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# ENVIRONMENTAL IMPACT ASSESSMENT OF E-WASTE MANAGEMENT IN INDIA: A Socio-Legal Study

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***[Abstract:*** *E-waste management poses significant challenges in India due to the country's rapid growth in technology usage, high population density and inadequate infrastructure for handling electronic waste. India is one of the largest producers of e-waste globally. E-waste includes discarded electronic devices and appliances such as computers, mobile phones, refrigerators and other electronic gadgets. E-waste leads to hazardous environmental and health risks if not handled properly. The rapid growth in technology adoption and the increasing middle-class population contribute to the significant generation of electronic waste. A considerable portion of e-waste management in India is handled by the informal sector, consisting of small-scale recyclers, scrap dealers, and informal workers. While this sector plays a vital role in waste collection, their methods often involve unsafe and environmentally harmful practices like open burning and manual dismantling. India. The present research highlights the urgent need to rethink e-waste management and explore opportunities to harness its potential. This paper also highlights various problems and challenges in managing e-waste and provides solutions for e-waste management in India.]*

***Keywords:*** *E-Waste, Global Environmental Impact, Recycle, Health Hazards, Indian Approach*

## I

## Introduction

Over the decade, the electronics sector has grown at the fastest levels amongst all manufacturing sectors. It has been an asset that has given civilization the boost that is required to grow economically, culturally, and technologically. People use a variety of Electrical and Electronic Equipment (EEE) in their daily life, from the workplace to household chores. The honorable Prime Minister of India Sh. Narendra Modi introduced the "Digital India Programme," intending to use technology to improve the life of every civilian. The digital India programme was also aimed to use connectivity and technology to collaborate so as to improve

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the various facets of government and daily life for all citizens.[1] Therefore, there has been a significant surge in the electronic equipment market, fundamentally transforming people's lives. Simultaneously, the extensive utilization of electronic devices has led to a noticeable increase in the generation of e-waste in India. This rise is further attributed to the expanding market presence in developing nations.[2] All electronic and electrical equipment (EEE) are rapidly discarded which ultimately led to notable rise in the generation of electronic waste.[3]

The generation of electronic waste (e-waste) is influenced by various factors, encompassing both systemic and individual levels. Understanding the causes of e-waste is essential for developing effective strategies to mitigate its environmental and social impacts. Many systemic and human factors have contributed to the increase in electronic garbage, or "e-waste." Electronic and electrical equipment is constantly being upgraded and replaced due to the rapid speed of technical breakthroughs. This occurs as EEE reaches the end of its useful life or when new and improved technologies are introduced to the market.[4] The rapid innovation cycles like this have a vital role in the quick disposal of EEE, which is a major source of e-waste. Furthermore, users are encouraged to discard working but outmoded products prematurely due to the frequency of short product lifecycles, which are frequently caused by shifting technology or manufacturers' deliberate obsolescence plans.

The prevailing consumer culture, driven by forceful marketing strategies, encourages a trash culture in which older electronics are thrown away even though they still function and maintains a mindset of constant updates. In addition, certain electronic gadgets are not repairable, which deters users from choosing to have repairs done and adds to the growing amount of e-waste. The issue of e-waste is made more complex by the globalization of manufacturing and consumption since devices may be made in one area and disposed of in

[1] Jyoti Sharma, *Digital India and its Impact on the Society* 4(4) IJRS 64-70 (May-June 2022).
[2] Michael Minges, *Exploring the Relationship between Broadband and Economic Growth, available at: http://pubdocs.worldbank.org/en/391452529895999/WDR16-BP-Exploring-the-Relation-ship-between-Broadband-and-Economic-Growth-Minges.pdf* (last visited 12 Jan., 2022).
[3] Pooja Singh & Shanu Thomas, *E-waste Management and Environment Protection: A Critical Legal Analysis*, 5 BLR 27-35 (Jan-March 2022).
[4] *Id.*,

another which makes regulatory control and proper disposal more difficult. The issue is made worse by inadequate infrastructure for recycling e-waste, unofficial recycling methods, low consumer awareness, gaps in the law, and difficulties putting Extended Producer Responsibility (EPR) programs into place. These factors highlight the need for a thorough and multifaceted strategy to address the underlying causes of e-waste. Before delving into the issue of e-waste management, it is necessary to understand the concept of e-waste.

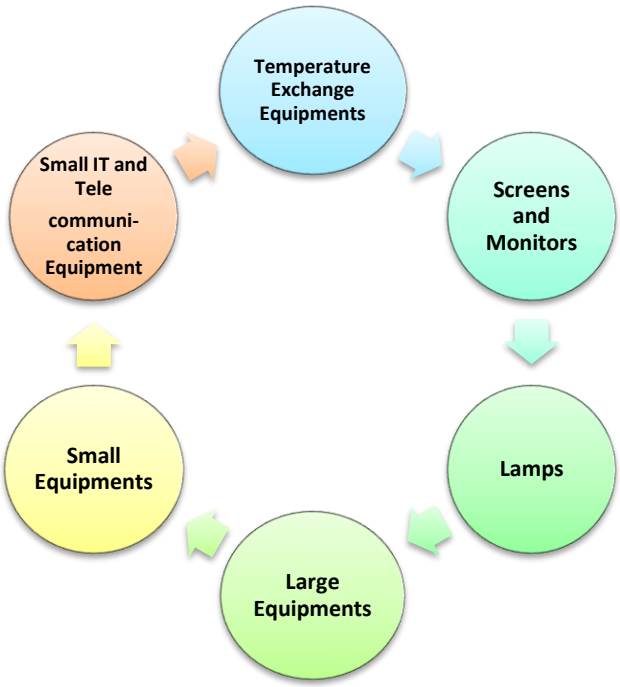
## II

### Conceptualization of E-waste

Electronic waste, commonly known as e-waste, encompasses all discarded electrical and electronic equipment (EEE) and its components, devoid of any intention for re-use by the owner. The terminology for e-waste may vary across regions and circumstances, with alternative terms including waste electrical and electronic equipment (WEEE), electronic waste, or e-scrap. This category spans a diverse range of products, encompassing virtually any household or business item containing circuitry or electrical components powered by electricity or batteries. According to Organisation for Economic Cooperation and Development OECD (2001) e-waste has been defined as "any appliance using an electric power supply that has reached its end of life.[5] Hence, electronic waste encompasses devices related to information technology, including discarded computers, electronic gadgets, mobile phones, and refrigerators. According to Basel Action Network (BAN), E-waste means "discarded appliances using electricity, which include a wide range of e-products from large household devices such as refrigerators, air conditioners, cell phones, personal stereos, and consumer electronics to computers which have been discarded by their users.[6] The comprehensive definition of e-waste covers six primary categories:

[5] Harpreet Kaur, *Legal Framework for Handling and Management of Hazardous Waste: A Critical Study* (2016) (Unpublished Ph.D. Thesis, Panjab University, Chandigarh).

[6] G. Gaidaji, K. Angela Koglou et.al., *E-waste: Environmental Problems and Current Management*, 3(1) J. Eng. Sci. Technol. Rev. 193-199 (2010).




- **Temperature Exchange Equipments**: The category comprises air conditioners, heat pumps, freezers, refrigerators, and other cooling and freezing appliances.
- **Screens and monitors:** Encompassing devices like televisions, monitors, laptops, notebooks, and tablets.
- **Lamps**: Involving various types of lamps like fluorescent lamps, high-intensity discharge lamps, and LED lamps.
- **Large equipment**: This category comprises substantial appliances like washing machines, clothes dryers, dishwashing machines, electric stoves, large printing machines, copying equipment, and photovoltaic panels.
- **Small equipment**: Encompassing everyday items like vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, and small monitoring and control instruments.

- **Small IT and telecommunication equipment**: Covering devices like mobile phones, Global Positioning Systems (GPS), pocket calculators, routers, personal computers, printers, and telephones.[7]

**III**

**Components of E-waste**

On the basis of above classification, components of e-waste have been given below:

**A. Chemicals and Metals with their Source in E-Waste**

| **Chemicals and Metals** | **Source** |
|---|---|
| Indium | LCD screens |
| Antimony | CRTs, PCBs and fire retardant and plastics |
| Arsenic | Light Emitting Diodes (LEDs) |
| Barium | Panels/getters of CRTs and florescent lamps |
| Beryllium | Silicon controlled rectifiers, motherboards of computers, beamline components, x-ray machines, photographic equipment, electrical insulators, resistors, rotating mirrors in laser printers |
| Cadmium | Printed Circuit Boards (PCB) like chip resistors, semi-conductors and infrared detectors |
| Chromium | Mobiles and computers |
| Copper | Electrical wires and conductor |
| Hydro chlorofluorocarbons (HCFCs) | Cooling units and insulation foam in coolers and older refrigerators |
| Lead | PCBs, computer monitors, lithium batteries, stabilizers, LEDs etc. |
| | LCDs, mercury wetted switches, alkaline batteries, switches, |

[7] UNITAR, *Global E-waste Surging: Up 21 percent in 5 Years,available at https://globalewaste.org/* (Last visited on Dec. 23, 2022).

| | |
|---|---|
| Mercury | printed circuit boards, pocket calculators, steam iron, batteries in clocks etc. |
| Polychlorinated biphenyl (PCBs) | Lubricants, dielectric fluids, lubricants and coolants in generators, old electric products, transformers, capacitators, ceiling fans, electric motors and dishwashers |
| Nickel | Rechargeable batteries, alloys, semi-conductors, relays and pigments |
| Lithium | Rechargeable batteries, mobile telephones, photographic equipment and video equipment |
| Polyvinyl Chloride (PVC) | Forming structure of computer housings and keyboards |
| Silver | Capacitors, switches, batteries and resistors |
| Sulphuric and Hydrochloric Acid | Circuit boards |

It is also seen that during recycling of computer components there have been harmful emissions which pose threat to human life and environment. These are given below:

**B. Computer Components causing E Waste during Recycling**

| **Source** | **Emissions during Recycle** | **Effects** |
|---|---|---|
| Plastics from Computers and Peripheral | dioxins, heavy metals and hydrocarbons | Cancer, adverse impact on hypothalamic, pituitary and thyroid glands affecting the functioning in infants |
| Printed Circuit Board | Metals, dioxins, lead, tin, dioxin, cadmium and mercury | Permanent damage to central & peripheral nervous system and respiratory tracks |
| Chips and | Nitric acid and hydrochloric acid | Damage to eyes and skin if gets |

| | | |
|---|---|---|
| Other Related Components | | inhaled |
| CRTs and Monitors | Lead, mercury, toxic phosphor into water and soil | Weakens the muscles of the body |
| Toner Cartridges | Different Chemicals | Soil and water pollution |
| Wires and Cables | Brominated and chlorinated dioxins | Air Pollution |
| Miscellaneous Computer parts | Dioxins and Polycyclic Aromatic Hydrocarbons (PAH)s into | Air Pollution |

## IV

**Impact of E-waste on Environment**

The ecosystem may suffer substantial and long-lasting effects from the inappropriate handling and disposal of electronic trash, or "e-waste." These are some of the main environmental issues that e-waste raises-

- **Pollution of the Soil**: Toxic materials may leak into the ground as a result of disposing of e-waste in landfills. This contamination has the ability to destabilize ecosystems and have an impact on the food chain by harming microorganisms and plants.[8]
- **Pollution of Water**: Rainwater can carry pollutants from e-waste into adjacent water bodies when the garbage is inadequately managed or disposed. This may lead to pollution of lakes, rivers, and seas, which could have an effect on aquatic ecosystems and drinking water quality.[9]

[8] Versha Bhagat-Ganguly, E-WASTE MANAGEMENT CHALLENGES AND OPPORTUNITIES IN INDIA 75 (2021).

[9] Rakesh Johri, E-WASTE IMPLICATIONS, REGULATIONS, AND MANAGEMENT IN INDIA CURRENT GLOBAL BEST PRACTICES 126 (2008).

- **Air Contamination**: Airborne contaminants are released by the unofficial recycling techniques that are frequently employed in some areas, such as burning e-waste to recover metals. Burning plastic casings, circuit boards, cables, and PVCs exposes people to dioxins and furans, two extremely toxic substances. Risks to health posed by these harmful substances that are released into the air. These pollutants, which contribute to air pollution and endanger the health of those nearby, can include heavy metals, dioxins, and other harmful compounds. Moreover, in order to lower the risk of fire, brominated flame retardants, or BFRs, are frequently employed in the manufacture of electronic gadgets. BFRs can emit hazardous materials into the air and cause air pollution when e-waste is burned or disposed of incorrectly.[10]
- **Emissions of Greenhouse Gases**: The manufacturing, shipping, and disposal of electronic equipment all add to the emission of greenhouse gases. Furthermore, burning is one method of disposing of e-waste that releases greenhouse gases into the atmosphere, which exacerbates climate change.
- **Depletion of Resources:** Precious and rare earth metals are among the valuable, frequently non-renewable resources found in electronic devices. Because e-waste is not properly disposed of, these resources cannot be recycled, which results in ongoing raw material extraction and accelerates the depletion of resources.[11]
- **Impacts on Biodiversity:** As e-waste may disrupt the food chains and ecosystems, it can also negatively affect biodiversity. Plants and animals can suffer from contaminated water and soil, which can result in population decreases and a loss of biodiversity. Besides, dangerous heavy metals like lead, mercury, cadmium, and chromium are present in a lot of electronic products. The improper handling of e-waste can cause these materials to seep into the ground and water, endangering both human health and ecosystems.[12]

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[10] Sanchari Ghosh, *Electronic Waste Recycling for Developing Economies* 46 (49) EPW 17-21 (2011) *available at: http://www.jstor.org/stable/41319452* (last visited 15 Oct., 2022).

[11] Rakesh Johri, E-WASTE IMPLICATIONS, REGULATIONS, AND MANAGEMENT IN INDIA CURRENT GLOBAL BEST PRACTICES 126 (2008).

[12] Joseph F.C. Dimento, THE GLOBAL ENVIRONMENT AND INTERNATIONAL LAW 8-9 ( 2003).

## V

### Global Legal Regime for E-waste Management Strategies

The quantity of electronic waste is increasing uncontrollably, and developed nations are irresponsibly disposing of large volumes of this waste in developing nations. The consequences of such actions are catastrophic, highlighting the urgent need for effective e-waste management. While e-waste has become a detrimental burden for developing countries, it also hinders sustainable development. The hazardous composition released during the recycling and material recovery processes poses a clear threat to life, health, and the environment.[13] The international legal framework, initially focused on basic principles for environmental protection, is now evolving towards a more comprehensive approach to mitigate, prevent, and control various pollutants that adversely affect the environment. As the first international conference to address global environmental concerns, the United Nations Conference on the Human Environment in 1972 produced the historic Stockholm Declaration on the Human Environment. This historic declaration established the foundation for global environmental law and policy. It emphasized the interdependence of nations in tackling common challenges and the inextricable connection between environmental preservation and human development. The recognition of the fundamental right to a quality environment, as well as the assertion that the right to development must not jeopardize the well-being of others or jeopardize environmental integrity, had been key principles of the declaration. This proclamation was a turning point in raising environmental consciousness worldwide, influencing later international accords and campaigns. It also had a significant impact on the creation of the United Nations Environment Programme (UNEP), reaffirming the commitment to teamwork in the pursuit of a sustainable and environmentally sound future.

During the Earth Summit (1992) in Rio de Janeiro, Brazil, the United Nations Conference on Environment and Development produced the influential Rio Declaration on Environment and Development. The declaration, which contained twenty-seven principles, articulated a vision

[13] Timu Koivorova, INTRODUCTION TO INTERNATIONAL ENVIRONMENTAL LAW 10-12 (2014).

for sustainable development that struck a balance between environmental preservation and human well-being. Principle 1 of the declaration asserts that humans have a right to a healthy life in balance with nature and places these individuals at the center of concerns for sustainable development. In addressing environmental challenges, the declaration also emphasized the significance of international cooperation[14] and active citizen participation. [15]The declaration further emphasized the need of taking preventive measures while dealing with environmental hazards. The Rio Declaration embodies a commitment to integrating environmental and developmental considerations for a more sustainable future. It served as a foundational framework that influenced subsequent international agreements and initiatives. It also had a significant impact on the creation of the United Nations Environment Programme (UNEP), reaffirming the commitment to teamwork in the pursuit of a sustainable and environmentally sound future.[16]

Then the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, enacted in 1989, stands as a pivotal international agreement addressing the intricate challenges associated with the cross-border transport and disposal of hazardous wastes. This treaty holds a comprehensive scope as to apply to hazardous wastes and other substances deemed hazardous. A cornerstone of the Basel Convention is the Prior Informed Consent (PIC) procedure, ensuring that exporting nations seek approval from importing countries before transferring hazardous wastes, fostering transparency and collaboration. Additionally, the convention imposes a ban on hazardous waste exports from developed to less developed countries, underlining a commitment to prevent environmental exploitation. The agreement emphasizes the imperative of environmentally sound management, setting standards to safeguard both human health and the environment. Furthermore, the Basel Convention introduces liability and compensation mechanisms to address the consequences of damages resulting from trans-boundary movements of hazardous wastes. Over the years, the

[14] United Nations Conference on Environment and Development, *Rio Declaration on Environment and Develpoment*, U.N Doc. A/CONF.151/26/Rev. 1 (June 3-14, 1992).
[15] *Id.*
[16] United Nations Treaty Series, Vol 1522, I-26369, *available at https://treaties.un.org/doc/ publication/ unts/volume%201522/volume-1522-i-26369-english.pdf.* (last visited Oct. 27, 2022).

convention has evolved, reflecting a collective global endeavor to enhance responsible waste management practices and mitigate the potential environmental and health risks associated with hazardous waste disposal.[17] The Basel Convention of 1989 did not initially address e-waste directly, but it did include provisions governing the recycling and exportation of hazardous waste from developed to developing nations. But e-waste topped the main agenda at the 8th Conference of the Parties to the Basel Convention.

The Nairobi Declaration was adopted during the COP-8 conference which addresses e-waste use, manufacture, reuse, recycling, illegal traffic, and disposal,. It acknowledges the rise in the use of EEE, the rapid transnational movements of e-waste, and the ecologically sound management of e-waste. Additionally, it recognizes the potential negative effects on the environment and human health that may result from the illegal movement of e-waste. Finally, it encourages the manufacture of green designs. The Convention emphasizes the need for local governments, the general public, and non-governmental organizations to participate in the at-source segregation and collection of electronic waste from homes and commercial spaces. The convention seeks to create strong mechanisms in the form of national laws and policies that outline the various roles stakeholders should play.[18]

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was established in 1998 and enforced since February 24, 2004. It stands as a pivotal international agreement fostering responsible trade practices in hazardous chemicals and pesticides. Named after Rotterdam, the Netherlands, where it was finalized, the convention introduces a PIC procedure that necessitates exporting countries to secure the prior informed consent of importing nations before shipping certain hazardous substances. A key objective is to empower importing countries with comprehensive information about potential risks associated with these

[17] The Basel Convention, UNEP/CHW.12/5/Add. CoP 12, *available at http://www.basel. int/The Convention/ ConferenceoftheParties/Meetings/COP12/tabid/4248/mctl/ViewDetails/EventModID/ 8051 /EventID/ 542/ xmid/ 13027/Default.aspx*. (last visited Dec. 10, 2022).

[18] Nairobi Declaration, *Environmentally Sound Management of Electrical and Electronic Waste*, December 2006 *available at http://www.basel.int/portals/4/basel%20convention/ docs/meetings/cop/ cop8/nairobide-claration.pdf* (Last visited July 3, 2022).

chemicals, enabling them to make informed decisions regarding imports. The convention maintains a regularly updated list of chemicals subject to the PIC procedure, fostering transparency and collective efforts in managing the risks of hazardous substances. Additionally, the Rotterdam Convention encourages the promotion of alternative chemicals and technologies that pose fewer risks to human health and the environment.[19]

Later, the Stockholm Convention on Persistent Organic Pollutants (POPs) is a historic international agreement designed to reduce the harmful effects of a number of chemicals that are bio-accumulative and environmentally persistent. The convention, which was conceived in Stockholm, Sweden, focuses its efforts on a list of 12 particular POPs, which includes well-known compounds like furans, PCBs, dioxins, and DDT. Signatory parties agree to put into effect policies that, in order to safeguard the environment and public health, either completely prohibit or severely limit the production, use, and release of these substances. Although the convention permits certain exemptions in certain situations, such as when there are no workable alternatives or for health and safety concerns, it emphasizes the importance to encourage research, observation, and information sharing among participating nations. Hence at International level, there are many conventions which address the problem of e-waste and hazardous waste including trans-boundary transportation of e-waste system. In the light of above, it is necessary to understand e-waste mechanism in the south Asian regions.

## VI

### E-Waste Management in South Asia

The South Asian region is increasingly acknowledging the significance of effective electronic waste (e-waste) management. While India stands as the sole country in southern asia with existing e-waste legislation, several other nations in the region are contemplating similar legal measures. In Southeast Asia, there are varying levels of advancement in e-waste management.

[19] Rotterdam Convention, *Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade*, (Revised in 2017) (UNEP and FAO of United Nations) *available at http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx*. (last visited May 29, 2022).

While the Philippines lack specific regulations dedicated to e-waste, it does have a set of regulations for "hazardous waste," which includes e-waste due to its hazardous nature. The Philippines has developed the guidelines on the environmentally sound management (ESM) of Waste Electrical and Electronic Equipment (WEEE), anticipating its imminent approval. Cambodia has taken a proactive approach with the introduction of a specific law for e-waste management through the Sub-decree on Electrical and Electronic Equipment Waste Management (E-waste Management) in 2016. This Sub-decree comprehensively addresses activities related to the disposal, storage, collection, transport, recycling, and dumping of EEE waste. Myanmar currently lacks specific regulations for e-waste, and it hasn't been explicitly categorized as hazardous waste. However, Myanmar acknowledges the importance of hazardous waste management and is presently in the process of developing a Master Plan and guidelines for it.

Asia's e-waste management systems are quite extensive. The levels of e-waste management vary from highly developed systems found in South Korea, Japan, China, and the province of Taiwan to unofficial practices that coexist with China's advanced recycling technique which is regulating e-waste management in other Asian countries. In South Asia, the majority of e-waste management activities for collection, dismantling, and recycling come from the unofficial sector. The establishment of official recycling facilities in India has been facilitated by rules; currently, there are 312 approved recyclers in India, with a treatment capacity of about 800 kt per year.[20]

Since e-waste contains valuable and costly metals, recycling it can be a lucrative business for many people in India. Informal methods are used to conduct business in the unorganized sector. Manual labor and extensive procedures involving crude techniques for resource recovery and recycling are components of informal mechanisms. Since 95% of e-waste is recycled through the informal sector, the informal sector has historically played a significant

[20] Manika Malhotra Jain, *Unpacking the New Set of E-waste Rules,* The Hindu, (Feb. 28, 2023) *available at https://www.thehindu.com/opinion/op-ed/unpacking-the-new-set-of-e-waste-rules/article66560850.ece*(last visited Feb.28, 2023).

role in waste management practices.[21] India produces about 18 lakh tonnes of e-waste annually, and the amount is increasing at a rate of thirty percent per year. About five percent of this is brought in by 153 authorized recyclers and dismantlers, with the remainder being collected by the unorganized or informal sector, which removes the most profitable metals and disposes of the leftovers in landfills.[22] In the context of environmental legislation, waste management has always been a significant issue. The genesis of e-waste management laws can be traced back to indirect legislative measures like the Rules of 1989.

## VII

### Indian Legal Regime on E-Waste Management

In India with the increased use of electronic and electrical equipment, the problem of managing electronic waste came to light in the early 2000. Soon the government acknowledged that improper disposal of e-waste pose risks to human health and the environment. In India, regulations governing e-waste have been in force since 2011, stipulating that only authorized dismantlers and recyclers are permitted to collect e-waste. The E-Waste (Management) Rules 2016 expanded the scope to include manufacturers, dealers, refurbishes, and Producer Responsibility Organizations (PROs).

Moreover, the Constitution of India places specific responsibilities on both the government and the citizens concerning the preservation and safeguarding of the environment. The inclusion of provisions related to environmental protection occurred through the Forty-Second Amendment in 1976, introducing Article 48A within the Directive Principles of State Policy and Article 51A(g) in the Fundamental Duties. Despite being non-enforceable, the Directive Principles of State Policy serve as guiding principles to advance the state's objectives. Moreover, Article 21 of the Constitution ensures the right to life and personal liberty for every individual. The judicial

[21] Sushant B. Wath, and P.S Dutt, *E-waste Scenario in India, Its Management and Implications,* 172(1-4) Environmental Monitoring Assessment 249-262 (January 2011).
[22] Rachana Arora, GENEVA INFORMAL-FORMAL RECYCLING LINKAGES: EXPERIENCES IN INDIA 2 (2017).

precedents have been set directing government to issue directions to protect wildlife[23] and safeguarding the right of the people to live in healthy environment with minimal disturbance of ecological balance[24]. The judiciary has also upheld that Article 21 of the Constitution and it includes the right of enjoyment of pollution free water and air for full enjoyment of life. If anything endangers or impair that quality of life in derogation of laws, a citizen has right to have recourse to Article 32 of the Constitution for removing the pollution of water or air which may be detrimental to the quality of life.[25] By enlarging the ambit of Article 21, the supreme court took under its ambit the concern for protection of environment from hazardous toxic and solid wastes. The judiciary kept in mind the strong need for industrialization but at the same time kept check on reckless and haphazard development which could create ecological imbalance.[26]

To ensure these mandates, the guidelines for environmentally sound management of E-Waste were introduced by the Indian government in 2008 in cooperation with the Central Pollution Control Board (CPCB) and the Ministry of Environment, Forests, and Climate Change (MoEFCC). [27] The impetus for this initiative stemmed from the increasing amount of electronic waste that can be attributed to the swift obsolescence of electrical and electronic equipment (EEE). These guidelines are in line with the National Environment Policy (NEP) and are intended to encourage material recovery and reuse in order to reduce waste volumes and enable environmentally friendly recycling practices.[28]

In May 2011, notification was issued for the initial broad set of e-waste management rules in India which are titled as E-Waste (Management and Handling) Rules, 2011. The purpose of

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[23] *Tarun Bharat Sangh, Alwar v. Union of India*, AIR 1992 SC 514 (India)

[24] *Rural Litigation and Entitlement Kendra, Dehradun v. State of Uttar Pradesh*, AIR 1988 SC 2187 (India).

[25] *Subash Kumar v. State of Bihar*, (1991) 1 SCC 613(India).

[26] Niyati Mahajan, *Judicial Activism for Environment Protection in India* 4 (4) Int. J. Soc. Sci. Res. 7-14 (April 2015).

[27] *Indian Parl. Deb.,Rajya Sabha*, The Electronic Waste (Handling And Disposal) Bill. 2005) *available at http://rsdebate.nic.in/rsdebate56/handle/123456789/61427?viewItem=browse* (last visited June 03, 2022).

[28] MINISTRY OF ENVIRONMENT & FORESTS CENTRAL POLLUTION CONTROL BOARD, Guidelines for Environmentally Sound Management of E-Waste, 2008, *available at https://cpcb.nic.in/e-waste* (last visited Apr. 20, 2022).

these rules was to monitor the production, gathering, storing, moving, handling, and disposal of electronic waste. The distinguished feature of these Rules was the introduction of concept of EPR. Extended Producer Responsibility (EPR) is a strategic environmental policy approach that assigns accountability for a product's entire life cycle to its producer. Instead of placing the burden on consumers or local authorities, EPR mandates that manufacturers take active responsibility for the management of their products, particularly those with potential environmental consequences if improperly disposed of. Under EPR, producers are obligated to establish and finance systems for the collection, recycling, and proper disposal of their products once they reach the end of their usable life. This approach not only addresses the environmental impact of waste but also incentivizes producers to design products with eco-friendly considerations. By integrating EPR into regulatory frameworks, governments aim to encourage sustainable production practices and contribute to the transition towards a circular economy. Industries such as electronics, packaging, and automobiles have seen the implementation of EPR programs as part of broader efforts to minimize the environmental footprint of products.[29] Due lack of stringent provisions, key stakeholders manage to escape from the regulatory mechanisms and continue with the practices convenient and financially suitable to them irrespective of contemplating their impact on human health and environment.

After encountering gaps in previous rules and regulations relating to e-waste, the government came up with new set of rules to regulate e-waste management in India. The E-Waste (Management) Rules, 2016, were introduced in India to address the growing environmental and health concerns associated with the increasing generation of electronic waste (e-waste). The primary objectives of these rules were to establish a systematic and environmentally sound framework for the management and handling of e-waste. Compared to the Rules, 2011, these regulations are more comprehensive and cover anyone who is directly or indirectly involved in the use, handling, transporting, storing, purchasing, selling, producing, recycling, or disposing of e-waste. Accordingly, it is the duty of manufacturers to gather and sort e-waste produced during the production of EEE, either for recycling or disposal, and to obtain the necessary

[29] Yamini Gupt and Samraj Sahay, *Review of EPR: A Case Study Approach*, 33(7) Waste Management & Research Journal 595–611(2015).

authorization from State Pollution Control Board (SPCB). It is also the duty of all the stakeholders listed in the Rules to ensure that no environmental harm is caused during the transportation or storage of e-waste, to keep a record of all e-waste handled, generated, and disposed of. Besides they are also required to file to file annual returns.[30]

Entities involved in these activities are mandated to seek prior authorization from the appropriate regulatory bodies, such as the State Pollution Control Board (SPCB) or the Pollution Control Committee of Union Territory (PCBUT). The SPCBs/PCCs were expected to provide an update on the state of implementation regarding the capacity building at the district, state, and CPCB levels; verification of informal trade; dismantling, recycling, and collection of e-waste; governance framework for monitoring compliance; and IEC plan and enforcement system.[31] This authorization process involves a comprehensive assessment of the entity's infrastructure, processes, and adherence to environmental standards. The regulatory authorities evaluate the application based on predefined criteria to ensure that the entity possesses the capability to handle e-waste safely.[32] If it is found compliant that authorization is granted for a specified period, subject to renewal upon demonstrating continued adherence to the rules. Additionally, producers of electronic and electrical equipment are obligated to register with either the Central Pollution Control Board (CPCB) or the relevant SPCB, depending on their operational location.[33] This registration process necessitates providing details about the producer's business, the types and quantities of electronic products placed on the market, and proposed mechanisms for implementing Extended Producer Responsibility (EPR).

Producers commit to fulfilling their EPR obligations, which include managing and recycling a specific percentage of the e-waste generated by their products. Regulatory authorities actively monitor authorized entities and producers to ensure ongoing compliance through inspections, audits, and other verification measures. Non-compliance with these authorization and

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[30] E-Waste(Management) Rules, 2016, R. 1. *available at: https://efaidnbmnnnibpcajpcglclefindmkaj/ https://cpcb.nic.in/ uploads/Projects/E-Waste/e-waste_rules_2016.pdf* (last visited Apr., 20, 2022).
[31] *Shailesh Singh* v. *State of U P and others*, (2021) NGT 54(India).
[32] E-Waste (Management) Rules, 2016, Guideline 2.0, R. 5 (f)(ii).
[33] *Id., R. 24.*

registration requirements may lead to penalties and legal consequences, reinforcing the importance of adhering to environmentally sound practices in the e-waste management ecosystem. The target based approach is incorporated for the collection of e-waste depending upon the expected production of the EEE for the particular fiscal year in Rules 2016.[34] It stipulates that manufacturers must gather 10% of the electronic waste produced in 2017–18, 20% in 2018–19, 30% in 2019–20, and so forth, with an additional 10% increase annually until 2023.[35] Overall, these provisions aim to establish a regulated framework that promotes sustainable practices, prevents environmental pollution, and holds stakeholders accountable for the proper management of e-waste throughout its lifecycle. The 2016 regulations were amended in 2018 to emphasize the promotion of authorization and product stewardship, thereby broadening their scope.

A concept and methodology known as "product stewardship" highlights the accountability of producers, manufacturers, and other stakeholders for a product's complete life cycle, from its inception to its eventual disposal or recycling.[36]

The Indian Cellular and Electronics Association (ICEA) report states that 90% of e-waste collection and 70% of recycling in India are handled by the competitive informal sector. Whereby the e-waste management rules 2018 undergone a change and rules 2022 were enforced. The primary goals of the government of India's E-Waste (Management) Rules, 2022 are to increase visibility and digitize the e-waste management process. The E-waste Management Rules, 2022 were issued by the Ministry of Environment, Forests, and Climate Change on November 2, 2022, and they came into effect on April 1st, 2023. Additionally, it prohibits the use of dangerous materials (like lead, mercury, and cadmium) in the production of electrical and electronic devices that endanger public health and the environment.[37] All manufacturers, producers, refurbishers, and recyclers who are involved in the production, sale,

[34] E-Waste (Management) Amendment Rules, 2018, Schedule III.
[35] *Id*, Schedule III (A).
[36] E-Waste (Management) Amendment Rules, 2018.
[37] Manika Malhotra Jain, *Unpacking the New Set of E-waste Rules,* The Hindu, (Feb. 28, 2023) *available at https ://www.thehindu.com/opinion/op-ed/unpacking-the-new-set-of-e-waste-rules/article66560850.ece* (Last visited Feb. 28, 2023).

transfer, purchase, disassembly, recycling, and processing of electrical and electronic equipment (or "EEE") listed in Schedule I of the Rules are subject to the terms and conditions of this rule.[38] Besides it is the duty of the manufacturer to gather electronic waste, make arrangements for its recycling or disposal, and complete annual and quarterly reports on the Central Pollution Control Board (or "CPCB") portal. The producer bears the responsibility of executing the extended producer responsibility (EPR) objective, guaranteeing that a minimum of 60% of their electronic waste is gathered and recycled by 2023, with the aim of raising that percentage to 80% by 2025.[39]

The Rules require CPCB to establish policies for enforcing and collecting environmental compensation from producers who fail to comply with their obligations.[40] In accordance with the due process of law, the CPCB may also think about imposing environmental audits on the relevant organizations in order to evaluate and collect damages for environmental standard violations.[41]The Rules make it very clear that paying environmental compensation will not release producers from their EPR obligations; rather, any unmet EPR obligations for a given year will be carried over to the following year and so on for a maximum of three years. Besides that a legal framework for prosecution and appeal is prescribed in cases where individuals provide false information to obtain EPR certificates, use forged or false certificates, or neglect to cooperate with verification and audit procedures.[42]

## VIII

**Recommendations for E-waste Management in India**

India is currently known for being the world's largest e-waste dump, with inputs expected to rise by 1 lakh tons by 2020 and 8 million (80 lakh) tonnes by 2025 at a rate of 4.1 million tons per

[38] E-waste Management Rules 2022, Section 6 and 7.
[39] *Id*.
[40] LIVE LAW, *available at: https://www.livelaw.in/news-updates/cbic-implement-the-e-waste-management-rules-2022-218518* (last visited June 25, 2022).
[41] *Aditya Dubey* v. *Amazon Retail India Private Limited and others*, 2020 NGT 67 (India).
[42] The Environment Protection Act, 1986, S.15.

year.[43] This huge amount of e-waste needs sustainable disposal. Unfortunately, in India, majority of waste is still managed by informal sector who is much worried about profits rather than environment protection. Workers in recycling plants and inhabitants in the surrounding recycling areas are particularly vulnerable to health problems, including the development of cancer, skin conditions, problems with the nervous, respiratory, gastrointestinal, immune, and endocrine systems, among other conditions. Exposure to e-waste can even result in gene mutations and chromosomal abnormalities. People who work or live in areas where there is e-waste have already seen significant environmental damage as well as health issues due to e-waste contamination. The management of e-waste is more organized in developed nations like the United States, Japan, Switzerland, and the United Kingdom. On the other hand, the EPR mechanism for managing e-waste in developing countries such as India is not as well-organized as in developed countries.

As the awareness among the consumers is very low, in majority of cases, flow of e-waste chain ends with network of informal scrape dealers. A total of 31 authorized PROs offer compliance services, such as organizing awareness campaigns and gathering and directing e-waste to authorized recycling facilities. The enforcement of regulations is still a challenge, as are other factors like inadequate infrastructure for collection and logistics, low consumer awareness of the risks associated with improper disposal of e-waste, a lack of standards for the collection, dismantling treatment of e-waste, and a complicated and ineffective reporting process. In India, it is the MoEFCC, which is the key agency for suggesting, planning, monitoring and regulating the Environmental Protection Programmes including management of e-waste. It is the national authority responsible for waste management and environment protection. It is necessary to raise awareness of the hazardous nature of EEE and the consequences of choosing inappropriate disposal techniques. Producers, Pollution Control Boards, Resident Welfare Associations, Schools, Colleges, Municipalities, etc. must work together to implement the awareness regime.

[43] C. Smitty Smith, *The Economics of E-Waste and the Cost to the Environment*., *30*(2) Natural Resources & Environment38–41 (2015) *available at http://www.jstor.org/stable/44134066* (last visited on Sept. 9, 2020).

Besides that the definition of e-waste is ambiguous. When it comes to shipping e-waste to developing nations like India, developed countries have an advantage due to ambiguity and disparities in definitions. Therefore, the United Nations Organization and other nations worldwide should adopt a single, comprehensive definition of e-waste.

It has been also seen that the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, which do not totally forbid the import of electronic waste. These regulations cover the trans-boundary transportation of hazardous waste, not electronic waste in particular. E-waste (Management) Rules, 2016 should include provisions about the transportation of e-waste. The import of e-waste for recycling, reuse, recovery, and utilization should be strictly prohibited. Additionally, when a dealer sells a product, they should be instructed to tell or educate the customer about the proper disposal of electronic waste.

To promote more sustainable approach to e-waste management, it is imperative to put in place financial incentives and tax benefits for companies and individuals who properly dispose of their electronic devices. Governments can lessen the environmental impact of electronic waste by encouraging responsible disposal practices through the provision of such incentives. Particularly businesses can be encouraged to adopt sustainable practices by offering tax breaks or other financial benefits. This strategy supports environmental stewardship and is consistent with the circular economy's tenets. It promotes the adoption of procedures that place an emphasis on how long-lasting, repairable, and recyclable electronic equipment are. In the end, these monetary rewards produce a win-win scenario that helps the environment and people who actively participate in ethical e-waste management.

It is essential to promote a circular economy for solving the problems associated with electronic waste,. This entails moving away from the conventional linear model of production and consumption and toward one that gives products' durability, repairability, and recyclable nature more weight. One can lessen the environmental effect of e-waste by pushing for the design of electronic devices with long life spans, simple repair options, and effective recyclability. Additionally, one of the main components of this strategy is to encourage the development of modular electronics. Embracing a circular economy approach not only reduces

the volume of e-waste but also fosters sustainable consumption patterns, contributing to a more environmentally friendly and resource-efficient electronics industry.

## IX

## Conclusion

Unconsciously converting verdant, green forests and agricultural land into uncontrolled urbanization has put the purity and balance of the environment at serious risk for the past few centuries. The biggest threats to life on Earth, however, have been population growth, intensive agriculture, overuse of pesticides, fast industrialization, unsustainable waste disposal, disregard for the environment, etc. Under such situations, environmental protection necessitates the full and committed participation of all global communities in order to address the concerns of environmental degradation that are emerging and posing enormous management challenges to policy makers and society at large. In addition, organizations and individuals within civil society keep accountability for the emergence of ecological problems.

Promoting international collaboration is crucial for tackling the worldwide issues brought about by e-waste, specifically with regards to the exchange and elimination of electronic gadgets. Global cooperation is crucial because of the interconnectedness of the electronics sector and the transboundary movement of e-waste. To create comprehensive frameworks that control the trade in electronic goods and encourage appropriate disposal methods, nations must work together. It is equally important to share technologies and best practices for managing e-waste across national borders. Countries can adopt effective strategies adapted to their unique contexts and learn from successful initiatives thanks to this knowledge exchange. By fostering a cooperative atmosphere, the global community can cooperate to lessen the risks that electronic waste poses to the environment and human health, all the while advocating for a more sustainable and accountable global electronic ecosystem.

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