
EXTENDED PRODUCER RESPONSIBILITY AND CIRCULAR ECONOMY IN INDIA: STRENGTHENING LEGAL MECHANISMS FOR REUSE, REPAIR AND RECYCLING

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ABSTRACT

India's rapid urbanization and industrial growth have led to a significant increase in waste generation, with the country ranking among the top ten globally for municipal solid waste production, generating over 62 million tonnes (MT) annually. However, only about 43 MT is collected, with just 12 MT treated, while 31 MT is disposed of in landfills, resulting in substantial untreated waste that exacerbates environmental and public health issues. A study in the *Journal of Urban Management* (2021) reveals that the waste stream includes harmful components such as 7.9 MT of hazardous waste, 5.6 MT of plastic waste, 1.5 MT of electronic waste, and 0.17 MT of biomedical waste. The Central Pollution Control Board (CPCB) projects that waste generation may rise to nearly 165 MT by 2030, underscoring the urgent need for effective sustainable waste management strategies. In response to these challenges, a circular economy is an alternative framework that aims to extend product lifecycles through reuse, repair and recycling in order to minimise waste and maximise resource efficiency. Extended Producer Responsibility (EPR) is a regulatory system that assigns producers accountability for the post-consumer stage of products, has become increasingly prominent within this framework. In India, the EPR obligations have been incorporated under rules established under the Environment (Protection) Act, 1986 like the Plastic Waste Management Rules, E-Waste Management Rules, Battery Waste Management Rules etc. EPR is primarily discussed in policy discussions as a waste management mechanism, with little consideration given to its potential to promote circular economy objective, including reuse and repair. In order to identify regulatory shortcomings and suggest reforms, this paper critically evaluates India's EPR framework through doctrinal and policy analysis, while drawing comparative insights from international circular economy models to strengthen reuse, repair and recycling to support India's transition towards a sustainable and resource-efficient green economy.

Keywords: Circular Economy, Extended Producer Responsibility, Waste Management Law, Recycling, Environmental Regulation in India.

I. INTRODUCTION

The global waste crisis is a systemic failure of the linear economy, not just merely an environmental inconvenience and India stands at its epicentre. The country produces around 62 million tonnes of solid waste annually, yet the manufacture infrastructure captures only 43 MT¹ of this in waste management. Plastic waste chokes the rivers and coastal zones, end of the life vehicles rusts in unauthorised dismantled yards, e-waste accumulates in informal recycling colonies, construction debris overwhelms urban landfills etc. Assigning waste management as a municipal obligation has historically been a dominant regulatory response, but this model has demonstrably failed to scale with India's growth in consumption and its demographic expansion.

Rather than treating waste as an inevitable externality of production, the Circular Economy paradigm offers a structural correction. It envisions a regenerative where the products are designed for longevity, reuse and recyclability and where material loops are closed rather than broken². Various scholars have characterised the circular economy as a new sustainability paradigm, that challenges the foundational logic of industrialisation itself³, requiring a fundamental redesign of production, consumption and end of life systems and not merely better waste management.

The Organisation for Economic Co-operation and Development (OECD) identifies Extended Producer Responsibility (EPR) as the policy instrument which is most capable of operationalising circular economy principles at scale, by extending the producer's responsibility to the post-consumer stage of the product's lifecycle with respect to both physical and/or financial⁴. When properly designed, EPR creates a set of interlocking incentives as it shifts the cost of the end-of-life management from public authorities to producers, it incentivises producers to reduce waste management at the design stage and it also generates revenue streams for recycling infrastructure.

¹ Central Pollution Control Board, *Annual Report on Solid Waste Management 2020-21* 12-14 9 Ministry of Environment, Forest and Climate Change 2022), <https://cpcb.nic.in/annual-report>

² Martin Geissdoefer et al. *The Circular Economy- A New Sustainability Paradigm?*, 143 J. Clean. Prd. 757, 758 (2017), <https://doi.org/10.1016/j.jclepro.2016.12.048>.

³ Swati Singh Sambyal & Richa Sharma, *Waste Management in India: Status and Issues* 24 (Centre for Science and Environment 2021), <https://www.cseindia.org/waste-management-in-india>

⁴ OECD, *Extended Producer Responsibility: A guidance Manual for Governments* 9 (2001), <https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm>

In India, we adopted the EPR model in 2011 through the Plastic Waste (Management and Handling) Rules and the E-Waste Management (Management and Handling) Rules, and has also expanded the framework across eight waste categories. Yet, this framework primarily remains compliance oriented as it imposes targets on collection and recycling but does not meaningfully incentivise the upstream design choices that enables reuse and repair. Therefore, resulting in a system that only manages the symptoms of the linear economy rather than treating its cause. On paper, India's EPR rules are among the most comprehensive in the developing world, thus the challenge is not of legislative ambition, but of structural design, enforcement architecture and the systematic exclusion of the informal sector that performs the bulk of actual waste processing.⁵

II. CONSTITUTIONAL AND STATUTORY FOUNDATIONS

A. Constitutional Basis for Environmental Regulation

India's constitutional framework offers an essential basis for regulating the circular economy. Article 48-A, added by the 42nd Constitutional Amendment Act, 1976, mandates the State to 'endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.'⁶ Article 51-A(g) similarly places a fundamental responsibility on all citizens to 'protect and improve the natural environment, including forests, lakes, rivers and wildlife.'⁷ Although these provisions are non-justiciable in isolation, the Supreme Court has progressively interpreted them as forming part of the right to life under Article 21, thus creating a constitutional right to a clean and healthy environment.⁸

In *M.C. Mehta v. Union of India* (Ganga Pollution Case)⁹, the Hon'ble Supreme Court held that industries contaminating the Ganges River could be directed to set up effluent treatment facilities, stressing that the right to a pollution free environment is a part of right to life. In *Vellore Citizens' Welfare Forum v. Union of India*¹⁰, the Court incorporated both the precautionary principle and the polluter pays principle, that uncertainty regarding environmental harm does not justify inaction and that those who cause environmental damage

⁵ Rural Litigation and Entitlement Kendra v. State of U.P., MANU/SC/0111/1986 (India)

⁶ India Const. art. 48-A (inserted by the Constitution (Forty-Second Amendment) Act, 1976, § 10)

⁷ India Const. art. 51-A(g)

⁸ Subhash Kumar v. State of Bihar, MANU/SC/0106/1991 (India)

⁹ M.C. Mehta v. Union of India, MANU/SC/0586/1988 (India) (Ganga Pollution Case)

¹⁰ Vellore Citizens' Welfare Forum v. Union of India, MANU/SC/0686/1996 (India)

must bear the cost of redemption respectively in the Indian environmental jurisprudence. These principles provide the constitutional framework for EPR, if producers create waste generating products, they must bear the cost of their post-consumer environmental impact as well.

B. The Environmental (Protection) Act, 1986 as the Enabling Statute

The Environmental (Protection) Act, 1986¹¹ is the primary legislation that operationalises EPR in India. This act has been enacted after the Bhopal Gas Tragedy, which was one of the world's worst industrial disasters. This act confers a broad mandate on the Central Government to take measures for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.¹² Section 6 of the Act empowers the government to make rules regarding the handling of hazardous substances and the procedures and safeguards for their management and to authorise the notification of sector specific EPR rules, this provision has been interpreted very expansively. Section 15 of the act provides for penalties, which include imprisonment for up to 5 years and fines for violations.

The validity of all the sector specific EPR rules are derived from the EPA, like, the Plastic Waste Management Rules, 2016; the E-Waste (Management) Rules, 2022; the Battery Waste Management Rules, 2022; the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2022 (covering waste tyres) and the 2023 Amendment Act (covering used oil); the Environment Protection (End of Life Vehicles) Rules, 2025; and the Environment (Construction and Demolition) Waste Management Rules, 2025. This legislation framework of a single statute with a proliferating set of sector specific subordinate rules, has both strengths and weaknesses, where it enables rapid regulatory adaption to new waste streams, but also produces fragmentation and inconsistency in definitions, and enforcement silos across waste categories.

C. The Concept of Extended Producer Responsibility: Doctrinal Foundations

Thomas Lindhqvist was the first person to articulate EPR as a formal policy concept in a 1990 report to the Swedish Ministry of environment¹³, which proposed that manufacturers should be

¹¹ Environment (Protection) Act, 1986, § 3(1)-(2), No. 29 of 1986 (India).

¹² Martin Geissdoefer et al. *The Circular Economy- A New Sustainability Paradigm?*, 143 J. Clean. Prd. 757, 758 (2017), <https://doi.org/10.1016/j.jclepro.2016.12.048>.

¹³ Thomas Lindhqvist, *Extended Producer Responsibility as a Strategy to Promote Cleaner Products* 5 (Swedish Ministry of Environment, Discussion Paper 1990)

made responsible for the entire lifecycle of their products, including the post-consumer stage.¹⁴ The OECD's 2001 Guidance Manual defined EPR as an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of the life cycle of a product¹⁵. The OECD's 2016 Guidance Manual, further disaggregated EPR instruments into take-back obligations, advance recycling fees, deposit refund systems and eco modulation of EPR fees based on product design, which is a typology that Indian law has only adopted them partially and unevenly.¹⁶

EPR is also instrumentally linked to the Sustainable Development Goals (SDG's). EPR framework that functions properly supports SDG 12, Responsible Consumption and Production, by incentivising producers to design products with high recycling value; SDG 13, Climate Action, by reducing greenhouse emissions from resource extraction and landfilling; and SDG 6,14 and 15 reducing environmental pollution from unmanaged waste. The understanding of the relation between EPR and SGD's helps contextualize why its effective implementation is not merely a domestic policy question but a matter of India's international sustainable development commitments.

III. CRITICAL ANALYSIS OF INDIA'S SECTOR-SPECIFIC WISE EPR FRAMEWORK

A. Plastic and Plastic packaging

The Plastic Waste (Management and Handling) Rules, 2011¹⁷ were the first to introduce EPR for plastics in India, which defined EPR for producers and manufacturers of plastic carry bags and multilayered packaging, but has critically failed to define the producer or prescribe substantive collection obligations. The Plastic Waste Management Rules, 2016 represented a significant improvement where, Rule 2(h)¹⁸ defined EPR as "the responsibility of a producer for the environmentally sound management of the product until the end of its life"; Rule 9 obligated producers, importers, and brand owners to set up waste collection systems; and the regulations required CPCB registration for all parties involved in the plastic waste chain.

¹⁴ Thomas Lindqvist & Kari Lidgren, Models for Extended Producer Responsibility, in *Ministry of Environment, Towards Cleaner Production* 44, 44-47 (1992)

¹⁵ OECD, *supra note 6*

¹⁶ OECD, *Extended Producer Responsibility: Updated Guidance for Efficient Waste Management* 27-31 (2016)

¹⁷ Plastic Waste (Management and Handling) Rules, 2011, S.O. 680 (E), rule 2(f) (India)

¹⁸ Plastic Waste (Management and Handling) Rules, 2016, rule 2(h) (India)

The most significant change that took place to the 2016 rules was when Schedule II- the Guidelines on Extended Producer Responsibility for Plastic Packaging was incorporated in 2022.¹⁹ Schedule II prescribes specific recycling targets, reuse requirements, recycled content obligations, end of life disposal quotas, a centralised CPCB portal for required registration, and an environmental compensation mechanism for non-compliance. On paper, the framework is one of the more extensive EPR regimes for plastics in the developing world, and the portal is operational.²⁰

However, a critical evaluation exposes serious structural issues. First, with minimal third-party verification, the framework primarily depends on self-reported data provided by producers, importers, and brand owners (PIBOs).²¹ The regulations are based on a certificate-market model, in which PIBOs buy EPR certificates from registered plastic waste processors to prove compliance. This results in a system that cannot accurately track actual physical recycling volumes and is susceptible to certificate fraud. Second, the EPR framework structurally excludes the informal recycling sector, which makes up more than 90% of actual plastic recycling in India.²² The informal rag-pickers and kabadiwalas who source and sort plastic for those processors are not directly recognised or compensated by the official EPR system; instead, producers meet their targets by buying certificates from registered processors. Third, a large portion of India's plastic pollution comes from illegal plastic dumping and burning because recycling infrastructure is geographically concentrated in urban areas, leaving rural and peri-urban areas without compliant disposal pathways.²³ Fourth, although the 2022 amendment imposes reuse requirements, these are quantitatively small and lack design guidelines that would encourage manufacturers to create packaging that is actually reusable, that is, packaging that can be cleaned, refilled, and returned, instead of just labelling it as "reusable" to meet the checkbox requirement.²⁴

¹⁹ Plastic Waste (Management and Handling) Rules, 2016, Schedule II (inserted by Plastic Waste Management (Amendment) Rules, 2022, S.O. 1069(E))

²⁰ Central Pollution Control Board, EPR Portal for Plastic Packaging, <https://eprplastic.cpcb.gov.in>

²¹ Saroj Kumar Pani & Arun Pathak, *Managing Plastic Packaging Waste in Emerging Economies: The Case of EPR in India*, 288 J. Environ. Manage. 112405, 11248 (2021).

²² Amrita Dey & Denis Ashok S, *Policy Pathways Utilizing Extended Producer Responsibility and Eco-modulation Frameworks for Sustainable Food Packaging Waste Management in India*, 26 Results Eng. 104885, 10488 (2025).

²³ Nishith Jardosh & Vinish Katharia, *Impact of Regulatory Policy Instruments on Plastic Waste Generation in India: A System Dynamics Approach*, *Waste Mgmt. Res.* 0734242X241304342 (2024).

²⁴ Dipti Gupta & Satya Dash, *Challenges of Implementing Extended Producer Responsibility for Plastic Waste Management: Lessons from India*, 19 SRJ 1595, 1597 (2023)

B. Electronic Waste

With an annual production of about 3.2 million metric tonnes, India is the world's fifth-largest producer of e-waste.²⁵ The E-Waste (Management and Handling) Rules, 2011; the E-Waste (Management) Rules, 2016; and the E-Waste (Management) Rules, 2022 are the three generations of the e-waste EPR framework. The 2022 Rules are the most comprehensive version; they include five new categories of electrical and electronic equipment (EEE) (large and small EEE, electrical and electronic tools, toys and leisure equipment, and medical devices), extend applicability to over 100 categories of EEE (solar photovoltaic modules, panels, and cells), set EPR targets in Schedule IV, allow the creation and acquisition of EPR certificates, and provide environmental compensation under Rule 22.²⁶

The 2022 Rules still have a basic structural flaw despite their extensive reach: they are collection-and-recycling-centric rather than truly circular. The regulations set goals for e-waste collection and recycling, but they don't offer any incentives for manufacturers to create products that can be repaired, upgraded, replaced modularly, or have longer service lives²⁷. In contrast, the European Union's Ecodesign for Sustainable Products Regulation (ESPR) 2024 requires software updates, minimum spare-parts availability periods for at least ten years after sale, and repairability scores, all of which have no equivalent in Indian law²⁸. Additionally, the informal e-waste sector, which manages an estimated 95% of India's electronic waste via a network of dismantlers, scrap dealers, and informal recyclers primarily located in urban areas like Seelampur in Delhi and Dharavi in Mumbai, is largely overlooked by the 2022 regulations' centralized portal model.²⁹ Incorporating informal workers into the official Extended Producer Responsibility (EPR) framework is not just a matter of fairness; it is essential for meeting the collection targets set by the rules.

C. Battery Waste

The Battery Waste Management Rules, 2022, which replace the Batteries (Management and

²⁵ Ashwani Kumar et. al., *Sustainable Waste Electrical and Electronic Equipment Management Guide in Emerging Economics Context: A Structural Model Approach*, 336 J. Clean. Prod. 130391, 130393 (2022).

²⁶ E-Waste (Management) Rules, 2022, rules 4, 22, Schedule I, Schedule IV (India)

²⁷ Deblina Dutta & Sudha Goel, *Understanding the Gap between Formal and Informal E-Waste Recycling Facilities in India*, 125 Waste Mgmt. 163, 167 (2021).

²⁸ Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 Establishing a Framework for the Setting of Ecodesign Requirements for Sustainable Products (ESPR), 2024 O.J. (L) 1 (EU), arts. 4-7.

²⁹ Rama Mohana R. Turaga et.al., *E-Waste Management in India: Issues and Strategies*, 44 Vikalpa 127, 130 (2019).

Handling) Rules, 2001³⁰, originally applicable only to lead-acid batteries and lacking EPR terminology, mark a significant legislative progress³¹. The 2022 Rules encompass all types of battery chemistries, regardless of their size, volume, or application; clarify the definition of EPR and the process of EPR registration; outline EPR objectives and minimum recovery goals according to battery type in Schedule II; facilitate the creation of EPR certificates by recyclers and refurbishers; enforce environmental penalties for non-compliance; and importantly requires producers to integrate a minimum percentage of domestically recycled materials into new batteries³². This mandate for recycled content represents the most straightforward circular economy element within India's EPR framework.

The main issue at hand is structural-economic. India's ambitious Electric Vehicle (EV) strategy, aiming for 30% EV adoption in personal transportation by 2030, requires a comprehensive lithium-ion battery recycling system that is not yet implemented on a large scale.³³ The current scrap value of decommissioned lithium-ion batteries is less than the expense of secure recycling, creating a systemic incentive for improper disposal or exportation to unregulated recyclers abroad³⁴. Past instances of informal lead-acid battery recycling have been shown to result in significant occupational health issues, such as lead poisoning among informal smelter employees and their families, illustrating the consequences of unregulated recycling practices for high-value batteries. The 2022 Regulations fail to tackle the cost-inversion issue: without a collection subsidy funded by producers or a deposit-refund scheme for consumers, the financial rationale for informal disposal continues to exist despite official Extended Producer Responsibility (EPR) requirements.

D. Waste Tyres

India generates around one million metric tonnes of discarded tyres each year³⁵. In 2022, Extended Producer Responsibility (EPR) for waste tyres was established through an

³⁰ Battery Waste Management Rules, 2022, Preamble, rules 2, 3(m), 3(n) (India); Batteries (Management and Handling) Rules, 2001, rule 4 (Suspended) (India)

³¹ Battery Waste Management Rules, 2022, rules 9,10,13, Schedule II (India)

³² Vivek Anand Asokam et.al., *Ambitious EV Policy Expedites the E-Waste and Socio-Environmental Impacts in India*, 190 Resour. Conserv. Recycl. 106832 (2023).

³³ Wojcieh Mrozik et.al., *Environmental Impacts, Pollution Sources and Pathways of Spent Lithium-Ion Batteries*, 14 Energy Environ. Sci. 6099, 6104 (2021)

³⁴ Yamini Gupta & Samaj Sahay, *Managing Used Lead Acid Batteries in India: Evaluation of EPR-DRS Approaches*, 5 J. Health Pollut. 52, 56 (2015)

³⁵ Wajiha Khan, *Management of End-of-life Tyres in India: Current Practices, Regulatory Framework, Challenges and Opportunities*, 26 J. Mater. Cycles Waste Mgmt. 1310, 1313 (2024).

amendment to the Hazardous and Other Wastes Rules, leading to the inclusion of Schedule IX. This Schedule provides a broad definition of 'producer' that encompasses manufacturers, importers, and sellers of both new and waste tyres; mandates the registration of producers, recyclers, and retreaters on a centralized portal (<https://www.eprtyrespcb.in/>) ; sets EPR collection and recycling targets; offers EPR certificates for registered recyclers; and imposes environmental penalties for those who do not comply.³⁶

Although India claims a 98% recovery rate for waste tires, research shows that a sizable amount of this "recovery" happens through environmentally harmful processes, especially open burning and co-combustion in cement kilns, which produce dioxins, polycyclic aromatic hydrocarbons, and toxic particulate matter³⁷. The EPR framework does not differentiate between ecologically sound recycling methods (such as devulcanization for rubber recovery, crumb rubber for sports surfaces and asphalt, and pyrolysis for fuel obtained from tires) and unsound disposal. Because of this compliance gap, manufacturers may be able to reach their goals by sending tires to cement kilns instead of high-value recyclers. Additionally, the framework lacks dynamic pricing mechanisms to encourage consumers to return end-of-life tires to official channels. Researchers have determined that this gap is essential for real circular economy results in the tire industry.

E. Used Oil, End-of-Life Vehicles, and Construction Debris

EPR used for oil was introduced through a 2023 amendment to the Hazardous and Other Wastes Rules, inserting Chapter VII. According to the chapter, importers of old oil or manufacturers of lubricating or base oil are required to satisfy recycling objectives through authorised recyclers.³⁸ Energy recovery or refining to create refined base oil or lubricating oil are the two EPR compliance methods that are allowed. One significant flaw is the lack of a mandated hierarchy that favours re-refining above energy recovery, which is thermodynamically inferior to material recycling.

India's most recent EPR framework is the Environment Protection (End-of-Life Vehicles)

³⁶ Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2022, Schedule IX, clauses 2, 4, 5, 10 (India)

³⁷ Anup Ratan Paramanik & Buswajit Mahanty, *A Circular System for End-of-Life Tires under Extended Producer Responsibility*, 39 Mater. Manuf. Process. 1964, 9168 (2023)

³⁸ Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2023, rule 25(h), Chapter VII, rule 27 (India)

Rules, 2025,³⁹ which went into effect on April 1, 2025 after being announced on January 6, 2025. The regulations specify EPR goals in the Schedule, allow for EPR certifications and environmental compensation, and apply to manufacturers, registered owners, bulk consumers, registered vehicle scrapping facilities (RVSFs), and testing bodies. The market was ahead of the legislative framework since Maruti Suzuki and Tata Motors had previously implemented voluntary take-back programs ('Take Back' and TATVA/Re.Wi.Re, respectively) before to the laws' passage.⁴⁰ The predominance of informal disassembly, which releases lubricants, coolants, and refrigerants into the environment, is the main structural concern. Vehicles are frequently sold to informal dismantlers who undertake no depolluting procedures⁴¹. EPR framework risks paper compliance, without consumer incentives such as extended warranties contingent on formal ELV surrender or scrappage bonuses routed through RVSF's.⁴²

An estimated 90% of the 150 MT of construction and demolition (C&D) debris produced in India each year ends up in landfills⁴³. With effect from April 1, 2026, the Environment (Construction and Demolition) Waste Management Rules, 2025⁴⁴ establish EPR for large construction projects (built-up area \geq 20,000 sq. m.), specify EPR targets in Schedule I, require producers and recyclers to register, and impose environmental compensation. The 2025 Rules address some of these issues, most notably through waste utilisation frameworks and a registration interface, but the 20,000 sq. m. threshold excludes a significant portion of India's construction activity. Studies have identified the exclusion of small-scale construction, the lack of urban mining mechanisms, and inadequate building design standards as major challenges.⁴⁵

IV. REUSE, REPAIR AND RECYCLING: A CRITICAL ASSESSMENT OF INDIA'S LEGAL FRAMEWORK

A. The Circular Economy Hierarchy and Its Implications for Indian Law

³⁹ Environment Protection (End-of-Life vehicles) Rules, 2025, S.O. 98(E), rules 2-15 (India)

⁴⁰ Arul Sharma & Ajai Prakash, *Driving Sustainability: Exploring the Implementation, Opportunities and Challenges of Circular Economy Practices in India's Automobile Industry*, 15 Adhyayan J. Mgmt. Sci. 70,73(2025)

⁴¹ Zambri Harun, *Development, Critical Evaluation and Proposed Framework: End-of-Life Vehicle Recycling in India*, 14 Sustainability 15441, 15445 (2022).

⁴² Nitish Arora, *Framework for Sustainable Management of End-of-Life vehicles in India*, 21 J. Mater. Cycles Waste Mgmt. 79,94 (2019)

⁴³ S. Nair, *India Manages to Recover and Recycle Only About 1% of its Construction and Demolition (C7D) Waste*, Centre for Science and Environment (2021)

⁴⁴ Environment (Construction and Demolition) Waste Management Rules, 2025 (India)

⁴⁵ Namya Sharma, *Global Review of Circular Economy and Life Cycle Thinking in Building Demolition waste Management: A Way Ahead for India*, 222 Build. Environ. 109413, 109424 (2022)

The circular economy is a hierarchy of waste control techniques rather than a single, cohesive idea. In declining order of environmental acceptability, the European Environment Agency's waste hierarchy, which is widely recognised globally and codified in EU law—prioritizes: prevention → reuse → recycling → recovery → disposal.⁴⁶ The hierarchy's logic is both thermodynamic and economic: reuse preserves a product's embodied energy, labour, and material value in its most complete form; recycling recovers raw materials at a high energy cost; recovery transforms waste into energy at an even higher thermodynamic loss; and disposal completely destroys value. According to the hierarchy, a genuinely circular EPR system should prioritise the top rungs, prevention and reuse, and employ recycling as a backup plan for items that cannot be fixed or reused.

In fact, this hierarchy is essentially structured by India's present EPR system, which places a strong emphasis on recycling and recovery goals while offering no legal foundation for reuse and repair. Design guidelines are not used to implement the PWMR's modest reuse requirements for plastic packaging. Although the EWR allows for refurbishment, it does not necessitate it or specify conditions for repairability. Product lifespan extension, spare parts availability, and software update requirements, all of which are present in the EU's developing circular product law, are not imposed by any EPR regulations in India.⁴⁷

B. Reuse and the Indian EPR Gap

The PWMR 2016 (as revised in 2022) has explicit reuse obligations among all sector-specific EPR regulations, mandating manufacturers to attain minimum reuse rates and integrate a percentage of reusable plastic packaging. The EWR 2022 does not set reuse goals or design requirements for repairability, but it does include "refurbishers" in its stakeholder scope and consider refurbisher-generated EPR certifications, which would provide an indirect financial incentive for reuse. Refurbishment is acknowledged but not required by the BWMR 2022.

This difference has important practical ramifications. According to research from the European Commission's Ecodesign methodology, a just one-year increase in the average lifespan of electronic items would result in a 4-6% reduction in their lifecycle carbon footprint⁴⁸. This job

⁴⁶ European Environment Agency, *Manging Municipal Sold Waste- A review of Achievements in 32 European Countries* 14 (EEA Report No. 2-2013)

⁴⁷ Plastic Waste Management Rules, 2016, Schedule II, Clause 6 (India); E-Waste (Management) Rules, 2022, rule 2(s) (India); Battery Waste Management Rules, 2022, rule 3(r) (India)

⁴⁸ European Commission, *Ecodesign Working Plan 2022-2024*, COM (2022) 31 final, at 8 (Jan. 21, 2022)

is carried out spontaneously and on a large scale by India's informal repair sector, or the "jugaad" ecosystem of street-level repair businesses that service anything from mobile phones and refrigerators to motorbikes and agricultural equipment. However, the increasing tendency of manufacturers' purposefully unrepaired designs, such as bonded components, proprietary screws, undocumented software, and the removal of spare-parts supply chains, is attacking this economy. Regarding these practices, Indian EPR law is completely silent. The result is that while the rules oblige producers to collect and recycle their products at the end of life, they permit and arguably incentivise design choices that hasten end of life.

C. The Right to Repair: A Critical Legislative Gap

Globally, the right to repair has become a supplement to EPR that focuses on the upstream design phase. In the United States, Colorado enacted the Repair of Digital Electronic Equipment Act (2022), Minnesota enacted the Digital Fair Repair Act (2023), and California enacted the Right to Repair Act (2024), all requiring manufacturers to provide independent repair shops and consumers with access to diagnostic tools, spare parts, and repair manuals at fair and reasonable prices. The European Union's Right to Repair Directive (2024/1799/EU) forbids software and design barriers to repair and places minimum requirements on manufacturers to guarantee the availability of spare parts, repair documentation, and diagnostic access for at least 10 years after sale.

India has taken no comparable legislative step in this regard. Although it does not specify any requirements for repairability, the Bureau of Indian criteria (BIS) sets quality criteria for goods. Although the customer Protection Act of 2019 establishes customer rights for faulty items, producers are not required to encourage independent repair. In its 2021 market analysis, the Competition Commission of India looked at aftermarket limits on spare parts in the automotive industry and discovered indications of anti-competitive behaviour.⁴⁹ However, competition law is a weak and slow-acting replacement for targeted repair regulation. The absence of right to repair framework is not a minor policy gap, but is a structural failure that constrains India's circular economy transition and places the Indian informal repair economy, which employs millions, at a systematic legal and economic disadvantage relative to manufacturer-authorised repair networks.

⁴⁹ Competition Commission of India, *Market Study on the Automobile Sector in India* 43-48 (2021)

D. Recycling: Achievements and Structural Constraints

India's EPR framework has made measurable progress in formalising recycling obligations. A major administrative advancement is the centralised CPCB portals for plastics, e-waste, tires, batteries, and used oil allow thousands of firms to register, establish targets, and generate certificates. However, three structural limitations prevent successful recycling results.

The first is the issue with certificate integrity and self-declaration. Producers acquire EPR certificates from registered recyclers to offset their EPR obligations. According to research on EPR compliance in India, certificate fraud is made possible by the regulations' dependence on self-declared processing volumes and the State Pollution Control Boards' (SPCBs') passive inspection⁵⁰. In its own 2022–2023 Annual Report, the CPCB admitted that a number of certifications had been awarded for either over-reported or nonexistent recycling operations. The certificate market favours paper compliance over actual recycling in the absence of required third-party audits and mass balance verification of recycling claims.

The paradox of the exclusion of the informal sector is the second limitation. Although they get little integration into official EPR systems, informal recyclers are thought to be responsible for 20–90% of real material recycling in various waste streams⁵¹. Because producers meet their nominal EPR objectives through certificates but the actual recycling operation is being carried out informally, outside of any quality, safety, or environmental standard, their exclusion is not only a social equality issue but a systemic compliance failure.

The demand failure for recycled material is the third limitation. Because virgin material extraction benefits from implicit subsidies through underpriced natural resource concessions, demand for recycled materials is still lower than that of virgin materials, even in areas where recycling does place⁵². EPR rules in impose recycled content mandates only in the battery sector and therefore extending such mandates to plastics, construction materials and metals would create demand-side pull for secondary materials that currently depresses the recycling economies.

⁵⁰ M.Z.M. Nomani, *Extended Producer Responsibility and Enforcement of Single-Use Plastic Ban in Pune City of India*, 22 Nat. Env. Poll. Tech. 1519, 1523 (2023)

⁵¹ Darius Corbier, *Shaping Sustainable Consumption Practices: changing Consumer' habits through Lifestyle Changes and Extended Producer Responsibility Schemes*, 217 Resor. Conserv. Recycl. 108214, 108217 (2025)

⁵² Okasana Nikishyna, *A Circular Ecosystem for the Implementation of Sustainable Development Goals Based on Extended Producer Responsibility*, 7 Multidiscip. Sci. 2025071, 2025073 (2024)

V. COMPARATIVE ANALYSIS: LESSONS FROM INTERNATIONAL EPR MODELS

A. The European Union: Ecodesign, eco-modulation and the Right to Repair

The European Union Model of Circular economy is the most comprehensively developed in the world and the most instructive in India. The EU Circular Economy Action Plan (2020) and the legislative program that is associated with it places EPR in a larger design-led framework that also includes consumer information requirements, eco-modulation of producer levies, product design standards, and the right to repair. The Ecodesign for Sustainable Products Regulation (ESPR, Regulation 2024/1781/EU), adopted in June 2024, gives the European Commission the authority to require software updates, minimum spare-parts availability periods, repairability scores, and recycled content for particular product categories.⁵³ There is no legal counterpart in India for the ESPR's product passport, which is a digital record of a product's composition, repairability, and recyclability.

The Packaging and Packaging Waste Regulation (PPWR, Regulation 2024/1673/EU), which currently governs the EU's packaging EPR framework, introduces eco-modulation of producer fees: producers whose packaging is made for easy separation, high-quality recyclability, or reuse pay lower EPR fees, while producers of packaging that is difficult to recycle or contains hazardous materials pay higher fees. In contrast to India's EPR charge structure, which is unaffected by the recyclability of the product, this system offers a direct financial incentive for circular package design. The Right to Repair Directive (2024/1799/EU) also forbids physical and software obstacles to independent repair and mandates that manufacturers supply spare parts, repair manuals, and diagnostic access for a minimum of ten years.

B. Germany: Transparency, Dual Systems and Retailer Take-Back

Germany has pioneered modern EPR with the Verpackungsverordnung (Packaging Ordinance) of 1991⁵⁴ and the founding of Duales System Deutschland (DSD), the first producer responsibility organization (PRO) for packaging. A centrally managed registration system (the LUCID Packaging Register), mandatory participation in dual systems, eco-modulation of fees

⁵³ Regulation (EU) 2024/1673 of the European Parliament and of the Council of 24 April 2024 on Packaging and Packaging Waste (PPWR), 2024 O.J. (L) 1, art. 44 (EU)

⁵⁴ Verpackungsverordnung (Packaging Act) [VerpackG], July 5, 2017, Bundesgesetzblatt [BGBl] I at 2234 (Ger.)

based on packaging design and recyclability, and mandatory minimum recycling quotas for each material type⁵⁵ are all ways that the current Verpackungsgesetz (Packaging Act, VerpackG 2017) operationalises EPR. The transparency of the LUCID record, which allows civil society, competitors, and enforcement agencies to identify non-compliant manufacturers by name, is a unique aspect of the German model. In contrast, producer-level compliance data is not published on India's CPCB portals, which restricts public accountability.

The Elektro- und Elektronikgerätegesetz (ElektroG, 2015, amended 2021)⁵⁶ in Germany imposes an obligatory retailer take-back requirement for e-waste: all online shops and retailers with floor areas more than 400 square meters are required to receive small e-waste from customers without requiring a purchase. This significantly lowers the barrier for customers to return end-of-life devices through official channels by establishing a dense network of easily accessible take-back locations throughout German cities and towns. In contrast, producer-established take-back schemes, which are typically concentrated in metropolitan areas and inaccessible to a large portion of the populace, are the sole basis for India's e-waste regulations. One major enforcement issue that India may easily fill is the lack of a statutory store take-back responsibility.

C. Japan: The 3R's Hierarchy and Consumer-Facing Deposit Refund Systems

The waste management system in Japan is distinctive in its structural commitment to the 3R's- Reduce, Reuse, Recycle, operationalises a number of sector specific laws by the Basic Act for Establishing a Sound Material-Cycle Society (2000)⁵⁷. The Home Appliance Recycling Law (1998)⁵⁸ requires retailers to collect end of life appliances from customers and send them to manufacturers for recycling. Manufacturers must meet mandatory recycling rate targets, which are 74% for air conditioners, 82% for washing machines and dryers, and 70% for televisions. Crucially, end-of-life management is funded by a "recycling fee" that customers pay at the time of purchase and which is kept in a producer-managed trust. This mechanism internalises the circular economy cost at the consumer level, creates a direct consumer incentive to return appliances through formal channels and avoids the unrecoverable cost problem that drives informal disposal in battery and appliance market.

⁵⁵ LUCID Packaging Register

⁵⁶ Elektro-und Elektronikgerätegesetz [ElektroG], Oct.20, 2015, BGBl. I at 2223, § 17(3) (amened 2021) (Ger.)

⁵⁷ Basic Act for Establishing a Sound Material-Cycle Society, Law No. 110 of June 2, 2000 (Japan)

⁵⁸ Home Appliance Recycling Law, Law No. 97 of June 5, 1998 (Japan)

India's EPR framework lacks an equivalent consumer facing fee mechanism for any waste category and because of which the producers bear the entire cost of complying with the circular economy. This results in incentives for non-compliance, cost externalisation onto informal workers, or design decisions that minimise short-term compliance costs at the expense of long-term recyclability. The Japanese approach shows that it is both economically and operationally feasible to spread circular economy expenses over the whole product lifespan, including the consumer stage.

VI. PRODUCER RESPONSIBILITY ORGANISATIONS, ECOMARK AND INSTITUTIONAL DESIGN

A. Producer Responsibility Organisations (PROs) in India

Producer Responsibility Organisations (PROs) are organisations that collectively fulfil EPR responsibilities on behalf of several producers. As of 2024, the CPCB acknowledged more than 40 PROs for plastic packaging and more than 20 for e-waste. Their application is specifically considered in India's plastic and e-waste EPR regulations, and they have spread quickly. In addition to managing compliance reporting on behalf of its members, PROs combine resources from several producers to attain economies of scale in collection, logistics, and recycling.

However, structural accountability deficiencies plague India's PRO ecosystem. According to research, PROs in India function more as certificate intermediaries than as actual waste management companies. They collect EPR fees from producers, buy recycling certificates from registered recyclers (who may or may not have actually recycled), and send these certificates to the CPCB as proof of member compliance.⁵⁹ The real physical movement of garbage through PRO-affiliated collection systems is seldom confirmed due to the lack of independent audits of PRO activities. On the other hand, Germany's dual systems, like DSD, are required to undergo independent audits of collection volumes, and the integrity of their recycling claim data is confirmed by cross-referencing it with municipal collection statistics.⁶⁰ PROs are required in the Indian EPR rules to maintain transparent, publicly accessible waste flow data verified by independent third-party auditors as a condition of continued recognition.

⁵⁹ Daniel Faibil, *Extended Producer Responsibility in Developing Economies: Assessment of Promoting Factors through Retail Electronic Firms for Sustainable E-Waste Management*, 41 Waste Mgmt. Res. 117,121 (2023)

⁶⁰ Sarita Kumari Sadwal, *E-Waste Challenges in India: Environmental and Human Health Impacts*, 15 Appl. Sci. 4350, 4355 (2025)

The conflict of interest seen in the PRO model is a similar institutional design issue. Because they are supported by producers, PROs may be more motivated to limit compliance costs for their producer-clients than to promote real garbage collection and recycling in the absence of strict regulatory control. Effective PROs need transparent, published accounts, independent governance with civil society representation, mandatory membership in a government-approved system, and a regulatory backstop that allows the government to withdraw recognition from PROs that don't meet their stated collection and recycling targets, according to the European experience with PRO governance.⁶¹ As of right now, India's EPR regulations do not require any of these governance components.

B. The Ecomark Rules, 2024 and the Interference with EPR

The scheme of Ecomark was originally introduced in India in 1991 as a voluntary eco labelling programme, but it failed to materialise owing to lack of political will, aggressive industry lobbying and weak institutional management. The Ecomark Rules, 2024 which were notified under the EPA 1986, creates a mandatory registration eco labelling scheme that allows products that met environmental requirements, such as recyclability, reduced pollution, use of recycled materials, use of non-hazardous substance and compliance with EPR guidelines, may apply for “Ecomark” certification.

An essential formal contact between the EPR framework and the larger green economy is created by the inclusion of EPR compliance as a condition for Ecomark certification, which offers a market-facing signal of environmental performance in addition to the legislative duty. A level of openness that is completely lacking in the present EPR structure, where compliance data is held behind CPCB websites unavailable to regular customers, is provided to consumers who buy Ecomark-certified items.

However, manufacturers are not obligated to apply for the Ecomark, hence the Ecomark Rules 2024 are entirely optional. Therefore, generating consumer demand for Ecomark-certified products is essential to the scheme's success as a circular economy tool. This calls for ongoing public awareness campaigns, government procurement preferences for Ecomark products, and the incorporation of Ecomark criteria into green public procurement policies. Without these demand-side steps, the Ecomark program runs the danger of suffering the same fate as its

⁶¹ Furkan Sariatl, *Linear Economy Versus Circular Economy: A Comparative and Analyzer Study for Optimization of Economy for Sustainability*, 6 *Visegr. J. Bioecon. Sustain. Dev.* 31, 33 (2017).

predecessor from 1991: a well-crafted tool that is unable to gain market acceptance due to a lack of institutional commitment.

C. The SDG Nexus: EPR as an Instrument of Sustainable Development

India's EPR framework is primarily related to the nation's worldwide obligations to sustainable development, making it more than just a local environmental governance issue. Several SDGs are supported by an effective EPR framework: SDG 12 (Responsible Consumption and Production) by encouraging manufacturers to design products with high recycling value; SDG 13 (Climate Action) by lowering greenhouse gas emissions from resource extraction, manufacturing, and landfilling through increased use of secondary materials; SDG 11 (Sustainable Cities and Communities) by lessening the strain on municipal waste management systems; SDGs 6, 14, and 15 by lowering environmental pollution from undamaged plastic, e-waste and hazardous material flows; and SDGs 8 and 9 by creating green jobs in the circular economy and stimulating investment in recycling infrastructure and reverse logistics.

Conversely, the failure to implement EPR effectively has directly affected India's ability to meet its SDG commitments. The structural connection between EPR reform and SDG attainment is shown by the CPCB's prediction that waste generation in India will exceed 165 MT by 2030, the same year as the SDG deadline. In order to attain the resource efficiency improvements anticipated in India's mitigation scenarios, the National Action Plan on Climate Change and India's Nationally Determined Contributions (NDCs) under the Paris Agreement implicitly rely on a functional circular economy. Therefore, EPR reform is part of India's climate and sustainable development plan rather than just a regulatory objective.

VII. CRITICAL OBSERVATIONS AND PROPOSED LEGAL REFORMS

A. The Structural Diagnosis

India's EPR framework suffers from three foundational deficits. First, it is not truly circular; instead, it is recycling-centric, enforcing collection and recycling goals while neglecting the higher-value circular strategies of product lifespan extension, reuse, and repair. Second, the informal sector, which handles the majority of real trash processing but is not acknowledged or compensated, is practically excluded but officially included. Third, it is compliance-driven rather than incentive-rich; it imposes duties and penalties but lacks the financial incentives,

such as recycled content regulations, deposit-refund systems, and eco-modulated fees, that make circular conduct economically sensible for producers. Targeted legislative reform can address each deficiency.

B. Six Proposed Legal Reforms

Reform 1: Eco-Modulation of EPR Fees. In order to implement eco-modulated EPR fees, the Central Government needs modify the PWMR, EWR, and BWMR. makers should pay reduced rates for items that are easy to disassemble, have a high recycled content, or are certified for reusability; makers of single-use, hazardous substance-containing, or difficult-to-recycle products should pay higher prices. This reform, which forms the basis of the EU's PPWR and is well-established in European national EPR systems, establishes a market-wide financial incentive for sustainable design without the need for prescriptive design requirements. In collaboration with business, public society, and technological experts, the CPCB should be given the authority to create eco-modulation standards unique to each product category.

Reform 2: A Right to Repair Act. In order to compel manufacturers to provide spare parts, diagnostic software, repair manuals, and calibration tools to independent repairers and consumers at fair and reasonable prices for a minimum of seven years after the last date of product sale, India should either pass a specific Right to Repair Act or amend the Bureau of Indian Standards Act, 2016 and the Consumer Protection Act, 2019. Firmware locks and pairing restrictions that hinder independent component replacement are examples of software-based repair limitations that need to be outlawed as unfair trade practices under the Consumer Protection Act. Right-to-repair complaints shall be heard by the National Consumer Disputes Redressal Commission (NCDRC) in a timely manner.

Reform 3: Formal Integration of the Informal Sector. Through streamlined registration, skill certification programs, occupational health and safety training, and EPR fee sharing with registered informal collectors, the PWMR, EWR, BWMR, and ELVR should be modified to establish formalised onboarding pathways for workers in the informal sector, such as rag-pickers, kabadiwalas, and informal dismantlers. A domestic precedent is provided by the practice of incorporating Kudumbashree Self-Help Groups (SHGs) into municipal solid waste management in Kerala. Kudumbashree collects, separates, and processes garbage on behalf of municipalities and is compensated by the official waste management system.

Reform 4: Mandatory Recycled Content Standards. The Central Government should expand mandatory recycled content standards to plastic packaging (minimum 30% recycled content by 2030, scaling to 50% by 2035), construction materials (minimum 20% recycled aggregate for projects over 10,000 sq. m.), and consumer electronics (minimum 10% recycled metals), building on the BWMR's precedent of requiring domestically recycled content in new batteries. By correcting the market failure that lowers the price of recycled materials and makes virgin resources more cost-effective, recycled content rules provide demand-side pull for secondary materials.

Reform 5: An Independent EPR Audit Authority. The existing architecture, which is a self-declared EPR data provided to CPCB portals, passively overseen by SPCB's of varying capacity, is structurally inadequate. In order to perform mandatory third-party audits of EPR certificates through mass balance verification, cross-referencing producer-reported data with actual recycler throughput data, and physical inspection of registered recycling facilities, the paper suggests establishing an independent EPR Audit Authority under the MoEFCC. In order to leverage market and civil society accountability in addition to official enforcement, the Authority should provide yearly compliance scorecards for every waste category and make producer-level compliance data publicly available, following the German LUCID model.

Reform 6: Consumer-Facing Deposit Refund Mechanisms. Based on Germany's Pfand (bottle deposit) system and Japan's appliance recycling fee model, requiring deposit-refund systems for EV batteries, major home appliances, and high-value packaging. In addition to providing a strong financial incentive for customers to return goods through official channels, a deposit that is taken from customers at the time of purchase and kept in a producer-managed trust finances end-of-life collecting and administration. The CPCB should oversee the management of trust funds, and the BWMR and EWR should be modified to approve and provide a regulatory framework for such mechanisms.

C. Judicial Oversight and the Role of NGT

The National Green Tribunal Act of 2010 established the National Green Tribunal (NGT), which has the original jurisdiction over civil disputes involving significant environmental issues. In order to hold producers accountable for poor post-consumer waste management, the Tribunal has invoked the polluter-pays principle, which the Supreme Court acknowledged in

*Indian Council for Enviro-Legal Action v. Union of India*⁶², and the precautionary principle, which was outlined in *A.P. Pollution Control Board v. Prof. M.V. Nayudu*⁶³. In order to close the gaps created by the executive, the NGT has also given the CPCB instructions on EPR compliance monitoring, creating an expanding corpus of EPR jurisprudence.⁶⁴

However, judicial intervention is case-specific, episodic, and reactive. Courts lack the institutional capacity to oversee portal-based compliance systems, create eco-modulated charge structures, or impose recycling requirements. Although India's court activity in environmental concerns has been revolutionary, environmental law specialists have pointed out that it cannot replace a proactive, well-resourced regulatory framework. It is better to think of the judiciary's involvement in EPR enforcement as a backup plan, crucial in the event that regulators fail but not a first-order replacement for institutional and legislative reform.

D. Federalism and the Centre-State Enforcement Gap

The inconsistency between state enforcement and central standard-setting is a recurring structural issue in Indian environmental management. While SPCBs are primarily in charge of on-the-ground monitoring, inspection, and enforcement, the CPCB establishes EPR standards, runs centralised portals, and provides guidance. SPCBs differ greatly in terms of workforce levels, political protection from industrial lobbying, and technological capability. Research on e-waste and plastic EPR compliance has shown that SPCB enforcement action is sporadic and unequal regionally, with states with greater resources, like Maharashtra and Karnataka, achieving higher compliance rates than regions with lower incomes.

It is necessary to address the federalism gap between both institutional and fiscal reforms. Institutionally speaking, the proposed EPR Audit Authority should have a federal mission that covers both state and federal enforcement. It should have the authority to order SPCBs to conduct enforcement action and to take concurrent enforcement jurisdiction in cases where an SPCB has clearly failed to take action. Financially speaking, environmental compensation received from non-compliant producers ought to be set aside, at least in part, for the

⁶² *Indian Council for Enviro-Legal Action v. Union of India*, MANU/SC/1112/1996 (India) (Polluter Pays Principle)

⁶³ *A.P. Pollution Control Board v. Prof. M.V. Nayudu*, MANU/SC/0032/1999 (India) (Precautionary principle)

⁶⁴ *In Re: Mantri Techzone Pvt. Ltd. v. Forward Foundation & Ors.*, MANU/SC/0315/2019 (India) (NGT jurisdiction over EPR violations)

development of SPCB capacity, which includes more technical personnel, infrastructure for laboratories, and information systems.

The function of Urban Local Bodies (ULBs) is another aspect of federalism. The EPR framework, which allocates main duty to manufacturers and licensed recyclers, functions mostly in parallel with, rather than integrated into, the municipal waste management system, despite the fact that municipal corporations are the major trash collecting authority in India's cities. As a result, producers operate EPR take-back programs that supplement or overlay municipal collection infrastructure, creating a parallel system. Both Germany and Japan serve as examples of the benefits of combining EPR collection systems with municipal waste management. In Japan, producers pay the additional costs of sorting and recycling streams that satisfy EPR standards, while municipalities collect residential garbage on their own. There is a similar model in India, where the municipalities are compensated by producers for the EPR complaint segregation and collection of plastic, e-waste and battery materials in the municipal waste stream, which would both reduce collection costs and leverage the extensive reach of the municipal infrastructure.

VIII. CONCLUSION

India's EPR framework, since its inception in 2011, has undergone a remarkable legislative evolution. A legislative commitment to producer accountability for post-consumer waste is among the most extensive in the developing world, as evidenced by the proliferation of sector-specific regulations across eight waste categories, the creation of centralised CPCB registration and compliance portals, the introduction of quantified EPR targets and environmental compensation mechanisms, and the recent expansion into end-of-life vehicles, construction debris, and non-ferrous metals. India's regulations significantly meet international standards when compared to the OECD's EPR policy checklist, which includes goals, essential definitions, scope, legal approach, targets, and information distribution.

However, reaching circular economy goals is not the same as following a checklist. No amount of portal improvement can solve the three fundamental flaws in India's EPR architecture. It lacks the upstream design incentives, eco-modulated pricing, repairability criteria, and product lifespan standards, that set a circular economy apart from an advanced garbage collection program, making it recycling-centric rather than truly circular. The informal sector, which handles the majority of real waste processing but is not acknowledged or compensated in the

official EPR framework, is practically excluded yet technically included. Additionally, it is compliance-driven rather than incentive-rich, depending on fines for non-compliance rather than the financial mechanisms, such as requirements for recycled content, deposit refunds, and eco-modulated fees, that make circular behaviour financially sensible for both producers and consumers.

The institutional dimension of India's EPR enforcement depends on an architecture which includes, CPCB portals, SPCB oversight and self declared data, and this lacks the technical capacity for reliable verification. The physical impact of formal EPR compliance is further diminished by the growth of PROs, many of which function as certificate intermediates rather than actual waste management. Although the Ecomark Rules 2024 offer a potential link between the consumer market and the EPR framework, their effectiveness is contingent upon the implementation of demand-side initiatives. A proactive, well-resourced regulatory framework cannot be replaced by courts, while the NGT's expanding EPR jurisprudence offers a judicial safety net.

These shortcomings are not inherent to EPR as a policy tool, as evidenced by the global experience, the EU's ecodesign requirements and eco-modulated fees, Germany's transparent LUCID registration and required retailer take-back, Japan's consumer-facing deposit-refund mechanisms and sector-specific 3Rs hierarchy. They are the result of certain design decisions that can be changed by focused legislative reform. Each of the six changes put forth in this paper, eco-modulation of EPR fees, a Right to Repair Act, integration of the informal sector, mandated recycled content requirements, an independent EPR Audit Authority, and consumer-facing deposit-refund systems, is doable on its own and, taken as a whole, revolutionary. Together, these changes will transform India's EPR system from a compliance-management tool to a true catalyst for the country's transformation to a circular economy. Each reform targets a distinct fundamental flaw in the present framework.

India will produce significantly more waste over the next 20 years due to its population and socioeconomic trajectory. The CPCB's forecast of 165 MT of municipal solid trash by 2030 is a policy problem with a policy solution rather than a fixed outcome. Millions of kabadiwalas, electronics repairers, and refurbishers work in the unofficial repair sector, which already exemplifies the fundamental ideas of a circular economy at the local level: prolonging product life, recovering material value, and completing material loops. Instead of unintentionally

undermining this economy with EPR regulations that privilege formal registered firms at the expense of the informal workers who carry out the majority of actual circular economy activities, India's legal system must identify, encourage, and grow this economy.

The transition to a circular economy is an economic opportunity as well as an environmental need. A well designed EPR framework integrated with right to repair legislation, informal sector formalisation and recycled content mandates can generate hundreds and thousand of green jobs which will reduce reliance on imported virgin materials, lower lifecycle greenhouse gas emissions and improve public health outcomes in communities near waste management sites. India has laid the regulatory foundation through its EPR architecture, but what remains is the more difficult and significant task of building a circular economy framework that is appropriate for the scope of India's waste problem and the aspirations of its sustainable development commitments.