

Right to Repair and E-Waste Governance: A Comparative Legal Analysis of India and the United States

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The rapid expansion of digital technologies, consumer electronics and connected devices has contributed significantly to the generation of electronic waste (e-waste). The increasing frequency of technological upgrades, limited product repairability, restricted access to spare parts and diagnostic information, and practices associated with planned obsolescence have shortened the useful life of electronic products. Consequently, e-waste governance can no longer be approached solely as a question of waste disposal and recycling. It requires a lifecycle-oriented regulatory framework that incorporates product durability, repair, reuse, refurbishment, recycling and responsible disposal. Against this background, the Right to Repair has emerged as an important regulatory and consumer-protection concept. It seeks to facilitate access to spare parts, repair manuals, diagnostic tools, software and other information necessary for repairing products. This paper comparatively examines the emerging Right to Repair and e-waste governance frameworks in India and the United States. It analyses the relationship between repairability, reuse, planned obsolescence and extended producer responsibility and identifies regulatory gaps that affect the effective implementation of circular-economy principles. The paper proposes an integrated “Repair–Reuse–Regulate” framework. The strategy involves extending product life by repairing things and decreasing premature product disposal/reuse and refurbishment of products to keep product economic and material value; and regulation – puts enforceable responsibilities on manufacturers, consumers, repairers and recyclers. The paper describes the need of an effective governance framework for the e-waste involving interventions throughout the whole product life. This comparative study between India and the United States illustrates the lessons that can be gained from the different approaches being implemented by the two countries in terms of institutional structure, regulatory design and enforcement mechanisms to illustrate a more holistic sustainable governance of electronics.

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INTRODUCTION

Today information and communication technology (ICT) has undergone tremendous growth and diffusion, shaping the modern society. Electronic devices plays an important role in communication, education, employment, health-care, trading, entertainment etc. But with technological innovations, there has come a rising portion of electronic waste as the environment's repercussion.

Generally, electronic waste is defined as the discards, discarded electrical or electronic products and components. It is not just the volume of discards that's the issue. Valuable recoverable materials and substances with potential for environmental or health hazard if not handled properly might be included in electronic products. As a result, issues regarding e-waste management encompass questions about its environmental impact, resource utilization, consumers' rights, the design of products and their sources of creation, public health and economic control. Old-fashioned waste-management structures focus on how to deal with waste products after they've reached the end of their life cycles. However, a 'solution' like this does not get to the causes of products becoming waste, or the waste factor itself. A device may be discarded due to physical damage, lack of replacement parts, lack of repair information, lack of software support or due to economies of scale considerations (as it becomes easier to replace the device than repair). The regulating of e-waste accordingly crosses the interweaving of e-product design and product life cycle. In this regulatory framework, the Right to Repair has come about. At the heart of the Right to Repair is all about the capacity of consumers and independent repairers to access the desired information and materials, tools and technical information to independently repair products. It discourages or prohibits unnecessary and costly or difficult repair, and increases the useful life of products.

The idea is intertwined with the vast idea of "circular economy." An action taken to maintain the function of a product in good working order can avoid its premature entry into the waste stream. Product life can be further extended through refurbishment and reuse or through recycling (when they no longer can reasonably be refurbished or reused). This provided material outlines an important distinction between the approach of two countries to regulation: that of the United States and of India. The U.S. system is said to be relatively decentralized – focusing in the past mostly on specific dangerous constituents and state-based initiatives on aspects of producer responsibility and repair. In contrast, India has adopted a policy approach which is more oriented towards the country, including e-waste regulation, EPR and the Right to Repair (RTR) programs. This paper therefore questions the approach of Rights to Repair being understood merely as a consumer right and explores if it should be considered as a part of e-waste governance. It embarks on an argument to advance the idea of repair, reuse and regulation as interdependent functions within a so-called life cycle-based regulatory approach.

STATEMENT OF THE RESEARCH PROBLEM

Current waste management models of e-waste governance tend to focus on e-waste collection, recycling and disposal. However, those points are still significant, but a predominantly end-of-life management-based governance might not take into account ways to avoid creating waste from earlier in the product's life cycle. The three following problems are especially at the point of interconnectivity. Customers are likely to experience issues in accessing the ability to repair electronic products, and more specifically. These barriers include limited access to spare parts, repair manuals, diagnostic tools and technical information. Second, the increasing pace of technological development and product replacement can shorten the practical life of

electronic devices. Planned obsolescence, whether technological, physical or psychological, may contribute to premature replacement. Third, regulatory responsibility remains distributed among manufacturers, consumers, repairers, recyclers and government institutions. Where responsibilities are fragmented, the effectiveness of e-waste governance may be weakened. The central research problem addressed by this paper is therefore whether a legal framework combining repair, reuse and regulation can provide a more comprehensive approach to e-waste governance than an approach concentrated primarily on recycling and disposal.

RESEARCH OBJECTIVES

The objectives of this study are:

1. To examine the relationship between the Right to Repair and e-waste governance.
2. To analyse the legal and policy approaches to Right to Repair and e-waste management in India and the United States.
3. To identify regulatory and institutional gaps in the existing frameworks.
4. To develop an integrated **Repair–Reuse–Regulate** framework for lifecycle-oriented e-waste governance.

RESEARCH QUESTIONS

The study addresses the following research questions:

1. What is the relationship between the Right to Repair and effective e-waste governance?
2. How do India and the United States approach the regulation of repair and electronic waste?
3. How do planned obsolescence and product design affect the practical ability

of consumers to repair electronic products?

4. What role can repair, reuse and refurbishment play in reducing premature electronic waste?
5. What regulatory gaps affect the effective implementation of the Right to Repair?
6. Can a Repair–Reuse–Regulate framework provide an integrated model for lifecycle-based e-waste governance?

RESEARCH METHODOLOGY

This study adopts a doctrinal and comparative legal research methodology. It examines legal rules, regulatory frameworks, governmental initiatives and policy approaches relating to Right to Repair and e-waste governance. The study comparatively examines India and the United States because the two jurisdictions demonstrate different institutional and regulatory approaches. The U.S. framework reflects significant state-level variation, while the Indian approach has developed through national regulatory and policy initiatives. The analysis also draws upon the conceptual relationship between Right to Repair, extended producer responsibility, circular economy principles, reparability and planned obsolescence.

CONCEPTUAL FRAMEWORK: FROM WASTE MANAGEMENT TO LIFECYCLE GOVERNANCE

The regulation of e-waste can be conceptualised through a hierarchy of interventions. At the end-of-life stage, recycling and responsible disposal seek to reduce environmental harm. However, interventions at earlier stages may prevent waste from arising in the first place. Generally, the life cycle of an electronic product would be an outline of:



The focus of the traditional e-waste regulation is mainly in the last mile. The second principle of a circular economy is to try and keep the value and usefulness of products and materials as long as possible. This lifecycle is populated with an important place for the Right to Repair. The useful life of products can potentially be extended because of the capacity that it provides in repairing. The fact that a product may no longer be well adaptable to the original user will further delay its movement towards being a waste product. Then Regulation outlines the duties and obligations to ensure that the manufacturers, retailers, repairers and recyclers are engaged in a system responsibly.

RIGHT TO REPAIR: MEANING AND SIGNIFICANCE

The Right to Repair is a general term for consumers' and third-party's access to products' resources to repair them. They can contain rep[air] parts, manuals and diagnostics, special tools, software, and technical procedures.

This concept extends beyond the ease on which the consumers can use.

- **Consumer Protection**

If the customer cannot fix a product, then in some cases they will be forced to replace the product even if there is a minor defect in itself. The economic costs of premature replacement can then be minimised with ease of access to repair.

- **Environmental Protection**

Repair is one way to increase the useable life of products and can decrease the amount of e-products going into waste streams.

- **Competition**

Application of repair information and spare parts may offer repair opportunities for independent repair companies. This can help to decrease the exclusive Internet of Managed Repair networks.

- **Resource Conservation**

Energy, resources are used to obtain the materials used in electronic products. Increasing the product life will cut down the number of times that a new product is to be produced.

Hence the Right to Repair is not only situated between the rules of consumer law, competition, the rights of intellectual properties and rules on product law, but also those of environmental law and product regulation.

RIGHT TO REPAIR AND E-WASTE GOVERNANCE IN THE UNITED STATES

Right-to-Repair Legislation in the United States: Federal and State Developments

The right-to-repair campaign aims to put a stop to monopolists from putting parts, tools, or any other required information behind a paywall so that consumers and independent repairers are able to maintain and repair products such as digital electronics. This agenda has come a long way in the United States, mainly argued in state legislatures and investigated and enforced on a case-by-case basis in the federal courts.

The Federal Landscape

Nixing the Fix was authored by the Federal Trade Commission for Congress in 2021, and heavily influenced the federal position. It looked at the concerns levelled by manufacturers about independent repair and documented the limited evidence to support the three main stated reasons outlined – safety, intellectual property rights and quality assurance. It found 5 key barriers: the products are designed in a way that makes them physically impenetrable for repair, like using adhesives or non-modular construction, software puts serialisation or 'pairs' on parts which means that third party parts no longer can be used, withholding of diagnostic tools and repair documentation, restrictive end-user licence terms, and warranty with conditions that make the warranty dependent on use of authorized service. Congress is recommended to catch up on the legislation by the Commission.

Ever since then the FTC has depended upon the prevailing consumer protection law. It has sent warning letters to eight companies—such as those selling air purifiers and computing hardware—that had warranty text in their products that seemed to run afoul of the Magnuson-Moss Warranty Act in July 2024. The letters focused on warranty void if removed stickers and requirements, such as those that would require use of their original-equipment parts and services for coverage. To date, looking at the information provided by trade sources the Commission has not had open rulemaking concerning repair, and consumer advocates have not received a public reply from the Commission to their petition for open rulemaking on repair in 2023. Though Congress has taken a look at some repair-related bills, including one on digital electronics, none of the bills passed into law in the United States address digital electronics repair.

State-Level Enactments

It is the state that has thus emerged as the key reform baton-wielders. In December 2022, it was first enacted in New York, which Gov. Hochul signed the Digital Fair Repair Act. The law requires companies to ensure that parts, tools and

documentation are made available to independent (IDI) customers and repairers on terms similar to the terms that they provide to their licensed customers. Minnesota, along with California, were next with both enacting in 2024. The California law is unique because it links repair capabilities with bands; repair resources will be made available for 7 years, if the price is above \$100, and 3 years if price is \$50 or more.

This new, 2024 Oregon legislation, which will take effect in 2025, has broadened in scope. It is described as the first to prohibits "parts pairing," which means that software designed by manufacturers is not allowed to cause to unnecessary warnings, make the machine run slower or cause other harm to the machine so it is not desirable to have someone repair it with a non-original part. Colorado has instituted a similar plan, set to be in effect in 2026. The development is relevant, since simply having parts is not a lot of use to repairers once they are installed and software can make the parts unusable.

Points of Contention

There are three questions that continually come up in the law-making process. The term "parts pairing itself: is the first of these. A critics view of the situation is that the software verification wasn't addressed by the New York and California laws, which manufacturers have taken advantage of. The second is cyber security "exemptions". Groups like SecuRepairs say the general repair parts language is too broad, could be used to justify general repair materials withholding and that its Minnesota equivalent should be drafted differently. Colorado's language is preferable, while groups like SecuRepairs have argued that the language is overbroad and that material to compromise security equipment should be exempted. The third one is coverage of the products. Some categories are carved out of the scope of some of the laws, such as (typically) motor vehicles, medical devices, agricultural equipment, and video game consoles, and the scope of enforceable rights differ between the laws, with some granting it to consumers but not to independent shops and others granting it to

independent shops but not to the consumers themselves.

The conflicts are indicative that there is a deeper disagreement among stakeholders. Industry groups including CTIA and the Consumer Technology Association say the sharing of the diagnostic tools compromises security, the use of serialisation would help prevent counterfeit parts and complying with the cost requirements are a disincentive to innovation. Consumer groups question the benefits of restrictions on repair, arguing that they lead to unnecessary waste and replacements, boost costs, and exacerbate e-waste, while security experts state that making it possible for customers to collect and hand over their devices for repairs can disperse rather than focus vulnerabilities.

Implications

As manufacturers rarely make product lines for states, there is also a sort of a national standard, but the most stringent that actually does apply in Oregon, namely the parts-pairing ban. Whether the FTC pursues formal rulemaking or continues with warning letters will largely determine whether this state-driven approach is eventually consolidated federally.

RIGHT TO REPAIR AND E-WASTE GOVERNANCE IN INDIA

RIGHT TO REPAIR IN INDIA

As electronic devices become central to daily life, questions about how long they last, and whether they can be repaired, are attracting growing attention. The Right to Repair movement holds that consumers should be able to have their products mended, by the manufacturer or by independent providers, rather than being pushed toward replacement. In India, the movement has drawn support from consumers who want greater transparency and efficiency in repair services.

Since 2022, the Department of Consumer Affairs has advanced a national Right to Repair initiative covering sectors such as electronics, automobiles, and agricultural machinery. Its aim is to improve access to spare parts, repair information, and independent repair services.

A tool associated with this agenda is the Repairability Index, a scoring approach that indicates how easily a product can be repaired. Such an index usually takes into account the number of spare parts, ease of dis-assembly, access to repair manual and the repair costs, and it reports the index in a numeric score. The higher the score, the easier it will be to repair the product, the lower the score, the harder it will be. The aim is two fold: firstly, to empower the buyer at the time of purchase and secondly to promote repair thinking over disposal, that could contribute to lessen electronic waste.

It has close connection with the debate around designed for failure (planned obsolescence) – an intentionally finite lifespan of a product. There are several descriptions of forms in the literature. Older devices are subject to technological obsolescence when software updates are no longer available or kept up-to-date for them. Physical obsolescence is due to component life. Physical obsolescence occurs when components "go bad" early on. Psychological obsolescence takes place whenever people need to buy something, but the marketing makes them feel like they will be obsolete if they do not proceed up with the purchase. Those who oppose these practices state that these practices increase the cost to consumers, create additional electronic waste (EW) which uses a lot of natural resources and may contain hazardous materials. Manufacturers are not "one size fits all." Some have implemented self-repair schemes, providing real parts and manuals for in-house repair and some have used modular design. Others deny access to parts and/or repair information, usually in the name of IP, safety and device security reasons.

COMPARATIVE ANALYSIS OF INDIA AND THE USA

Both India and the USA want to encourage the development of a more repairable world – their methods are not quite the same and they have differing sets of legislation. Perhaps the most noticeable, and stark, difference has to do with policy making. Americanly, it has been brought forward chiefly by consumer groups and the State

legislatures. Some states, for instance, New York passed its Digital Fair Repair Act that mandates that manufacturers provide parts, tools and documentation to the independent repairer and the end consumer. The Federal Trade Commission has looked at repair restrictions at the federal level and reported to Congress, although none' broad Federal legislation for digital electronics has been adopted. The endeavor in India, however, has been spearheaded via the national government via the Department of Consumer Affairs, and is a set of guidelines and approaches instead of individual state-by-state laws.

The two are also differentiated in terms of their coverage. The U.S. repair laws have focused primarily on digital electronics and other industries related to repairs such as motors vehicles and agricultural equipment have been treated separately. As stated, the Indian programme, will be wide-ranging across various sectors all under one umbrella, such as electronics, automobiles, farm machinery etc.

There are challenges — both opposition and implementation — for both countries. It remains somewhat ironic that in the United States, makers of technology products have stated that opening up the to third parties could involve potential security and safety threats, whereas third-party advocates have disagreed that third-party repair doesn't threaten security. Issues of implementation are more prominent in India as the effectiveness of the policy framework would rely on the way manufacturers, repairers and the regulators would implement this.

It also varies in particularly the repair landscape. There are a number of local technicians and repairer shop in informal sector in India which consumers get service of low cost. In such an environment there may be few occasions where repair is considered a right as opposed to a standard practice. Access to parts and information has been a legal affair, more so in the United States. However, these contrasting experiences imply that there is scope for there to be learning and development between both countries. Well-regulated formal markets can

further support consumer rights and meeting their needs for genuine parts and a repairable environment can provide a glimpse into the possibilities for a low cost, high access repair culture to flourish.

WAY FORWARD

Although there has been increasing interest, legal, economic and technological obstacles are preventing the development of the movement. Any patents or proprietary software can restrict the ability for third-party maintenance, and commercial motivations may drive frequent product changes over using the product for a longer period of time. Also, consumer awareness is an issue as many consumers may not be aware that information is available regarding reparability or repair services are available independent from the manufacturer.

There will thus need to be several fronts of action in order to achieve any progress. First, governments can put the Right to Repair into law by clearly defining responsibilities for manufacturers and making it easy (e.g. letting consumers know which tools and manuals are required to provide spares and repair) and enforceable (e.g. setting up monitoring tools to enforce the obligations on manufacturers). Second, tools like the Reparability Index should be clear and user friendly; and public campaigns to raise consumer awareness of how to use the tools when purchasing items can assist the process. Third, there is a need for backing of independent repair houses. Enhancing local repair systems can provide opportunities for affordable alternatives for the consumer and generate economic opportunities.

Probably manufacturers can contribute as well, for them making the product modular and durable, widening authentic self-repair programs or making information on repairing the product accessible. Security and safety concerns are well-founded and do not need to preclude repair, but could be addressed through appropriate and well thought-out measures such as certifying repairers. There will be a need for cooperation between the policymakers, industry, independent repairers and consumers. Electronic products designed

lifespan could minimizing electronic waste, making them more affordable and provide consumers with more control of products.

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