



## Patent law and circular economy technologies: A legal study under TRIPS, WIPO, and emerging sustainability frameworks

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### Abstract

The CE is tightly intertwined with advanced eco-innovative technologies, including waste-to-resources, recycling, and recycling. However, the global ecosystem is hampered by strong exclusivity of patents and high fees in addition to restrictive IP practices, particularly by multinational enterprises. Thus, the present paper investigates the interrelations of legal and policy frameworks in relation to patents within the context of the circular economy and the TRIPS Agreement, the World Intellectual Property Organization (WIPO) and Initiatives on Sustainable Development, as well as contemporary global Environmental Law. Based on doctrinal and comparative methods of research, the study investigates how certain TRIPS flexibilities, most notably the compulsory licensing and government use of patents, can be used to facilitate the accessibility of technologies of the circular economy to the Global South. It seeks to propose some best practices pertaining to collaborative licensing, open innovation, and state-initiated technology transfer from South Korea, China, Japan, and the United States of America (USA) and the European Union (EU) as international benchmarks of the foregoing. It also attempts to analyse the domestic legal environment of India to ascertain the discrepancies in patent law, environmental law, and circular economy law within India. It was found that the lack of harmonization in patent law with environmental policies within the context public interest, patent pools, voluntary licensing, inter-institutional collaboration, and sustainability is what created the inequitable accessibility to technological innovations within the circular economy. The study ends with the assertion that harmonized patent law and the environment can function as viable instruments to deliver transformative the circular economy.

**Keywords:** Circular economy, patent law, TRIPS Agreement, WIPO GREEN, technology transfer

### Introduction

The development of patent law and governance surrounding sustainability are becoming more and more connected as more countries move towards low-carbon and resource-efficient economic systems. Patent law is an economic and legally sanctioned monopoly which feature of law is designed to protect an individual's right to recover costs incurred in research, development, and innovation of an inventive product. However, during this era of contemporary sustainability, more of its purpose is driven by global imperatives such as the need to foster the diffusion of eco-innovations (Panico, 2022) <sup>[1]</sup>. The fast-paced development of technologies within the circular economy (CE) epitomizes this vacuum. Transformational approaches within CE such as waste/resource conversion, advanced recycling, industrial symbiosis, and innovation in closed loop biodegradable materials are critical for tackling the multifaceted challenges of environmental degradation and fostering sustainable growth of industries (Zisopoulos *et al.*, 2022) <sup>[2]</sup>. CE technologies are designed to extend the life cycle of products, recover, and utilize otherwise wasted materials, and are thus pivotal in the transition towards eco-efficient production and consumption models. Although circular economy (CE) innovations provide a range of public benefits, challenges to intellectual property (IP) policies persist, presenting a unique set of challenges. Multinational enterprises, often located in advanced economies, hold patents to several CE innovations, such as chemical recycling, high-performance biodegradable polymers, and plastic-degrading polymers (Bespalova, 2024) <sup>[3]</sup>. While patents incentivize creativity, they remain the primary barrier to access for developing economies. CE

technologies are desperately needed by developing economies due to their considerable climate challenges. Patents increase costs, restrict local production, slow the diffusion of CE technologies, and create a barrier to access for most developing economies (Ballardini *et al.*, 2021) <sup>[4]</sup>. This stimulates an access dilemma, in which several needed technologies for positive environmental outcomes are locked behind a strict set of IP policies. The dislocated nature of global standards for patenting, enforcement, and rights, as well as their embedding within the broader global trade framework, are governed by the TRIPS agreement, which also addresses the standards of treaty synthesis. Although the TRIPS agreement harmonises the global protection of intellectual property rights, it also provides the Member States some flexibilities which include compulsory licensing, public non-commercial use, as well as the public order and the environment exception. Although initially designed as flexibilities for the protection of public health, they gain significance for the protection and promotion of climate and sustainability technologies (Rognstad *et al.*, 2024) <sup>[5]</sup>. At the same time, global organisations, especially the World Intellectual Property Organisation (WIPO), have increased their climate and eco-focused initiatives. WIPO Green, as one of its initiatives, acts as a global marketplace for the voluntary exchange and licensing of eco-innovations, fostering collaboration and the diffusion of technologies from green innovators to developed countries. These initiatives and WIPO's eco-focused activities mark a significant shift towards sustainability as a legitimate framework within which to govern and manage intellectual property rights. The focal point of this research problem, therefore, lies in the existing constellation of conflicting

legal norms that define and govern the balance and applicability of patent exclusivity, on the one hand, and the dissemination of technologies and innovations that promote the circular economy, on the other. In order to meet their climate change obligations, advance the Sustainable Development Goals (SDGs), and minimise waste, countries also need urgent and ready access to circular economy innovations. However, with the existing intellectual property systems, the balance is tilted in favor of the rights of the patent holders rather than the environment and the broader public (Ballardini & Vesala, 2024) <sup>[6]</sup>. This research aims to address the balance of incentives for public innovation. Access to public innovation is governed by existing frameworks of international sustainable legal orders, WIPO, and TRIPS.

### The goals of this paper include

1. To explore the conceptual and technological underpinnings of circular economy innovation and its intersection with patent law.
2. To assess the international intellectual property law regime, primarily TRIPS and WIPO, with respect to the circulation of CE technology.
3. To explain how international sustainability frameworks, such as the Paris Agreement and the EU CE Action Plan, shape the governance of CE technologies.
4. To investigate the balance between patent protection and the right to use the environment, particularly in the case of the global south.
5. To provide conclusions where the greatest need is identified as the interplay between patent law and the need for circular economy innovation.
6. Conceptual Framework: Patents, Innovation, and Circular Economy Technologies

The Circular Economy (CE) is a paradigm shift that looks to counter linear “take-make-dispose” industrial systems by focusing on the recycling of materials, efficiency of resources, and elimination of waste (Ipaki & Heydarie, 2025) <sup>[7]</sup>. Based on three considerations— (i) designing out waste and pollution by the use of advanced materials and processes, (ii) retaining products and resources through recycling, reuse, and remanufacturing, and (iii) restoring and sustaining the natural systems by regulating the flow of materials—CE transforms the manner in which the business of making goods operates. These tenets assume reliance on technological development, which in turn requires the protection of intellectual property rights (IPRs) for such innovations. CE innovations span a broad spectrum of techno-economic advances. Waste to renewable energy and other waste valorization technologies, for instance bio-refineries, are capable of transforming waste streams into economically useful byproducts. Advanced recycling technologies such as mechanical or chemical recycling that are employed in e-waste, textiles, and closure of loops in other streams of recycling are in operational use (Shabanu, 2025) <sup>[8]</sup>. The design of products using materials that are biodegradable, such as bio-polymers, and eliminate the persistent nature of plastics is a valuable innovation. Technologies of eco- design that promote and are economically advanced by the longevity of a product, modularity, repairability, and low environmental impact, are technologies that are increasingly obtaining more patents to reflect their economic value. European innovation in

Circular Economics (CE) also shows contradictory traits. Enhanced protection under patent law is necessary to reward the sustainable development of technologies and to ensure that inventors realise a positive net present value from their green R&D activities. In contrast, for a successful global transition to a CE, there is a burning need for the rapid and widespread deployment of such technologies (Rantasaari, 2024) <sup>[9]</sup>. Protection can also rationally restrict the access of and increase the costs of licenses to developed countries, which limits the adoption of CE systems at scale in the poorer regions of the world. The tension is aggravated by the principle of the normative public interest in the environment, which states that technologies that are beneficial for the environment should be developed, and also, for the sake of the planetary well-being, should be made available. International law also underpins this paradox. In SDG 12, the UN promotes responsible consumption and production, while in SDG 9 it embraces innovation and the development of infrastructure as a means to sustainability. The Paris Agreement includes the development and transfer of technologies as relevant to the achievement of climate change mitigation and adaptation (Zhuang, 2017) <sup>[10]</sup>. Thus, all these instruments combined recognize CE technologies as to be provided as a public good which requires the availability of positive legal instruments. However, as with all IP, patent law, and particularly under TRIPS, there is a default to exclusivity—the adverse consequences of which are well documented— unless there is an open-ended public interest ‘compulsory licensing’ provision. This introduces a primary contradiction between the environmental sustainability objective and the global rules on IP. Consequently, this study develops a conceptual framework predicated on the intersections of patent incentives, innovations in technology, sustainability, and the environmental public good. The societal purpose of these circular economy technologies will remain unfulfilled until the legal systems of a jurisdiction develop a balance between exclusivity and accessibility. The conceptual tension will be the foundation for an analysis in the sections that follow.

## International IP Framework: TRIPS, WIPO, UNFCCC & Sustainability Standards

### 1. TRIPS Agreement

Determining how to aid protection and regulation of CE technologies, the TRIPS Agreement, along with national regulations, becomes integral. Under TRIPS, each invention needs to pass criteria of patentability: novelty, inventive step, and industrial applicability. These criteria would encapsulate CE technologies, including, for instance, enzyme-based recycling, or chemical depolymerisation processes. Article 7 underlines IP protection in order to promote transfer of IP and added social welfare, while Article 8 provides for measures, which the state might find necessary, aiming for protection of the public interest, including ecological protection (Zampella, 2025) <sup>[11]</sup>. Article 27(2) of TRIPS gives permission to states to exclude certain inventions from patentability should the commercialisation of such inventions be contrary to public order or protection of the environment, albeit such exclusions remain the subject of quite narrow interpretations. What remains pertinent to this discussion is the fact that TRIPS present flexibilities to be used by member states of the WTO such as compulsory and government-use provisions and public

non-commercial use exceptions, which could be of relevance to certain environmental technologies. While being of primary focus in the discussion of pharmaceuticals, these provisions could however legally be extended to CE technologies by providing states with the ability to override exclusivity for the purpose of aid in sustainability, reduction of waste, and climate activities.

## 2. WIPO Frameworks

WIPO augments TRIPS by using soft-law and voluntary mechanisms to foster innovation in climate-positive technologies. Sustainable technology marketplace, WIPO GREEN, accelerates the licensing of sustainable technologies, the collaboration of R&D activities, and the dissemination of climate-positive innovations. The environmental technology transfer guidelines also grant structural support to developing countries by WIPO assisting in the evaluation, selection, and application of various green technologies. Furthermore, the IPC Green Inventory, in relation to climate and sustainability, offers a classification tool for identifying recycling, waste-management, and CE innovations.

## 3. UNFCCC & Paris Agreement Technology Transfer Mechanisms

The UNFCCC and the Paris Agreement stresses the key role of technology transfer for the purposes of mitigating and adapting to climate change. Though not directly IP treaties, they motivate member states to allow and facilitate the diffusion of safe for the environment technologies (Madhumitha, 2024) <sup>[12]</sup>. Technologies of circular economy distinctly reduce the emissions generated from resource extraction, waste decomposition, and from many industrial processes. Hence, access to CE technologies constitutes a relevant part of climate obligations and therefore, the governance of patents becomes a tool for climate policy.

## 4. Emerging Global Sustainability Frameworks

Global CE governance has been profoundly impacted by the EU Green Deal and Circular Economy Action Plan as guiding frameworks for eco-design, waste minimisation, and sustainable product lifecycles (Panico, 2022) <sup>[11]</sup>. These frameworks are moulding patent policy, albeit indirectly, through their scaling requirements on CE-focused innovation. The same applies to the ISO circularity standards (e.g. ISO 59000 series), which support the loss of local CE practice siloing, albeit, increasing the need for technology that is both accessible and interoperable.

### Patent Exclusivity, Green Innovation, and Circular Economy Technologies

Patents serve a foundational function within the promotion of innovation within the circular economy by providing inventors the incentives associated with exclusive rights, enabling them to invest within the higher-risk  $\text{r}\u0026d$  (Zisopoulos *et al.*, 2022) <sup>[12]</sup>. Within the circular economy, there exists a variety of high-tech, expensive, and scientifically advanced research, proof of concepts, and pilot plants related to, for instance, plastic-degrading enzymes, biodegradable polymers, carbon-neutral materials, and energy systems. Patents allow the funding of pilot plants as a certain period of commercial interest exists and the retrieval of the sunk investment is guaranteed. For instance, firms with chemical recycling technologies depend on solid

patent portfolios to acquire chemical recycling technologies from venture capital and obtain partnerships with other firms. On the other hand, patented technologies give rise to a unique set of difficulties, particularly within the circular economy, and diffusing them to developing countries and other and economically constrained regions. For instance, advanced recycling technologies or waste-processing units may charge huge license fees. Large multinationals often tightly constrain themselves to proprietary circular economy processes, hence, severely limiting local adaptations of them or their low-cost replicative processes (Bespalova *et al.*, 2024) <sup>[13]</sup>. Furthermore, to developing countries, the absence of domestic capacities for restricted imports may lead to a paradox of concentration on the very technologies. Hence, the paradox of concentration on the very technologies is exacerbated by the flow of waste. There are specific examples that demonstrate these tensions. Corporations have dense patent portfolios that cover PET-hydrolase enzymes and other similar technologies for enzymatic plastic recycling. Corporations in Europe and East Asia have gasification, pyrolysis, and anaerobic digestion, and other forms of waste-to-energy technologies that are also monopolized. Biodegradable substances such as PHA and PLA biopolymers are patented in thickets that further stifle local production (Ballardini *et al.*, 2021) <sup>[14]</sup>. The same is true for chemical depolymerisation methods in textile recycling, which are also concentrated in a few multinational corporations. New forms of alternative IP have been developed to address these concerns. With patent pools, multiple innovators are able to share rights and simplify transactions. The open licensing approach enables wider diffusion of eco-technologies, through lowered licensing fees, or through a collaborative licensing approach. The green open-source approach advocates the free diffusion of certain sustainable technologies, particularly in the areas of waste processing and eco-design. WIPO GREEN aims to promote voluntary licensing, although this has been uneven. Notwithstanding the aforementioned accomplishments, the market linewidth by highly integrated players restricts access to CE technologies (Rognstad *et al.*, 2024) <sup>[15]</sup>. These players build extensive patent collections, not only to defend the spearhead of innovation, but also to sustain the commanding lead within the CE value chain on a global scale. These players raise the specter of market power, foreclosure, and technology stagnation of critical sustainability technologies. In the absence of strong legal remedies, critical CE technologies will continue to be inaccessible due to patent thrashing, while global environmental challenges of significant scale demand inclusive solutions.

### Technology Diffusion Mechanisms for Circular Economy Technologies

As nations, industries, and local actors acquire new and protected technologies, the implementation of resource-efficient systems becomes possible; therefore, the diffusion of technological resources is critical for the transition of circular economies (CEs). Nonetheless, numerous systemic factors slow the adoption of CE innovations. Advanced recycling, proprietary waste managing technologies, and biodegradable material technologies have exorbitant licensing fees, thereby precluding many developing countries from accessing these resources. Particularly, chemical recycling, eco-design tools, and waste-to-energy

conversion processes have repressive patent silos which allow multi-national corporations (MNCs) to dominate CE markets. Such patent barriers discourage local production and tailored adaptations, and they prolong the socially desirable technologies to be deployed at scale (Shabanu, 2025) <sup>[8]</sup>. To overcome these limitations, the TRIPS Agreement records several flexibilities, some of which may be relevant to the diffusion of CE technologies. These include compulsory licensing, government-use authorizations, exceptions of public use for non-commercial purposes, as well as some of the provisions of Article 30 that allow for limited exceptions to be made with regard to patent rights. Compulsory licensing has been most prevalent within the pharmaceutical sector. Nevertheless, under the TRIPS Agreement, these flexibilities have no sectorial limitations. Hence, in light of evolving equalities as well as climate-related obligations which ESCAP, among other countries, is encouraging in principle, it would not be irrational to invoke TRIPS flexibilities in order to access downcycling, waste extraction, industrial symbiosis, etc (Rantasaari, 2024) <sup>[9]</sup>. CE technologies. Within some restrictions, the TRIPS Agreement strikes a balance between exclusive rights and environmental protection, and, therefore, gives legal ground in enabling access without the approval of the patent owner. When licensing expenses or barriers limit the CW, Compulsory Licensing (CL) emerges as a potential tool for facilitating CE diffusion. Although rarely noted for environmental tech, CL has characteristically strong relevance. CE tech provides important public health benefits, environmental protection, waste decrease, and climate change mitigation. These are all pertinent public interest CL grounds under TRIPS. Monopolisation in primary technologies like pyrolysis reactors, enzymatic PET-depolymerisation reactors, or waste-to-energy turbines. Although political and administrative reluctance are barriers, CL remains a legally robust but neglected tool for unlocking sustainable innovation. In addition to regulatory measures, certain voluntary arrangements are also essential for the rapid spreading of CE innovation. For example, voluntary licensing arrangements, patent pools, and open licensing models allow a number of innovators to share CE technologies, which lowers the transaction costs and helps bypass patent thickets. Patent pools are especially relevant in cases where there are complex CE systems that require multiple patents to interoperate, such as in certain chemical recycling processes that need catalysts, reactors, and process control software from different patent holders. Collaborative open innovation ecosystems, as well as open-source software in sustainable design and green manufacturing, foster the rapid spreading of eco-technologies and collaborative solution finding (Zhuang, 2017) <sup>[10]</sup>. These models also help reduce the dependency on single patent holders, thereby also enhancing local customization and broader participation in CE innovation. CE technology transfer also benefits greatly from public-private partnerships (PPPs). CE technologies can be jointly developed and commercialised by public and private research institutions, facilitating and broadening techno-economic diffusion. For example, PPPs can underpin local recycling, composting, and industrial symbiosis demonstration plants, and help to build local capacities (Zampella, 2025) <sup>[11]</sup>. National innovation ecosystems – which comprise incubators, technology clusters,

universities, and networks of start-ups – also help to lower the nd reliance on foreign patents, by supporting the indigenous innovation needed to adopt CE. National ecosystems, when synergised with patent offices, ministries of the environment, and industry associations, can improve access, cost, and decarbonisation of CE technologies.

### **Comparative and International Legal Perspectives (EU, USA, China)**

Through the observation of multiple jurisdictions, it becomes apparent how the integration of patent law and the circular economy paradigm are interrelated.

#### **1. The European Union**

The European Union (EU) is the first international actor to develop comprehensive CE governance, particularly the sustainable product design, waste reduction and eco-innovation mandates contained within the CEAP. CEAP encourages the funding of R&D, the adoption of green public procurement and the provision of public regulations to support the recycling, remanufacturing and resource efficient circular economy (Madhumitha, 2024) <sup>[12]</sup>. The EU fosters cooperative research and strategic partnerships, such as Horizon Europe, which finances CE technology with the stipulation of open access and shared research. The establishment of patent pools, voluntary licensing and cross-border innovation initiatives focused on the recycling of plastics, eco-design and industrial symbiosis, signal the EU's willingness to balance the protection of IP with sustainable diffusion. The EU fosters eco-innovation through financial aids and soft loans, which further removes the IP barriers for the entry of eco-innovations into the CE.

#### **2. The United States**

The United States employs a hybrid model which integrates robust patent protection with voluntary approaches to foster environmental innovation. The Clean Tech Patent Program and GreenXchange have facilitated the cross-licensing of patents in the areas of recycling, renewable materials and waste management (Ballardini *et al.*, 2021) <sup>[4]</sup>. The US has a strong civic innovation tradition through the development and distribution of open source environmental monitoring and composting systems and repair tools. The US enjoys strong patent protection and strong IP enforcement. This has created an environment in which voluntary diffusion of CE technologies thrives, especially in the case of academic-industry partnerships and associated federal financing. The lack of a comprehensive national CE policy, however, means that diffusion of CE technologies will continue to be largely market driven and will depend on the engagement of the private sector.

#### **3. China**

China has incorporated Circular Economy (CE) innovations into the national regulatory system through the Circular Economy Promotion Law and its Waste Law (2008) which focuses on all sectors and industries with a proactive, strong state regulatory approach focused on industrial policy (Rognstad *et al.*, 2024) <sup>[5]</sup>. With the state entering technology localisation, domestic firms are able to adapt and produce CE technologies from abroad under a flexible licensing model. Publicly funded state-supported R&D and public procurement further scale CE innovations. China obligates firms to rapidly accumulate green patents with a licensing model that encourages domestic usage. China is

characterized by a high degree of patenting and a high degree of technology diffusion which the state encourages, creating a hybrid model of CE.

### Lessons for India and Developing Countries

Comparative analysis shows that CE technology diffusion is most advanced in CE jurisdictions that are characterized by a strong patent system, public investment and state-sponsored innovation. Developing countries including India, would benefit by adopting hybrid IP models which allow sufficient protection, while removing barriers to access key CE technologies. Instruments such as patent pools, co-creation of CE technologies, voluntary licensing, TRIPS flexibilities used strategically, can all be catalysts for socio-economic CE transitions at scale.

### National Legal Context: Patent Law and Circular Economy Technologies

Differentiated as an engineering discipline, the circular economy as an integral part of engineering technologies have started to gain relevance in India due to the confluence of high waste generation, resource scarcity, and sustainability promises. However, the dissemination of the technologies is severely limited in the patent law challenges. Biotechnological waste recycling, enzymatic recycling, and muffins technologies have added complexities in patentability assessments. There is also a lack of expertise and specialized training in CE jurisprudence by Indian patent offices. The overlap of the patent law, environment oversight, and management of waste namely Solid Waste Management Rules, Plastic Waste Management Rules, Bio-Medical Waste Rules, and E-Waste Management Rules is still in its infancy stage. These statutes encourage recycling and recovery of resources but fail to offer freedom to operate and to license the patented technologies to meet compliance (Ballardini & Vesala 2024) <sup>[6]</sup>. Hence, municipalities, and other public and small private entities are unable to adopt these technologies due to lack of access and high dependency to unvetted augmenting materials. Another issue is the dominance of CE technologies by multinationals. Pyrolysis, advanced recycling and production of biopolymers machineries are monopolized by the foreign firms, inhibiting local production. Entry of Indian innovators in these oligopoly markets collapses due to unregulated intangibles, aggressive patenting and broad patent monopolies held by the global innovators. Moreover, India has no coordinated policy which seeks to align its IP law with CE objectives (Shabanu, 2025) <sup>[8]</sup>. Although the National Resource Efficiency Policy and the Waste to Wealth Mission sing the praises of technological innovation, none of these Policies systematically incorporate IP policies, including compulsory licensing, patent pooling, or government use authorizations. Such policy incoherence results in disjointed implementation, and delays in the diffusion of technologies and in the development of opportunities for domestic innovation.

### Case Study: Chemical Recycling of Plastics

Recently, the pyrolysis of plastic waste streams has come to be considered one of the more promising CE technologies to address the conversion of hard-to-recycle plastic materials to fuels and/or other raw materials. The technology, however, is substantially patented by primarily multinational companies located in the European Union, the

United States, and Japan. Patent landscapes indicate considerable breadth of coverage over the design of pyrolysis reactors; the catalysts; process optimization and control methodologies; and the design of purification systems for the process outputs. This concentration of ownership and control results in significant licensing costs and access issues in the developing world (Rantasaari, 2024) <sup>[9]</sup>. The licensing situation in India and other comparable countries is particularly problematic. In-country manufacturers are unable to obtain the requisite rights to design and “cost” manufacture pyrolysis reactors. Landfill diversion and the incorporation of pyrolysis systems by municipal solid waste management authorities is stymied, as well, by exorbitant prices and restrictive licensing conditions for the advanced systems. The lack of technology transfer is further impacted by the lack of local adaptation as a result of the restrictive confidentiality agreements. The result in India is a continued reliance on inefficient thermal processes, mal-integration of chemical recycling in the management of the country’s waste, and slow assimilation of a circular economy for plastics. There are still considerable sustainability benefits to chemical recycling, however, chemical recycling remains in India an unaddressed and inefficient necessity (Zhuang, 2017) <sup>[10]</sup>. Greater and more effective access to these patented inventions in India, as an example, through modifications to licensing, compulsory licensing, or collaborative research and development will enable India to increase the efficiency of plastic recovery and the concomitant emissions reduction.

### Policy and Legal Harmonisation under Emerging Sustainability Frameworks

As the circular economy is currently unfolding, there is an immediate need to strengthen the interaction between patent law and the legal frameworks for the environment. It is especially true for India’s patchwork legal regime, which needs to support IP rights legal frameworks on the circular economy, rather than act in a silo. Easing the access for CE patents \ by the proposed changes to the Patents Act is possible. Reconceptualizing the legal frameworks for the environment (the environment protection act in this case) with public interest ideology on the protection of the environment in the Patents Act, and introducing greater flexibility for access to civil technologies is possible (Zampella, 2025) <sup>[11]</sup>. Like patents with a green label, which have been in place for some time now, India is likely to gain CE foresight from a fast patent examination track. India introducing a green patent classification administered by a public office would also encourage research in the CE-related category of patents. Public legal norms could support the CE by procuring CO<sub>2</sub> reducing technologies and strategies for CE related technologies to public legal norms, and support the legal norms applauded by civil society (Madhumitha, 2024) <sup>[12]</sup>. Integrating IP to the Swachh Bharat Mission, the Waste to Wealth initiatives, the Smart Cities Mission, and the National Resource Efficiency Policy would vision India’s patent law with the CE initiatives. IN this vision, India will strengthen the CE innovation, harmonize access, promote a sustainable and legal coinline.

### Conclusion

As the circular economy continues to evolve, the strengthening of a “flexible” patent system becomes necessary. Although the promotion of strong patent rights

may be directly linked to incentivization of “green” innovations, on the other hand, the effective “flexibilities” of the patent system ensure equitable access to a range of technologies essential for CE for the greater social good of the environment. Consequently, the need for equitable IP governance in sustainable development requires an unfettered balance of exclusive IP rights and a rapid, widespread distribution of CE technologies. TRIPS, WIPO, and International Sustainable Development remain essential for fostering equitable access to the ‘technological commons,’ and supporting the innovation needs of the Global South. In the final analysis, the effective integration of patent law in the areas of circularity and climate change, accompanied by the necessary legal reforms and policy adjustments to the system, would make patent law a facilitator rather than an obstacle for sustainable development.

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