns about e-waste, and identifies information gaps.
- Establishes a foundation for knowledge and awareness building as well as technology advancement to help the world achieve long-term sustainability.

1.2 Research methodology

The qualitative research method was used, and the researchers documented their findings through observations, focus group interviews (colleagues), and surveys.

II. LITERATURE REVIEW

The majority of the garbage is hazardous by nature. It will

decay and produce leachate, which can pollute water, as well as explosive lowland gas. Product design should be used to reduce not only the type and quantity of waste, but also to increase end-of-life usage. A product-centred approach to the environmental effects of commerce should be used to preserve and protect the environment **(Vijay N. Bhoi et al. 2014).** Governments must also distribute adequate funds and uphold globally agreed-upon environmental regulations within their borders. Because e-waste is a known primary source of heavy metals, toxic compounds, and carcinogens, skin, respiratory, digestive, immunological, and reproductive system disorders are unavoidable **(Sivakumaran Sivaramanan, 2013).**

E-waste can be managed by developing eco-design devices, effectively collecting e-waste, recovering and recycling material using safe methods, disposing of e-waste using suitable methodologies, prohibiting the transfer of used electronic devices to developing countries, and raising awareness about the impact of e-waste. No single tool is sufficient, but they can work together to address this issue **(Peeranart Kiddee et al., 2013)** Due to the hazardous components of e-waste, improper treatment may have an impact on the environment and human health.

Regardless of the current state of recycling and reuse. Manufacturers should also aim to establish a trash take-back programme to handle waste, allowing for proper e-waste management and disposal **(Samarkoon M.B., 2014).**

2.1 Hypothesis

- Today's infrastructure for electronic waste management is not viable for sustainable development.
- Electronic waste has harmful effects on the environment.
- Under-developed countries and developing countries does not have proper electronic waste management system
- Technological advancement and awareness building activities can help in reducing the electronic waste and lead to sustainable development goals.

III. ANALYSIS

3.1 Qualitative Research:

Table 1
E-waste Categories

Sl. No.	Category	Label as
1	Large Household Appliances	LHA
2	Small Household Appliances	SHA
3	IT & Telecommunication Equipments	ICT
4	Consumer Equipments	CE
5	Lighting Equipments	LE
6	Electrical & Electronic Equipments	EEE
7	Leisures, Toys & Sports Equipments	TOYs
8	Medical Devices	MD
9	Monitoring & Control Instruments	M & CI
10	Automatic Dispensers	AD

Source: EU Directive 2002/96/EC

3.1.1 E-waste and Sustainability Challenges

E-waste is becoming a more serious threat to global sustainability. Humans, animals, and the environment are all put in danger by e-waste. Even in trace amounts, heavy metals and extremely poisonous chemicals such as mercury, lead, beryllium, and cadmium represent a serious hazard to the environment (Saira V. K., 2004).

According to the Global E-waste Monitor 2020 study, the world generated an all-time high of 53.6 million tonnes of e-waste in 2019. Only 17.4% of all waste was recycled (Binegde, 2015).

3.1.2 E-Waste and Its Environmental Consequences

Improper e-waste disposal in landfills or other non-dumping sites poses serious threats to current public health and has the potential to pollute ecosystems for future generations. Toxic chemicals are released when electronics are improperly disposed of and end up in landfills, affecting the earth's air, soil, water, and, ultimately, human health (Jadhav, S., 2013).

3.1.3 Electronic-waste and Human Health

Up to 60 distinct elements can be found in modern electronics. These gadgets are made of both man-made and natural materials. Many are valuable, while others are dangerous, and still others are both. Printed circuit boards usually contain the most intricate mixture of components (Agarwala, V., 2014) When toxicants are released into the environment, they can cause lung cancer as well as damage to the heart, liver, and spleen. DNA damage can also be caused by chromium VI and lead. When consumed or inhaled, substances like mercury can

Table 2
Composition of Some Common Electronic Devices

Sl. No.	Type of E-Waste	Contents (ppm)			Composition (%)			
		Ag	Au	Pd	Fe	Al	Cu	Plastic
1	TV Boards	280	20	10	30	15	10	28
2	PC Boards	900	200	80	7	5	18	23
3	Mobile/Cell phones	3000	320	120	7	3	13	43
4	DVD/CD/Flopy	115	15	4	62	2	5	24
5	Calculator	260	50	5	4	5	3	61
6	Others	290	124	0	8.3	0.7	8.5	00

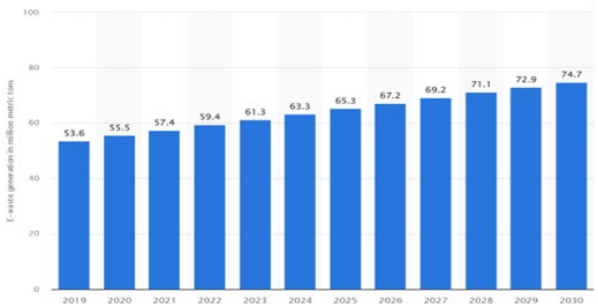
Source: UNU, 2009

harm the brain and liver. In developing nations, the burning of electronic garbage is highly widespread, and it can result in high amounts of lead in soils and water **(**M. H., 2013).

3.1.4 Pollutants and their occurrence in waste electrical and electronic equipment

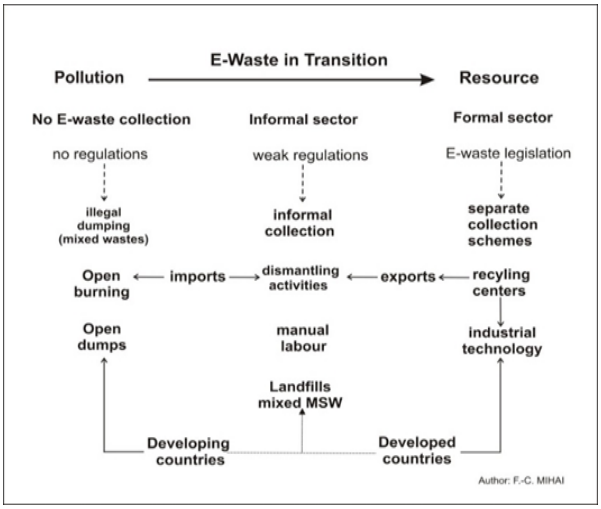
	Batteries, pigments, solder, alloys, circuit boards, computer batteries, monitor cathode ray tubes (CRTs)
Chrome	Dyes/pigments, switches, solar
Cobalt	Insulators
Copper	Conducted in cables, copper ribbons, coils, circuitry, pigments
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC(polyvinyl chloride) stabilizers, lasers, LEDs, thermoelectric elements, circuit boards
Liquid crystal	Displays
Lithium	Mobile telephones, photographic equipment, video equipment (batteries)
Mercury	Components in copper machines and steam irons; batteries in clocks and pocket calculators, switches, LCDs
Nickel	Alloys, batteries, relays, semiconductors, pigments
PCBs (polychlorinated biphenyls	Transformers, capacitors, softening) agents for paint, glue, plastic
Selenium	
Silver	Photoelectric cells, pigments, photocopiers, fax machines
	Capacitors, switches (contacts), batteries, resistors
	Steel, brass, alloys, disposable and rechargeable batteries, luminous substances

3.1.5 The Global E-Waste Crisis



In 2019, around 54 million metric tonnes of electronic garbage were created globally. Several reasons, including greater spending power and the availability of electronics, have spurred e-waste development in recent decades, making it the world's fastest growing waste origin (Sahay, S., 2015). This trend is anticipated to continue, with forecasts indicating that global e-waste creation would have grown by nearly 30% by 2030 (M. A., (2011).

3.1.6 Practices widely used to reduce E-Waste



3.1.7 The best practises for e-waste disposal can be

Donation: Donating old or unwanted electronic devices is one of the best e-waste disposal practises.

Extending the lifespan of your electronics: To keep your current devices in good working order, make sure they are well maintained and that you follow the manufacturer's usage instructions.

Using a certified recycler's services: Inquire about the recycling process and certifications of potential e-waste recyclers when selecting or approaching them

Taking advantage of cloud computing's capabilities: Cloud computing is a viable and proactive best practise for reducing e-waste disposal by assisting your organisation in avoiding the purchase of storage equipment, allowing you to reduce your e-waste.

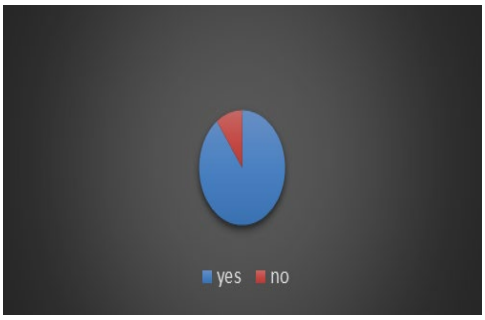
Using trade-in programmes to upgrade your electronics and devices: Cloud computing is a viable and proactive best practice for reducing e-waste disposal by assisting your organisation in avoiding the purchase of storage equipment, allowing you to reduce your e-waste.

IV. SURVEY

By conducting a survey on our 52 colleagues using google form we are able to generate following results-

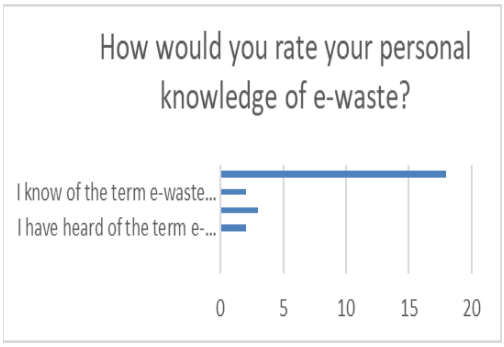
Questions I

Are you aware what is E-waste- Yes/no



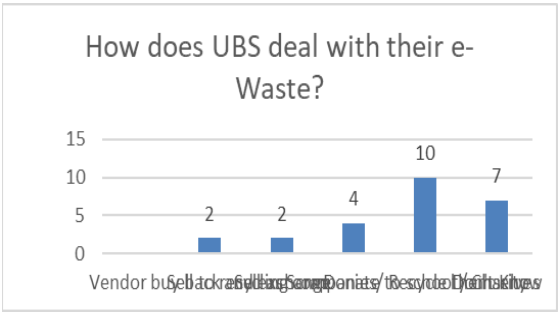
- Majority of the people is aware of the E-waste.
- We need to work on increasing the awareness among the non-aware people.

Question II



- Majority of the audience know what E-waste is.
- Some people know about E- Waste but do know know its relevance to them and their organisation.
- Some of the audiences do not know about E-waste.

Question III

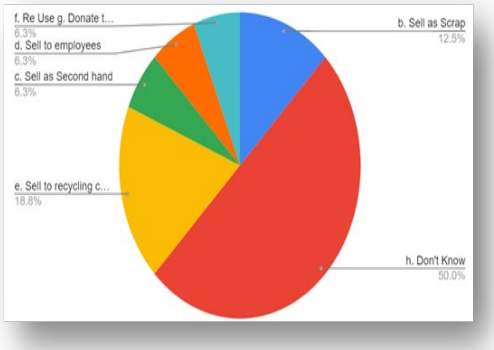


- UBS donate to school/ charity to reduce E-waste and recycle.
- Many do not know how UBS deals with their E-waste.
- Others believe that UBS promotes recycling, selling as scraps and to vendors.

Question IV

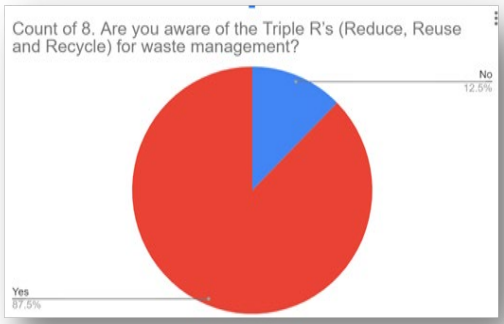
- There is a 50% distribution in awareness about the hazardous and negative effects of E-waste.

How do you deal with your E-waste?



- 50% don't know about how they should deal with their E-waste
- 19% believes in selling the old items to recycling, 12% do sell as scrap
- Rest audience also sells with different motives

- More than half of the audience do not know who is responsible to deal with their E-waste
- Others believe it's the responsibility of office administration, I.T or Human Resource department.



- People know about the RRR of waste management.
- About 25% do not know about it.

4.1 Results Analysis

- Majority of UBS students are aware of what e-Waste is.
- Majority of UBS students have self-knowledge about e-Waste.
- Majority of students believes UBS donates their e-Waste or recycling companies/Recycle themselves or don't know.
- Majority of the students are aware of the 3 R's.
- Majority of the students knows about how e-Waste is being managed in their institute.
- There are 50% students from our survey group knows the hazardous effect of e-waste, and 50% have no idea about it.

4.2 Findings

- E-waste should not be mixed with unsorted municipal waste destined for landfills because electronic waste can contain a variety of substances, many of which are toxic, such as lead, mercury, arsenic, cadmium, and so on.
- Bioremediation may be an environmentally friendly and fruitful method complementary to engineering-based approaches that is also an effective solution for environmental sustainability.
- Uncontrolled emissions of harmful toxins into the air, water, and land result from informal recycling. The health risks posed by fumes, ash, and hazardous chemicals affect more than just the employees who come into contact with them.
- Informal recycling results in the unregulated release of harmful toxins into the air, water, and soil.
- Because global hazardous waste always travels from origin to destinations with lower environmental restrictions, the nasty aspect of its recycling operations is never effectively handled.

V. CONCLUSION

By combining social, economic, environmental, technical, cultural, and gender aspects, sustainability is being prioritised for all development efforts. Given the negative potential eco-toxicological consequences and various health implications of e-waste, a global multilateral agreement addressing its management (i.e., processing, storage, transportation, recycling, and final disposal), whether by land filling or incineration, is urgently required. Because of the worldwide character of the problem and the difficulties of creating sustainable and ecologically sound e-waste processing in low-income nations, international negotiation and collaboration is the only viable answer. Furthermore, comprehensive global e-waste management and legislation might help to mitigate e-waste risks and are the greatest method for attaining sustainable development.

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