GREEN TECHNOLOGY AND IPR: TACKLING CLIMATE EXTREMES IN INDIA

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Abstract

The innovations on Green Technology products is central in dealing with climate change and achieving sustainable development goals. This paper explores the twofold influence of Intellectual Property Rights (IPR) on diffusion and creation of greener technology specifically to India. Although a well-developed IPR system encourages innovation by offering protection to R&D inputs, they lead to limitations in transferring of these technologies, especially to the less endowed technologically and financially. The causes of the current problems relate to search for innovative incentives for reward mechanisms by governments, which touches on issues like compulsory licensing, use of patent pool and open source models of innovation, among others. Examining the cross-country and domestic initiatives as contextualised by the Paris Agreement and the TRIPS Agreement, the paper assesses policy metrics and international cooperation strategies linked to green technology transfer. In doing so, it also compares the IPR regimes in the United States, Australia and the European Union with that of India. The study demonstrates the necessity for policies and coordinate the frictions that stem from IPR and technology availability. Therefore, stakeholders can be in a position to develop green technologies that address sustainable development through the adoption of collaborative frameworks and development of innovative legal mechanisms.

Keywords: Intellectual Property Rights, Green Technology Diffusion, Alternative Models, International coordination, Sustainable Development

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1. Introduction

Climate extremes in India have caused the loss of human lives,¹ livestock,² crops³ and buildings.⁴ India is extremely hit by the adverse effects of climate change be it the pollution in Delhi,⁵ the landslides in Wayanad⁶ or the monsoon floods.⁷ Such situations can be tackled by using green technologies. Intellectual Property Rights (IPR) plays a pivotal role in the development and dissemination of green technology by balancing innovation incentives with the need for widespread accessibility. Green technology, which encompasses innovations like renewable energy systems, carbon capture technologies, and sustainable materials, is critical for addressing climate change and fostering sustainable development. IPR frameworks significantly influence both the pace of innovation in green technology and the extent to which these technologies can be accessed globally. However, IPR is quite unclear when it comes to providing access to green technologies.⁸

One argument by the companies who favour strong IPRs has often been that it would enhance the dynamic efficiency.⁹ There are big energy players in the global market who strategically acquire the patents over new technologies and put them on hold, which allows them to engage in unfair commercial negotiations.¹⁰ This exclusivity encourages private-sector R&D and the commercialisation of innovative technologies, particularly in

¹ Preetha Banerjee, "Deaths due to extreme weather events rose 18% in India in just 3 years: DTE-CSE analysis", *available at:* https://www.downtoearth.org.in/climate-change/deaths-due-to-extreme-weather-events-rose-18-in-india-in-just-3-years-dte-cse-analysis (last visited on January 16, 2025). These events claimed 3,238 lives.

² Mohd. Imran Khan, "India Faced More Extreme Weather Events in 2024, Higher Damages Than Last Year: CSE Report", *available at*: https://www.newsclick.in/india-faced-more-extreme-weather-events-2024-higher-damages-last-year-cse-report (last visited on January 16, 2025).

³ *Ibid.* 3.2 million hectare (mha) of crops have been destroyed.

⁴ *Ibid.* 235,862 houses have been destroyed.

⁵ Aakash Hassan, "Pollution in Delhi hits record high, cloaking city in smog", *The Guardian*, Nov. 18, 2024. *available at*: https://www.theguardian.com/world/2024/nov/18/pollution-in-delhi-hits-record-high-cloaking-city-in-hazardous-smog (last visited on January 16, 2025).

⁶ Imran Qureshi and Ashraf Padanna, "India landslides kill 120 and trap dozens", *available at:* https://www.bbc.com/news/articles/c51y7k2y7v10 (last visited on January 15, 2025).

⁷ "Monsoon floods kill dozens in India, thousands in relief camps", available at: https://www.aljazeera.com/news/2024/9/2/monsoon-floods-kill-dozens-in-india-thousands-in-reliefcamps (last visited on January 15, 2025).

⁸ Rohan Cherian Thomas, "A Legal Analysis of Transfer and Compulsory Licensing of Green Technology in India to Mitigate Climate Change" 8 *Environmental Law and Practice Review* 60 (2023).

⁹ Janusz A Ordover, "A Patent System for Both Diffusion and Exclusion" 5 Journal of Economic Perspectives 43 (1991).

¹⁰ Pradeep S Mehta, "Green Implications of Compulsory Licensing", *Financial Express*, Sept. 10 2012, *available at:* https://www.financialexpress.com/india-news/green-implications-of-compulsory-licensing/1000252/ (last visited on January 15, 2025).

high-investment areas like solar energy, wind turbines, and advanced battery systems. While some authors argue that clean technology transfer from developed to developing countries is occurring despite the presence of IPR, they cite the example of nine clean technology transfers between various countries within a single year leading up to the Copenhagen talks in December 2009 as evidence of this trend.¹¹ Others argue that IP may not be the ideal policy to promote innovation owing to the double externality problem consisting of environmental and knowledge externalities and claim that strong patents facilitate technology diffusion to developing countries through imports, FDI and licensing but they have negligible impact on diffusion to lowest income countries, and found it difficult to provide clear evidence that suggests that patents positively favour innovations apart from the chemical-related sectors.¹²

Countries like the United States and Australia, which have robust patent regimes, have seen significant advancements in green technology, with firms leveraging patents to secure market leadership. In these countries, policies like tax incentives for green R&D and expedited patent grants for environmentally sustainable technologies further encourage innovation. However, the exclusivity provided by IPR can also create barriers to the diffusion of green technology, particularly in developing countries that lack the financial resources to access patented technologies. High licensing fees, the concentration of patents in developed nations, and restrictive trade practices hinder technology transfer to regions that most need green innovations for climate adaptation and mitigation. For example, India, despite its robust domestic patent framework under the Patents Act, 1970, faces challenges in accessing advanced renewable technologies due to high costs imposed by patent holders in developed countries.

While the promotion of IPR as a key to unlocking green innovation and guaranteeing access to enabling technologies is a well-discussed topic, there are still essential blind spots left unanswered. While other works demonstrate improved research and development driven by IPR controls, there is scant research on how these rights structure disparities in technology distribution, particularly in capturing developing

¹¹ Eric L.Lane, "Clean Tech Reality Check: Nine International Green Technology Transfer Deals Unhindered by Intellectual Property Rights" 26(4) *Santa Clara Computer & High Technology Law Journal* 534 (2010).

¹² Bronwyn H. Hall and Christian Helmers, "The Role of Patent Protection in (Clean/Green) Technology Transfer", 26(4) Santa Clara Computer & High Technology Law Journal 487 (2010).

countries. Also, the applicability of different models including patent pools, compulsory licensing and open-source to regulate the overwork of patents and at the same time meet the social demands for innovation requires further research especially in the Indian context. These mechanisms have been suggested as the feasible solutions, although only few have explored their real-time application, cost effectiveness, and lifelong consequences in India.

2. The Impact of IPR on Green Technology Development and Access

Patent and Trademark are the two important components of IPR. There are many arguments from both sides, surrounding the debate around IP. The foremost being that it acts as a catalyst and boosts innovation by providing exclusive rights over the newly innovated products. Innovating a product requires huge capital investment in Research and Development (R&D) and such investment will be made only when the marginal benefit from innovating is more than the investment made. Once the product is patented, it can be commercialised by the innovator and he can cover up the sum he invested in the R&D of the product. In the absence of IPR, the innovators would be inclined towards inventions that they can keep secret.¹³ If a firm has a patent for a particular product and another firm comes with an improved version of that product, the latter can be patented. Permitting early patenting can retard technology development. Patenting does not truly serve any social cost as it is intended towards monopolising a product or prevent others from copying the invention.¹⁴

Studies highlight that patents on technological advancements often impede widespread adoption by creating monopolistic practices. For instance, research by Jonathan M. W. W. Chu (2013)¹⁵ shows that while IPR positively influences non-technological rights by protecting innovation, it has a more restrictive impact on technological rights due to the costs and confidentiality requirements associated with patents. Such barriers disproportionately affect low-income countries, limiting their capacity to integrate critical green technologies into their economies.

¹³ Richard A. Posner, *Economic Analysis of Law* 403 (Aspen Casebook Series, 9th ed., 2014).

¹⁴ *Id.* at 405.

¹⁵ Jonathan M. W. W. Chu, "Developing and Diffusing Green Technologies: The Impact of Intellectual Property Rights and Their Justification" 4(1) Washington and Lee Journal of Energy, Climate, and the Environment 53-102 (2013).

To address these challenges, mechanisms like compulsory licensing and patent pools are being explored to balance IPR protections with accessibility. Compulsory licensing, permitted under TRIPS flexibilities, allows governments to authorise the use of patented technologies without the consent of the patent holder, particularly in cases of public interest. India has used such measures selectively to promote affordable access to essential technologies. Similarly, patent pools, where multiple patent holders share rights to their innovations, are being implemented in sectors like renewable energy to lower costs and encourage broader adoption. Alternative models like open-source green technology have also gained traction. These frameworks encourage collaboration and shared innovation by making green technologies freely available, reducing barriers to entry for developing nations. However, critics argue that open-source models may undermine incentives for private-sector investment in high-cost R&D.

The intersection of IPR and international climate agreements also shapes the global landscape of green technology access. Agreements like the Paris Agreement stress the importance of technology transfer to meet climate goals, but implementation remains uneven. Developed countries dominate cross-border patenting, as evidenced by Wei Yang, Xiang Yu, *et.al.* (2021),¹⁶ which observed that globalisation has increased the need for cross-border IP protections, creating a skewed distribution of green technology in favour of wealthier nations. Efforts to address these disparities include the promotion of cooperative frameworks like the UNFCCC Technology Mechanism, which seeks to enhance technology transfer and capacity building. Nevertheless, the success of such mechanisms depends on equitable global coordination and the willingness of developed nations to ease restrictive IPR policies.

3. Judicial Approaches

In *Ferid Allani* v. *Union of India & Ors.*,¹⁷ the court was concerned with the question of the patenting of a computer implemented method i.e., the method of accessing information using computers. The Indian Patent Office (IPO) had earlier rejected Allani's application stating that it relates to mathematical formula or business method and hence

 ¹⁶ Wei Yang, Xiang Yu, *et.al.*, "Mapping the landscape of international technology diffusion (1994–2017): Network analysis of transnational patents" 46 *The Journal of Technology Transfer* 139 (2021).
¹⁷ Ferid Allani v. Union of India & Ors., W.P.(C) 7/2014.

it shall not be patentable under Section 3(k).¹⁸ The applicant then appealed by stating that his invention invoked technical effect and has solution more than an algorithm or abstract idea. The Court held that there should be no automatic ban on patentability of computer-related inventions under Section 3(k) if inventions have one or more technical effects. The Court reversed the decision to reject the application by stating that India's patent law must comply with international norms to encourage advancement in technological disciplines. This decision which underlines the necessity to encourage technological development could indicate a more favourable position for innovators in green technology in India and consequently improve the country's efforts toward sustainable development together with enhancing competitiveness at the global level.

In the case of *Bayer Corporation*,¹⁹ the Court gave a nod to grant of the country's first compulsory license under Section 84.²⁰ Bayer Corporation, the manufacturer of the anti-cancer drug "Sorafenib Tosylate" (Nexavar) had priced the drug at a very high level and therefore hardly any patients across India could afford the drug. Natco pharma then sought a compulsory license claiming that Bayer has not complied with the provisions that the patented invention should be available for use at an affordable price and it should be working within territory of India. The compulsory license was not set aside and Natco was permitted to manufacture a low-cost copy of the compound. The court stated that the concerns for public interest for legitimate access to necessary lifesaving products was more important than pure patents. Thus, the judgement paved the way in adopting compulsory licenses for environmentalism and for better access to green technologies.

The case of *Novartis* AG^{21} relates to the rejection of an application by Novartis for a patent on its anti-cancer drug "Glivec". The controversy was concerning Section $3(d)^{22}$ which prohibits the patenting of modifications to known substances unless these modifications afford better therapeutic cure. Novartis maintained that "Glivec" was a new invention while the Indian authorities held that it was only an improvement on a known molecule. The Supreme Court affirmed the rejection on the grounds that granting a patent

¹⁸ The Patents Act, 1970 (Act 39 of 1970), s. 3(k).

¹⁹ Bayer Corporation v. In Union of India, W.P.(C) 1323/2013.

²⁰ The Patents Act, 1970 (Act 39 of 1970), s. 84(1)(c).

²¹ Novartis AG v. Union of India, AIR 2013 SC 1311.

²² The Patents Act, 1970 (Act 39 of 1970), s. 3(d).

to such minor inventions would reduce the availability of cheap drugs by putting a damper on generic manufacturing. In case of green technology, the judgement sets the legal framework by categorically setting high standards for green technology patents and incorporates the tool of rewarding innovation that provides significant gains in environmental legislation; therefore, the existing technology is advanced with the goal of becoming sustainable.

These rulings reconfirmed India's stance to strike a fair ground between owners of patents exclusive rights and the need to preserve and promote public health especially under the advantages permitted by TRIPS. For green technologies, these rulings guarantee that only true innovation will receive patent monopoly thereby encouraging competition that makes available various green technologies needed in combating climate change impacts. However, sufficient attention is often paid to the issue of how innovative incentives can be provided while avoiding negative effects on public welfare.

4. International Coordination

4.1. The Paris Agreement

The Paris Agreement signed in 2015 marks an important stage of international climate governing as it encourages the countries to make commitments to decrease climate change. It is fundamental to such areas of green technology and IPR because it aims at achieving access as well as incentives around the world. The subject of technology development and transfer to help countries fulfil their Paris climate commitments is underlined in Article 10 of the Paris Agreement. The developed countries are being encouraged to increase cooperation in extending the access technology, as well as technology transfers while respecting IPR thereby injecting technology within the climate finance and capacity-building regimes.

A major consequence of the Paris Agreement is that there is a growing global market for green technology owing to national pledges for the reduction of GHG emissions. The submission of increasingly ambitious NDCs²³ under the Agreement has driven the enhancement and advancement of green technological solutions that are used in systems like renewable energy, carbon capture and storage and energy efficiency. All these trends have enhanced the function of IPR to facilitate the spread of technology

²³ Nationally Determined Contributions.

besides protecting the economic rights of inventors. The Agreement has facilitated innovation in green technology by anchoring climate change goals on innovation needs. Nevertheless, it does not openly change IPR systems, relying on national governments and multi-lateral processes to resolve possible tensions between the protection of proprietary assets and the need for access on a large scale.

Especially the developing countries have stressed the need for an appropriate balance to be achieved between IPRs and access. The Paris Agreement also recognises this conflict through recognition and encouragement of cooperative approaches such as the Technology Mechanism under the UNFCCC in relation to technology transfer although bearing in mind IPR systems. Such mechanisms help to erase barriers imposed by high licensing charges and rigid patent conditions and restraints that hamper green technologies access within developing countries. Further, the decision that accompanies the Agreement urges increased support to innovation, including through the Green Climate Fund, which may potentially offer sources of funds whereby they can buy or build such green technology in these places.

4.2 The TRIPS Agreement

The provisions of the Agreement on TRIPS²⁴ have a great impact on green technology IPRs to determine the framework for innovation and technology transfer systems worldwide. The TRIPS agreement was accepted by the developing countries in exchange for better access to the developed markets where they can sell their agricultural products.²⁵ The concern sets the basic level of measures which shall be taken by WTO member countries to protect IPR, which in turn has paved way for enhancing the IPR regimes across the world.

It has synchronised the IPR standards by eliminating differences in protection of patents particularly those on green technologies. This has promoted innovation in the application of renewable energy, the use of water, and sustainable agricultural technologies to inventors because of the certainty of rights and possible innate returns on the inventions. Nonetheless, the trade-related provisions have elicited debates over

²⁴ Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994.

²⁵ Mercedes Campi and Marco Due nas, "Intellectual Property Rights, Trade Agreements, and International Trade" SSRN Electronic Journal (SSRN, 2017), available at: http://dx.doi.org/10.2139/ssrn.3030826 (last visited on January 14, 2025).

availability of technology, especially in the developing and LDCs, given complexity of affordability as well as infrastructural requirements for green technology. Increased patent rights make local adaption and innovation difficult given high licensing fees, and restricted access to know-how.

The deal also provides for compulsory licensing so that the countries could effectively avoid patents during crises such as environmental disasters. This flexibility, however, has been rarely used in the green technology sector, mainly because of the uncertainties regarding its use and opposition from owners of patents. Similarly, the extended measures of the subsequent trade agreements known as the "TRIPS-Plus" have further deepened the inequalities by providing more stringent IPR protection than those mandated by the TRIPS deal. These measures constrain the extent to which developing nations can use flexibilities to import and tailor green technologies for their markets.²⁶

However, critics argue that TRIPS can decrease the investment in developing nations.²⁷ This is because weak IPRs can decrease the investment flowing in a country because when a firm discovers that its property rights are in a vulnerable situation, it tries not to involve in Foreign Direct Investment with that country.²⁸ Further, the lack of precise implementation procedures and monitoring frameworks has produced a disparity and frequently insufficient technology transfers. Solving these issues entails fine-tuning of the TRIPS provisions so that they address conflicting requirements of IPR protection and global environment needs, stress on cooperative frameworks, and the efficiency of technology transfer activities.

5. Other Alternate Models

There are other models, different from conventional IPR as open licenses, compulsory licenses, patent pools, that can be considered possible solutions for the problems that the more traditional models present, mostly in areas like green technology, health, and computer sciences. These models seek to promote innovation while at the

²⁶ Richard Newfarmer (ed.), "Trade, Doha, and Development: A Window into the Issues", 36 (The World Bank, Trade Department, 2006).

²⁷ Jamie Feldman, "Compulsory Licenses: The Dangers behind the Current Practice", 8 *The Journal of International Business and Law* 137 (2009).

²⁸ Robert Bird and Daniel R. Cahoy, "The Impact of Compulsory Licensing on Foreign Direct Investment: A Collective Bargaining Approach", 45(2) *American Business Law Journal* 284 (2008).

same time making the innovation solution and resources more open. However, that can be done both as opportunities and threats in defined manners.

5.1. Compulsory Licensing

Compulsory licensing falls under Article 31 of the TRIPS and it allows the government to give permission to the use of inventions covered under patents, even if it goes against the owner's wish most commonly for the benefits of public interest.²⁹ It can be granted by the Indian Government if the product is not worked within three years of the grant of the patent.³⁰ Gupta, R. R. (2011)³¹ describes the policies of Compulsory Licensing under TRIPS to promote GTDD both in developing nations such as India and China. It suggests that strict IP protection regimes in developed nations compromise affordable access to key climate-friendly technologies to developing nations. It discusses how compulsory licensing can help speed up the acquisition of cheaper and cleaner technologies, lower emissions, and stimulate further innovation. The TRIPS does not provide for any such standards of non-working but the action is taken by the Indian government by applying the provisions of the Paris Agreement.³² India and China both have contended that the TRIPS provision dealing with compulsory licensing should include ESTs too.³³ Further, the World Bank also suggests that it can be helpful in boosting green growth in low-income states.³⁴ Over the course of TRIPS, this model is especially suitable in case of emergency, for example, access to needed medicines during the pandemic. For example, due to compulsory licensing, India ensured the availability of cheap medicine that saved people's lives. Although it guarantees crucial technology access, its application raises legal concerns because, for some individuals, cross-reference is equivalent to theft of ideas and innovations, as protected by patents.

²⁹ Daniel R. Cahoy, "Confronting Myths and Myopia on the Road from Doha", 42 *Georgia Law Review* 131 (2007).

³⁰ The Patents Act, 1970 (Act 39 of 1970), s. 84(1)(c).

³¹ Rishi R. Gupta, "Compulsory Licensing in TRIPS: Chinese and Indian Comparative Advantage in the Manufacture and Exportation of Green Technologies", 12(3) Sustainable Development Law & Policy 21 (2012).

³² The Paris Convention for the Protection of Industrial Property, 1884, art. 5(4).

³³ Copenhagen Economics and The IPR Company, "Are IPR a Barrier to the Transfer of Climate Change Technology?", 22 (2009).

³⁴ World Bank, Inclusive Green Growth: The Pathway to Sustainable Development, 2012, available at: https://hdl.handle.net/10986/6058 (last visited on January 15, 2025).

It not only saves the cost which firms put in to get their product patented but also the cost of inventing around the patents of their rivals, and may lead to an increased welfare benefit but it would encourage them to keep their innovation secret.³⁵ Further, the less developed countries find no-advantage in administering and enforcing the IPRs, especially in a scenario when most of them belong to the developed countries.³⁶ It can prove to be useful to provide access to essential medicines but the current framework of compulsory licensing in India is too complex and time consuming.³⁷ The law controlling compulsory licenses must be made less ambiguous, more objective, and overall more stringent. In India's socio-economic context, a large saving with respect to renewable energy technologies and pollution control mechanisms could be enough bring a larger adoption of the respective technologies. It helps address India's climate targets under international treaties by addressing the bouyant citizens' interests and rights, allowing local industries to adopt enhanced green measures. Further, compulsory licensing can spur local production, create employment, and increase self-reliance in greener technologies apart from contributing towards economic development and meeting social, economic, and environmental needs without unnecessary import dependence.

There is no evidence to suggest that compulsory licensing can disincentivise Green Technology development.³⁸ India has clarified its stance to use this mechanism in Green technology if the rates demanded by the patentee are not reasonable.³⁹ However, even though the option of compulsory licensing is available to the Government of India, it may not easily opt for it for the fear of losing Foreign Direct Investment (FDI). It is not viable for India because the production capacities of the country cannot match with the tech giants. Additionally, it may lead to sanctions by other countries and by private corporations. There are certain Investment agreements like the Bilateral Investment Treaty which also prohibits compulsory licensing.

³⁵ Pankaj Tandon, "Optimal Patents with Compulsory Licensing", 90(3) Journal of Political Economy 485 (1982).

³⁶ Marshall A. Leaffer, "Protecting United States Intellectual Property Abroad: Toward a New Multilateralism", 76 *Iowa Law Review* 281 (1991).

³⁷ Dipika Jain and Jonathan J. Darrow, "An Exploration of Compulsory Licensing as an Effective Policy Tool for Antiretroviral Drugs in India", 23(2) *Health Matrix* 425 (2013).

³⁸ Qin Qian and Ren Yanying, "Research on the Construction of Compulsory License System for Green Technology Patent in China", 24 *Higher Education of Social Science* 19 (2023).

³⁹ Government of India, "The National Manufacturing Policy, 2011", *available at*: https://pib.gov.in/newsite/PrintRelease.aspx?relid=76843 (last visited on January 17, 2025).

5.2. Open Source Licensing

Open source Licensing allows patents, knowledge and other content to be used under certain quality of conditions for further innovation. Used mainly in software development, this type of model encourages international cooperation and levelling of technology resources accessibility. In the field of green technology, open licensing can make a quick path to the adoption of renewable energy solutions. For instance, when Tesla elected to release its patents it did so with the goal of spreading awareness of electric automobiles.⁴⁰ Narendran Thiruthy (2017)⁴¹ critically examines the viability of open source as an alternative to Intellectual Property Rights while arguing that open source brings an idea of social production but the reliance on private property and business interests prove to be its limitation. Although the labour may go in vain, it may be used to initiate a price control. Open source can emerge as an alternative to the IPR if the property relationship is restructured. However, critics suggest that the proponents of open licensing may be mistaken in their estimates for, while open licensing enhances sharing, it weakens incentives for private R&D investments because the companies may not be willing to invest big resources for their exclusive juicy rewards.

In the Indian socio-economic setting where factors such as cost and availability are very important, open source models will spur uptake of renewable energy and environmentally friendly approaches. For instance, in the case where green technology innovation is adopted, allowing local entrepreneurs and SMEs full access to adopting this technology without costly licenses makes this process an easy one thereby boosting diffusion. This approach helps to consolidate clean energy in India, develop young green start-ups, and encourage community initiatives for creating sustainable economic growth and environmental conservation to ensure equitable access to the existing and advanced technology from lower socio-economic background as well.

5.3. Patent Pools

The economics of innovation is often highlighted while examining the present IPR framework and awarding prizes after attaining a successful level of innovation and

⁴⁰ Jerry Hirsch & Tiffany Hsu, "Elon Musk opens up Tesla patents; it 'isn't entirely altruistic", *Los Angeles Times*, June. 12, 2014, *available at*: https://www.latimes.com/business/autos/la-fi-hy-elon-musk-opens-tesla-patents-20140612-story.htmla (last visited on January 15, 2025).

⁴¹ Narendran Thiruthy, "Open Source - Is It an Alternative to Intellectual Property", 20 Journal of World Intellectual Property 68-86 (2017).

patent pools are recommended as an alternative to IPRs.⁴² Patent pools refer to cooperation between multiple patent owners who deposit their patents in one pool to promote licensing for many by many at less expensive rates. They are especially popular in sectors that rely on pioneering solutions such as telecommunication and renewable power. For instance, photovoltaic patent pools may lower the cost of wind power to developers. Nonetheless, experience with patent pools has shown that their performance highly covets the extent of the governance mechanism, distributive justice of the gross income, and interaction of the relevant stakeholders. In the absence of a set of clear rules for their formation and functioning, there is a possibility of monopolistic activities in pools. Patent pools in India would go a long way in improving the usage of green and healthcare technology because multiple patentees license out their technologies in one pool. In sectors such as renewable energy and phased medicines where affordability and speed of implementation forms a basis, consolidation of patents comes with added benefits of cutting costs and legal encumbrances. For instance, forming a green technology patent pool may help reduce costs for manufacturing solar panels, thereby increasing usage in, rural electrification initiatives.

6. Comparative Analysis

The analysis of IPR frameworks for green technology in India as well as other countries shows a set of both similarities and differences concerning their focus, enforcement mechanisms and openness. The focus in India is the socio-economic and equitable aspects of innovation as well as using compulsory licensing under the Indian Patents Act, 1970 to drive development of affordable solutions for green technology, particularly as it relates to climate change adaptation. India has thus put in place general policies but also sectorial policies aimed at green innovation at home through provision of subsidies and incentives. The overall IPR application filing has increased from 601789 in 2022-23 to 635508 in 2023-24, indicating an overall increase of 5.6%.⁴³ Nevertheless, there are some contentious issues, including weak R&D capacities, as well as the problem of enforcement.

⁴² Jerome Reichman, Arti K. Rai, *et.al.*, "Intellectual Property and Alternatives: Strategies for Green Innovation, Energy", *Environment and Development Programme Paper* No. 08/03 (2008), *available at*: http://dx.doi.org/10.1093/acprof:oso/9780199660759.003.0012 (last visited on January 13, 2025)

⁴³ Government of India, "Annual Report 2023-24", 1 (Ministry of Commerce and Industries, DPIIT, 2023).

6.1. European Union

The European Patent Framework that exists under European Patent Convention (EPC) is still considered less stringent in comparison to Indian patent laws primarily because of the differences in the standard of examination, and enforcement procedures. The European system enables the registration of poor quality patents where customer value growth rates are low; where technology advances are gradually enhancing with an emphasis on software and green technology. This is so partly because of the loose interpretation of the legal concept of an "inventive step" as well as the relaxed examination procedures exercised in most of the systems. While India now follows a patent regime focused on novelty and inventive steps as per the stringent provisions of the Indian Patents Act, 1970, the European System allows inventions with modifications only as far as patents are concerned.⁴⁴

Secondly, the Indian system, as we have seen, excludes several subject matters for patents under Section 3(k) of the Indian Patents Act harshly to avoid being flooded with mere software and algorithms "as such" claims, whereas Europe has quite a liberal approach of generally avoiding the examination of patentability to the merit of the application to allow multiple applications even of probably meritless inventions. This has resulted in the emergence of concerns on formation of patent thickets and monopolistic dominance in the European framework thereby posing a negative impact on challenges and competition and innovation.

6.2. United States

Views of the United States and India on the IPR for green technology differ because of the difference in their economic motives and their ability to put up advanced technologies. The IPR structure in the United States consists of stringent and effective patent rights that can provide incentives for creativity in different sectors supported by enforcement mechanisms and encouraging official policies including tax credits and grants for renewable energy and climate tech.⁴⁵ The United States Patent and Trademark

⁴⁴ "A Comparative Study of European and Indian Patent Laws", *available at*: https://www.intepat.com/blog/a-comparative-study-of-european-and-indian-patent-laws/ (last visited on January 16, 2025).

⁴⁵ United Nations Trade & Development, "\$369 Billion in Investment Incentives to address Energy Security and Climate Change", *available at*: https://investmentpolicy.unctad.org/investment-policymonitor/measures/4004/-369-billion-in-investment-incentives-to-address-energy-security-andclimate-change- (last visited on January 15, 2025).

Office promotes accelerated processing of green technology patents under programs such as the Green Technology Pilot Program to boost the adoption of the green inventions.⁴⁶ But this serious IPR protection can lead to increased costs of green technologies and therefore not easily implementable in the developing countries.

However, the IPR framework in India appears to be much more aligned to providing general equilibrium between innovation incentives and access to such innovation with a particular emphasis on climate-sensitive technologies. Section 3(k)⁴⁷ and Section 4⁴⁸ does not permit the patents on business models and atomic energy while the U.S. patent laws allow for such patents.⁴⁹ Patents in India are granted for twenty years and cannot be extended further whereas, the US patents can be extended in certain circumstances.⁵⁰ The provisions related to compulsory licensing are very rare in U.S and are considered to be the last option but the Indian Patent Act permits it on certain grounds under Section 84(1),⁵¹ which also includes public health and environmental issues. Though the Indian government provides subsidies and incentives to enforce green technology production within its territory, weaknesses such as poor R&D setup and poor patenting activity in the green field slow the pace of innovation. The US, despite holding a large share of green tech patents, has been accused of transferring little technology to developing countries. On the other hand, India supports fair access to medicines, but frequently fails at the stage of implementation and partnership.

6.3. Australia

IPR legislation in Australia aims at promoting innovation and global competitiveness through well protected legislation for technology, especially the Australian Patents Act, 1990 that positively establishes very strong protection particularly in the areas of green technology. This framework nurtures research and development by allowing industries providing electricity and water along with other eco-friendly

⁴⁶ United States Patent and Trademark Office, "Pilot Program for Green Technologies Including Greenhouse Gas Reduction", (Federal Register, Department of Commerce, 2009), *available at:* https://www.federalregister.gov/documents/2009/12/08/E9-29207/pilot-program-for-greentechnologies-including-greenhouse-gas-reduction (last accessed on January 15, 2025).

⁴⁷ The Patents Act, 1970 (Act 39 of 1970), s. 3(k).

⁴⁸ *Id.* at s. 4.

⁴⁹ "What are the key IP law differences between India and other countries?", *available at:* https://www.maheshwariandco.com/faq/ip-law-differences/ (last visited on January 15, 2025).

⁵⁰ *Ibid*.

⁵¹ *Supra* note 47, s. 84(1).

technologies and products to avail tax credit and grants.⁵² Furthermore, exporting green technologies and increasing their diffusion is helped by agreements, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), signifies collaborations in which Australia has embraced.

Australia's structure is grounded in its high-income country membership status and centres around rewarding private sector innovation, in contrast to India's policydriven methodologies that are adjustable for cheap dissemination of upgraded technology to confront climate issues. India however lags in a few ways such as in the effective realisation of IPR and in closing the technology divide.

7. Conclusion

This paper aims at discussing how IPR and green technology play out the rationale and as well as the hurdles in the pursuit of sustainable development. On one block, it creates a right to IPR that encourages investment in research, development, and the commercialisation of novel technologies. On the other hand, these same frameworks contribute to exclusion from essential green technologies, especially to developing countries that may need to either purchase expensive licenses or surrender to monopolistic bargains. This paper tries to draw parallels between the 'x factor' and the extent to which incentives for innovation and the greater call for environmental protection can coexist or work in parallel.

Ultimately, licensing techniques such as compulsory licensing, patent pools, and open source frameworks may provide a light at the end of the tunnel to these challenges. Compulsory licensing is used by governments to protect the interest of the public while patent pools are a form of ownership which makes costs lower. Open-source models encourage cooperation but raise doubts as to whether compelling the private sector to publish its research would contribute positively to innovation. What the above said alternatives are, however, indicate that they can work well only with strong legal, regulatory and collaborative backing. In this context, Multilateral conventions such as the Paris Agreement and the TRIPS Agreement have rightly emphasised on the issue of

⁵² Mark Summerfield, "Australian Government Announces a (Sort of) 'Patent Box' Tax Incentive", available at: https://blog.patentology.com.au/2021/05/australian-government-announces-sort-of.html (last visited on January 17, 2025).

Technology transfer and cooperation. Nevertheless, they continue to exist as developed countries with first-world economies seize the market of green technology, while the developing nations fight to have a share. A more equitable approach calls for policy convergence, more IP flexibility and enhanced global commitment to the diffusion of innovations around the globe.

Based on an examination of IPR regimes in different countries, targeting socioeconomic realities of a country, for instance India's policies concentrating on compulsory licenses and reasonable and affordable prices, it is again pointed out that these can fit the strong innovation systems in the United States, Australia and other developed countries. They highlight such approaches' usefulness in reconciling approaches towards IPR frameworks that are suitable for innovation while facilitating access to content. Lastly, they argue that the journey to green innovation is possible through developing sustainable IPR and mass-equitable access to green technology. Stakeholder engagement, specialised and effective regulation mechanisms, and, especially, policy sensitivity will be the key to the climate issues and a successful transition to a sustainable future.

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