

E-WASTE MANAGEMENT AND ENVIRONMENTAL JUSTICE IN INDIA: THE EVOLVING ROLE OF THE NATIONAL GREEN TRIBUNAL

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Abstract

Electronic waste, or e-waste, is one of the fastest growing types of waste in India. This increase is due to the growing use of electronic devices, while recycling efforts remain weak. India has regulatory framework such as the E-Waste (Management) Rules of 2016 and the updated Rules of 2022 to improve Extended Producer Responsibility, collection targets, and proper recycling practices; however, the execution part remains inconsistent. A significant proportion of discarded electronics is still handled by the informal recycling sector, exposing workers and nearby communities to hazardous substances and resulting in severe environmental contamination and public health risks. This uneven distribution of environmental risk raises serious environmental justice concerns in India, as vulnerable communities disproportionately bear the health burdens and ecological consequences of toxic e-waste processing, while the economic benefits of the electronics industry accumulate elsewhere.

The National Green Tribunal (NGT), as a specialized environmental adjudicatory body, plays an important role in strengthening compliance with environmental norms, including those governing e-waste. However, poor coordination among agencies, data deficiencies, and weak operational capacity continue to limit the effectiveness of judicial intervention. This paper examines the concept of e-waste, its linkage with the Sustainable Development Goals (SDGs), and the existing regulatory framework governing e-waste management in India. It further analyses the role of the National Green Tribunal (NGT) in improving e-waste governance, evaluates the key enforcement challenges that hinder effective implementation, and suggests judicial reforms to enhance environmental accountability and support India's transition towards a circular economy.

Keywords: Circular Economy, E-waste Management, Extended Producer Responsibility, India, National Green Tribunal

1. INTRODUCTION

In today's world, gadgets play a key role in making life easier and connecting people more closely than in the past. As people use more digital gear, mountains of electronic waste is piling up across the planet. Electronic waste, known as e-waste, refers to discarded electronic devices that no longer work or are outdated. These discarded electronic items hold both valuable and harmful materials. The valuable materials include gold, silver, copper, palladium, indium, and gallium. These materials have great potential for recovery and reuse, which helps in supporting circular economy goals. However, these devices also contain harmful substances, including lead, mercury, cadmium,

antimony, arsenic, and brominated flame-retardants which poses serious environmental and health risks when dismantled or disposed of carelessly.

India ranks third globally in producing electronic waste, behind only China and U.S., as per the 2020 Global E-Waste Report. Over the last five years, its discarded e-waste levels have climbed sharply. Data from the Central Pollution Control Board shows a jump rising from 1.01 million metric tonnes in 2019–20 to 1.751 million metric tonnes in 2023-24. As India continues to expand its presence as both a major manufacturer and consumer of electronic products, it faces a significant challenge in managing the rapid surge of discarded devices. Most e-waste recycling is still carried out by the informal sector, where workers operate without safety measures and in highly hazardous conditions. The problem is further aggravated by the lack of proper infrastructure for scientific collection, segregation and safe disposal. A major step towards addressing this critical issue came with the introduction of the E-Waste (Management & Handling) Rules, 2011, which first brought the concept of Extended Producer Responsibility (EPR) into India's regulatory landscape. Building on this foundation, the E-Waste (Management) Rules, 2016 and subsequent amendments introduced more structured collection and recycling targets, expanded the range of covered electronic products, and established a digital EPR framework to improve accountability and traceability. These reforms were designed to guide India towards safer and more sustainable e-waste practices. However, expected outcomes have not yet come to fruition.

The issue of e-waste is linked directly to the constitutional right to a clean and healthy environment. The judiciary has increasingly recognized the importance to shield neighborhoods from dangerous dumping habits. The National Green Tribunal (NGT), India's specialized environmental court, has the potential to improve e-waste governance. The body holds power to track whether rules are adequately followed and push officials or makers to answer for their actions. If given better backing, the tribunal might act faster and help deliver fair decisions.

Effective e-waste governance is crucial for India's move toward a circular economy, which aims to recover valuable materials and putting it back into use. However, this opportunity comes with a serious challenge. Shady recycling spots expose people to harmful chemicals every day. Kids and Daily wage laborers often end up doing risky jobs like breaking down gadgets without protection. Addressing these issues is not only an environmental need; it is also a constitutional responsibility. Therefore, the future of e-waste management in India should prioritize both sustainable resource recovery and environmental justice for the communities impacted.

2. OBJECTIVES OF THE STUDY

- To examine the nature of e-waste and its environmental impact in India.
- To analyze how e-waste management aligns with key Sustainable Development Goals (SDGs).
- To evaluate India's regulatory framework on e-waste, including the 2011, 2016 and 2022 Rules.
- To assess the role of the National Green Tribunal (NGT) in shaping and enforcing e-waste governance.
- To assess how NGT interventions contribute to the advancement of environmental justice, particularly in protecting the rights and health of communities impacted by informal recycling and toxic waste exposure.

- To identify the major judicial and institutional challenges in effective e-waste regulation.
- To suggest reforms that can strengthen India's institutional and judicial framework for effective e-waste governance.

3. METHODOLOGY

This study adopts a doctrinal legal research methodology, focusing on constitutional provisions, statutes, judicial pronouncements, policy frameworks, and academic literature to assess the role and effectiveness of legal mechanisms governing e-waste management in India.

Sources of Data

a. Primary Sources:

- **Constitutional provisions:** Articles 21, 48-A and 51-A(g) of the Constitution of India
- **Environmental statutes:** Environment (Protection) Act, 1986; E-Waste (Management & Handling) Rules, 2011, E-Waste (Management) Rules, 2016 and the E-Waste (Management) Rules, 2022 (including subsequent amendments), Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, etc.
- **Judicial decisions:** Landmark judgments of the Supreme Court and National Green Tribunal relating to hazardous waste management and e-waste governance, such as Subhash Kumar v. State of Bihar, Shailesh Singh v. State of Uttar Pradesh, Mahendra Pandey v. Union of India and Research Foundation for Science, Technology & Natural Resource Policy v. Union of India.
- **International instruments:** Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal, OECD guidelines on Extended Producer Responsibility, UNFCCC, Global E-Waste Report, etc.

b. Secondary Sources:

- Scholarly articles, law review journals, and textbooks on environmental law.
- Reports and guidelines from CPCB, SPCBs, etc.
- News articles and technical papers on e-waste statistics and challenges.

Method of Analysis

- **Statutory and Policy Analysis:** Interpretation of e-waste management laws in light of regulatory intent, implementation challenges, and environmental protections ensured under Article 21.
- **Case Law Analysis:** Examination of judicial directions issued by the NGT and higher courts to understand the evolution and limitations of legal enforcement in e-waste governance.
- **Comparative Legal Study:** Reference to successful international models of e-waste regulation (e.g., Switzerland, Japan, Germany) to identify potential adaptations for India.

Scope and Limitations

• Scope:

The study focuses on the legal and judicial dimensions of e-waste governance in India, with special reference to the evolving role of the National Green Tribunal. It examines the legal framework,

policy reforms, and enforcement mechanisms in the context of sustainable development goals (SDGs), particularly SDGs 3, 11, 12, and 13.

- **Limitations:**

- The absence of uniform and reliable national data on e-waste generation, collection, and recycling restricts the analysis and creates dependence on secondary estimates that vary across sources.
- The doctrinal nature of the research limits empirical insights.
- Assessment of State-level implementation remains constrained due to fragmented reporting practices and the overwhelming dominance of the informal sector.

4. E-WASTE AND SUSTAINABLE DEVELOPMENT GOALS (SDGS)

The Sustainable Development Goals (SDGs), adopted by all United Nations Member States under the 2030 Agenda, lay out a shared path for promoting social well-being, economic development, and environmental protection in a balanced and inclusive way. India, as a committed signatory to the SDGs, has incorporated these goals in its national policies and development priorities. The country recognizes that sustainable growth cannot happen without protecting environmental and public health interests.

In this context, managing electronic waste becomes a crucial issue. As the amount of discarded electronic products keeps increasing, improper handling poses risks that directly obstruct India's progress on several key SDGs. During informal recycling process, hazardous substances are released which harm human health and also pollute natural environment. This threatens the goals of SDG 3 (Good Health and Well-Being) and SDG 6 (Clean Water and Sanitation). At the same time, the valuable metals found in e-waste provide a chance to boost SDG 8 (Decent Work and Economic Growth) by creating safe green jobs. It can also support SDG 12 (Responsible Consumption and Production) by encouraging circular economy practices. Effective governance and proper recycling are also vital for sustainable urban development under SDG 11 (Sustainable Cities and Communities) and for reducing emissions linked to unsafe disposal in accordance with SDG 13 (Climate Action). Reaching these goals depends on coordinated actions and collaboration among different stakeholders, which aligns with SDG 17 (Partnerships for the Goals).

Therefore, improving e-waste management is not just a regulatory duty but a national necessity for fulfilling India's commitments to the SDGs and ensuring long-term environmental sustainability.

5. REGULATORY FRAMEWORK ON E-WASTE IN INDIA

A. Constitutional Framework

In India, environmental protection is deeply ingrained in the Constitution, which mentions it as both a Directive Principle of State Policy and a fundamental duty of citizens. The 42nd Constitutional Amendment Act of 1976 introduced Article 48-A, which mandates that the State shall "protect and improve the environment and safeguard the forests and wildlife of the country." In a similar vein, every citizen is required by Article 51-A(g) to "protect and improve the natural environment including forests, lakes, rivers, and wildlife, and to have compassion for living creatures." A framework of shared responsibility for environmental governance, including the

control of hazardous waste like electronic waste, is established by these constitutional provisions. The Supreme Court has been expanding the purview of Article 21 by interpreting the constitutional Right to Life to include the right to a clean and healthy environment. In *Subhash Kumar v. State of Bihar*, (1991) 1 SCC 598, the Court held that environmental degradation which affects the life and health of people is a direct violation of Article 21. This legal safeguard becomes especially relevant in electronic waste, since hazardous substances can seriously harm people's health when scrap is processed without proper controls and the judiciary acknowledging such risks highlights why clear rules are necessary to manage disposal of e-waste safely.

B. Legislative Framework

India's legal foundation for environmental protection is based upon the Environment (Protection) Act, 1986, which is a general law that empowers the Central Government to take measures to prevent, control and abate pollution, establish environmental authorities, and set standards for pollutants. It serves as an "umbrella legislation" in India, empowering the Central Government to coordinate and enact specific rules for various aspects of waste management.

In the beginning, e-waste generated in India was regulated under the Hazardous Waste (Management & Handling) Rules, 2003, with components of e-waste being classified as hazardous material requiring safe management. The approach regarding e-waste changed through the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, in which recyclers dealing with hazardous waste, including e-waste, were required to register with the Central Pollution Control Board (CPCB). The 2008 rules also empowered the Ministry of Environment, Forest and Climate Change to be the nodal authority of hazardous waste transboundary movement, in accordance with India's obligations to the Basel Convention.

Acknowledging the need for a regulatory regime to address e-waste, the E-Waste (Management & Handling) Rules, 2011 was enacted, which was India's first set of specific rules concerning e-waste governance. The 2011 Rules established Extended Producer Responsibility (EPR), mandating that producers take responsibility for the collection and channelization of end-of-life electronic products. However, these rules lacked specific and measurable collection targets. EPR was introduced conceptually without clear obligations, so compliance was voluntary. This led to minimal formal recycling activity and allowed the informal sector to continue dominating the trade.

In response, the Government adopted a more robust framework called the E-Waste (Management) Rules, 2016. The 2016 Rules represented a significant regulatory shift with three major changes: expanding coverage of categories of electronic products, greater responsibility for producers, and specific roles for State Governments to address the health and safety of workers involved in recycling operations. In addition, the Rules established phased collection targets to enable producers to comply progressively and required manufacturers to also collect and recycle waste generated during production. The rules formally recognized and regulated Producer Responsibility Organisations (PROs), which are third-party groups hired by producers to handle their collection and recycling duties. They also included e-retailers, dismantlers, and refurbishers in the regulatory framework.

To improve further compliance and transparency, the Government issued the E-Waste (Management) Rules, 2022, establishing a centralized digital EPR portal for producers, recyclers, and refurbishes to register, track and report their activities. The latest revision, effective April 2023, aims to close the gaps found in the 2016 framework. It enforces digital transparency and stricter penalties. This process is now more closely connected to the circular economy. A major overhaul requires mandatory registration for every entity, including Manufacturer, Producer, Refurbisher, and Recycler, on a dedicated Central Pollution Control Board (CPCB) online portal. This digital system aims to provide real-time tracking of e-waste flow, from generation to final recycling. The amendment to the Rules inserted provisions for environmental compensation for non-compliance and brought new categories of waste, e.g. solar photovoltaic modules/ panels, under its purview. In 2023 and 2024, amendments to the Rules further aimed to refine the operational mechanisms of the legislation, signaling a wider shift in India towards circular economy. Hence, the success of the E- Waste (Management) Rules, 2022, now depends entirely on the commitment of the judiciary and the executive to enforce the new digital reporting and penalize non-compliant activities.

C. Extended Producer Responsibility in India

Extended Producer Responsibility (EPR) is a key concept for understanding e-waste management laws in India. It is a regulatory approach that assigns financial and environmental responsibility to producers for their products throughout their entire lifecycle, including collection, recycling, and disposal when these electronic products reach the end of their life. The Organization for Economic Co-operation and Development (OECD) first introduced this principle in the early 1990s to promote sustainable waste management by shifting the responsibility of waste handling from consumers and municipal authorities to manufacturers. In India, the EPR framework was officially established through the E-Waste (Management and Handling) Rules, 2011. These rules required producers to set up dedicated collection systems. However, the lack of enforceable collection targets and weak monitoring made effective implementation challenging. As a result, the provisions did not lead to significant real-world outcomes.

The framework saw a major improvement with the E-Waste (Management) Rules, 2016. These rules broadened the range of covered products and established clear EPR obligations. Producers were required to meet progressive collection targets, starting at 30% of the waste generated in the first two years and increasing to 70% in subsequent years. The 2016 Rules also allowed collective compliance through Producer Responsibility Organizations (PROs), which promoted industry-wide solutions. Furthermore, they included a deposit refund scheme to motivate consumers to return their end-of-life products. A more significant change occurred with the E-Waste (Management) Rules, 2022. These new rules introduced a digital system for compliance. Producers must now register on a centralized portal and meet their annual obligations by purchasing EPR Certificates from authorized recyclers. This market-driven approach aims to improve traceability and reduce

regulatory discretion. At the same time, the Rules removed the responsibility of bulk consumers such as IT companies, educational institutions, and government offices, which has led some

scholars to suggest that this could create gaps in accountability. The 2023 amendments made the system more efficient by clarifying processes for certificate trading and penalties for non-compliance.

Despite these advancements, the practical implementation of EPR in India still faces challenges. Nearly 90% of e-waste is processed by the informal sector, which is excluded from the formal EPR framework. Producers often meet their obligations through documentation rather than actual waste collection, and the weak enforcement by Pollution Control Boards exacerbates the problem. Although the Indian EPR framework has evolved from a basic obligation in 2011 to a more organized, target-based, and digitally monitored system in 2022, its success depends on stronger enforcement, integration of the informal sector, and greater consumer participation.

6. JUDICIAL RESPONSE TO E-WASTE GOVERNANCE

The existing complexity of electronic waste management in India highlights the importance of the role of judiciary in protecting the environment. The legal framework for e-waste outlines specific rules for safely collecting, recycling, and disposing of hazardous electronic materials. However, issues persist regarding the implementation part of such rules. In such circumstance, the role of judiciary, including the National Green Tribunal (NGT) becomes important as an active protector of environmental rights. By applying principles like polluter pays, precautionary principle and sustainable development, judicial bodies have not only upheld laws but also built a stronger basis for e-waste management.

In the significant case of *Shailesh Singh v. State of Uttar Pradesh (2018)*, the National Green Tribunal (NGT) instructed the Central Pollution Control Board to submit a 'review and action-taken' report by January 31, 2020, for the enforcement of the 2016 Rules and the Environment Protection Act of 1986. This order was issued by the Principal Bench while addressing a petition seeking corrective measures against improper disposal of e-waste, which has led to groundwater contamination and soil acidification. A compliance report dated September 14, 2018, submitted by the Ministry of Environment, Forest and Climate Change, indicated that India ranks as the fifth largest producer of e-waste worldwide. A substantial 95% of e-waste is processed by the informal sector, with only 5% being handled by the formal sector. Nonetheless, the exact total amount of e-waste being recycled remains unclear.

In *Mahendra Pandey v. Union of India (2019)*, the Uttar Pradesh Government was fined Rs.10 lakhs for failing to take sufficient measures to remove hazardous e-waste from the banks of the Ram Ganga River. Despite the NGT's order for the District Magistrate to initiate steps for establishing temporary facilities for treatment, storage, and disposal, the Ram Ganga incident serves as a stark reminder of the potential consequences if the issue of e-waste continues to be undervalued. In an earlier case of *Research Foundation for Science, Technology and Natural Resource Policy v. Union of India (2007)*, the Court examined the Petitioner's arguments, which referred to the Basel Convention and the High-Powered Committee led by Prof. Menon which facilitated the enactment of the Hazardous Waste Management and Handling Rules, 2003. The court's ruling prohibited the importation of toxic materials; however, the current situation still differs significantly from this ideal.

The NGT and higher courts have started attempting to bridge the gap between legal requirements and their implementation. They are pushing authorities to take action against dangerous dismantling practices and to protect communities affected by toxic e-waste dumping. However, these cases also show a clear limitation. Judicial involvement often stays reactive, relying on occasional lawsuits instead of being part of a regular oversight system. The judiciary needs to become a more consistent force in ensuring environmental compliance.

Thus, the future of electronic waste management in India relies on the effectiveness of the existing law as well as judicial interpretation to help protect the rights of vulnerable communities and natural environment.

7. CHALLENGES TO JUDICIAL ENFORCEMENT IN E-WASTE MANAGEMENT

Despite the detailed rules for electronic waste in India and existence of the National Green Tribunal (NGT) as the specialised environmental court, enforcing e-waste laws still encounters significant challenges.

1. *Inconsistent and Lack of Uniformity in Data:* A major barrier is the lack of comprehensive and uniform data on e-waste generation, collection, recycling, and informal sector handling. There is no standardized tracking of e-waste. While the Central Pollution Control Board notes shifting figures yearly, independent analyses show wide gaps in estimated volumes processed officially or otherwise. For instance, CPCB reports that India generated approximately 1.7 million tonnes of e-waste in FY 2023-24, a good increase from approximately 0.7 million tonnes in FY 2018-19, rising at a pace of over 25% per year. In spite of this increase, the formal sector is treating less than 20% of total e-waste treated, thereby leaving approximately 80% to the informal recyclers operating without environmental protections. On the other hand, a study released by the Centre for Science and Environment (CSE) indicates that only about 6% of India's total e-waste is being physically recycled by formally registered facilities, and still about 95% of this is being handled by the informal sector. So, there exists inconsistency in the existing data on e-waste from different sources. This inconsistency indicates the technical challenges of real-time tracking.
2. *Dependence on Executive Agencies for Enforcement:* The NGT's effectiveness in managing e-waste heavily relies on executive agencies, such as the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs), for implementation and follow-up. In the case of *Shailesh Singh v. State of U.P.*, the Tribunal noted that many State authorities were not enforcing the E-Waste (Management) Rules, 2016, stating that "environmental crimes are as serious as assaults."
3. *Informal Sector Dominance and Lack of Judicial Reach:* One of the biggest challenges is the overwhelming presence of the informal e-waste sector, which handles an estimated 90% or more of total waste. The informal nature of these operations means that judicial orders directed at formal actors often do not reach the primary processing centres. As a result, even well-meaning judicial directions may not tackle the core issue which exists outside the formal regulatory framework.

4. *Weak Use of Sanctions and Environmental Compensation:* Although the NGT can order environmental compensation and remedial actions, its use of these powers in the e-waste sector often lacks a systematic approach. Critics argue that judicial involvement in e-waste is still developing rather than fully established.
5. *Jurisdictional Complexity and Delays:* E-waste regulation overlaps with multiple sets of rules, such as hazardous waste rules, municipal solid waste laws, and import/export regulations. Judicial bodies frequently face delays in resolving issues, implementing orders, and following up with executive agencies. For instance, the NGT criticized State PCBs for non-compliance in 2021, yet reports in 2024 and 2025 still reveal large informal operations and unmonitored dumping.

India's judiciary helps strengthen e-waste management. Yet, persistent challenges such as flawed data tracking, reliance on enforcement actions, poor facilities, unregulated recycling, low fines, and unclear legal boundaries weaken their impact.

8. STRENGTHENING THE ROLE OF THE NATIONAL GREEN TRIBUNAL IN E-WASTE GOVERNANCE:

The earlier challenges show that the Tribunal's limited impact comes not only from a lack of authority but also from missing institutional measures for ongoing regulatory compliance. A more active judicial approach supports India's push for a circular economy and strengthens the protection offered under Article 21, which gives people the right to a clean, healthy environment. The National Green Tribunal needs to move from acting only when disputes are brought before it to providing steady, ongoing oversight. A structured system of routine compliance checks would form the backbone of this shift and ensure that issues are addressed before they escalate. The National Green Tribunal needs to move from acting only when disputes are brought before it to providing steady and continuous oversight. A structured system of routine compliance checks ensure that issues are addressed before they escalate. The Tribunal can direct the Central Pollution Control Board and State Pollution Control Boards to submit periodic reports on e-waste generation and recycling activity. These updates support early detection of regulatory gaps and keep the Tribunal engaged throughout the governance cycle. A stable monitoring structure works best when paired with clear deterrence. The Tribunal needs to follow uniform process for imposing fines when producers disregard Extended Producer Responsibility rules or when hazardous e-waste is processed unlawfully and also ensure that its decisions are implemented.

Effective enforcement also depends on integrating the informal sector with the formal system. The informal sector handles most of India's e-waste (around 80-90%). The Tribunal can instruct States to create lawful entry points for the informal workers through skill training, authorization procedures, and workplace safety measures. Adding digital tracking systems and geo-tagged collection points supports transparency and ties informal activities to formal compliance mechanisms.

Additionally, improved coordination across institutions further strengthens regulatory outcomes. The Tribunal can encourage States to form working groups with municipal bodies, labour departments, producer organizations, recyclers, refurbishers, and informal-sector representatives.

These groups support smoother decision-making, consistent communication, and shared responsibility across the chain of e-waste management. Technical guidance provides another layer of institutional support. Recycling practices differ widely across India, leading to inconsistent recovery rates and environmental harm. The Tribunal can promote national guidelines for safe dismantling and material extraction and encourage partnerships with IITs and CSIR laboratories. These collaborations raise technical standards and support long-term goals related to resource security.

Also, Public engagement forms the final link in this governance structure. Many households remain unaware of safe disposal options or authorized collection systems. The Tribunal can direct producers and municipal bodies to run structured outreach campaigns through digital platforms, collection events, and school programs. As awareness improves, waste leakage into unregulated channels would eventually decline and formal collection would gain strength.

The significance of the above suggestions is supported by a comparative learning approach. Switzerland adopts some of the best practices for e-waste management in the world. Under its Ordinance on the Return, Take-back and Disposal of Electrical and Electronic Equipment (ORDEE), producers and importers are legally required to provide free take-back of used electronics through retailers and designated collection points. Producers often operate via non-profit “Producer Responsibility Organizations” (PROs) that manage financing, collection, logistics and recycling. Municipal disposal of e-waste is prohibited and export outside OECD/EU standards is strictly controlled. Hence, the collection rates are among the highest globally. Similarly, in Japan under the Home Appliance Recycling Law (2001) and the Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment (2013), manufacturers, importers and retailers share responsibility for certain categories of home appliances. In the appliance recycling law system, consumers pay collection & transport fees, retailers accept end-of-life units and manufacturers handle recycling. Such laws provide useful lessons to India on structured take-back requirements, shared cost burdens and enforceable recycling targets.

Another notable example is of Germany, Germany’s ElektroG regime uses strict reporting and meaningful penalties, producing high compliance rates and accurate data. The ElektroG is the German Act which governs the sale, return and environmentally sound disposal of electronic equipment. It requires the manufacturers/importers of electrical and electronic equipment to organize and finance the collection and proper disposal of e-waste. They are required to offer reasonable collection options for all non-private users.

Thus, when viewed together, these countries show how firm oversight, clear responsibility, solid collection systems, and public involvement lead to the environmental gains India still aims for. Their examples suggest that once the NGT is able to take a stronger governance role backed by informed directions, India’s e-waste system would shift from an informal, scattered setup to one built on defined rules, environmental justice, and a working circular economy.

9. ENVIRONMENTAL JUSTICE DIMENSIONS OF E-WASTE IN INDIA

The environmental justice implications of e-waste management in India reveal deep structural inequalities in how environmental risks and benefits are distributed across society. Although the

rapid diffusion of digital technologies has expanded access to economic and social opportunities, it has simultaneously intensified the generation of electronic waste. The burden of this waste, however, falls disproportionately on marginalized communities that participate in the informal recycling sector. These workers—often women, children, migrants, and economically vulnerable groups—engage in hazardous dismantling and material recovery practices without adequate safety equipment, legal recognition, or institutional support. Exposure to toxic substances such as lead, mercury, and persistent organic pollutants contributes to severe health consequences, while contamination of soil, air, and water further exacerbates community vulnerability.

This unequal risk distribution highlights the inadequacy of India's regulatory approach, which, despite notable improvements through the E-Waste (Management) Rules of 2016 and 2022, remains oriented largely toward environmental control rather than social protection. Extended Producer Responsibility (EPR) frameworks have strengthened accountability for manufacturers, yet implementation gaps allow much of the e-waste stream to remain outside formal systems. Consequently, the informal sector continues to play a dominant role without adequate integration into policy structures.

The National Green Tribunal (NGT) has emerged as a critical institution addressing these governance failures. Through various judgments, the NGT has pushed for stricter enforcement, improved monitoring, and enhanced coordination among regulatory agencies. Nonetheless, systemic constraints—including data deficiencies, limited administrative capacity, and fragmented institutional mandates—have restricted the transformative potential of judicial intervention.

Advancing environmental justice within e-waste governance requires a shift toward inclusive and participatory policy models that recognize the socio-economic realities of informal workers. Integrating informal recyclers into formal systems, promoting safer technologies, and strengthening community rights are essential steps toward an equitable and sustainable e-waste management regime in India.

10. CONCLUSION

India's growing e-waste crisis shows a widening gap between the speed of technological advancement and the country's ability to handle the hazardous waste it creates. The E-Waste (Management) Rules of 2016 and the subsequent amendments reflect good legislative intent based on Extended Producer Responsibility and circular-economy ideas, but their practical impact is limited. A weak formal recycling system, fragmented regulations, and ongoing informal sector dominance harm environmental protection and public health. This situation directly challenges the constitutional guarantee of a clean and healthy environment under Article 21. In this context, the judiciary, especially the National Green Tribunal, has become an essential protector of environmental accountability. The judiciary's role is still limited by structural issues like inadequate compliance data, reliance on executive agencies, and minimal oversight over major informal operations.

These challenges show that judicial activism alone cannot achieve systemic change without improving institutional mechanisms. In order to close the enforcement gap, the NGT must adjust to a more structured model of governance. Regular compliance auditing, increased sanctioning of

violators, formal inclusion of informal recyclers, and transparent digital monitoring systems could add considerable regulatory value. These reforms would collectively enhance the legislative framework that has potential benefits for applied sustainability and help India move towards realizing the Sustainable Development Goals.

India can benefit greatly from adopting the best practices used in countries like Switzerland, Japan, and Germany. These countries have structured take-back systems, logistics funded by producers, and strict enforcement that ensure high recycling efficiency and accountability. With informed judicial support, similar reforms in India could speed up the shift from an informal and fragmented e-waste economy to a regulated and efficient model.

Ultimately, the goal is to create a system where environmental protections, technological progress and socio-economic inclusivity advance together. A stronger judicial role can close the ongoing gap between legislative goals and real-world practical implementation. This will help make the promise of e-waste regulation a reality for both people and the environment.

REFERENCES

- [1] Abhijay Negi & Smita Gupta, “Electronic Waste Management – The Crisis Everyone Saw Coming,” 1 *RGNUL Student Research Review* (2019).
- [2] Apeksha Chaudhary & Dr. Vaibhav Goel, “Legal Aspects of E-Waste Management in India: A Study” 7 *Journal of Emerging Technologies and Innovative Research* (2020).
- [3] Mahendra Pandey v. Union of India, Original Application No. 621/2018
- [4] Pooja Singh and Shanu Thomas, “E-Waste Management and Environment Protection: A Critical Legal Analysis”,(2016) Jan.–Mar. *Bharati Law Review* , available at: <http://docs.manupatra.in/newsline/articles/Upload/15168156-32A9-4EBB-8554E051222A8D96.pdf>
- [5] R. Mohana, R. Turaga, K. Bhaskar, S. Sinha, D. Hinchliffe, M. Hemkhaus & H. Sharma, “E-Waste Management in India: Issues and Strategies,” 44 *Vikalpa: The Journal for Decision Makers* (2019).
- [6] Research Foundation for Science, Technology and Natural Resource Policy v. Union of India, Writ Petition (C) No.657 of 1995
- [7] S.Kathiravan and Gayathri K.S.,“E-Waste and Environmental Law in India: A Constitutional Approach to Sustainable Management” 2 *Journal of the School of Language, Literature and Culture Studies* (2025).
- [8] Shailesh Singh v.State Of Uttar Pradesh, Original Application No. 512/2018 With O.A. No. 621/2018 & O.A. No.1001/2019
- [9] Subhash Kumar v. State of Bihar,(1991) 1 SCC 598
- [10] Wason, Ritika, Parul Arora, Devansh Arora, and M. N. Hoda. “An Empirical Investigation into AI- based E-Waste Management Strategies for Sustainable Development WRT India.” 20 *J. Electrical Systems* (2024).
- [11] E-Waste (Management) Rules, 2022 in force since 1 April 2023, Press Information Bureau, Government of India (PIB Release), available at: <https://www.pib.gov.in/PressReleaseDetailm.aspx?PRID=1986201>

- [12] E-waste management in Japan – Best Practices, International Telecommunication Union (ITU), 2021, *available at*: https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2021/E-WASTE/E-waste%20management%20in%20Japan_no_animation_no_notes_Daniel%20Ternald.pdf
- [13] Elektro-G (Elektro- und Elektronikgerätegesetz / ElektroG) – German Act for Electrical and Electronic Equipment, EAG GmbH, *available at*: <https://www.eag-gmbh.de/en/elektro-g>
- [14] Extended Producer Responsibility: A Guidance Manual for Governments, OECD Publishing, Paris, *available at*: https://www.oecd.org/en/publications/2001/03/extended-producer-responsibility_g1gh2874.html
- [15] Government of India, *E-Waste (Management) Rules*, 2016, issued by the Ministry of Environment, Forest and Climate Change (MoEFCC), Notification dated March 23, 2016.
- [16] Government of India, *E-Waste (Management) Rules*, 2022, issued by the Ministry of Environment, Forest and Climate Change (MoEFCC), Notification dated November 02, 2022.
- [17] How e-waste crisis continues to plague informal sector, Down To Earth, 2021, *available at*: <https://www.downtoearth.org.in/waste/how-e-waste-crisis-continues-to-plague-informal-sector-72033>
- [18] Innovating for Impact: Transforming E-Waste into Sustainable Tech Solutions,” The Times of India, 4 November 2025, *available at*: <https://timesofindia.indiatimes.com/technology/tech-news/innovating-for-impact-transforming-e-waste-into-sustainable-tech-solutions/articleshow/125080562.cms>
- [19] Managing India’s e-scrap is a growing challenge, Waste Recycling Magazine, 2024, *available at*: <https://www.wasterecyclingmag.com/news/managing-india-s-e-scrap-is-a-growing-challenge>
- [20] Miles Park, Electronic Waste Is Recycled in Appalling Conditions in India,(2019) The Conversation *available at*: <https://theconversation.com/electronic-waste-is-recycled-in-appalling-conditions-in-india-110363>
- [21] Tess Falkner-Kenny, “How e-waste is creating a growing environmental and health crisis across the world” U.S. PIRG, May 05, 2021, *available at*: <https://pirg.org/articles/how-e-waste-is-creating-a-growing-environmental-and-health-crisis-across-the-world/>