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A RESEARCH ON E-WASTE MANAGEMENT AND ITS IMPACTS ON ENVIRONMENT AND HUMAN HEALTH

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Abstract

The world is experiencing a period of rapid growth in manufacturing industries, largely driven by the increasing global population. This paper investigates how this population growth fuels a peak demand for electronic components. As a consequence of this customer-oriented growth, coupled with rapid product obsolescence and advances in technology, new and significant environmental challenges are emerging. *Electronic wastes or e-waste means obsolete electronic devices .Due to fast growing technology , environmental challenges occur whether from raw material extraction or waste generated from the used product.This paper presents research on the development of e-waste, utilizing data collected over a decade. It categorizes 21 types of e-waste into two broad categories: consumer electrical and electronics, and information technology communication equipment.The management of e-waste in India has been subject to a series of evolving legislative measures, with key laws being put in place in 2011, followed by a comprehensive set of rules in 2016 that became effective in 2017.The study based on literature survey of the raw material that is being used and played major role for creating harmful environment. A brief explanation of each topic and future research are also provided in this paper. Appreciable steps have been taken by authorities but till now only a small population is aware of it. The hazardous nature of electronic waste, aggravated by its widespread and increasing use, presents a direct threat to human health. Due to the massive amount of e-waste , a separate subject of e-waste has been kept in engineering institutes.*

Keywords:- *E-waste, environment sustainability,EEE , Developing countries*

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Abbreviation

EEE	Electrical & Electronic equipment
EU	European union
CFC	Chlorofluorocarbons
MT	Metric tonnes
ICT	Information & communication technology
EPR	Extended producer responsibility
BASEL CONVENTION	It is the treaty that controls the transboundary movement of hazardous e-waste for their disposal.
BAMAKO CONVENTION	This convention or treaty is for the africans for prohibiting the import of waste including radioactive waste which came into force in 1998

Introduction

It has been seen that due to rapid increase of use of ICT devices, there is an alarming growth of e-waste in India or World wide .It is because of frequent innovation and technological change thus resulting in shorter life span of the product.Actually what does e-waste mean? E-waste are those components which are intended to be discarded or the parts which is rejected from the unused components or during manufacturing and repairing process .It is being observed that in developed and developing countries the volume of e-waste is not controlled which results drastically increased of e-waste component which further influence the environment aspects and human health.The awareness e-waste was emerged in the year 2002 in basel convention and “EU waste of electronic and electrical equipment devices”. E Waste contains many toxic components which are hazardous for both humans and the environment. China is the major contributor of E-waste because it is an import or hub of manufacturing EEE products across the world. Electronic equipment like mobile phones , laptops, tubelight, fans etc. when it stops functioning at that period it becomes e-waste.

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LITERATURE SURVEY

Globally 62 million tonnes of e-waste generated in the year 2022 and expected to increase about 82 million tonnes by 2030 as per the data of UN's Global E Waste monitor 2024 report (Balde et al,2024)[15] .According to the study of (Laxmi kant, prangya ,Harshita and Mohana ., 2025)[10] that India generates about 1.45 million metric tonnes of waste per annum and recycling rate is only 5%. According to EPI
2024 ,India ranked 176th out of 180 countries with a score of 27.6 which indicate more challenging in the area like air and water quality .Commitment to next zero emission by India by 2070 is a sign of positive effort and step.A study by Panwar and his colleagues showed the hazardous materials which are released into the environment increases if e-waste is not discarded properly.Studies disclose that few samples of soil and water are taken from the area where e-waste units are pinpoints.The microbes which are present in the soil are adversely affected due to dumping of e-waste which weaken the fertility of soil.A new cost effective technique has been developed by some of the researchers like phytoremediation. In 2019 data e-waste was generated globally, a 21% growth compared to 5 years ago (Balde et al,2017) [11]. Instead of this growth, only 17.4 wt% of e-waste was collected and recycled (Forti et al ., 2020)[12].This article reviews the sources ,effects on human health ,method of disposal, e-waste generation statistics country wise, e-waste generation statistics state wise.This review paper adopted a method of literature survey from database like scopus,web of science and science direct, research gate.net, springer,md searchlight,Google scholar.

CLASSIFICATION

The e-waste are broadly categorized in two types that are as follows:-

1.Consumer Electrical & Electronics

- Refrigerators
- Tubelight , Bulb
- Washing Machines
- Television
- Fan
- AC etc.

2.Information Technology and telecommunication equipment

- PC (Personal computers)
- Mobile phones
- Laptops
- Telephones
- Typewriters
- Fax machines
- Cellular telephones
- Cordless telephones
- Printers
- Notepads etc.

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GENERATION OF E-WASTE STATISTICS

E-waste generation by the country according to the recent data –

Rank	Country	Kilo tonnes	Recycle rate
1.	CHINA	10129	16%
2.	USA	6918	15%
3.	INDIA	3230	1%
4.	GERMANY	1607	52%
5.	UK	1598	57%

In India , E-waste is estimated to comprise about 68% for computer accessories , 12% for telecommunication equipment, 8% for electrical equipment , 7% for medical equipment and about 5% for household e-scraps.

E-waste generation of India statistics:

	Financial year	Generation
1.	2023-2024	1.75 million MT
2.	2022-2023	1.609 million MT
3.	2021-2022	1.601 million MT
4.	2020-2021	1.346 million MT
5.	2019-2020	1.041 million MT
6.	2018-2019	7.71 lakh MT
7.	2017-2018	7.08 lakh MT

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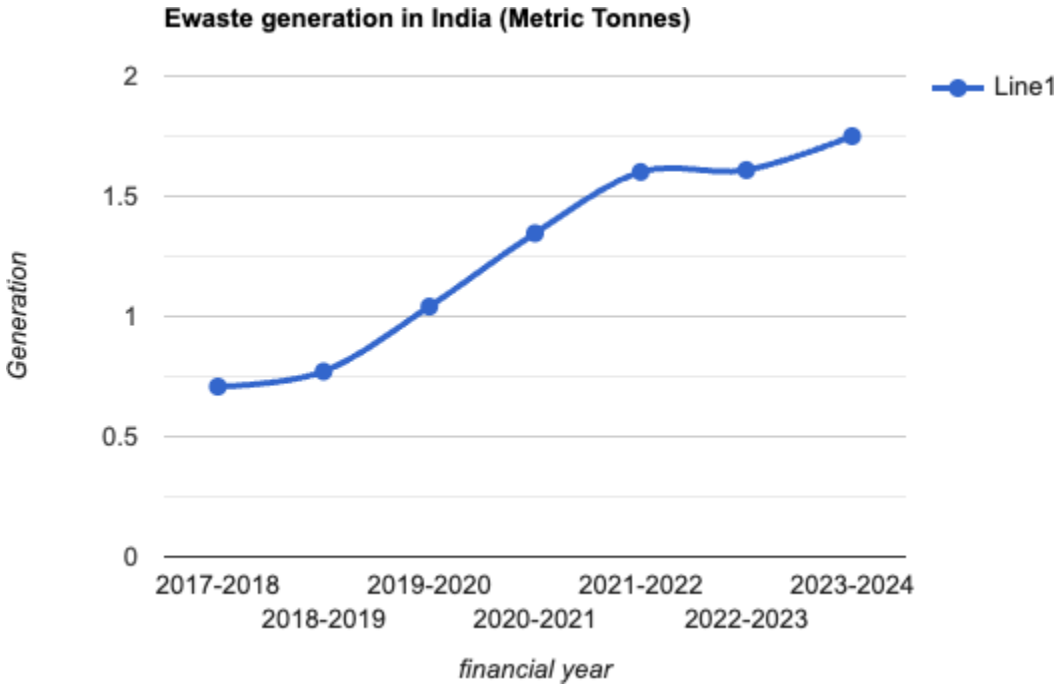

Sources of E-waste

According to the study conducted, 53.6 million tonnes production of e-waste in 2019 .A study by Farida Arinie et al(2023) [1]that electric waste will reach 74 million tonnes by 2030 and is about to increase by 120 million tonnes in 2050. Another study by El-hout et al (2022)[12] states that major contributors of e-waste are from mobile phone devices due to increasing technology inventions . A study concerning electronic waste and its management in developing countries states that the
number of electronic waste is increasing along with people's need for advanced technology. A study by Rania et al (2023) states that the end life of the products has been landfill and recycling centers
,creating new challenges among stakeholders .

Name of compounds	Sources	effects on health	Reference
PVC (polyvinyl chloride)	Electrical cables insulation	It contains dioxins that cause cancer,immune system damage ,hormone disordering	[2]

		.	

Cadmium(Cd)	PCBs ,light sensitive resistor,switches,CR Ts	Bone diseases ,Renal damage and several forms of cancer.	[3]
Lead(Pb)	LCD screens ,optical fibres,lead acid batteries	Affects the nervous system,headache,attention deficits ,memory loss, mental dullness and hallucination .	[4]
Sulphur(S)	Lead acid batteries	Severally irritates the nose ,throat and lungs and burns the skin ,eye damage .	
Mercury(Hg)	Television,Laptops ,Fluorescent tubes,Electric motor	Headaches, Limb pain ,tooth loss, Respiratory and cardiovascular disorders, liver , kidney and brain damage .	[6]
Arsenic (As)	Light emitting diode , transistors, solar cells , batteries manufacturing	Cardiovascular disease , neurological effect ,hematological disorders ,cancer of skin,lung kidney and bladder.	[7]
Lithium(Li)	Lithium ion batteries, mobile, photographic , video equipment .	Gastrointestinal effects ,nausea ,vomiting, loss of appetite , burning sensation.	[8]
Beryllium(Be)	Power supply box, X-rays machine	Skin disease,damage lung tissue and damage to the skeletal system ,berrylicious.	
Chlorobenzene	Combustion of chlorinated plastic PVC	Irritate the eyes, nose,throat,headache, dizziness, damage lungs ,liver ,kidney.	[5]
Antimony(Sb)	Battery manufacturing,crt glass, solder alloy in cabling	Nose bleeds, abdominal pain, chest pain decreased urine, ringing in ears, blood in vomit and stool.	[16]

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PRESENT STATUS OF E-WASTE IN INDIA

The Country's journey toward Viksit Bharat enhances the digital transformation with increase in electronic devices . From mobile phones to medical equipment technology has become backbone for economic growth.EPR mandates producers ,importers and other brand owners to use waste from
their product end life span which promotes sustainable design ,low pricing and supports e-waste management.

State Wise e-waste generation in India:-

Sl.no	State	% (Tonnes/year)
1.	Maharashtra	19.8%
2.	Tamil nadu	18.1%
3.	Andhra pradesh	12.5%
4.	Uttar Pradesh	10.1%
5.	WestBengal	9.8%
6.	Delhi	9.5%
7.	Karnataka	8.9%
8.	Gujarat	8.8%
9.	Madhya pradesh	7.6%
10.	Punjab	6.4%

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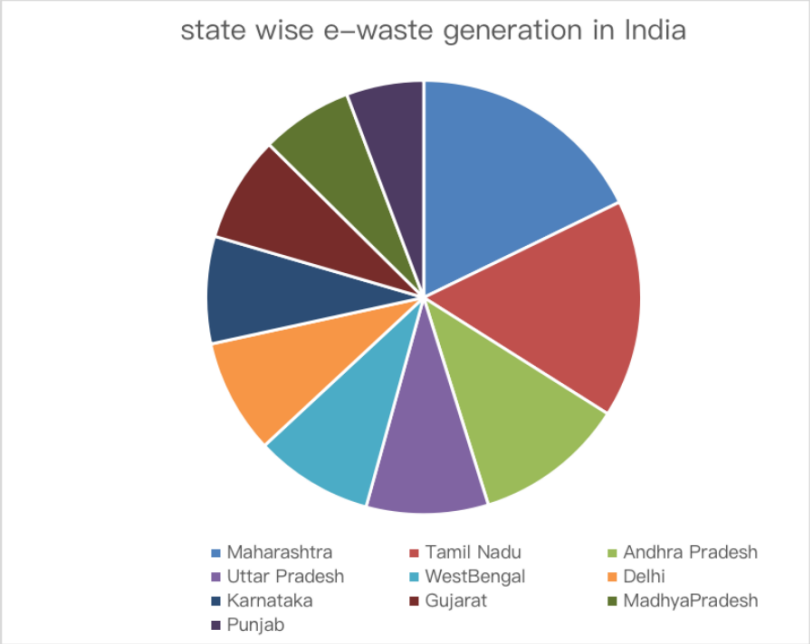

IMPACTS OF E-WASTE IN ENVIRONMENT

Heavy metals,persistent organic pollutants ,flame retardants,and other potentially hazardous substances are present in E-waste.These pollutants can cause risk to the environment if not managed properly .Three main groups of substances are utilized in recycling and material recovery.The initial components of equipment ,such as lead and mercury are grouped together,while the second group such as cyanide is added during a recovery process .If dioxins and furans ,which
form a third group during recycling processes are improperly managed ,they could pose significant health risks (Joseph ,2007)[14].

Soil contamination

When e-waste is improperly disposed it causes reduced fertility and contamination of soil causing
soil pollution .e-waste include heavy metal Hg & Pb are found in Electronic devices like AC, Washing machine ,Refrigerator etc.These toxins enter our food chain by leaching into soil from landfills and dumping side. As these toxins enter our food chain it negatively impacts plant growth and heavily poses risk to human health.

Water contamination

E-Waste burning beside contaminating the soil also increases the concentration of air pollutants, particularly particulate matter.Based on the blood analyses , it was discovered that residents of
e-waste burning sites have the highest level of exposure.The estimation of human exposure showed that the dust ingestion was the primary cause BFRs intake, while air inhalation was the primary

cause of PCB intake.The study showed that open burning by the informal waste sector contributed to a high level of air contamination which affected the high level of heavy metal exposure to the residents. (Gangwar et al., 2019)[9].

Air Contamination

The presence of dust particles toxins are responsible for air contamination .During burning of e-waste air get polluted by the fumes when improper dismantling.Biodiversity get imbalance due to this electronic air pollution .The burning of e-waste release the hydrocarbons which contribute greenhouse effect and causes the occurrence of global warming.

CONCLUSION

Nowadays , E Waste becomes a major problem in our society because of improper disposal of Ewaste which leads to soil, water and air pollution that has an adverse impact on both human health and environment .The increasing demand of advanced technology plays a crucial role in e-waste . This article summarizes the scenario of generation of e-waste in India and other countries. Due to inadequacy of policies there are many issues related to
e-waste and lack of awareness regarding disposal of products leads to problems in India. a.There must be a proper organized sector for treatment , collection and disposal etc can minimize the growth of e-waste. There should be awareness programs for the public which can also contribute for minimizing the e-waste problem in our society.

REFERENCES

[1]Farida Arinie Soelistianto, Marjono Marjono, Ponco Siwindarto, Bagyo Yanuwiadi:A LITERATURE STUDY ON ELECTRONIC WASTE MANAGEMENT IN INDONESIA AND OTHER DEVELOPING COUNTRIES: CHALLENGES AND OPPORTUNITIES:e-ISSN: 2582-5208 International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal) Volume:05/Issue:07/July-2023 Impact Factor- 7.868

[2]Marcin H. Kudzin 1,2,Dominika Piwowarska 1,3,4,5,Natalia Festinger 1,2 and Jerzy J. Chruście:Risks Associated with the Presence of Polyvinyl Chloride in the Environment and Methods for Its Disposal and Utilization:*Materials* 2024, *17*(1), 173; https://doi.org/10.3390/ma17010173

[3]Sushila Saini & Geeta Dhania :Cadmium as an Environmental Pollutant: Ecotoxicological Effects, Health Hazards, and Bioremediation Approaches for Its Detoxification from Contaminated Sites:Chapter First Online: 08 May 2019 pp 357–387

[4]Gopal Chandra Mandal,Arpita Mandal,Arya Chakraborty:The toxic effect of lead on human health: Vol. 3 (2022): Special Issue: Jaydip Sen Memorial

[5] Hazardous substance fact sheet: chlorobenzene :january2009:https://www.nj.gov/health/eoh/rtkweb/documents/fs/0379.pdf.
[6]Angelika Edyta Charkiewicz , Wioleta Justyna Omeljaniuk , Marzena Garley ,Jacek Nikliński :Mercury Exposure and Health Effects: What Do We Really Know?:Int J Mol Sci. 2025 Mar 5;26(5):2326. doi: 10.3390/ijms26052326
[7]Nrashant Singh,Deepak Kumar,Anand P. Sahu:Arsenic in the Environment: Effects on Human Health and Possible Prevention :May 2007:Journal of Environmental Biology 28(2 Suppl):359-65
[8]Michael Gitlin :Lithium side effects and toxicity: prevalence and management strategies nt J Bipolar Disord. 2016 Dec 17;4:27. doi: 10.1186/s40345-016-0068-y
[9]*Gangwar, C., Choudhari, R., Chauhan, A., Kumar, A.,Singh, A., and Tripathi, A. (2019). Assessment of air pollution caused by illegal e-waste burning to evaluate the human health risk. Environment International,125, 191-199.*
[10]Laxmi Kant Bhardwaj, Prangya Rath, Harshita Jain & Moharana Choudhury :Exploring the effects of e-waste on soil, water quality and human health:Published: 11 February 2025:Volume 2, article number 12, (2025)
[11] C.P Balde , V.Forti, V.Gray, R.Kuher,P.stegmann:THE GLOBAL E-WASTE MONITOR 2017:Quantities ,flowand resources :United nations university ,International telecommunication union and international solid waste association (2017)
[12]C.P Balde , V.Forti, V.Gray, R.Kuher,G.Bel:THE GLOBAL E-WASTE MONITOR 2017:Quantities ,flowand the curricular economy potential (2020) .
[13]S.I. El-Hout, S.Y.Attia,S.G. Mohamed., & S.M. Abdelbasir, "From waste to value-added products: Evaluation of activated carbon generated from leather waste for supercapacitor applications". Journal of Environmental Management, 304, 114222,2022.
[14]KURIAN JOSEPH :ELECTRONIC WASTE MANAGEMENT INDIA–ISSUES AND STRATEGIESProceedings Sardinia 2007, Eleventh International Waste Management and Landfill SymposiumS. Margherita di Pula, Cagliari, Italy; 1 - 5 October 20072007 by CISA, Environmental Sanitary Engineering Centre, Italy.
[15]C.P Balde ,R.Kuher,R.Mc Donald ,T.yamamoto:The Global E Waste Monitor 2024:Unitar united nation institute for training and Research.
[16]Hazardous substancefactsheet:August2002:https://www.nj.gov/health/eoh/rtkweb/documents/fs/1757.pdf[10]Rachel Martin MD,Vincent Lee MD. Antimony Toxicity StatPearls [September 2, 2024]:Antimony Toxicity:Authored by the MD Searchlight Team