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CHAPTER 1: ARTIFICIAL INTELLIGENCE AS INVENTOR RETHINKING PATENT ELIGIBILITY AND OWNERSHIP

BY NEETHU MARIA ABRAHAM AND JIA JOSE

INTRODUCTION

Artificial Intelligence (AI) is no longer a mere tool to help humans complete their mundane tasks but it has now stepped into the frontier by creating, designing and even applying results of scientific temper which meets the required criteria to be called a patent. Rather than creating the original content, AI is only capable of analyzing the content we give. Further it provides an answer based on the data fed to it. However, such analysis is generated in the the form of what was thought to be the human intellect, so we find ourselves left with no other choice but to pause and question whose analysis is it.

The concept of patent came into light because of one main reason, it was built on the idea that invention is something only humans can perform, the idea of AI taking up this domain was never in the plan. We thought only humans can invent but it turns out that machines that have been trained on massive loads of data, now produce outputs that actually meet every legal standard to be classified under the pretext of inventorship. The question is not some contingent discussion; it is happening right now as well. Now, the real concern is whether we should allow this new creator to be titled as an 'inventor' or if that title is an exclusive monopoly, forever an asset of mankind.

This debate has already reached the courtrooms and patent offices. Dr. Stephen Thaler filed the DABUS applications[1], which turned out to be a global stress factor for patent laws. The USPTO[2] and EPO[3] completely rejected the idea of an AI system, totally insisting that only humans can be

[1] European Patent Office, J. Eur. Pat. Off. (Bd. of Appeal, Dec. 2023) (DABUS inventorship decision).
[2] United States Patent and Trademark Office (USPTO)
[3] European Patent Office (EPO)

identified as inventors. Something different from the basic norm happened in South Africa which broke the golden lining. For the first time, things took a turn when South Africa granted a patent that listed an AI system as the inventor which was indeed unexpected, this landmark decision sent shockwaves throughout the global landscape. While other countries still ponder on this debate, surprisingly India has chosen to remain silent on this subject. Having a Revised Guidelines for Examination of Computer related invention from 2025 which do recognize AI-implemented inventions,[4] they have even gone far enough to give examiners scenario-based examples to work with. As this subject is not whole in its true sense and ambiguities still remain to address the real scenario-based examples to work with.

India clearly takes notes of the technological reality but it also hesitates to take any legal-challenges head-on.[5] This at no stage could simply be considered as a very plain and dry doctrinal quarrel, it has a deep story rooting from how societies choose to value creativity in its purest form. The question arises of clinging to the comforting fabrication that only humans can be identified as inventors, even on works where machines are demonstrably creating patentable solutions. Or do we simply forge a stronger foundation by expanding the definition of inventorship, which might however risk a world where accountability is blurred and the eagerness of discovery is only an ethical anchor.

This chapter positions AI within the belt of larger innovation networks and takes a keen look at the policy questions which suggest including AI under the ambit of an inventor.[6] It studies how different countries have chosen to define invention in their laws and examines judicial rulings that have set the bar by pushing the limits of what the word 'inventorship' means, it simply explores ownership models that could balance machine creativity with human responsibility. On combining the Government reports, real-world data and the philosophical reflections the discussion has moved past a simple either/or choice. It has analyzed statutes, judicial decisions, doctrines, administrative guidelines and policy frameworks which constitute the reasoning of India, the United States, the United Kingdom, Australia, South Africa and the European Union, all these jurisdictions have been explored in order to get a clear picture on how different

[4] Controller General of Patents, Designs & Trade Marks, Revised Guidelines for Examination of Computer Related Inventions (CRIs), 2025 (India), Press Information Bureau, Ministry of Commerce & Industry (July 29, 2025).
[5] Arul George Scaria, "Artificial Intelligence and the Inventorship Dilemma: Lessons from the DABUS Saga," 65 J. Indian L. Inst. 112 (2025).
[6] Ryan Abbott, The Reasonable Robot: Artificial Intelligence and the Law 87–92 (Cambridge Univ. Press 2020).

jurisdictions deal with the terms related to inventorship, ownership and accountability in relation to aspects of an AI generated invention. Particular emphasis has been given on the DABUS litigations[7] as a comparative jurisprudential lens through which competing legal approaches to machine creativity are evaluated.

DOCTRINAL FOUNDATIONS OF INVENTORSHIP

Inventorship isn't limited to a simple procedural formality. It's the very principle that decides who gets their rightful credits as the exclusive inventor of the major innovation. Legal frameworks across several countries have built their own assumptions on the illusion that inventors must be only humans.[8] That reflects a core belief that invention is completely tied to human thought and human responsibility alone and that they are inseparable elements.[9]

In India the Patents Act,1970 under Section 6(1)[10], allows "*any person claiming to be the true and first inventor*" to apply for a patent.

Section 2(1)(y)[11] defines "*true and first inventor*" in a way that completely excludes mere communications or importers, thereby presuming human agency.

Similarly, the United States Patent Act, coming under 35 U.S.C §100(f)[12], defines *"inventor"* as an *"individual,"* a term consistently interpreted by courts to redefine the meaning of a natural person.

The European Patent Convention (EPC) has reinforced the anthropocentric approach by requiring disclosure of the inventor's name and address under Article 18 and Rule 19(1).[13]

[7] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022);
Thaler v. Comptroller General of Patents, Designs and Trade Marks, [2021] EWCA (Civ) 1374, [2022] R.P.C. 1 (Eng.);
Case T-755/20, Thaler v. European Patent Office, ECLI:EU:T:2023:112 (Gen. Ct. Feb. 21, 2023);
South Africa Patent Office, Patent No. 2021/04506 (granted July 28, 2021).
[8] Ana Ramalho, Artificial Intelligence and Intellectual Property: Towards Human-Centric Legal Frameworks
[9] Mark A. Lemley, "Inventor or Machine? AI and the Future of Patent Law," 134 Yale L.J. Forum 1 (2024).
[10] The Patents Act, No. 39 of 1970, § 6(1) (India).
[11] The Patents Act, No. 39 of 1970, § 2(1)(y) (India).
[12] 35 U.S.C. § 100(f) (2020); Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).
[13] Convention on the Grant of European Patents art. 81, Rule 19(1), Oct. 5, 1973, 1065 U.N.T.S. 199.

These laws aren't neutral, they totally bring in a worldview that sees creativity as something only limited to humans , something tied entirely to responsibility and to getting the recognition for the work done. Courts have backed this up too, consistently reinforcing the idea that invention is fundamental and justifiably a human domain. In the United States, Burroughs *Wellcome v. Barr Laboratories*[14] defined conception as *"the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention."* These definitions link the concept of inventorship directly to human mental activities. Recently in the landmark case of *Thaler v. Vidal*[15], the Federal circuit reaffirmed that only natural persons can be inventors under the Patents Act, a view the U.S Supreme Court left standing when it denied certiorari in 2023. The United Kingdom came to a similar conclusion in *Thaler v. Comptroller General of Patents*[16], ruling that inventorship under the Patents Act, 1977 must involve a human being. In 2023, the European Patent Office's Boards of Appeal also confirmed that inventorship has to be human, pointing to Rule 19 of the EPC.[17]

India hasn't directly tackled the core question of AI inventorship but cases like *Bishwanath Prasad Radhey Shyam v. Hindustan Metal Industries*[18], showcased scenarios where Industries treat the inventive step as something born from human ingenuity, which reinforces that human-centred foundation. The only distinction has come from South Africa's administrative recognition of AI as an Inventor in the DABUS case[19], this significant decision didn't go through full judicial scrutiny, as it reads more like a symbolic anomaly than a real doctrinal shift that seems to finally clear up all the ambiguities.

A set of three major legal foundations explain why courts keep pushing back against AI inventorship. First U.S. law makes a clear split between conception and reduction to practice. Conception is the mental act of forming the idea for an invention, on the contrary reduction to practice means actually building or testing it. AI blurs this line completely as it generates necessary outputs without any human help, it forms the idea first on its own, which is enough to

[14] Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223 (Fed. Cir. 1994).
[15] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).
[16] Thaler v. Comptroller-General of Patents, Designs & Trade Marks, [2023] UKSC 49.
[17] European Patent Office, J. Eur. Pat. Off. (Bd. of Appeal, Dec. 2023) (DABUS inventorship decision, confirming inventorship must be human under Rule 19 EPC).
[18] Bishwanath Prasad Radhey Shyam v. Hindustan Metal Industries, (1979) 2 SCC 511 (India).
[19] In re Applications for Patent Naming DABUS as Inventor, J 8/20, European Patent Office Board of Appeal (Dec. 21, 2021).

shake the very foundation of this doctrine. Secondly, inventorship is also tied to the element of accountability. Inventors have to disclose their inventions, which cannot be questioned or challenged for misconduct and they get credit for what they contribute . AI can't do any of this, so it leaves a gap on how it would be considered legally responsible. Thirdly, the entire point of inventorship is utilitarian since patents are meant to reward intellectual work and encourage people to share their discoveries for the greater social good. Machines don't chase recognition or any achievements; they don't work on the basis of an incentive or purpose for a sense of achievement to arise.[20] So, the core reason for an invention to fall under this category starts to fall apart.

Recent legal analysis keeps coming back to the very same idea that inventorship is built on utilitarian theory.[21] Patents from the very start exist to reward human effort and push people to disclose and secure what they have created. Courts have struggled with the concept of AI inventorship because it breaks the line between originality and legal responsibility[22]. The question now is whether the law should change to accept machines as creativity or stay entirely focused on humans and risk becoming outdated in a world where innovations have started coming from algorithms.

HOW DABUS EXPOSED THE FAULT LINES OF PATENT LAW?

AI has already pushed patent law onto a very difficult positioning and nowhere is this clear than in the story of DABUS. When Dr. Stephen Thaler filed patent applications naming his AI system as the inventor, the filings became a test of how different countries would respond to the idea of a machine as an inventor.[23] The U.S responded with strict legal reasoning, with the Federal circuit in the landmark case of Thaler v. Vidal still holding that inventorship under the Patent Act belongs only to a natural person, a view the Supreme Court left in place in 2023. Europe and the

[20] Christopher Buccafusco, "A Theory of Inventor Incentives," 102 Iowa L. Rev. 1 (2016).
[21] Ana Ramalho, Artificial Intelligence and Intellectual Property: Towards Human-Centric Legal Frameworks (Edward Elgar Publ'g 2021).
[22] Peter Drahos, A Philosophy of Intellectual Property (Dartmouth Publ'g 1996).
[23] Matthew Fisher & Graeme Dinwoodie eds., Research Handbook on Intellectual Property and Artificial Intelligence (Edward Elgar Publ'g 2023).

UK took the same position but stinkingly with a contrasting political opinion. The EPO's Boards of Appeal and the UK Supreme Court both stressed that inventorship cannot be separated from human identity, treating the rule not just as legal text but as part of a cultural story about inventions itself.

On being specific South Africa broke this traditional approach when its patent office back in 2021 listed DABUS as an inventor, not through any court reasoning but through administrative practices. The South African system does not carry out any substantive examination, so the application went through without real doctrine review. The symbolic impact was large, showing that a legal system could at least administratively make room for any sort of machine inventiveness. Critics dismissed the decision as legally empty but its value in showcasing that the law can bend even if it is just an experimental approach.

Another example would be that of Australia which showcased an unclear and unsettled the rules still are about who can be named the inventor of something created by AI. In the case of *Thaler v. Commissioner of Patents.*[24] The Federal Court made a forward-looking decision that an AI system could be recognised as the inventor of something under Australian patent law. Justice Bench said that patent law should change as technology changes and we should not let any sort of strict interpretations of the law stop ideas from taking form. This decision was news across the globe because it was the first time a Court had said that a machine could be considered an inventor but this change was short-lived in 2022, the Full Federal Court changed the decision. They stated that only a human can own the title of being called an inventor under the Patents Act,1990[25]. Everything that occurred in the country of Australia is very interesting it clearly shows that even if courts are willing to change the rules about patents to fit the futuristic realm, they often date back to the traditional way of thinking when it comes to important ideas like who can be an inventor and what it means to be defined as a person under the law.[26] The Artificial Intelligence inventorship rules are still not clear. Australia is a fine example of this kind of situation.

[24] Thaler v. Commissioner of Patents, [2021] FCA 879 (Austl.).
[25] Thaler v. Comm'r of Patents (2022) FCAFC 62 (Austl.).
[26] Kimberlee Weatherall, "Patents and Artificial Intelligence: Australia's Response to DABUS," 44 Sydney L. Rev. 301 (2025).

India's position is kind of multi-dimensional in this realm. India's 2025 CRI guidelines accept the reality of AI-driven innovation by giving some scenario-based examination examples but they deliberately avoid answering the inventorship question.[27] That silence is not accidental, though India recognises the technological shift but it stays away from exploring any sort of legal confrontation, probably strategically awaiting a global agreement before changing its own framework.[28]

What comes out of these case studies is not a repeated standard rule but a split in philosophy and thinking. The United States, Europe and the UK hold on to a very anthropocentric view, defending inventorship as something only humans can have in order to keep track of accountability intact. Each jurisdiction reflects not just a legal interpretation but it also states the shifting national perspective on whether or not to discourage experimentation to attract innovation or to remain silent and buy time.[29] Inventorship is no longer a settled rule. It has now become a contested frontier.[30] Courts and patent offices are not merely interpreting plain statutes; they are deciding how modern society will define creativity in the age of intelligent machines. The DABUS litigation shows that law is being tested at its boundaries. It is not just a plain legal interpretation.[31]

REIMAGINING PATENT ARCHITECTURE FOR THE AGE OF AI

Patent law has finally gotten an urgent need to bring in change and evolve, shifting from rigid doctrine to a more structural innovation. The question isn't just whether machines can be inventors. It's also about completely designing a new framework that reflects how algorithms

[27] Arul George Scaria, "Artificial Intelligence and the Inventorship Dilemma: Lessons from the DABUS Saga," 65 J. Indian L. Inst. 112 (2025).
[28] Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy (Tata McGraw-Hill Educ. 2025).
[29] Reto M. Hilty & Matthias Lamping, The Illusory Standard of Significant Human Contribution to AI-Assisted Inventions After the DABUS Decision of the German Federal Court of Justice, 55 IIC: Int'l Rev. Intell. Prop. & Competition L. 123 (2024).
[30] European Patent Office, J 8/20 & J 9/20, Decision of the Legal Board of Appeal (Dec. 21, 2021).
[31] Axel Metzger, "DABUS" Decision of the Federal Supreme Court (Bundesgerichtshof), Case No. X ZB 5/22, 55 IIC: Int'l Rev. Intell. Prop. & Competition L. 456 (2024).

actually bring creation to practicality, while keeping the aspect of accountability intact. Reform should be built in step-by-step layers, borrowing lessons from other areas of law and regulation.

One strong option is bringing an AI-facilitated disclosure regime. Laws could require inventors to spell out exactly how AI was involved; it could either be the datasets used for training parameters and how much humans supervised this imperative process. That kind of transparency would help examiners judge inventive steps properly and create a public record of algorithmic creativity. Think of it like the registries required for a pharmaceutical trial. The EU's clinical trial rules offer a parallel they mandate disclosure of methods to ensure safety and reproducibility.[32] Patent law could borrow that same approach, making disclosures a built-in safeguard against the black-box nature of AI driven invention.

Ownership needs a more flexible approach by bringing in a more diverse model to this rigid landscape. Instead of fixed categories, rights could be split based on what each party actually contributes, the technical design from programmers, the problem framing from users and that the infrastructures and funding from corporations. It's similar to how corporate law assigns shareholder rights by equity but applied to invention. The Copyright law already has done something similar to this with joint-authorship, recognizing layered creative input. A patent outline could do the same and recognize that AI-driven inventions rarely come from a single personality; it is rather the products of a whole constellation of contributions.

International coordination is just as critical. Patents are territorial but the AI innovations cross borders. Without a defined alignment, innovators will shop for the most favourable set-up that breaks fairness and predictability. A WIPO-led model law could set some minimum standard for disclosure, ownership and accountability.[33] TRIPS changed the trajectory by harmonizing patent rules globally. Comparative law shows why frameworks like this matter, TRIPS set a global baseline for intellectual property protection, which cut down on forum shopping between major countries.[34]

[32] Regulation (EU) No. 536/2014 of the European Parliament and of the Council on Clinical Trials on Medicinal Products for Human Use, 2014 O.J. (L 158) 1.
[33] Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299.
[34] World Intellectual Property Organization, WIPO Intellectual Property and Frontier Technologies: Policy Issues (2022)

Any new reform must face the test of ethical safeguards for high-risk AI inventions.[35] Drawing on ideas from bioethics and the precautionary principle in environmental law,[36] laws would require stricter more careful reviews for inventions in high-stakes fields be it medicine, defense and finance. It creates a necessary balance that the law's openness to algorithmic invention doesn't outpace society's ability to manage the risks and unexpected consequences.

We need a reform which is bold, ethical and anticipatory rather than reactive, on embedding transparent disclosure requirements, a dynamic ownership model that reflects real contributions, coordinated global harmonization and robust ethical safeguards; patent law can evolve into a system that holds onto its core principles while also adapting to technological disruption.[37] This isn't mere procedural adjustment to existing rules or procedures. It's a fundamental reimagining of the architecture of justice in innovation making sure that there is a reward tied to machines' creativity and are distributed fairly and transparently in a responsible manner.

CONCLUSION

Patent law today stands at a mind-boggling threshold where its traditional doctrines no longer serve the purpose. The Court's refusal to recognize machines as inventors has drawn one clear boundary which is only part of the picture. The more pressing challenge is figuring out how ownership, accountability and the distribution of rewards should be re-engineered to reflect the reality of algorithmic creativity. We can't simply apply old rules to build a new kind of invention and expect them to sustain throughout.[38] This is not a matter of surface-level or cosmetic adjustments, it demands a thorough, fundamental restricting of the legal architecture so that innovation stays both grounded and equitable. Just changing a few definitions won't be enough when the underlying logic of the invention itself has drastically changed.

[35] Matthew Rimmer, Artificial Intelligence and Intellectual Property: Innovation and Governance (Edward Elgar 2021).
[36] Daniel J. Kevles, Patents, Protections, and Precaution: The Evolution of Intellectual Property in Biotechnology, 49 Nature Rev. Genetics 356 (2007).
[37] Sheila Jasanoff, The Ethics of Invention: Technology and the Human Future (W.W. Norton & Co. 2016).
[38] Ryan Abbott, I Think, Therefore I Invent: Creative Computers and the Future of Patent Law, 57 B.C. L. Rev. 1079 (2016).

The future cannot be reduced to a binary choice between anthropocentrism and machine centrism. A hybrid framework is an essential one that anchors legal responsibility I human actors which still acknowledges the multi- faceted layered contribution of algorithms, programmers, users and institutional needs.[39] Such a model would democratize innovation instead of concentrating power, prevent monopolisation by any single individual and embed accountability at every stage. That way the system stayed faithful to its main purpose, acting originally to reward ingenuity and fostering public disclosure that benefits everyone.

Patent law has always been more than a procedural command. At its very core, it is a moral economy that decides who gets to benefit from creativity and on what exact terms. In this age of abundant intelligence machines, this moral economy must evolve into a structure that balances justice with progress without sacrificing one for another. Reform should not only regulate invention as a legal process of intellectual property staying resilient , inclusive and responsive to the realities of machine-driven creativity, so that law co-exists with the technology advances.

[39] Bayh–Dole Act: Patent Rights in Inventions Made with Federal Assistance, 35 U.S.C. §§ 200–212 (2018). (Enacted by Bayh–Dole Act, Pub. L. No. 96 517, § 6(a), 94 Stat. 3018 (1980), as amended by Pub. L. No. 106 404, 114 Stat. 1742 (2000)).

CHAPTER 2: PATENTABILITY OF SOFTWARE AND ALGORITHMS IN THE AGE OF AUTOMATION
BY SHIPRA SALONI

INTRODUCTION

The author maintains that innovation is not merely a human process, but also a historical one. The author believes that innovation is history as well as human activity. Historically, patent law has been connected to the physical and tangible progress of the industrial revolution. The ideas of "manufacture," "machines," and "compositions of matter" were the foundation for the creation of the first patent systems, such as the English Statute of Monopolies as well as the early United States Patent Act of 1790. These laws were enforced on the physical apparatuses such as steam engines, textile looms, mechanical gears and chemical compounds. In those days something was considered an invention if it was observable, physical and had mass. [40]

In the late 20th century, however, the dawn of the digital revolution turned all these assumptions on their head. The change from vacuum tubes and transistors to software programmes made the focus of innovation move from hardware to abstract computational logic.[41] By definition, software is a structured set of instructions written to get a computer to do a particular action, and it does not have a physical shape. Rather, it uses mathematical logic performed by electronic pulses in silicon chips .[42] Over time, software has become more than just automation programs and autonomous algorithms, and cloud computing has become more than just networks - it has revealed a fundamental conflict between traditional property law.[43]

[40]The Patents Act, 1970 (Act 39 of 1970), s. 3.
[41]M.P. Jain and S.N. Jain, *Principles of Administrative Law* 38 (Wadhawa, Nagpur, 2001).
[42]*Ibid.*.
[43]Susan A. Bandes (ed.), *The Passions of Law* 180 (New York University Press, New York, 1999).

The legal structures, which imply a tangible assembly line, must now be confronted with intangible architectures of code, thus triggering a conceptual crisis: how do you apply legal frameworks to tangible machines to code architectures that are intangible and mathematical? As an illustration, let us consider the situation where an entrepreneur is restricted to a single product. As an example, suppose that an entrepreneur can only produce one product. The software patent issue is fundamentally an economic and philosophical dilemma, and it is one that's potentially at play in many other debates.[44]The central economic and philosophical question in the software patent debate is a question that's at play in numerous other debates: corporate incentive systems vs. protecting the common public domain.[45] The software and automation sector calls for huge investment in the software and automation.[46]

Scope and Objectives of the Chapter

The scope and objectives of the chapter are described below:

- The chapter discusses legal, technical and systemic challenges to the patentability of software and algorithms, with a focus on the world of today's cutting-edge automation and artificial intelligence.
- The main aim is to study the demarcation between abstract concepts and inventive contributions in various legal frameworks.[47]
- This chapter examines the changing nature of the statutory exclusions, administrative hurdles and consistent judicial decisions in three major jurisdictions, namely, the United States, European Union and India.[48]
- In addition, it explores the impact of the advent of deep learning and autonomous automation on other landmark concepts in patent law, such as human inventor ship and patent disclosures.

[44]S.K. Verma and Raman Mittal (eds.), *Intellectual Property Rights: A Global Vision* 38-42 (ILI, Delhi, 2004).
[45]Chatrapati Singh, P.K. Coudhary, et.al. (eds.), *Towards Energy Conservation Law* 78 (ILI, Delhi, 1989).
[46]Indian Law Institute, Index to Indian Legal Periodicals (ILI, Delhi, 2002).
[47]Upendra Baxi, "On how not to judge the judges: Notes towards evaluation of the Judicial Role" 25 *Journal of Indian Law Institute* 211 (1983).
[48]Jutta Brunnee, "Enforcement Mechanisms in International Law and International Environmental Law", in Ulrich Beyerlin, Peter-Tobias Stoll, et.al. (eds.), *Ensuring Compliance with Multilateral Environmental Agreements: A dialogue between practitioners and academia* 1-24 (Martinus Nijhoff Publishers, 2006).

- Last, this chapter provides policy guidance for modernizing global patent regimes, to support continued innovation in the real world while protecting the free and collaborative development of the global digital economy.[49]

INTERNATIONAL STATUTORY FRAMEWORKS

The TRIPS Agreement and WIPO Standards are the two most prominent examples of international statutory frameworks. The international administration of IP is a framework of international treaties that seek to align patent eligibility whilst providing flexibility for implementing individual member states. The basic international treaty on software patents is the World Trade Organization (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).[50] According to Article 27(1) of the TRIPS Agreement, there is a general requirement for patent eligibility:

"The invention of any product or process in any field of technology shall be subject of a patent application, if it is new, involves an inventive step and is suitable for industrial use."

The provision establishes a technology neutral regime, meaning that patent protection should, in theory, apply to computer-implemented inventions that satisfy the basic criteria of novelty, non-obviousness and industrial utility. But the member states have the right to exclude certain subject areas from patentability due to consideration of public order, morality, human life or human health as provided for in Article 27(2) and (3).[51] Moreover, the TRIPS Article 10 clearly provides that computer programs, in either source or object code, are protected as literary works.[52]

This places the copyright of the literal code on one side and the patentability of the underlying functional logic on the other side of the equation, under the international law system, the latter being left largely to national law and judicial interpretation. At the same time, the Patent Cooperation Treaty (PCT) is administered by the World Intellectual Property Organization

[49]B.B. Pande, "Criminal Law" XLI *Annual Survey Indian Law* 171-198 (Indian Law Institute, 2005).
[50]WTO Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 27.
[51]*Ibid.*, art. 27(2).
[52]*Ibid.*, art. 10.

(WIPO) and serves as a single streamlined system for the filing of international patent applications. Although a PCT application makes it easier to file and conduct a preliminary examination with over 150 Member States, it is not a ‘global patent'.

The substantive patent eligibility conditions continue to be governed by the patent offices of each country. WIPO is proactively engaged in tracking convergence and divergence on laws concerning Computer-Implemented Inventions (CII) in an effort to bring them into alignment throughout the world. But significant differences remain between jurisdictions where software patents are broadly granted and jurisdictions where there are robust statutory limitations.

ANALYTICAL DISCUSSION: HOW DIFFERENT COUNTRIES VIEW SOFTWARE PATENTS?

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1. The U.S. Alice Two-Step Test for Software Patents

The USPTO and U.S. courts have struggled with the question of patentability of software. As software is digital code, rather than a physical machine, the US examiners follow a two-step evaluation approach known as the Alice Two-Step Framework (from 2012 and 2014 Supreme Court rulings).[53]

Identify Abstract Ideas = step 1. Whether the software embodies a concept that is not patentable – that is, an abstract idea, a mathematical formula, or a basic business method, the examiner decides. If it simply automates the same business or data management process, they are not considered to meet Step 1 and need to be reviewed in Step 2. In Step 2, the examiner reads the details to determine whether the application "significantly more"--or accomplishes something significantly more--than restates the abstract idea.

To be patentable and to pass the test, the software must provide an "inventive improvement"—for instance, improving the computer's speed or efficiency, or decreasing the

[53]Alice Corp. v. CLS Bank International, 573 U.S. 208 (2014).

bandwidth used using a new compression technique. On the other hand, if you just tell a standard computer to run a normal business process, then that's not innovation, and it will not be accepted.

2. The EU 'Technical Character' Rules for Software Patents

The European Patent Office (EPO) has a clear position that under the European Patent Convention (EPC), mathematical methods and computer programs "as such" (pure code) are not patentable(EPC, Article 52).[54] To overcome this, the EU has adopted a Two-Hurdle Approach:

- **Hurdle 1:** The Physical Requirement ("Technical Character") is a low hurdle. An application passes just by referring to the physical equipment like a common computer, network server, or microchip. The term "computer implemented method" is sufficient to overcome this hurdle.
- **Hurdle 2:** The Inventive Step Test (The COMVIK Approach). In the EPO's view, there are only two types of features for which software can be patented, namely features that are functional and features that are non-functional. The EPO has a limited view of what features software can be patented on, namely functional features and non-functional features. Non-technical elements like office management, games, business rules and financial strategies are completely neglected. Thus, if a business idea is realized on a common PC, it won't pass this second test, and will not be considered as patentable.

3. Section 3(k) Rule and the 'per se' limit in India

The drafters of the law in India had two goals: one, to safeguard the public and local companies against companies seeking a monopoly in fundamental computer tools, and two, to enable companies to continue supplying the essential software. The Indian Patents Act, 1970 contains a list of things that cannot be patented (Section 3).[55] In particular, Section 3(k) of the Code provides that: A mathematical, business or computer program in itself or an algorithm is not patentable in any case.[56]

In Latin, the word "per" means "by" and the word "se" means "by itself. This little word has sparked decades of high drama, lawsuits, and policy shifts in Indian tech. This tiny word has

[54]European Patent Convention, 1973, art. 52.
[55]The Patents Act, 1970 (Act 39 of 1970), s. 3.
[56]*Id.*, s. 3(k).

been the source of decades of legal wrangling, policy shifts and high drama in India's tech industry. The Indian Patent Office has been relying on Section 3(k) as a mechanism to deny all software patents for a long time.

As India's tech sector and startups were expanding at an unprecedented rate, however, it was necessary to have more defined rules for developers. The Indian Patent Office later clarified guidelines, clarifying the meaning of "by itself". Under the current Indian patent law, if the computer program works closely with hardware and produces a definite technical contribution or a patentable technical effect, it can be patented. The software can be patented if it is used to improve the performance of a piece of hardware, to control an industrial machine, or to process a phone network signal. But, if the software is a standalone program, raw code or a program algorithm used on ordinary computers to perform basic office or business functions, it is still completely prohibited to patent the software.

CASE LAWS ANALYSIS

Now we will look into the landmark cases which have shaped the rules of patents in these digital areas like software and algorithms.

United States Jurisprudence

1. Gottschalk v. Benson

- **Citation:** - 409 U.S. 63 (1972) [57]
- **Facts:** - The applicants, Gary Benson and Arthur Tabbot developed a method that converted Binary Coded Decimal (BCD) into pure binary numbers. When they went for patent granting their application got rejected and the matter approached the Supreme Court.
- **Issues:** - Whether a mathematical formula or method for converting digital numbers can be patented if its only practical application is via a digital computer.

[57]Gottschalk v. Benson, 409 U.S. 63 (1972).

- **Judgement:** - The United States Supreme Court held that method non – patentable and reasoned that the formula was a pure mathematical procedure. If it is granted a patent then it will refrain others from using it in their work in any field which will create a monopoly in the market.

2. Parker v. Flook

- **Citation:** 437 U.S. 584 (1978) [58]
- **Fact:** - During the catalytic chemical conversion of hydrocarbons, Dale Flook applied for a patent for a method of calculating an "alarm limit". The invention relied on a mathematical algorithm for updating alarm thresholds for multiple temperatures and pressures ; the actual data used for the calculation was the only novel feature in the claim.
- **Issue:** - Will a mathematical formula that does not lend itself to a patent be patentable when its patent claim restricts its use to a particular industrial process with conventional post-solution activity.
- **Judgment:** The Supreme Court decided that the invention was not patentable. The Court ruled that the mathematical algorithm has to be considered as prior art, which means that it has to be considered to be public knowledge. After the algorithm was removed from the equation, the follow-up steps – including making the usual and routine adjustments to a standard alarm monitor – followed the standard routine and were routine. The Court explained that the normal, post-solution activities (such as triggering an alarm) do not make a non - patentable algorithm patentable.
- **Impact:** - In the context of interpretation/evolution of the article, it was a rigid treatment of the subject matter eligibility. It would place the inventive concept in the non-mathematical aspects of the claim, making patentability of software-based calculations more difficult.

3. Diamond v. Diehr

- **Citation:**450 U.S. 175 (1981) [59]
- **Facts:** - James Diehr and Lincoln Lutton applied for a patent for a method to mold raw synthetic rubber into cured rubber items. A well known mathematical equation (Arrhenius equation) was

[58]Parker v. Flook, 437 U.S. 584 (1978).
[59]Diamond v. Diehr, 450 U.S. 175 (1981).

inserted into a computer program which was used to continuously calculate the internal temperature of the mold and to automatically open the press at the exact time the rubber cured.

- **Issue:** - The question before the Court: Can a physical industrial process that relies on a computer program and a mathematical formula to run become non - patentable just because it does?
- **Judgement:** - In a key, 5-4 ruling, the Supreme Court ruled that the process was patentable. The Court explained that the patent did not attempt to "monopolize the mathematical equation itself". Rather, it wanted to be protected for a wide-ranging industrial process that sought to transform physical materials. The Court stated that claims must be considered as a whole, and not be broken down into the mathematical and non-mathematical elements.
- **Impact:** - Diehr was a significant event for the early software industry. It had set clear rules for the patentability of software closely linked to physical industrial machinery or for software transforming a tangible material. It had laid down clear guidelines for the patentability of software closely attached to physical industrial machinery and software that transforms a tangible material.

4.State Street Bank & Trust Co. v. Signature Financial Group, Inc.

- **Citation:** 149 F.3d 1368 (Fed. Cir. 1998) [60]
- **Facts:** The "Hub and Spoke" system was a data processing architecture that Signature Financial Group held a patent for. This system enabled several mutual funds to combine their funds into one investment portfolio, and software could be used to determine the value of the assets at the fraction of a cent per day. State Street Bank opposed the patent, claiming it's only a non - patentable business method and mathematical system.
- **Issues:** Whether a computer-implemented data system for processing financial transactions or transactions with financial value is patent eligible.
- **Judgement:** The Federal Circuit ruled in favor of the patent and provided a new definition of the "business method exception" that will not apply in the future. The court determined that a practical use of the mathematical algorithms and data processes to arrive at a precise, final price per share was a "useful, concrete, and tangible result.

[60]State Street Bank & Trust Co. v. Signature Financial Group, Inc., 149 F.3d 1368 (Fed. Cir. 1998).

- **Impact:** The effect on the interpretation/evolution of the article: This was the most liberal software patenting case in U.S. history. It opened up the floodgates for thousands of pure business methods, e-commerce strategies and transaction software patents, all contributing to the dot-com boom of the late 1990s.

5. Bilski v. Kappos

- **Citation:** 561 U.S. 593 (2010) [61]
- **Facts:** The facts are that Bernard Bilski and Rand Warsaw wanted a patent covering a process they had developed to hedge their risk against the seasonal price swings in the energy market as commodity traders. Patterns were not specific to any type of computer hardware system but were only a series of conceptual transactional steps.
- **Issues:** Is the "Machine-or-Transformation Test" the only test that can be applied to determine if a process is patentable under Section 101, and can abstract business transactions be patented.
- **Judgement:** The US Supreme Court denied a patent application. The Court explained that the "Machine-or-Transformation Test" (which focuses on whether an invention is "limited" to a particular machine or "transforms" a "physical substance" into a different one) provides a useful analytical point to consider, but that it is not the exclusive test for eligibility. The Court, however, determined that Bilski's hedging strategy was an non - patentable abstract idea: a fundamental commercial practice that could not be "encircled by a single patent.
- **Impact:** It was a major "red flag" against the broad interpretation/evolution of the article that it had been used in the past in "State Street". It restored the restrictions on business methods and paved the way for the landmark Alice decision in 2018.

Two decisions of the European Patent Office (The Boards of Appeal)

1. Vicom Systems Inc. (T 0208/84) – Digital Image Processing

- **Citation:** T 0208/84.[62]
- **Facts:** The applicants filed an application for a patent on a technique for digitally manipulating data that represented a 2D image. The examiner first objected to the invention as being a pure

[61]Bilski v. Kappos, 561 U.S. 593 (2010).
[62]Vicom Systems Inc. (T 0208/84), EPO Technical Board of Appeal, T 0208/84.

mathematical procedure, and found it useful for smoothing, sharpening and improving digital images by using mathematical filtering operations.

- **Issues:** Whether the exclusion of Article 52 EPC applies to a computer-implemented method comprising the application of mathematical filtering algorithms to digital information for the purpose of enhancing an image.
- **Judgement:** The Board of Appeal overturned the rejection and granted the invention patent. The Board understood that a mathematical method as such is abstract, but when it is used to manipulate physical data (e.g., pixels representing a digital image) to change a physical reality that it becomes a technical character. This manipulation of an image is a real world technical process, thus the software used for the process is patentable because it is solving a technical problem.
- **Impact:** This was a foundational decision which laid the cornerstone for the principle of 'technical contribution' in European patent law. It paved the way to software patents in the EU, if the code is aimed at a technical effect and not at a theoretical mathematical problem.

2. Dutch Auction Method (Hitachi Ltd. 0258/03)

- **Citation:** T 0258/03 of EPO Technical Board of Appeal.[63]
- **Facts:** On one hand, Hitachi applied for a patent covering the use of a computer-implemented system to run a Dutch auction on a network of internet browsers, which automatically reduces the price based on certain intervals.
- **Issues:** Whether an automated auction method carried out over a conventional client server system is inventive under Article 56 EPC.
- **Judgement:** The Board confirmed that an auction method implemented by a computer meets the first hurdle of eligibility (hardware) but not the second hurdle of an "inventive step. The most fundamental aspect of the patent was an economic concept of how to set up an auction, a non-technical process. The software did not offer a technical solution because the underlying internet protocols or server architecture didn't need to be modified.

[63]Dutch Auction Method (Hitachi Ltd.) (T 0258/03), EPO Technical Board of Appeal, T 0258/03

- **Impact:** It is more that an application with conventional computing infrastructure cannot be saved by structuring the software logic in an innovative business model, and that was reflected in the interpretation/evolution of the article, concluded by the EPO.

Indian Jurisprudence

1. Telefonaktiebolaget LM Ericsson v. Intex Technologies

- **Citation:** I.A. No. 6735/2014 in CS (OS) No. 1045/2014 (Delhi High Court).[64]
- **Facts:** Ericsson has sued Intex Technologies in India over its patents on 2G, 3G and 4G telecommunication software and hardware modules. Intex said that the patents were invalid under Section 3(k) because the patents applied to software-based communication protocols and algorithms.
- **Issues:** Whether software protocols used for telecommunication embedded in mobile hardware devices are patentable under Section 3(k) of Indian Patent act.
- **Judgement:** The Delhi High Court was directed to rule in favor of Ericsson in the case. The court concluded that "modern" infrastructure patents cannot be denied protection because of the wide coverage afforded by Section 3(k). The software protocols involved were closely coupled to the hardware architecture to control signal processing, data compression and the efficiency of the transmission over mobile networks. The software generated a clear technical effect and enabled the physical communication hardware to operate and so it was not a "computer program per se.
- **Impact:** This is a landmark ruling by an Indian court, affirming the legality of software embedded technology. It gave much comfort to the world's tech giants that software and hardware associated software patents can be enforced in India.

2. Ferid Allani v. Union of India & Ors.

- **Citation:** W.P. (C) 7/2014 (Delhi High Court).[65]
- **Facts:** Ferid Allani, a Tunisian citizen, made an application for a patent for a process for accessing and managing data on digital communication networks. The Indian Patent Office has

[64]Telefonaktiebolaget LM Ericsson v. Intex Technologies, I.A. No. 6735/2014 in CS (OS) No. 1045/2014 (Delhi High Court).
[65]Ferid Allani v. Union of India & Ors., W.P. (C) 7/2014 (Delhi High Court).

refused the application under Section 3(k) on the ground that it is a separate computer program and algorithm. This was challenged by Allani before the Delhi High Court.

- **Issues:** What does the word 'computer program per se ' mean in Section 3(k) and whether in India software, which has achieved a technical contribution, can be patented?
- **Judgement:** The Delhi High Court gave a groundbreaking judgment on Section 3(k). The court noted that the term "per se" was deliberately included by the Indian Parliament to make sure that all software innovations were not prohibited. In the digital era, the court argued, denial of protection for software that offers a ‘genuine technical contribution' or ‘technical effect' would be an obstacle to innovation. The exclusion does not apply to computer programs that optimize network operations, to improve efficiency of searching databases or to enhance device security.
- **Impact:** The consequence on interpretation/evolution of the article: The case is the backbone of present day software patent eligibility in India. It compelled the Indian Patent Office to evolve into a more technically sophisticated examination methodology, moving from mere use of code to making sure that the code actually represents a real technical progress.

Global Perspective & Contemporary Developments

Comparative Jurisdictional Analysis: USPTO, EPO and IPO

International software and automation patent management highlights significant differences in the global leading IP systems. The United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), and the Indian Patent Office (IPO) have established their own sets of legal standards, rather than adhering to a single, common international standard. They are all structured differently depending on their legal bases and differing understandings of "technical eligibility" and policy objectives concerning economic competition.

USPTO (United States)

The U.S. does not prohibit software or business methods in general, under 35 U.S.C. § 101 and the so-called Alice Two-Step Framework. Rather, the patentability depends on whether the software has a "new and inventive concept" beyond an abstract thought. Where software is closely tied to a novel computation architecture or is actually explicitly useful in improving

computer efficiency, the USPTO will grant the patent. The U.S. software market is relatively open, except for any claims that are based on functional outcomes.

EPO (European Union)

The EU employs a **"Two-Hurdle" policy** and is regulated very closely by Article 52 of the European Patent Convention (EPC). Hurdle 2 requires applicants to meet the more demanding COMVIK requirement, which is not easily satisfied by a physical computer or server. In this standard, non-technical components, such as business strategies or administrative rules, are not considered at all when assessing. This is a limited interpretation of the concept that excludes business software on normal hardware, but prefers software with a certain specialized and non-obvious engineering problem solution.

IPO (India)

Section 3(k) of the Patents Act, 1970, excludes mathematical methods, business methods, algorithms and computer programs per se from patentability, with the IPO following strict guidelines based on previous cases before the Delhi High Court on what constitutes a clear 'technical contribution' – software that is tightly coupled with physical hardware or one that directly optimizes the performance of infrastructure, India has one of the most challenging grounds for software patents.

The Patent Office has published the updated Patent Office Examination Standards for AI (2019-2026)

During the period from 2019 to 2026, more and more automation systems were introduced and the administrative examination manuals had to be constantly adapted in order to meet developments. The USPTO issued its Revised Patent Subject Matter Eligibility Guidance, which now requires that examiners move beyond the "AI" label. Rather, it is up to the examiner to determine if an AI model asserts an abstract mental process or a concrete technological improvement in network architecture, in data classification speeds, or in physical devices.

At the same time, the European Patent Office (EPO) released its new Guidelines for Examination with a special section on “Artificial Intelligence and Machine Learning”. Machine learning models and neural networks are considered mathematical methods at the EPO. Therefore, in Europe, a machine learning model in the abstract (such as a generic CNN architecture) is not patentable. For a patent, the applicant must associate the AI model with a concrete and useful technical use, for instance, a neural network to manage an automatic insulin pump or analyze digital heart rate monitors.

CHALLENGES

Ruling the regulation of modern digital technology in the context of old patent laws has caused some big issues:

1. **Problem of Vague Language (Functional Claiming):** Many software patents are written using the Problem of Vague Language (Functional Claiming), that is, they describe the functional effect of the software without providing any detail about how it achieves that effect. A company could patent a method to securely pay bills online, for instance, but not demonstrate the unique code or tech that it uses to make this possible. This means that one patent owner could prevent the other people from adding similar features even if their source code is quite different.
2. **The "Threat of Patent Trolls" :** Software patents are frequently written in this vague and wide language, so that opportunistic companies, aka patent trolls, purchase poor quality patents from bankrupt companies. They don't develop any software. Rather they sue active software companies and tech developers, seeking huge payouts in court and diverting funds from genuine innovation.
3. **Traditional Patent Law:** A 20-year monopoly.[66] Under traditional patent laws, a patent provides an inventor with exclusive control for 20 years. In software/automation, technology is extremely rapidly changing, and a program is typically outdated in 2-5 years. Making a simple software process locked for 20 years restricts technology's advancement, preventing other developers from building on top of it.

[66]The Patents Act, 1970 (Act 39 of 1970), s. 53.

4. **Highly Technical Applications Overwhelm Patent Offices:** Highly technical Applications, complex AI architectures and advanced codes workflows overwhelm overwhelmed Patent Offices: Patent examiners are overloaded by thousands of highly technical applications containing complex AI architectures and advanced code workflows. Most patent offices lack the trained software experts, the tools and the large computers needed to properly review these applications; this often leads to the granting of bad or overly broad patents.

SUGGESTIONS

Some useful hints for improvement are:

- Eliminate the need to proactively license gene research, as the U.S. Congress is currently considering.[67]
- Update the patent system to recognize that gene research is not something that needs to be licensed up in advance, with the U.S. Congress looking at doing just that.
- This is an adequate amount of time for companies to recoup their R&D investment, and for the technology to become available to the public without being completely outmoded.
- **Create a Specialized Law Framework (Sui Generis):** An international organization, such as WIPO, should develop a new type of IP system, rather than attempting to shoehorn invisible software code into a patent system designed for tangible machines.[68] This is a particular law which would safeguard the special form and layouts of a software but would not allow companies to "lock up" fundamental mathematical concepts.
- **Establish Public Registries of Existing Code:** Software communities and national patent offices should create large searchable databases of open source code and historic algorithms.[69] This would provide a stable set of "prior art" that allows patent examiners to quickly determine whether the software concept is truly novel or not, or whether it has been published on GitHub and other platforms for years.

[67]Law Commission of India, "144th Report on Conflicting Judicial Decisions Pertaining to the Code of Civil Procedure, 1908" (April, 1992).
[68]Sahil Kumar, *Corporate Governance: Regulatory Mechanism with Special Emphasis on Corporate Social Responsibility* (2017) (Unpublished LL.M dissertation, Indian Law Institute).
[69]P. Leelakrishnan, V. R. Jayadevan, "Concept of Common but Differentiated Responsibility in Climate Negotiations" 61 *Journal of Indian Law Institute* 47 (In Press, 2019).

CONCLUSION

The technical contributions, alongside the open digital ecosystems, must be balanced. Alongside the open digital ecosystems, the technical contributions must be balanced. A key issue in the debate on software and algorithm patentability is that of fundamental challenge in the core of modern property law. If the patent system is allowed to be too broad, it could be used to stifle the core building blocks of mathematics and computational logic, and enable large companies to claim monopoly over automation workflows.

On the other hand, if systems become too conservative, they fail to provide the economic security to support the development of new innovations, breakthroughs, and advances in industries such as autonomous automation, diagnostic healthcare AI, and advanced cyber-physical processing. The answer lies in a delicate balance, safeguarding both interests.

Patent systems should continue to require that there is a clear and clearly demonstrated technical contribution to allow an exclusive monopoly. The software can be patented only if it is "embedded" in a system that addresses a new technical problem or produces real-world improvements to hardware systems. To preserve the open, collaborative nature of the developer community around the world, vague, functional statements of business strategies and administrative automation should be excluded from the patent system.

In conclusion, this research examines how IP rights will be impacted by the automated era. Finally, this research will conclude with a final outlook on Intellectual Property Rights in the Automated Era. In the end, the patentability provisions for software boil down to a simple objective: to encourage people to invent great new technologies, but not to be able to "lock up" the basic rules of math and logic. Building our automated future is with software and algorithms. By allowing anyone to patent any simple computer use, we will further hinder further innovation by other developers and startups globally. The proliferation of automated systems and AI in daily life necessitates adaptation of legal systems. We can ensure that our laws foster innovative new solutions to real-world technical challenges without screening out basic logic from patent protection, while also ensuring that the digital world remains open, fair and creative for all.

CHAPTER 3: BLOCKCHAIN INNOVATIONS AND THE PATENT SYSTEM: CHALLENGES AND OPPORTUNITIES

BY ISHIKA GOYAL

INTRODUCTION

In the era of digital technology, blockchain technology is now one of the most disruptive innovations. After Satoshi Nakamoto published his Bitcoin whitepaper in 2008, blockchain simply started out as a crude cryptocurrency system to make Decentralized Finance (DeFi), supply chain collaboration, Non-Fungible Tokens (NFTs), digital identity systems and Central Bank Digital Currencies (CBDCs) easy. Its decentralization, transparency, immutability and cryptographic security properties make it possible for an entirely new kind of trust, efficiency and accountability technology to develop. This could therefore change trust and efficiency across many industries.

But this fast tech advance has created a lot of tension between the older patent system and these new technologies. Although this system was originally developed to accommodate physical and hierarchical inventions and patent types, it has found the patent regime is ill-suited for handling the decentralized, collaborative, and software enabled design of blockchain. The key questions are whether blockchain innovations are patent-eligible or not; namely novelty, inventive step, industrial applicability and also computer programmes as well as business methods. [2]

But this tension is greater in India. The Patents Act, 1970, s 3(k) prohibits under particular exceptions “a mathematical or business method or a computer programme per se or algorithms”. An important policy action is the Guidelines for Examination of Computer Related Inventions (CRIs), 2025 adding a technical effect-based assessment to blockchain inventions. This is already a step forward, as India desires to take over the world through the digital economy through new technologies like Digital India and Blockchain India. The key question driving this chapter will be this: to what scale does the traditional patent regime foster the introduction of an

innovation landscape for blockchain technologies based on decentralized, open source and rapid innovation change in its infancy? It enforces the discussion of the key issues and ambitions of this information centre in one period in time, primarily in relation to India and a comparison with the US, EU and ultimately China.

The theoretical background and the historical background of blockchain and the patent system are presented at the start of this chapter. It further elaborates on the legal landscape in India and a number of other important territories. The focus on judicial interpretation, pragmatism and grey area is the central analysis. Other sections cover contemporary trends and international perspectives before considering case law. The chapter ends with an acknowledgment of current constraints and enforcement challenges and provides evidence-based policy recommendations. Through probing the borders between blockchain and patent technologies, the chapter aims to prompt a further discussion on the nexus between enablers of innovation and the distinctive characteristics of decentralized technologies in the Web3 era.

BLOCKCHAIN PATENTS IN INDIA: NAVIGATING INNOVATION & IP BARRIERS

Blockchain Technology and India's Patent Framework

Blockchain is a distributed ledger technology (DLT) that allows secure, transparent, and immutable recording of transactions across a peer-to-peer network without intermediaries. Central to its concepts has been decentralization, cryptographic hashing for immutability, consensus mechanisms (Proof-of-Work, Proof-of-Stake), smart contracts for self-executing agreements, and enhanced data provenance. Blockchain took to the next level with Satoshi Nakamoto's Bitcoin whitepaper in 2008, transitioning from a cryptocurrency backbone to supply chain, DeFi, NFTs, digital identity, and CBDC applications.[70]

The Patents Act, 1970 (as amended) governs the patent system in India. Any invention must meet the criteria of novelty, inventive step, and industrial applicability outlined in Section 2(1)(j). Section 3(k), however, specifically excludes "a mathematical or business method or a computer

[70] Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System ", 43 (2008)

programme per se or algorithms" from patenting.[3]This provision frames the key tension for blockchain innovations (many of which are software intensive and built on open-source solutions).[71]

The Guidelines for Examination of Computer Related Inventions (CRIs), 2025 (which was notified on 29 July 2025) describe in detail the framework. In this section, blockchain-related inventions are explicitly cited using a test based on technical effect or technical contribution.[72]

Blockchain innovations which enhance scalability, security, energy efficiency, interoperability, or hardware integration (e.g., with IoT), may be included, meanwhile pure business and generic ledger concepts continue to be excluded.

Global IP Context and Implications

Outside of India, for instance, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), to which India is a signatory, imposes a patent requirement on all inventions in the various realms of technology (Article 27.1), on the condition that they satisfy the three prerequisites—novelty, inventive step, and industrial applicability. TRIPS does not ban computer software on application but grants member states a range of exclusionary powers for the technology as a whole.[73] Moreover, the global Patent Cooperation Treaty (PCT) for foreign applications and a continuing World Intellectual Property Organization (WIPO) effort for blockchain for managing and standardizing the IP are also in the literature. This backdrop will provide a context for this growing interaction of a national distributed-technological innovation and a national, territorially-based system of patents while providing a platform to discuss certain challenges and opportunities in the following pages.

Challenges Arising Out in Patenting

In these difficult circumstances, many blockchain patent applications in India still encounter major obstacles. Despite being generally considered to be flexible and open in general language

[71] The Patents Act, 1970 (Act 39 of 1970), s. 3(k).
[72] Office of the Controller General of Patents, Designs & Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs), 2025, at 5.4 (notified 29 July 2025).
[73] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), 1994, Art. 27.1

under 2025 CRI Guidelines, patent-seeking in India continues to meet with significant obstacles. A certain "technical effect" is subjective and hence may have to be shown to the examiner; consequently examiners often consider many blockchain solutions simply as an application of known cryptographic methods or business processes. Foundations of blockchain protocols like Ethereum or Hyperledger are open-source, so assessments for novelty are challenging even more so because the extensive and widely documented existing prior art is used extensively.[74] The rapid evolution of both the technology itself and the application poses challenges with crafting claims that can be broad enough to protect something meaningful even as they also must be narrow enough to satisfy the inventive step requirement. Blockchain networks are decentralized and cross-border, which makes enforcement challenging and costly for patent enforcement. [75]Provisional applications, documenting technical contributions, and concurrent application for international protection through the PCT route are becoming the default regime of filing strategies more and more. In this regard, India's CRI exam practices and jurisprudence developments would be more transparent as it is ready to emerge as a Technology Hub of the world. This emerging ecosystem offers a great opportunity for Indian startups and enterprises to protect IP in emerging avenues such as CBDCs, DeFi infrastructure, and blockchain solutions, while also playing a bigger role in nurturing a new landscape of innovation-compatible patents.

PATENTABILITY OF BLOCKCHAIN IN INDIA: LEGAL TENSIONS, JUDICIAL RULINGS, & PRACTICAL REALITIES

India's Legal Framework and Patentability Test

The patentability of blockchain advancements is the battleground in this debate which lies in the intersection of technology, and IP law. In India the fundamental problem is to do with Section 3(k) of the Patents Act, 1970, which precludes the patent applicability of "a mathematical or business method or a computer programme per se or algorithms." The Guidelines for

[74] Legal Frameworks and Patentability Standards for Blockchain Innovations," International Journal of Financial Management and Research (2026).
[75] Patent Cooperation Treaty,1970, art.21

Examination of Computer Related Inventions (CRIs), 2025, seek to clarify this confusion with regard to a structured four-step test in blockchain invention in Section 5.4.

To address this tension, the court first needs to see the claim in its entirety, establish its crucial technical aspects, identify the key technical problem to be solved and evaluate whether the resulting technical implication of the claim is not just a side effect of the computerization. Potential patentable inventions as diverse as new consensus mechanisms enabling greater scalability or greater energy efficiency, cryptographic improvements to privacy (for example to add zeroknowledge proof implementations) and blockchain-IoT integration for tamper-resistant supply system tracking. An application for a distributed ledger exclusively for financial transactions, or generic smart contracts without proven technical contribution, are rejected.

Key Judicial Precedents in India and Abroad

This framework has been molded in no uncertain terms from the court's rulings. Based on this interpretation, the Delhi High Court in *Ferid Allani v. Union of India (2019)* held that computerrelated inventions that exhibit a technical effect or address a technical problem are patentable, and advised the Patent Office to reconsider the application.[76] This ruling has served as a bellwether for blockchain applications, leading to demands by applicants to consider the hardwarecentric aspects of a claim (e.g., hardware integration, performance advancement, or device security) vs. the abstract techniques. In the U.S., the Alice/Mayo two-step model under 35 U.S.C. §101 remains a huge obstacle.[77] In BPROTOCOL Foundation v. Universal Navigation, Inc. (S.D.N.Y. 2026), the Court ruled that the addition of an automated market maker (a type of decentralized exchange) on the blockchain was still a lofty concept, even with smart contracts. This demonstrates a tenacious judicial position that transferring an abstract financial term or data management concept onto a blockchain does not in itself constitute an “inventive concept.”

The European Patent Office now has stricter, “technical character” rules. In cases like T 2078/22 (2025), the plain fact of recording supply-chain data on a blockchain was considered non-technical, whereas T 2153/22 permitted claims for smart contract execution and integration with IoT devices.

[76] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Delhi High Court, 12 December 2019)
[77] Foundation v. Universal Navigation, Inc., No. 25-cv-4214 (S.D.N.Y. February 2026).

Real World Use cases and Practical Problems

Many Indian startups and enterprises have rebuffed claims of blockchain for supply chain provenance or land records without mentioning technical enhancements. On the other hand, patents have been granted for blockchain-based systems that address certain technical demands, such as speeding up cross-border payments via optimized consensus or securing medical records to prevent loss due to information loss (with advanced cryptography). There are real-world uses of such patented innovations for AgriTech solutions in India's AgriTech and pharmaceutical supply chain, which are providing verifiable tracking, and reducing counterfeit medicines.[78]

Grey Areas and Current Disputes:

There is considerable uncertainty in determining the level of "technical effect." The 2025 CRI Guidelines include such examples, but leave an element of subjectivity that can be entered into judgement of their examiners. There is still a doubt what are improvements on energy use effectiveness of this kind as well as new sharding techniques over threshold. Another issue is how to enable us: Is that the detail required for disclosure of cryptographic primitives and node architecture satisfying Section 10 of the Patents Act?

Policy concerns are two-fold: One concerns against India's aspirations to become a global center of innovation; and the other concerns of over-patenting abstract ideas that would stifle open-source collaboration central for blockchain development-with which to deal today.[79] Enforcement remains a major problem because networks tend to be decentralized, and there are potential jurisdictional conflicts that complicate getting around these problems. Globally, the absence of convergence between India's technical-effect approach, the US's Alice framework on technology in the field, and China's volume-driven approach makes international patent policies increasingly challenging.[80] All together, while the 2025 CRI Guidelines represent a positive development. They might offer technology-specific policy guidance, the effective application of such guidance will help decide whether India can strike a proper balance between incentivizing development of blockchain technologies and preventing evergreening abstract methods.

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[78]Office of the Controller General of Patents, Designs & Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs), 2025.

[79] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Delhi High Court, 12 December 2019)

[80] World Intellectual Property Organization, WIPO Blockchain Task Force White Paper (2025) available at: https://www.wipo.int/en/web/cws/blockchain-and-ip (last visited on 12 June 2026)

MODERN DEVELOPMENTS & GLOBAL PATENT LANDSCAPE

Technological Advancements and India's Evolving Computer Related Inventions Guidelines

Blockchain technology is rapidly progressing, with large gains in scalability, privacy, and interoperability. Such trends are already in evidence: Layer-2 solutions, zero-knowledge proofs (ZK-proofs), and hybrid blockchain architectures.[81] The advent of blockchain and other technologies like quantum-resistant cryptography and artificial intelligence is the next step forward for secure, smart decentralized frameworks.

The 2025 Guidelines for Examination of Computer Related Inventions (CRIs) are a new stage in India. The Indian Patent Office has taken a clear route towards such a trend in Section 5.4 and gives specific instructions on blockchain-based inventions. This has resulted in a surge in patent cases on issues including supply chain tracking, digital identity and AgriTech applications. India is still far behind global leaders in terms of total grants, however

The United States remains a leader in quality patents, particularly in enterprise blockchain and DeFi solutions. Instead, this strict Alice/Mayo framework leads to high rejection rates for applications without defined technical advances. In the European Union, the European Patent Office (EPO) uses a "technical character" test. Previous Board of Appeal cases, e.g., T 2153/22 (2025), have permitted patents concerning the use of blockchain-IoT integration while rejecting mere data recording applications (T 2078/22). The EU's stance seeks to mix innovation with specific technical contributions.

International Outlook: China, WIPO and Strategic Implications

China's dominance in amounts and the biggest proportion of the applications on top of world blockchains is due to the heavy government backing and country strategy. Chinese companies

[81] Office of the Controller General of Patents, Designs & Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs), 2025, § 5.4.

like Alibaba, Tencent and Ant Group have vast portfolios, especially on supply chain and digital currency apps. [82]

WIPO and International Developments: The World Intellectual Property Organization's Blockchain Task Force is still investigating the utilization of blockchain to manage IP using immutable timestamping for proof of creation and smart contract-based licensing solutions. These endeavours are designed to transform global IP infrastructure and minimize disagreements involving ownership and provenance.[83]

The effects on technology are substantial. Blockchain improves transparency in global supply chains, curbs counterfeit in pharmaceuticals and benefits India's Digital India and Make in India programs. But challenges including high power consumption (in certain protocols), regulatory uncertainty and interoperability remain across areas.[84]

Here is a comparative landscape of international harmonization. Although India's 2025 CRI Guidelines provide a comprehensive and technical-effect-driven framework, divergence with US and EU approaches adds complexities for multinational enterprises with desire for global protection. Emerging economies like India can implement a pragmatic approach that fosters innovation as well as open-source collaboration.

CHALLENGES, ENFORCEMENT ISSUES & FUTURE RECOMMENDATIONS

Key Challenges and Enforcement Hurdles

Nevertheless, the patenting of blockchain innovations is under various issues. The main gap arises in how "technical effect" could be imputed as subjective as per Guidelines for Examination of Computer Related Inventions (CRIs), 2025.[85] Assessors have difficulty

[82] State Intellectual Property Office of the People's Republic of China, "Blockchain Patent Landscape Report" 45 (2025)
[83] Government of India, "Make in India Initiative: Blockchain Opportunities", 43 (2025) State Intellectual Property Office of the People's Republic of China, "Blockchain Patent Landscape Report" 45 (2025)
[84] Government of India, "Make in India Initiative: Blockchain Opportunities", 43 (2025) State Intellectual Property Office of the People's Republic of China, "Blockchain Patent Landscape Report" 45 (2025)

[85] Vikrant Rana & Renu Bala Rampal, "Decoding CRI Guidelines 2025", 56 (June 20, 2025).

reconciling their opinions and will judge if enhancements in consensus mechanisms, privacy protocols are patentable, and in most cases, their judgments will not reach the patent process as they are not consistent. Another considerable void is the absence of particular judicial precedent that focuses more on the context of blockchain technology (in India).[86]

Enforcement challenges pose a major practical hurdle to such systems. The decentralized topologies of blockchain are highly diverse with several such nameless or pseudonymous nodes, in many jurisdictions, and thus the rule of the law is difficult for anyone to identify and punish infringers. Conventional patent enforcement mechanisms, developed for centralized entities, do not allow for this network that spans borders. Complications relating to applicable law, evidence collection from distributed ledgers, and cross-border recognition of judgments also arise. The high rate of technological advances also generates a gap between the timelines for patent scrutiny and the adaptive character of blockchain protocols. There are also many innovations that go into obsolescence or are forked before patent issuance, diminishing the value of protection in practice.

Reforms, Policy Recommendations and Way Forward

India is lacking clearer and more detailed examples in CRI Guidelines that cover Layer-2 solutions, zero-knowledge proofs, interoperability protocols with crypto-oriented examples.
Specialisation programs for the Patent Office examination of new technologies are also required.[87]

The Indian Patent Office (IPO) might want to establish auxiliary practice notes or specific

Blockchain Patent Examination Manual. Implementation of a Technology Specialist Panel or FastTrack Mechanism for blockchain-based and AI applications, on one hand, can cut the time for examination and improve quality.[88]

India could work closely with WIPO's Blockchain Task Force to get international industry standards for the use of blockchain in IP administration — immutable timestamping for earlier created works, for example, or proof of creation — in place as an investment priority. The

[86] India's 2025 CRI Guidelines: "A New Era for Software and AI Patent Examination", 67 (Sept. 2, 2025).
[87] World Intellectual Property Organization, WIPO Blockchain Task Force White Paper (2025) available at: https://www.wipo.int/en/web/cws/blockchain-and-ip (last visited on 12 June 2026)
[88] Vikrant Rana & Renu Bala Rampal, "Decoding CRI Guidelines 2025", 24 (June 20, 2025)

government could also consider building patent pools or defensive patent coalitions for core blockchain infrastructure technologies to combine control with open access.[89]

Lastly, Section 3(k) could be amended or a sui generis protection regime introduced regarding certain blockchain innovations, to cover any risks. Such reforms should strive to strike the fine line between rewarding honest technical improvement on the one hand and maintaining this spirit of collaborative, open-source and collaborative work that keeps the blockchain development open-ended and vibrant on the other.[90]These measures would place India at a far-reaching level, a futurefacing jurisdiction able to foster decentralized innovation in the Web3 era with a view to emerging to facilitate Web3 decentralized innovation.

Applying Insights to Help Blockchain Innovators and Enterprises in India

Preventative Multi-layered IP Strategy: Blockchain startups, enterprises, and researchers in India must move beyond the status quo and take measures for maximum protection.Practically, innovators can conduct in-depth prior art searches in global databases that they are seeking cover (WIPO, USPTO, and EPO) whilst also providing detailed documentation of the narrative of technical problem-solution process to establish a clear "technical effect" according to 2025 CRI Guidelines: e.g. measurable improvements in transaction throughput, energy consumption, or security against specific attacks.[91] Early filing for a provisional patent can help secure a priority date, alongside time to refine claims, for application purposes. It is advisable to work with experienced patent lawyers dedicated to CRI and blockchain and to investigate hybrid applications, which have blockchain and/or hardware integration (e.g., IoT) or AI components for better eligibility. On the enforcement side, companies should integrate strong smart contract auditing, on-chain evidence logging, and overseas PCT submission processes to support cross-border protection.[92] Defensive patent portfolios, involvement in patent pools, and participation in industry bodies (such as NASSCOM and the Blockchain Association of India) can provide joint leverage. Combining these practical steps with ongoing oversight of IPO decisions and potential policy reform, Indian blockchain players can thus navigate the IP

[89] CRI Guidelines 2025, "Intellectual Property Owners Association", 54 (Apr. 15, 2025)
[90] Government of India, "Report on Blockchain and IP Administration",24 (2023)
[91] Vikrant Rana and Renu Bala Rampal, "Decoding CRI Guidelines 2025",34 (20 June 2025)
[92] Jatin Trivedi, "Dawn of Blockchain Technology in the Indian Patent Regime" (2020), art.12

landscape, mitigate litigation risks, and speed up the commercialization of their innovations in areas such as supply chain, digital identity, and decentralized finance.[93]

CONCLUSION

Where blockchain innovations converge in the patent landscape is a complex yet bright world of obstacles and potential opportunities. As a result, this chapter demonstrated that existing patent frameworks, developed for centralized and tangible inventions, suffer from non-adaptability towards decentralized technologies, open-source, and fast-paced development of blockchain technologies, but recent efforts towards policies for this new field suggest solutions. The significant takeaways from those interviews have highlighted the importance for proving "technical effect" or "technical contribution" for patent application, particularly in line with India's Guidelines for Examination of Computer Related Inventions (CRIs), 2025.

The main stumbling block is subject-matter eligibility, the evaluation and assessment of prior art for open-source, enforcement across decentralized environments and the inability to harmonize around international standards for patent compliance or practice. The judicial rulings like *Alice Corp. Pty. Ltd. v. CLS Bank International* and *Ferid Allani v. Union of India*[94] have forged an understanding of the proper treatment of cases with a balanced approach, one that is to promote technical advancements which really improve on their tangible characteristics and discards abstractions. Furthermore, there are many loopholes to patenting new consensus mechanisms, zero-knowledge proofs, layer-2 solutions and integrating blockchain and IoT solutions along with blockchain to create a new form of collaboration. In addition to patenting new innovation patents, blockchain technology also enables transformative solutions not limited to those patents, the blockchain provide tools for many other areas outside of the core legal tools for innovation within the intellectual property ecosystem, such as immutable time stamps for proof of creation that are necessary for an establishment of proof of creating something and smart contracts that can be used in the form of smart contracts for the automated licensing process.[95]

[93] Vikrant Rana and Renu Bala Rampal, "Decoding CRI Guidelines 2025",34 (20 June 2025)
[94] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Delhi High Court, 12 December 2019)

[95] S. Rana & Co., "India's 2025 CRI Guidelines: A New Era for Software and AI Patent Examination" ,54(2 September 2025)

This issue is of deep interest to the broader picture of intellectual property law, copyright and similar concepts like copyright, and thus to the IP law at large. Blockchain's provenance and ownership records can now be verified, which can be beneficial for copyrighted works, such as electronic art, music, literature, and software.[96] NFTs, for example, have revealed both the promise and the pitfalls of blockchain to deter piracy, create authorship, and facilitate fractional ownership and royalty transfers. In digital space like India, copyright enforcement is still difficult to implement in the context of AI technology and blockchain will enhance that for India as it provides clear, tamperproof records (transmission and creation) for copyright protection under Copyright Act, 1957.

Thus, the incorporation of blockchain technology with patents and copyright will be a step in the direction of increasingly efficient, transparent and open-source IP management solutions. With the vision of India becoming the world leader in Internet-Based Information Technologies (ISE) and related fields in general through Digital India and other technologies, a fair and progressive patent law has to be established for blockchain technologies. The 2025 CRI Guidelines represent a good start, but much more — such as examiner training, additional guidelines — patent pools, and increasing consultation with WIPO's Blockchain Task Force — is required.

Finally, although challenges of enforcement, compliance and legal certainty do exist, challenges which blockchain opens up for both the creation of new technologies, and the regulation of IP, they are much too far outweighed by the market opportunities. It is likely that a well-attuned attitude to the advancement of technology and the respect for the collaborative spirit of blockchain will promote India's patent system as well and play an active part in the development of the global IP regime in the Web3 era. The future of innovation is adaptive legal systems, which leverage transformative technologies rather than inhibit them.

[96] Mandip Kaur, "Legal Frameworks and Patentability Standards for Blockchain Innovations in the USA, European Union, China, and India" 42 (2026)

CHAPTER 4: QUANTUM COMPUTING AND EMERGING TECHNOLOGIES: ARE PATENT LAWS READY?

BY RUWA MUNEER AHMED

INTRODUCTION

The arrival of quantum computing as a commercially proximate technology is a major turning point in the history of science and also, in the history of intellectual property law. Unlike classical computers that manipulate information as binary digits constrained to the values of zero or one, quantum computers exploit the principles of quantum mechanics to process information through qubits capable of computational capability that renders tractable problems that are computationally infeasible for classical architectures.[97] The implications for cryptography, pharmaceutical discovery, financial modelling, and artificial intelligence are transformative.

Patent law, as the principal legal instrument for incentivising and disclosing technological innovation, is constitutively implicated in the quantum transition. Yet its doctrinal architecture was fashioned in an era of mechanical and chemical invention. Its foundational categories were developed in radically different contexts. As WIPO has acknowledged, the result is a framework under significant strain.[98]

This chapter addresses the central question: are existing patent law frameworks sufficiently equipped to address the unique challenges posed by quantum computing, or is doctrinal and policy reform necessary? It examines (i) the technological characteristics of quantum computing that challenge the present conventional patent doctrines; (ii) whether patentability requirements adequately address quantum inventions; (iii) issues of inventorship, disclosure, and eligibility;

[97] Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information (Cambridge University Press, Cambridge, 10th Anniversary edn., 2010) p. 1.
[98] WIPO, Technology Trends 2024: Patents in the Quantum Technology Space (WIPO, Geneva, 2024) p. 11.

(iv) comparative approaches across India, the United States, and the EU; and (v) reforms necessary to preserve patent law's coherence.

CONCEPTUAL AND TECHNOLOGICAL BACKGROUND

A qubit's ability to be in a *superposition* lets a quantum processor with n qubits to represent 2^n states simultaneously, giving it a form of exponential parallelism not available to classical computation. Entanglement links qubits so that the state of the whole system must be described together rather than as separate parts, which supports distributed quantum computation and enables communication protocols with strong information-theoretic security guarantees.

Quantum interference is used to strengthen the probability of correct computational outcomes and suppress wrong ones, which is the mechanism that gives Shor's algorithm its polynomial-time factoring power and Grover's algorithm its quadratic speedup for unstructured to achieve advantages that render classical encryption obsolete.[99]

Different hardware approaches like superconducting qubits, trapped-ion systems, photonic processors, and topological qubits face distinct engineering challenges including decoherence and gate fidelity that affect how the hardware inventions are designed and patented. *Quantum software* covers both quantum algorithms and the classical control and orchestration stack that is needed to run and manage quantum hardware.

Finally, *quantum cryptography* uses fundamental quantum principles (including the no-cloning theorem) and quantum key distribution, to provide security that can be information-theoretic rather than computational. Critically, quantum computing does not exist in isolation; its convergence with AI and biotechnology raises additional doctrinal and practical challenges for patent law.

EXISTING PATENT LAW FRAMEWORK

The four basic requirements for patentability should be stated briefly before their limitations are discussed. Under section 2(1)(1) of the Patents Act, 1900, novelty means that the invention is not

[99] NIST, Post-Quantum Cryptography Standardisation: Final Standards (NIST, Gaithersburg, 2024).

anticipated at the priority date.[100] Inventive step under Section 2(1)(ja) requires a feature involving a technical advance over existing knowledge such that the invention is not obvious to the skilled person. Article 27(1) of the TRIPS Agreement similarly provides that patents must be available for inventions that are new, involve an inventive step, and are capable of industrial application.[101]

On subject matter, three frameworks operate in parallel. In India, section 3(k) of the Patents Act, 1970 excludes a mathematical method, business methods, computer programme per se and algorithms from patentability.[102] In the United States, 35 U.S.C Section 101 is limited by judicial exceptions for abstract ideas, laws of nature, natural phenomena, which are applied through the *Alice/Mayo* two-step framework. [103]

In Europe, Article 52(2) EPC excludes mathematical methods and computer programs "as such", but this is moderated by the EPO's technical character approach, under which the claimed subject matter must produce a technical effect beyond the method itself.[104] Disclosure and enablement are also common across all three systems. The specification must describe the invention clearly enough to enable a person skilled in the art to perform the invention.[105]

QUANTUM COMPUTING AND PATENTABILITY CHALLENGES

Patent Eligibility

Quantum algorithms at their core are sequences of unitary operations on a Hilbert space. In that sense, they are mathematical methods. The legal question is whether they can also be patentable technical processes, a question that current patent law answers inconsistently.

Under *Alice*, a claim directed to quantum superposition or entanglement may be viewed as an abstract mathematical relationship, with quantum hardware treated as merely a conventional

[100] The Patents Act, 1970 (Act 39 of 1970), ss. 2(1)(j), 2(1)(ja).
[101] Agreement on Trade-Related Aspects of Intellectual Property Rights, Annex 1C, Marrakesh Agreement, 1869 U.N.T.S. 299 (1994), art. 27(1).
[102] The Patents Act, 1970, s. 3(k).
[103] 35 U.S.C. § 101; USPTO, 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (2019).

[104] European Patent Convention (1973), art. 52(2); EPO Guidelines for Examination, Part G, Ch. II, s. 3.3 (November 2023 edn.).
[105] TRIPS Agreement, art. 29(1); The Patents Act, 1970, s. 10(4)(b); 35 U.S.C. § 112(a).

substrate. This can lead to ineligibility even where the invention involves real technical complexity.[106] In India, Section 3(k) of the Patents Act creates a similar barrier, though it is partly softened by the technical effect doctrine developed in *Ferid Allani*. However, the Patent Office has issued no quantum-specific guidance.[107]

Inventive Step

The assessment of inventive steps is complicated by three structural features. First, the prior art landscape is highly concentrated in a small number of institutions that operate under strict confidentiality, which creates an artificial gap in the prior art and may allow questionable patents to be granted.[108]

Second, quantum computing advances extremely quickly. A twelve-to-eighteen-month prosecution cycle may span multiple generations of technological development, making priority analysis less reliable. Third, the identity of the 'person skilled in the art' is unusually difficult to define, because no single hypothetical skilled person is likely to have equal expertise in quantum physics, algorithm design, and hardware engineering.[109]

Disclosure and Enablement

Disclosure and enablement requirements are tested most severely in the quantum context. A patent specification may describe a quantum algorithm in mathematical terms and still satisfy the formal written description requirement, yet fail to enable the skilled person to actually implement the invention.

This is because the necessary quantum hardware, often operating at millikelvin temperatures and requiring specialized electromagnetic shielding, is not publicly accessible. As a result, there is a gap between disclosing what the invention is and enabling what it does in a reproducible way, and current law does not fully address this problem.

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[106] Alice Corp. Pty. Ltd. v. CLS Bank International, 573 U.S. 208, 217–218 (2014).
[107] Ferid Allani v. Union of India, W.P.(C) 7/2014, judgment dated 12 December 2019 (Delhi HC), para. 18.
[108] Daria Oswald, 'Quantum Computing and the Patent System' 23 Yale JL & Tech. 250 (2021).

[109] N.S. Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property (Eastern Book Company, Lucknow, 2nd edn., 2012) p. 162.

Inventorship

If a quantum-enhanced AI system independently generates an inventive concept through reinforcement learning, it may satisfy the functional idea of an inventor as the entity that conceived the invention. However, it may still fail the legal requirement of being a natural person.[110]

Section 6 of the Patents Act confines the right to apply to the true and first inventor, implying a natural-person requirement. *Thaler v. Vidal* confirmed the same limitation under US law.[111] The DABUS decisions in the EPO and the UK Supreme Court are to the same effect.[112] The resulting structural gap: AI-generated quantum inventions cannot be patented under existing law in major jurisdictions, and there is currently no legislative solution in place.

Patent Thickets

IBM, Google, and Microsoft together hold thousands of quantum-related patents with overlapping scope.[113] This creates the risk of a patent thicket, similar to the problem Shapiro identified in the semi-conductor context.[114] In addition, standard-essential concerns may arise in quantum communication protocols. For example, proprietary QKD systems could become de facto standards and may expose holders to FRAND obligations whose exact scope remains uncertain.

CASE LAWS AND ANALYSIS

The patentability of quantum algorithms and AI-generated inventions sits at the intersection of mathematical abstraction, physical implementation, and statutory personhood. Across the United States, India, and the European Patent Office (EPO), jurisprudence has evolved from categorical exclusions of algorithms to nuanced frameworks that demand technical effect, inventive step,

[110] The Patents Act, 1970, s. 6; Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).

[111] Thaler v. Vidal, 43 F.4th 1207, 1213 (Fed. Cir. 2022), cert. denied, 143 S. Ct. 1783 (2023).

[112] EPO, Application Nos. EP18275163 and EP18275174 (DABUS), Decisions of 27 January 2020; J 0008/20 [2021]; Thaler v. Comptroller-General of Patents [2023] UKSC 49.

[113] IBM Corporation, US Patent No. 10,552,751 (Quantum Circuit Depth Reduction, 2020); Google LLC, US Patent No. 10,657,432 (Quantum Processor Architecture, 2020).

[114] Carl Shapiro, 'Navigating the Patent Thicket' in Jaffe, Lerner and Stern (eds.), Innovation Policy and the Economy (MIT Press, Cambridge, MA, vol. 1, 2001) p. 119.

and human authorship. This analysis traces that evolution, demonstrating how each major decision shapes the current doctrinal landscape for quantum computing patents.

United States Jurisprudence

The U.S. Supreme Court's early 1970s decisions established a stringent barrier against patenting mathematical algorithms absent specific application. In Gottschalk v. Benson (1972), the Court rejected a claim for converting binary-coded decimal numerals into pure binary, holding that a mathematical algorithm not reduced to a specific application is ineligible.[115] The reasoning centred on pre-emption: the claim wholly pre-empted the mathematical formula itself, leaving no room for others to use it. This rationale directly imperils quantum algorithms, which are precisely unitary-transformation methods that risk the same pre-emption problem.

Seven years later, *Parker v. Flook (1978)* reinforced this barrier by rejecting a method for updating alarm limits in catalytic conversion using a mathematical formula.[116] The Court held that novelty in the formula alone does not transform an otherwise conventional process into a patent-eligible invention. For quantum computing, this means that speedup achieved through mathematical structure does not automatically confer patentability if the practical application is claimed at high generality.

The tide shifted slightly in *Diamond v. Diehr (1981),* where the Court approved a process for curing synthetic rubber that incorporated the Arrhenius equation.[117] The key distinction was that the claim was directed to an industrial process, not merely the algorithm itself. Proponents of quantum software patents now cite Diehr to argue that a quantum algorithm integrated into a physical quantum process is eligible as a whole.

However, the modern framework emerged with *Mayo Collaborative Services v. Prometheus Laboratories (2012)* and *Alice Corp. v. CLS Bank International (2014)*. In Mayo, the Court rejected a method for optimizing thiopurine dosage by measuring metabolite levels, ruling that conventional steps applying a law of nature add nothing sufficient to confer eligibility.[118]

[115] Gottschalk v. Benson, 409 U.S. 63 (1972).
[116] Parker v. Flook, 437 U.S. 584 (1978).
[117] Diamond v. Diehr, 450 U.S. 175 (1981).
[118] Mayo Collaborative Services v. Prometheus Laboratories, Inc., 566 U.S. 66, 79–80 (2012).

Quantum measurement steps, governed by quantum mechanical laws, risk failing this test even within technically complex inventions.

Alice reformulated the two-step framework: (1) determine whether the claim is directed to an abstract idea; (2) assess whether additional elements amount to "significantly more". This is the most consequential modern authority for quantum algorithm patents, yet step one's "abstract idea" characterization is analytically unstable when applied to quantum mechanical phenomena.

The Court also cited Myriad Genetics (2013), which held that isolated genomic DNA is ineligible as a product of nature, while cDNA is eligible as a laboratory creation.[119] Myriad illustrates the persistent doctrinal difficulty of distinguishing discovery from invention—a problem replicated in quantum computing where the phenomena exploited are laws of physics.

Most recently, *Thaler v. Vidal (2022)* foreclosed patent protection for purely AI-generated inventions. The Federal Circuit held that 35 U.S.C. §§ 100 and 115 require a natural person as inventor, directly excluding AI systems like DABUS as sole inventors. This decision foreclosed patent protection for purely AI-generated quantum inventions absent legislative reform.

Indian Jurisprudence

Indian patent law approaches quantum algorithms through Section 3(k) of the Patents Act, 1970, which excludes computer programs "per se." The foundational case *Novartis AG v. Union of India (2013)* refused a patent on the beta-crystalline form of imatinib mesylate, upholding Section 3(d)'s requirement for enhanced therapeutic efficacy.[120] The Court adopted a purposivist, development-oriented reading of the Act, establishing that Indian patent courts will scrutinize quantum patents with access-oriented skepticism, elevating the effective inventive step threshold.

The operative doctrinal framework emerged in *Ferid Allani v. Union of India (2019)*, where the Delhi High Court remanded a refused patent application for a method of accessing information in an interactive digital network. The Court adopted the "technical effect" doctrine: Section 3(k) excludes computer programs per se, but inventions producing a technical effect are eligible. This provides the framework for quantum algorithm patentability in India, though it remains unapplied to quantum inventions to date.

[119] Association for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 593–595 (2013).
[120] Novartis AG v. Union of India, (2013) 6 SCC 1, paras. 188–192.

Public interest considerations surfaced in *F. Hoffmann-La Roche v. Cipla (2012),* where the Court declined an injunction against Cipla's manufacture of erlotinib, holding that access to medicine outweighs private patent rights.[121] This signals that Indian courts will apply an access-balancing approach to quantum technology patents where market concentration is high.

In *Ericsson v. Intex Technologies (2015)*, the Court granted an interim injunction subject to FRAND (fair, reasonable, and non-discriminatory) terms for standard-essential patents (SEPs).[122] This is directly applicable to quantum communication protocols that may acquire standard-essential status, requiring SEP holders to honor FRAND commitments while enforcing patents.

EPO Jurisprudence

The EPO's framework centers on Article 52(2) EPC, which excludes computer programs per se, and the inventive step requirement under Article 56. In T 0258/03 — Hitachi (2004), the Board held that a computer-implemented auction method is not excluded if technical means suffice to escape Article 52(2), with inventive steps bearing the analytical load.[123] Quantum algorithms implemented on quantum processors thus escape the Article 52(2) exclusion, making inventive step the decisive battleground.

T 0641/00 — COMVIK (2003) clarified that non-technical features cannot support inventive step; only features contributing to technical character ground the analysis.[124] For quantum inventions, the mathematical algorithm informs the technical problem but does not constitute the inventive solution—the technical realization must itself be non-obvious.

The EPO aligned with the U.S. on AI inventorship in DABUS (2020–2021), holding that Article 81 EPC and Rule 19(1) require designation of a natural person. The right to a patent cannot vest in a non-person, establishing the European equivalent of Thaler v. Vidal. AI-generated quantum inventions are thus unpatentable across all three major patent systems without legislative reform.

[121] F. Hoffmann-La Roche Ltd. v. Cipla Ltd., FAO(OS) 188/2008 (Delhi HC, 2012), (2012) 49 PTC 173 (Del.).
[122] Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd., CS(OS) 1045/2014 (Delhi HC, 2015).
[123] EPO, T 0258/03 (Auction method/HITACHI) [2004] OJ EPO 575.
[124] EPO, T 0641/00 (Two identities/COMVIK) [2003] OJ EPO 352.

COMPARATIVE ANALYSIS

The three systems present a spectrum of doctrinal positions. The United States framework is the most restrictive on eligibility: *Alice/Mayo's* 'abstract idea doctrine generates acute uncertainty for quantum algorithms. Its strength is fifty years of judicial elaboration. Its weakness is the doctrinal instability of applying a category fashioned for business-method patents to inventions whose substrate is quantum hardware. The *Thaler v. Vidal* judgement foreclosed AI inventorship without legislative amendment.

The European framework is more workable. The technical character doctrine ensures that a quantum algorithm implemented on a quantum processor is not excluded in principle, and the COMWIK approach provides a structured mechanism for isolating the technical contribution. The EPO's demonstrated preparedness to examine complex simulations as technical inventions suggests a framework better adapted to quantum computing. Its weakness is the rigidity of the problem-solution approach when applied to radically novel technologies with no established prior at baseline.

The Indian framework is least developed. Section 3(k) and the Ferid Allani technical effect doctrine provides a starting point. However, the absence of quantum-specific examination guidelines and India's quantum policy ambitions outpace its unreformed patent law. At the international level, the TRIPS Article 27(1) sets a floor but not a ceiling, and the WIPO's discussions on AI disclosure remain pre-normative.

CONTEMPORARY DEVELOPMENTS

IBM, Google and Microsoft each control large quantum patent portfolios, focused respectively on error mitigation, superconducting processor architectures, and topological qubit systems. This concentration of patents creates conditions for patent thicket.[125] WIPO's 2024 Technology Trends report shows that quantum-related patent filings have grown rapidly since 2015, with China, the United States, and Japan together accounting for over 80% of global activity.

[125] Frank Arute et al., 'Quantum Supremacy Using a Programmable Superconducting Processor' 574 Nature 505 (2019).

The National Quantum Initiative Act and the EU's Quantum Flagship Programme reflect substantial public investment in quantum technologies but they are unaccompanied by meaningful reform. This creates a paradox whereby public funds accelerate quantum invention while the legal framework remains unchanged.[126] Post-quantum cryptography standardisation by NIST raises further urgency, because patents over standardised quantum-resistant algorithms may lead to standard-essential patent disputes similar to those seen in wireless telecommunications.

CHALLENGES, POLICY CONCERNS, & REFORM PROPOSALS

Three categories of reform are necessary.

First, patent eligibility reform. The USPTO should issue quantum-specific eligibility guidance that builds on its 2019 Revised Guidance. It should include worked examples showing how quantum algorithm claims can satisfy Alice step two by relying on technical quantum effects such as decoherence management and qubit fidelity improvement. The Indian Patent Office should also issue Quantum and AI Examination Guidelines that formally apply the *Ferid Allani* technical effect doctrine. In the EPO context, the COMVIK approach should be clarified for quantum-classical hybrid claims.

Second, enhanced disclosure standards. The quantum enablement gap requires a technology-sensitive disclosure obligation specifying: (a) the quantum hardware architecture on which the claimed algorithm has been implemented.; (b) the qubit count, gate fidelity, and coherence time required for practical operation; and (c) any classical simulation used to validate the claimed quantum advantage. The minimum disclosure standard under TRIPS Article 29(1) is insufficient. A WIPO Model Law should establish this higher threshold.

Third, AI-assisted inventorship reform. The combined effect of *DABUS*, *Thaler v. Vidal*, and *Thaler v. Comptroller General* is that AI-generated quantum inventions are unpatentable in all three major jurisdictions. A legislative solution that allows an AI system to be designated as a "contributing instrument" while vesting ownership in the deploying entity, would preserve

[126] National Quantum Initiative Act, Pub. L. No. 115-368, 132 Stat. 5092 (2018) (US); European Commission, Quantum Flagship Programme Mid-Term Evaluation (EC, Brussels, 2022) p. 14.

human accountability while still supporting quantum-AI innovation. In addition, concerns about patent thickets require antitrust scrutiny of major incumbents' quantum portfolios and FRAND-style access obligations for standard-essential quantum communication patents.

CONCLUSION

The central research question must be answered in negative. Existing patent law frameworks are not adequately prepared to address the challenges posed by quantum computing. The *Alice/Mayo* doctrine creates uncertainty for quantum algorithms. The quantum enablement gap is structurally unaddressed. AI-generated quantum inventions are unlikely to be unpatentable across India, the United States, and Europe without legislative reform. In addition, the concentration of quantum patents in the hands of technology incumbents creates structural barriers to access. The fourteen decisions analysed show that judicial adaptation cannot replace purposeful legislative and administrative reform.

Three interventions are urgent: (i) quantum specific patent eligibility and examination guidelines by the USPTO, the Indian Patent Office, and the EPO; (ii) enhanced disclosure standards calibrated to the enablement challenges peculiar to quantum hardware; and (iii) a WIPO-led framework for AI-assisted inventorship accommodating quantum-AI hybrid innovation without sacrificing human accountability. Patent law was not designed for the quantum age. The question is whether it will be reformed before its inadequacy becomes a material barrier to the technologies upon which the next era of scientific progress depends.

CHAPTER 5: DATA-DRIVEN INVENTIONS AND THE QUESTION OF TECHNICAL EFFECT

BY ANISHA ZENDE

INTRODUCTION

Emerging technology advancement utilized by organizations has increased including Artificial Intelligence (AI), Machine Learning (ML), and Big Data which questioned patentability. Data-driven innovation requires exclusive legal rights over the described invention to encourage research and development (R&D) investment, reduce commercial uncertainty, and drive technological progress. This chapter talks about the patentability of such inventions under Indian patent law, with particular focus on the exclusions under Section 3(k) of the Patents Act, 1970. Evolving CRI Guidelines and judicial doctrine of "technical effect."

The chapter proceeds in four parts. First, it defines data-driven inventions and examines their technological and economic significance. Second, it analyses the patentability framework applicable to such inventions in India, including the Section 3(k) exclusion, the evolution of the Computer Related Inventions (CRI) Guidelines, disclosure obligations under Section 10, and key judicial decisions. Third, it examines the technical effect doctrine and the distinction between "technical effect" and "technical contribution." Finally, it offers a comparative analysis through case laws adopted by the European Patent Office and the United States Supreme Court, which plays a role in India's evolving framework.

UNDERSTANDING DATA-DRIVEN INVENTIONS

Data-driven innovation may be defined as the collecting, processing and analysis of large-scale datasets for practical application. It will reduce the uncertainty and enhance creativity of

inventors.[127] The nature of innovation has shifted, whether the invention provides a technical solution by improving by efficiency, errors or speed is considered to have technical effect. It raised the question whether such inventions are eligible to patent or not. If it is, what are the requirements to be fulfilled by the inventor to protect the defined invention.

Artificial Intelligence (AI), Machine Learning (ML) and Big Data Technologies

Artificial Intelligence (AI) and Machine Learning (ML) are tools of data-driven inventions which help in analysing and interpreting large volumes of data extracted from Big Data. Organizations across diverse sectors are increasingly using AI-driven Platforms to navigate volatile environments, manage the growing "knowledge burden," and meet evolving customer and market requirements.[128] For example, the startup Atomwise uses neural networks to predict the performance of new drugs, while other researchers mine peptide and compound databases to accelerate COVID-19 vaccine discovery. Therefore, there is a need for emerging technology to ease the work of organizations in various sectors such as Healthcare, manufacturing, finance, e-commerce, telecommunications, etc.[129]

Big Data refers to datasets of such volume, velocity, and variety that they cannot be processed using traditional methods and require specialised computational infrastructure for storage and analysis. In this relationship, big data provides the "information and inspiration" required to reduce uncertainty and enhance creativity. Machine Learning is a subset of AI in which systems improve their performance on a given task by learning from data, rather than from instructions written by a human programmer. Artificial intelligence known as computer systems that perform tasks by human intelligence including complex problem-solving, reasoning, and pattern recognition.

These three technologies are interconnected with each other such as big data provides the raw material, machine learning provides the method of extracting important material and AI describes the result. An abstract idea, such as a mathematical formula or a theoretical construct of Artificial intelligence or Machine learning or Deep learning lack practical application and

[127] Jianxin Luo, 'Data-Driven Innovation: What Is It?', (2022) 69(1) *IEEE Transactions on Engineering Management*.
[128] 'Data-Driven Innovation: Digital Tools, Artificial Intelligence and Big Data' in *Innovation as a Competitive Advantage* (OECD Publishing, 2015).
[129] Jianxin Luo, 'Data-Driven Innovation: What Is It?', (2022) 69(1) *IEEE Transactions on Engineering Management*.

therefore are not patentable. AI fuelled with big data, the innovation process moves from abstract ideas into a real-world tangible application, which is a key requirement for these inventions for patentable application of patentable. [130]

Economic and Technological Significance of Data-Driven Innovation

Data has evolved into an infrastructural resource and a form of "non-trivial capital," which shows the growing economic significance of data-driven innovation. It can be used in several ways to form different products and services. Such as multiple sectors including healthcare, agriculture, manufacturing, finance and public sector, each deriving value of it in different ways. For example., in healthcare, data-driven innovation has the potential to shift models toward value-based delivery, rewarding the quality of treatment rather than just the quantity, which is vital for managing escalating costs.[131] This is why companies like Google, Amazon, and Jio Platforms are so valuable because their core asset is data, not physical infrastructure.

Businesses or Industrial firms experienced use of data-driven innovation which showed an increase of 5% to 10% faster productivity growth compared with others.[132] That`s not a small margin, it`s the difference between leading a market and falling behind. Organizations using Complex machinery where data-driven predictive maintenance allows firms to avoid unnecessary repairs and schedule them precisely when needed, reducing downtime.[133]

Inventors had limited exclusive rights of disclosure in which it can be revoked after some time. To provide protection as well as disclose the invention, thereby encouraging both innovation and broader economic growth.[134] When inventors know their data-driven inventions can be patented and protected, they are more willing to invest time and money into research. Without that protection, they would keep innovations as trade secrets which harms the public disclosure

[130] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).
[131] Sonja Zillner, et. al., "Big Data-Driven Innovation in Industrial Sectors" in J.M. Cavanillas, et. al. (eds.), New Horizons for a Data-Driven Economy 169 (Springer, 2016).
[132] "Data-Driven Innovation: Digital Tools, Artificial Intelligence and Big Data," in Innovation as a Competitive Advantage.
[133] Sonja Zillner, et. al., "Big Data-Driven Innovation in Industrial Sectors" in J.M. Cavanillas, et. al. (eds.), New Horizons for a Data-Driven Economy 169 (Springer, 2016).
[134] OpenTV Inc. v. Controller of Patents and Designs, 3035/2023, Delhi High Court.

because knowledge never gets shared. Therefore, slowing down technical advancement results in reduction in investment affecting economic growth.

Patentability Challenges of Data-Driven Technologies

Data-driven technologies including AI, ML, Big Data, and Blockchain face legal and technical challenges in patentability, primarily because they are excluded under Section 3(k) of Indian Patent Act, 1970. Historically, patent offices disqualify innovations from patentability based on abstract ideas, such as mathematical formulas or theoretical constructs, as unpatentable due to lack of practical application.[135] However, judicial development and revised CRI Guidelines transformed into tangible real-world application can be eligible for patent protection.

To overcome the exclusions of Section 3(k), an invention must demonstrate a technical effect which is a bridge between an input and a processor that results in an efficient output beyond mere incidental effects. The invention must improve the system`s functioning and efficiency to solve technical problems.[136] This requirement is the cornerstone of patent protection for data-driven inventions and the central doctrinal theme of this chapter.

The Challenge of "Sufficiency of Disclosure" Under Section 10(4), where a patent must fully and particularly describe "What" the invention is and "How" to perform it. AI-Generated Inventions created autonomously by AI and are not patentable because AI cannot be recognized as a "Person" (the true and first inventor) under Section 6 of the Patents Act.[137]

Disclosure Requirements under Section 10

Patent protection operates on a quid pro quo basis. The government grants an inventor a twenty-year monopoly in exchange for complete disclosure of the invention, enabling a person of ordinary skill in the art to understand and reproduce it without further inventive effort.[138] Where the inventor fails to disclose the invention with sufficient clarity, the application may be refused under Section 10(4) of the Patents Act, 1970, whether the invention is novel and inventive.

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[135] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).
[136] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).
[137] The Patents Act, 1970 (Act 39 of 1970).
[138] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).

Requirements under Section 10(4) of the Patents Act, 1970:

(a) Describe the invention fully and particularly, its operation or use and the method by which it is to performed;

(b) It must disclose the best method of performing the invention which is known to the applicant and for which he is entitled to claim protection;

(c) It must end with a claim or claims defining the scope of the invention for which protection is claimed; and

(d)It must be accompanied by an abstract providing technical information on the invention.[139]

For a traditional invention example an inventor designs a new car engine knows how every part works and can show it by diagram is easy to disclose. AI or ML inventions must disclose detailed structural data, such as neural network layers, depth, activation functions, and the specific type of learning algorithm used.[140]

The neutral networks learn by adjusting millions of internal numbers based on training data and it often gets difficult to explain fully why a network arrived at those specific numbers for complex inventions. This is called the “Black Box” problem. Complete enabling disclosure is inherently difficult for highly complex AI systems.

In *Caleb Suresh Motupalli vs Controller of Patents and Designs (2023)*, the Delhi High Court held that the invention failed the test under Section 10(4) because the specification was devoid of technological enablement for its claimed features. The court noted that merely mentioning the use of standard techniques (like "Object Oriented Analysis and Design") without teaching or providing working examples on how the claimed integration was achieved forced the PSITA to use their own inventive faculty, which is impermissible.[141]

[139] The Patents Act, 1970 (Act 39 of 1970).
[140] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).
[141] Caleb Suresh Motupalli v. Controller of Patents and Designs, Delhi High Court, 2023.

PATENTABILITY FRAMEWORK IN INDIA

To qualify for a patent under the Patents Act, 1970, an invention must satisfy four cumulative requirements. As defined under Section 2(1)(j), an "invention" means a new product or process that involves an inventive step and is capable of industrial application. Inventions with mere abstract ideas are not patentable as practical application is must to provide technical solutions.[142]

Novelty

Introduced by the Patents (Amendment) Act, 2002, the novelty requirement mandates that an invention must be new, that is, it must not have been anticipated by publication in any document or used in the country or elsewhere in the world before the date of filing of patent application with complete specification.[143]

Recent jurisprudence in *Ericsson v. Lava* has proposed a "Seven Stambhas Approach" for determining novelty in case which includes: (i) understanding of the claims; (ii) identify prior art; (iii) analysing the prior art; (iv) determine explicit and implicit disclosures, identify the material differences between the claim and prior art; (vi) confirming that such differences were not previously disclosed; and (vii) documentation of the Analysis and Novelty Determination.[144]

Inventive Step

Under Section 2(1) (ja), "inventive step" means a feature of an invention that involves technical advance as compared to existing knowledge, or having economic significance, or both, such that the invention is not obvious to a person skilled in the art.[145] Indian courts apply a five-step analysis to this question:

1. Identify the "person skilled in the art," being a competent craftsman or engineer, as distinguished from a mere artisan;
2. Identify the relevant common general knowledge of that person as of the priority date;

[142] The Patents Act, 1970 (Act 39 of 1970), s 2(1)(j).
[143] Controller General of Patents, Designs and Trade Marks, *Guidelines for Examination of Computer Related Inventions (CRIs)* (2017).
[144] Telefonktiebolaget Lm Ericsson (Publ) vs Lava International Ltd (2024).
[145] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).

3. Identify the inventive concept of the claim in question;
4. Identify the differences, if any, between the prior art and the inventive concept of the claim; and
5. Determine whether, viewed without knowledge of the alleged invention, those differences would have been obvious to the person skilled in the art, or whether they required a degree of inventive ingenuity.

Obviousness must be assessed strictly and objectively. The invention must always be considered as a whole rather than deciding on the basis of a particular part.[146]

Industrial Applicability

Under Section 2(1) (ac), an invention must be capable of being made or used in an industry. It must be workable and useful for organizations. Mere speculative utility or vague indications are not qualified. For data-driven inventions, the general three requirements are their novelty, inventive step, and industrial applicability which constitute a general threshold that must be satisfied before any further analysis under Section 3(k) is undertaken.

Exclusive matter under section 3(k)

Section 3(k) of the Patents Act, 1970 is the obstacle for data-driven and computer-related inventions. It provides that "a mathematical or business method or a computer programme per se or algorithms" shall not be patentable.[147] Four categories of subject matter are thereby excluded: mathematical methods, business methods, computer programmes, and algorithms. Here the core question is whether AI inventions can be patentable or not.

The provision was inserted by the Patents (Amendment) Act, 2002, added the “per se” which means “by itself” or “as such” by replacing computer programmes without qualification. It says mere coding or computer programmes or pure mathematical methods are not eligible for patent. It consists of four distinct subject matter that act as hurdles for data-driven and software inventions-

[146] Biswanath Prasad Radhey Shyam vs Hindustan Metal Industries Ltd (AIR 1982 SC 1444).
[147] The Patents Act, 1970 (Act 39 of 1970), s 2(1)(j).

Mathematical Methods: Abstract intellectual exercises (e.g., equations, formulations) are excluded unless they form part of a larger technical process achieving a broader technical objective.

Business Methods: The exclusion of business methods is absolute in India and is not qualified by the term per se. If the core of an invention is a commercial or administrative strategy (e.g., a financial scheme or marketing plan), it is non-patentable even if it has technological features.

Algorithms: These are excluded in all forms, a set of rules or any sequence of steps or procedures, or finite instructions.[148] However, if an algorithm is implemented through software to achieve a technical effect, it can be judged for patentability.

Computer Programs per se: The suffix "per se" was a conscious legislative addition to ensure that genuine inventions developed based on computer programs that include substantive technical features are not refused.[149]

Data-driven inventions are formed by coding which is a part of computer programs which give a set of instructions to perform tasks. While S.3(k) of the Patents Act, 1970, excludes "computer programs per se" and "algorithms," the law recognizes that AI inventions can be patentable when they provide a technical solution to a technical problem.[150] If the invention is purely a set of instructions or a business method (commercial), it will be rejected as non-patentable, regardless of whether it is implemented through AI.

EVOLUTION OF CRI GUIDELINES

The CRI Guidelines are administrative instructions issued by the Indian Patent Office (IPO) directing patent examiners in the application of Section 3(k) to computer-related patent applications. Because Section 3(k) is not explained properly, the Guidelines serve as a practical manual to guide examiners in determining whether to grant or refuse a CRI patent application. It

[148] Controller General of Patents, Designs and Trade Marks, *Guidelines for Examination of Computer Related Inventions (CRIs)* (2017).
[149] Ferid Allani v. Union of India & Ors., W.P.(C) 7/2014, Delhi High Court, 2019.
[150] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).

leads to a balance between promoting innovation and preventing the monopolisation of abstract ideas.

2013-2016: The CRI Guidelines excluded all subject matter under Section 3(k) including business methods, mathematical methods and algorithms from patentability. A rigid three-stage test was adopted for examination where it must be both the computer program as well as "novel hardware" to be patentable.[151]

2017: The 2017 Guidelines abolished the novel hardware requirement and removed the illustrative examples of patent-eligible and ineligible subject matter that had previously guided examiners. This omission subsequently led courts to call for new "signposts" to assist in the examination process of CRI Guidelines.[152] The 2017 revision represented a progressive shift toward substance over form.

2025: The "Advanced Technology" Framework in 2025 Guidelines addressed high-tech fields including AI, ML, Blockchain, and Quantum Computing.[153] To remove the ambiguity of the 2017 Guidelines, eight detailed hypothetical scenarios were included to illustrate the "Sufficiency of Disclosure" standard and the application of the Section 3(k) bar. The Guidelines codified the technical effect doctrine established in judicial decisions e.g., Ferid Allani v. Union of India (2019) and Microsoft v. Assistant Controller (2023). Where the court held that "technical effect" or "technical contribution" test which provides a technical solution to a technical problem (e.g., faster data processing or improved security) becomes an exception of s.3(k) exclusion.

For Data-driven inventions it is mandated to disclose u/s.10 of Patents Act, 1970, so that a person with ordinary skill in the art can understand the innovation and reproduce it. Disclosing the logic of input-to-output transformation, neural network architecture, and defining traits of training data to prevent "black box" secrets.[154]

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[151] Microsoft Technology Licensing, LLC v. Assistant Controller of Patents and Designs, 3342/2023, Delhi High Court, 2023.
[152] Microsoft Technology Licensing, LLC v. Assistant Controller of Patents and Designs, 3342/2023, Delhi High Court, 2023
[153] Pritivika Jaishi and Vibha Kulkarni, "Decoding Section 3(k): The Evolving Landscape for Software and AI Patent", V & VI *IP Bulletin* 31 (2024-2025).
[154] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).

The 2025 Guidelines explicitly state that AI-generated inventions (created without human intervention) are not patentable, as AI is not a "Person" under Section 6 of the Act. It explained Inventorship in AI related inventions and distinguished broad categories like AI-generated inventions and AI-assisted inventions.

The Significance of CRI Evolution

Translate Vague law of Section 3(k) as it is difficult to determine whether invention has “per se” or technical effect. The Guidelines fill this gap by giving examiners concrete steps and examples. Give clarity that AI-assisted inventions remain patentable if they meet another requirement. It is flexible in absence of legislative reform and extended examination standards for emerging technologies in India developed from administrative guidance.

The patent system acts as a quid pro quo, encouraging companies to disclose complex technological knowledge in exchange for limited exclusive rights, thereby preventing these innovations from remaining as "black box" trade secrets.[155]Advancements in CRI Guidelines are transforming industries such as Healthcare (early diagnostics), Finance (risk management), and Manufacturing (Industry 4.0/predictive maintenance).[156]

JUDICIAL INTERPRETATION

Ferid Allani v. Union of India (2019)

The petitioner filed a patent application in India for “a method and device for accessing information sources and services on the web," which consists of both method and device claims. The application was rejected due to lack of novelty and non-patentability under Section 3(k), on the basis that the claimed method constituted a "computer program" within the meaning of that provision and that the remaining claims lacked novelty. The Intellectual Property Appellate Board (IPAB) dismissed the subsequent appeal in 2013, stating that the application failed to

[155] Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (2025).
[156] Sonja Zillner, et. al., "Big Data-Driven Innovation in Industrial Sectors" in J.M. Cavanillas, et. al. (eds.), *New Horizons for a Data-Driven Economy* 169 (Springer, 2016).

disclose a "technical effect" or "technical advancement". The petitioner thereafter filed a writ petition before the Delhi High Court.[157]

The central issue was whether an invention based on a computer program is automatically excluded from patentability by the bar on "computer programs per se" in Section 3(k). Justice Prathibha M. Singh held that not all inventions based on computer programs are so excluded. A genuine invention which demonstrates a technical effect is patentable even if implemented via software. The Court identifies several indicators of technical effect, including higher processing speed, reduced memory usage, enhanced user interfaces, improved database searches and better device control.

This is a landmark case as it is given as the primary test for AI programme or Data-driven invention in India. This case given the "technical effect" doctrine the mandatory standard for the Indian Patent Office (IPO) when examining Computer Related Inventions (CRIs).[158] The emerging innovations such as Artificial Intelligence (AI), blockchain, and other digital products are patentable if they provide a technical solution. It shaped the CRI guidelines and abolished “Novel Hardware” necessity.

Open TV Inc. v. Assistant Controller of Patents and Designs (2023)

The case of *OpenTV Inc. v. Assistant Controller of Patents and Designs (2023)* that clarifies exclusion of Business methods under Section 3(k) of the Patents Act, 1970. The case was filed by OpenTV Inc., a U.S- based company providing interactive television solutions. A patent application titled "System and method to provide gift media" was rejected on grounds that the subject matter fell under the Section 3(k) exclusion for business methods. A data analytics system that optimizes commercial transactions, price algorithms, or customer segmentation- where the core problem being solved is commercial rather than technical will be treated as a business method and refused u/s.3(k).

The central issue was whether the "technical effect" test, applicable to computer programs claims or extends to business methods claims. The Delhi High Court held that, unlike the exclusion of "computer programs," which is qualified by the term “per se” and the exclusion for business

[157] Ferid Allani v. Union of India & Ors., W.P.(C) 7/2014, Delhi High Court, 2019
[158] Pritivika Jaishi and Vibha Kulkarni, "Decoding Section 3(k): The Evolving Landscape for Software and AI Patent", V & VI *IP Bulletin* 31 (2024-2025).

methods in India is absolute. The "technical effect" or "technical contribution" analysis is accordingly inapplicable to business method inventions in the same manner as it is to software claims.[159] This decision carries significant implications for AI-driven business optimisation patents in India.

Microsoft Technology Licensing, LLC v. Assistant Controller of Patents and Designs (2023)

Microsoft Technology Licensing, LLC filed a patent application for "Methods and Systems for Authentication of a User for Sub-locations of a Network Location." The application was rejected on the ground that the subject matter is related to algorithms and therefore fell within the "computer program per se" exclusion Section 3(k). The Delhi High Court set aside the rejection.

The Court found that the two-tier authentication protocol provided a technical solution to a technical security problem. This improvement in security and authentication for network sub-locations constituted a clear technical contribution sufficient to overcome Section 3(k).[160] The court remanded the application back to the Patent Office to be evaluated solely on novelty and inventive steps.

The Court emphasised that patent applications must be assessed on the basis of technical advancement and practical applicability rather than rejected solely because they involve algorithms. The decision confirmed that algorithmic inventions in domains such as cybersecurity may satisfy the technical effect requirement and remanded the application to the Patent Office for fresh consideration of novelty and inventive step only.

TECHNICAL EFFECT DOCTRINE

The term “technical effect” is defined neither in the Patents Act, 1970, nor in the European Patent Convention. The doctrine developed through judicial interpretation- primarily by the Boards of Appeal of the European Patent Office. It was subsequently adopted and applied by the Indian courts. Interpretation based on excluded subject matter rather than tangible real-world

[159] OpenTV Inc. v. Controller of Patents and Designs, 3035/2023, Delhi High Court.
[160] Microsoft Technology Licensing, LLC v. Assistant Controller of Patents and Designs, 3342/2023, Delhi High Court, 2023.

application. Now when an invention is said to produce technical effect when it brings physical results beyond mere abstract instructions.

In the Ferid Allani Case, the Delhi High Court held that a computer program is patentable if it demonstrates a technical effect or contribution. For patent eligibility under s.3(k) technical effect it is must and its focus on the output consistency and efficiency of the system. Example improvement in the speed or efficiency, enhanced accuracy in a measurement, reduced access time or strengthened security of a computer system.[161]

Technical Effect vs. Technical Contributions

Although the terms "technical effect" and "technical contribution" are frequently used interchangeably, they bear distinct legal meanings and serve different functions within patent law. Technical effect refers to the solution produced by the invention by solving technical problems. Technical effect needed patent eligibility u/s. 3(k) in which “computer programme per se” is excluded.

Technical Contribution refers to the advancement features of the invention over prior art. In legal perspective it lies in Inventiveness under Section 2(1) (ja) which define and develop with judicial decisions. Technical advancement generally comes with a technical effect but all technical effects do not show technical advancement.[162]

In practical terms, technical effect focuses on the output consistency, robustness, and efficiency of the system whereas technical contribution focuses on the innovative nature of the implementation itself over what was previously known.

Comparative Analysis

European Approach:

In *VICOM Systems Inc. (1987)* case of patent application for digital image processing. It used a mathematical algorithm to enhance image quality. The Examining Division rejected on ground

[161] Microsoft Technology Licensing, LLC v. Assistant Controller of Patents and Designs, 3342/2023, Delhi High Court, 2023.
[162] Ferid Allani v. Union of India & Ors., W.P.(C) 7/2014, Delhi High Court, 2019.

that mathematical methods excluded subject matter from patentability under Article 52(2)(a) of the European Patent Convention.[163]

The Board relied on technical processes and set aside previous approaches. Claiming that rejecting on ground of using mathematical methods in abstract ideas are not eligible for patent. It is a must to show a technical entity for approval. A mere abstract method is not eligible for patentability.

The "claim as a whole" approach clearly in VICOM and evaluating whether a claim is taken as entirely to make sure technical processes exist or not. Similarly, in Ferid Allani v. UOI (2019) Delhi High Court applied the same logic that computer related inventions demonstrating "technical effect" or "technical contribution" are exceptions to s.3(k) of Patents Act, 1970.

United States Approach:

The case of *Alice Corp. v. CLS Bank International (2014)* is a landmark case giving two Step Tests for patent application. In this case the Supreme Court invalidated Alice's patents on the basis of an abstract using generic computer functions. Lack of "inventive concept" and therefore not eligible for patent protection. Two Step test was given: First, Whether the claims are directed to patent ineligible subject matter. And if so, whether it contains inventive concepts beyond abstract methods.

In the US it limited the approach of AI & Data-driven inventions have been rejected as directed to "abstract ideas" with no sufficient inventive concept beyond generic computer implementation.

CONCLUSION

The patentability of data-driven inventions under Indian law presents a complex and evolving challenge due to enforcement in Data-driven inventions. Data-driven technologies continue to grow in complexity and economic significance such as development in the sector like healthcare, fintech, and cybersecurity. It explains Section 3(k) of the Patents Act, 1970 which excludes

[163] VICOM System Inc. (Computer-related invention), T 208/84, European Patent Office, Technical Board of Appeal, 1987.

mathematical methods, business methods, algorithms, and computer programs per se. These exclusions are not absolute in respect of software and AI-driven innovations. Due to landmark decisions and revised CRI Guidelines, Indian courts and IPO have developed the "technical effect" doctrine as the governing standard for determining the patentability of data-driven inventions.

Three critical principles emerge from this analysis. First, a data-driven invention is not considered non-patentable merely it shows an algorithm or implemented through software. What is seen is whether the invention is taken as a whole and produces a technical effect to a technical problem through technical solution. Second, the exclusion of business methods under Section 3(k) is absolute. It carries substantial implications for AI-driven business optimisation applications, where the core problem being solved must be technical rather than commercial in order to attract patent protection. Third, full disclosure under Section 10 is a prerequisite to protection. It’s difficult for an inventor to explain in detail architectural disclosure for complex AI systems and machines.

The evolution of the CRI Guidelines in the 2025 put effort to maintain technical effect doctrinal coherence in the face of rapid technological change. Nevertheless, the vague or undefined statutory terms and the absence of legislative amendment to the Patents Act, 1970 continue to generate uncertainty for inventors and patent practitioners navigating this space. Viewed comparatively, both jurisdiction lesson from the European "claim as a whole" approach and the United States, the risks of doctrinal rigidity in a rapidly evolving technological landscape. When the legal framework is sufficiently clear and predictable for application, it helps inventors to understand and develop accordingly.

CHAPTER 6: CYBERSECURITY INNOVATIONS AND PATENT PROTECTION IN THE DIGITAL AGE

BY JANVI SEHGAL

INTRODUCTION

A modern digital economy is heavily reliant on secure information systems, interconnected networks, and information technologies. With the rise of government institutions, organizations, and individuals utilizing digital infrastructure for purposes of communication, transactions, decision-making, innovation, and other activities, cybersecurity has developed into an essential component of both economic and national security. The need for such infrastructure has only been strengthened by developments like Digital India, use of more fintech services, the Digital Personal Data Protection Act, 2023, and CERT-In's expanding role in India. Cyber attacks, which include ransomware, data breaches, denial-of-service attacks, and other actions committed against computer infrastructure and digital devices have contributed to an increased need for innovation in cybersecurity technology. In turn, innovation in cybersecurity technology is becoming one of the fastest growing sectors of information technology, with high investment in research and development.

This has led to an increase in patent filings in this sector, as patents protect inventors' intellectual property rights and stimulate technological innovation. Patent law ensures that creators are protected by exclusive rights to inventions that meet the criteria of novelty and non-obviousness. In the cybersecurity domain, some examples of innovations receiving patents may be intrusion detection systems, encryption methods, AI tools for identifying potential threats, blockchain technology for enhancing security, quantum-resistant cryptographic algorithms, and other cybersecurity innovations.[164]

[164] World Intellectual Property Organization, *WIPO Patent Landscape Report on Cybersecurity Technologies*.

Examples could be RSA Security's patents for encryption techniques, IBM's solutions in blockchain security, Palo Alto Networks' network threats detection techniques, and the patents from ID Quantique for quantum key distribution techniques.

However, there is more to this connection between innovation in the sphere of cybersecurity and patent law. First of all, most inventions in cybersecurity are software-related and therefore run into issues connected with patenting software inventions. Software patents are widely debated across jurisdictions and vary greatly, which may result in problems for companies operating in several countries simultaneously. Moreover, patent law obliges inventors to disclose their discoveries to the public, while in many cases cybersecurity requires protecting confidential technical information, creating a rather unique situation of conflicting interests.

These problems become especially obvious in the case of India, whose Patents Act, 1970 does not provide patent protection for computer programs *per se* (Section 3k). Although the judicial practice has been trying to make things clearer for the inventor in regard to what types of computer inventions may be patented, it remains unclear how this provision will affect advanced cybersecurity techniques. Similar discussions arise in such jurisdictions as the USA and Europe.

This chapter analyzes the evolution of cybersecurity technology, evaluates the laws governing the patenting process, examines the approaches taken by India, the United States, and the European Union, and discusses the challenges facing the patenting of AI, blockchain, and quantum computing technologies.

While patents are crucial in motivating cybersecurity innovation, it has become increasingly difficult for the traditional system to accommodate innovations based on software, artificial intelligence, blockchain technology, and post-quantum cryptography. Furthermore, the chapter suggests that India ought to take a more technical effect-oriented approach in addressing the need for innovation with cybersecurity considerations in mind.

EVOLUTION OF CYBERSECURITY INNOVATIONS

Historical Development of Cybersecurity Technologies

Over time, the evolution of cybersecurity technologies has been accompanied by developments in information technology and digital communication. In its initial stages, cybersecurity was a purely defensive measure that entailed securing individual computers against any form of hacking and intrusion. The main cybersecurity technologies used between the 1980s and the early 1990s included passwords for access control and antivirus programs for removing viruses.[165]

The widespread use of the internet changed the demands for cybersecurity completely. As companies integrated their computers into networks, the need arose for more sophisticated techniques of cybersecurity. This resulted in the invention of technologies such as firewalls, intrusion detection systems (IDS) and intrusion prevention systems (IPS). These were meant to monitor all data transferred over the network.

The emergence of cloud computing resulted in more innovative ideas within the field of cybersecurity. With more businesses moving their sensitive data and services into the cloud, there was a need for more robust cybersecurity systems. Multi-factor authentication systems, endpoint protection solutions, and cloud access security brokers became key components to secure cloud-based systems. The use of cloud computing created challenges relating to the privacy of data, data transfers across borders, and security of third-party vendors.[166]

Artificial intelligence and machine learning technology have been applied within the last few years within cybersecurity systems. Conventional cybersecurity systems based on signatures are unable to detect many cyber attacks, especially when it comes to zero-day exploits and advanced persistent threats. Artificial intelligence allows the system to process large quantities of network

[165] Ross J. Anderson, *Security Engineering: A Guide to Building Dependable Distributed Systems* (Wiley, Indianapolis, 3rd edn., 2020).
[166] William Stallings, *Network Security Essentials: Applications and Standards* (Pearson, London, 7th edn., 2021).

traffic, look for unusual patterns, and forecast the occurrence of certain security events. Machine learning systems that help in threat intelligence have become common.[167]

Another important trend has been the introduction of blockchain technology as a cybersecurity solution. The decentralized structure of blockchain offers possibilities for managing identities securely, maintaining records that cannot be manipulated, and securing transactions. The same is true about the application of zero-trust security principles, which is another trend towards continuous authentication and verification of systems, abandoning perimetrical cybersecurity models.

The evolution of cybersecurity technology has clearly shown that today's solutions are highly dependent on software, rely on large volumes of data, and use computing techniques extensively. Hence, there is little difference between developing software and developing cybersecurity measures anymore. It has resulted in a heated discussion about whether computer technologies can be patented.

PATENT PROTECTION FOR CYBERSECURITY TECHNOLOGIES

The efficiency of cybersecurity innovations does not only depend on advancements in science and technology but also on the presence of laws that can be used to stimulate research and development activities. The patent law is one of the best intellectual property laws in promoting innovations since it provides inventors with exclusive rights to use their newly invented product or processes. With regard to cybersecurity innovations, a patent provides the inventor with the right to recover investments in research, attract venture capital, achieve competitive advantage, and license the technology to other companies.

In India, a patented invention should meet several conditions, which include being new, containing an inventive step, and being industrially applicable. Under section 2(1)(j) of the Patents Act of 1970, an invention is defined as a new product or process that contains an

[167] David S. Wall, “Artificial Intelligence and Cybersecurity: Emerging Challenges and Opportunities” 18 Computer Law & Security Review 211 (2022).

inventive step and can be industrially applied.[168] Being new means that it has not been revealed before, while having an inventive step implies that the invention involves technical advancement and economic significance.[169] Due to this reason, most cybersecurity technologies can fit the requirement of inventions under patent laws.

Patent protection holds greater significance in the cybersecurity sector due to the high cost required for research and development of sophisticated security technologies. Businesses spend significantly on threat intelligence solutions, cryptography protocols, antivirus software, cloud computing systems, and intelligent surveillance systems. Through patent protection, it is possible for businesses to capitalize on the invention and prevent their exploitation through piracy. As such, patents ensure that a competitive environment is fostered as well as promoting the development of new technologies.

There are special challenges surrounding patents in the cybersecurity domain. In comparison to mechanical inventions, there are many differences as far as software programs are concerned. One of the biggest controversies surrounding patenting has been the issue of software patents since software typically involves algorithms, computer programs, and mathematical methods. This problem is exacerbated in India because section 3(k) of Patents Act, 1970 does not allow patents for "a mathematical or business method or a computer programme per se or algorithms."[170]

Interpretation of Section 3(k) has led to much controversy over whether protection is possible for any computer-based invention. Strict interpretation can possibly prevent many cybersecurity inventions from patent protection because the use of algorithms, machine learning models, and decision-making in modern times can all be performed using computers. But recent judicial and administrative pronouncements have emphasized that inventions by computers leading to technical effects should be granted patent protection.

[168] The Patents Act, 1970 (Act 39 of 1970), s. 2(1)(j).
[169] The Patents Act, 1970 (Act 39 of 1970), s. 2(1)(ja).
[170] The Patents Act, 1970 (Act 39 of 1970), s. 3(k).

One important decision rendered by the Delhi High Court is in *Ferid Allani v. Union of India.*[171] In this case, the petitioner applied for a patent for a computer-based invention and was denied because he did not satisfy the requirement set forth in Section 3(k), meaning that his invention was a computer program *per se*. The Court took note of how technology had developed considerably since the enactment of the Patents Act. The Court then ruled that a narrower interpretation of Section 3(k) would stifle technological progress. The Court stressed the significance of the "technical effect" test and "technical contribution" test.[172]

The significance of Ferid Allani extends beyond the broader question of software patentability. From the perspective of innovators of cybersecurity systems, the judgment offers a road map for the protection of technical inventions such as artificial intelligence-based threat detection, behavior analysis, authentication, and intrusion prevention systems.

The principle applied in Ferid Allani is pertinent to cybersecurity technology innovations. In most instances, technologies like intrusion detection systems, network monitoring technologies, and threat detection technologies using artificial intelligence provide a measurable technical effect through improved system functionality, network security protection, and prevention of access by unauthorized users. It follows that cybersecurity technology inventions would meet the requirements of the technical effect requirement regardless of significant software involvement in the innovation.

There has been a similar controversy in the United States. The landmark case of *Alice Corp. v. CLS Bank International* laid down a restrictive standard for patenting software innovations.[173] According to the Court's decision, simply performing an abstract idea on a computer will not make the invention patent eligible. The judgment provided a test for judges to first determine whether the claimed invention was directed to an abstract idea, and second, consider if there were any elements that could convert the idea into something eligible for patent protection. While the objective of Alice was to prevent overbroad software patents, some people have raised

[171] *Ferid Allani v. Union of India*, W.P.(C) 7/2014, Delhi High Court.
[172] *Ferid Allani v. Union of India*, W.P.(C) 7/2014, Delhi High Court.
[173] *Alice Corp. Pty. Ltd. v. CLS Bank International*, 573 U.S. 208 (2014).

concerns about its negative impact on computer-related inventions including cybersecurity technologies.

More recent judgments have sought to clarify the implementation of Alice. For instance, the United States Court of Appeals for the Federal Circuit ruled in Enfish, *LLC v. Microsoft Corp.* that enhancements in software that improve the functioning of computers can be patented.[174] The above decision is akin to the technical effect test which has become common in Europe and India.

The European Patent Office (EPO) takes a fairly balanced stance by applying a technical character test. Even though Article 52 of the European Patent Convention does not recognize computer programs as being patentable, the EPO has held that if there is a computer implemented invention that offers a technical solution to a technical problem, then the invention qualifies for patentability.[175] Such cases include IBM (T 1173/97) and COMVIK (T 641/00).[176]

It is especially appropriate for cybersecurity technologies since they usually deal with technical issues such as data security, network protection, and authentication. This is why using the criteria of technical contribution helps not only patent innovations but also prevent monopolizing the idea that lacks concrete application.

Nevertheless, one has to admit that patents for cybersecurity face another peculiar problem of disclosure. In fact, patent legislation demands from its applicants to disclose invention details in order to make it possible for people qualified in the field to replicate it.[177] Disclosure of inventions serves the interest of the community in terms of spreading technological advancements. Nevertheless, there are numerous cases when cybersecurity presupposes confidentiality of technical information, since disclosing security architecture or encryption techniques can be very helpful for people intending to attack computer systems.

[174] *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016).
[175] The European Patent Convention, 1973, art. 52.
[176] *IBM/Computer Program Product* (T 1173/97) [1998] EPO; *Two Identities/COMVIK* (T 641/00) [2002] EPO.
[177] The Patents Act, 1970 (Act 39 of 1970), s. 10.

This is indicative of the dilemma that faces contemporary patent laws. While on one hand, there can be too much secrecy, which may discourage innovation and the transfer of technology, on the other hand, there can be too much transparency, which can run counter to the objective of cybersecurity measures. Thus, a careful balance needs to be struck by the patent regimes so as to encourage innovation while also ensuring that cybersecurity measures are effective.

Judicial interpretation in India, the United States, and Europe has shown increasing readiness to accept innovations as such, regardless of whether they use software or not. However, there still seems to be some confusion about the exact scope of patents for cybersecurity technologies. Given the fact that future developments in this area would largely revolve around artificial intelligence, blockchain, and cryptography technologies, this is a challenge that will persist.

EMERGING TECHNOLOGIES AND PATENT CHALLENGES

The development of digital technologies has led to changes in the way cybersecurity innovation takes place. The latest cybersecurity innovations depend on the use of artificial intelligence, blockchain technology, quantum cryptography, and automatic threat intelligence. As such developments create new possibilities for enhancing digital security, they have also created some difficulties regarding patent law. Existing patent laws were mainly created in order to protect physical inventions in industry; however, they are ill-equipped to handle innovative technologies in the digital world.

Artificial Intelligence and Machine Learning in Cybersecurity

Both artificial intelligence (AI) and machine learning (ML) play essential roles in current cybersecurity processes. Unlike other security measures based on specific pre-established signatures and rules, AI-based cybersecurity solutions are able to process large amounts of data, spot potential anomalies, detect emerging cyber threats, and respond to any attacks instantly. It is becoming more common for banks, healthcare companies, governmental departments, and tech firms to implement intelligent systems to protect their infrastructures from various cybersecurity attacks.[178]

[178] Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach* (Pearson, London, 4th edn., 2021).

The use of artificial intelligence in cybersecurity greatly improves the capacity of companies to combat complex cyber risks. Due to its adaptive nature, ML is able to evolve and react to changing attack patterns, ensuring the proactive detection of potential threats. It is especially effective when dealing with advanced persistent threats (APTs) and zero-day attacks.

Recently, the emergence of generative AI has proved to be an important security measure. Generative AI is used in applications such as malware detection, vulnerability assessment, phishing detection, and threat intelligence generation. On the other hand, with the advancement of AI in generating solutions independently, important concerns regarding ownership, inventorship, and patent eligibility have arisen.

On the other hand, the rise in the dependence on artificial intelligence has created several legal issues from the point of view of patent law. In the first place, the patent eligibility of the invention is often disputed because of the nature of AI inventions that include algorithms, data processing methods, and mathematical models excluded from patent protection on account of being abstract ideas and computer programs. Secondly, the difference between patentable invention and non-patentable algorithm is not always clear in various jurisdictions.[179]

Moreover, another problem pertains to the issue of inventorship when cybersecurity inventions are made by the artificial intelligence software independently of the human. Although today most countries require human inventors of any patent, there are increasing discussions concerning intellectual property rights in case of inventions with minimum human input in view of an expanding role of artificial intelligence.[180]

Blockchain-Based Security Technologies

The area of blockchain technology is also worth mentioning. Initially designed to operate with cryptocurrencies, blockchain has become a highly innovative technological platform that can be utilized in order to improve data integrity, identity, authentication, and record-keeping. The

[179] Ryan Abbott, "Artificial Intelligence and Patent Eligibility" 24 Stanford Technology Law Review 59 (2021).
[180] Ryan Abbott, *The Reasonable Robot: Artificial Intelligence and the Law* (Cambridge University Press, Cambridge, 2020).

decentralized nature of blockchain systems makes them especially valuable for solving cybersecurity issues arising from the centralized nature of database management.

Today, businesses are increasingly relying on blockchain-based solutions for verifying digital identities, securing supply chains, implementing effective access control mechanisms, and preventing any changes made to sensitive digital data. Moreover, using blockchain systems may contribute to increased transparency and accountability since blockchain architecture can create a verifiable record of any transaction or event related to digital security.[181]

Concurrent with the increasing practical value of blockchain technology, there has been a significant rise in patent filings for blockchain solutions.[182]

Although there have been such developments, patenting of blockchain technology comes with certain legal issues. First, since many blockchain innovations involve computer software, cryptography, and business method claims, the definition of what is patentable becomes ambiguous. Additionally, as the patent concentration in the blockchain space becomes increasingly more pronounced amongst tech giants, it is becoming more difficult to navigate the issue of patent thicket. A patent thicket is characterized by an abundance of overlapping patents that make innovation more costly due to licensing issues. This is particularly a problem in cybersecurity.

Quantum Cryptography and Post-Quantum Security

Quantum computing is one of the most revolutionary technological breakthroughs of the twenty-first century. On the one hand, quantum computing offers the possibility of solving complicated computations. However, on the other hand, there are great risks associated with quantum computing and cybersecurity. The reason is that some encryption algorithms used nowadays are based on complicated math tasks that can be resolved using quantum computing.

[181] Melanie Swan, *Blockchain: Blueprint for a New Economy* (O'Reilly Media, Sebastopol, 2015).
[182] World Intellectual Property Organization, *WIPO Technology Trends: Blockchain* (WIPO, Geneva, 2022).

Thus, scientists have created quantum-resistant cryptosystems as well as quantum key distribution (QKD). QKD technologies are built on the basis of quantum physics allowing secure transmission of messages and detection of any attempt to intercept them. Nowadays, quantum cryptography is considered an inevitable part of cybersecurity in the future.[183]

However, there are several specific issues related to the patenting of quantum cybersecurity technologies. First, the fast pace of innovation makes patents become obsolete well before they expire after twenty years. Second, the use of such technologies in national security raises questions concerning export control and technological independence. Hence, issues relating to quantum cybersecurity patents cannot be considered separate from other issues associated with the field.

On the policy level, the role of patenting is to strike a balance between motivating companies to invest resources in innovation on the one hand, and ensuring that these innovations are widely used to increase cybersecurity for all citizens on the other.

Patent Thickets and Technological Convergence

Technological convergence is a salient feature of cybersecurity innovations in the modern era. Today's cybersecurity platforms usually include artificial intelligence, cloud computing, blockchain technology, cryptography, and data analytics all on one platform. Though the convergence improves the level of technological innovation, it presents challenges when applying patent rights.

There are many overlapping patents that raise uncertainties about legal issues associated with cybersecurity innovations. In addition, start-ups and small companies find it hard to deal with patent issues due to an overwhelming number of patent-holding multinationals. The emergence of patent thickets, strategic patenting, and anti-competitive activities has been noted by scholars and practitioners.[184]

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[183] Gilles Van Assche, *Quantum Cryptography and Secret-Key Distillation* (Cambridge University Press, Cambridge, 2006).
[184] Michael A. Heller and Rebecca S. Eisenberg, “Can Patents Deter Innovation? The Anticommons in Biomedical Research” 280 Science 698 (1998).

There is another problem which arises due to fragmentation. The issue becomes quite critical when it comes to cybersecurity because here, successful cybersecurity solutions are often reliant on interoperability and information exchange. An overly fragmented intellectual property system can hinder collective efforts designed to deal with cyber threats at the international level. Therefore, it becomes imperative that there should be certain patent models through which innovation can be promoted without compromising the principle of competition and cooperation.

The recent rise of artificial intelligence, blockchain technology, and quantum security technologies clearly proves that the process of innovation in cybersecurity has been accelerating significantly. While patents have always been very crucial for spurring innovations, certain legal principles would now need to be refined to resolve concerns related to software patentability, inventorship, disclosure, and market dominance.

COMPARATIVE AND INTERNATIONAL PERSPECTIVES

The growing trend of globalization of technology innovations has contributed immensely towards making the comparative study of patents very crucial in the cybersecurity field. Cybersecurity technologies tend to be invented, marketed, and put into use in different jurisdictions, thus demanding that innovators consider the different patent laws. Even though there are similarities in the aims and purposes of patent laws, which include encouraging innovations and development of technologies, there are notable dissimilarities with regards to computer-based inventions.

The Indian Approach

Indian patent legislation indicates a more cautious position concerning software patents. The Indian Patents Act of 1970 provides for "mathematical or business method or a computer programme *per se* or algorithms" as exceptions to be non-patentable under section 3(k).[185] The reason behind this is the prevention of patenting of abstract computational processes as well as achieving an equitable balance between incentives to innovations and access to information.

[185] The Patents Act, 1970 (Act 39 of 1970), s. 3(k).

For decades, Section 3(k) raised doubts about the patentability of inventions related to computer programs. The patent examiners tended to reject inventions based on software because they were regarded as computer programs *per se*. Nonetheless, some court rulings paved the way to patenting real inventions.

The landmark case of *Ferid Allani v. The Union of India* brought about a change in the Indian law of patents.[186] Here, the court observed that technological developments have changed the very essence of innovation and pointed out that innovations with a technical effect or technical contribution are not to be automatically disqualified from being patented merely because the innovations make use of any software. It was decided that patentability should focus on the technological aspect of the invention rather than whether it uses software components.

The Computer Related Inventions (CRI) guidelines, laid down by the Indian Patent Office, also recognize the fact that technical effects can make an invention patentable.[187] Technical effects refer to increased efficiency of process, improved security mechanisms, enhanced resource management, and better communication systems. Considering that several cybersecurity technologies contribute to these very effects, Indian laws become accommodating towards cybersecurity patents.

There still exist uncertainties. In particular, the lack of clear statutory definitions for the term "technical effect" makes patent examination inconsistent and unpredictable. Hence, applicants have serious problems in determining whether cybersecurity-related innovations meet patentability criteria.

The United States Approach

The U.S. has traditionally had a more liberal view towards the patentability of software. For many years, innovations made using computer code were widely protected by the United States patent system, leading to significant technological progress and investments in software

[186] *Ferid Allani v. Union of India*, W.P.(C) 7/2014, Delhi High Court.
[187] Office of the Controller General of Patents, Designs and Trade Marks, *Guidelines for Examination of Computer Related Inventions (CRI), 2017*.

development. However, the possibility of obtaining broad software patents and abusing lawsuits became the focus of judicial attention.

In *Alice Corp. v. CLS Bank International,* the Supreme Court of the United States established a new standard for patenting computer-implemented inventions.[188] It was clarified that an abstract idea performed using a generic computer could not be patented simply due to software implementation. The ruling of Alice established the two-part test, which required determining the existence of an abstract idea in a patent claim and the presence of additional elements that turn the idea into a patentable invention.

On one hand, the decision was aimed at preventing monopoly in the market and protecting the competition in software development. At the same time, in practice, the ruling generated uncertainty about patent eligibility, especially in regards to innovative technologies. In particular, cybersecurity inventors often faced problems proving the patentability of their innovations under the ruling of Alice.

Later cases have sought to interpret this principle better. The Federal Circuit case of Enfish, *LLC v. Microsoft Corp.* acknowledged that there could be software-based inventions enhancing computer operation which could possibly be patented.[189] This ruling makes room for cyber innovations which involve technological advances related to network security and performance.

The European Union Approach

The European Patent Convention takes a middle path compared to the strict approach adopted by India and the U.S. doctrine of abstract ideas. In Article 52 of the European Patent Convention, computer programs "as such" are not patentable.[190] But in Europe, there is a well-developed jurisprudence that emphasizes the technical nature of the invention.

According to the EPO approach, computer-implemented inventions are considered patentable if they solve a technical problem through technical means. Some of the decisions that have shaped

[188] *Alice Corp. Pty. Ltd. v. CLS Bank International*, 573 U.S. 208 (2014).
[189] *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016).
[190] The European Patent Convention, 1973, art. 52.

this jurisprudence include IBM (T 1173/97), COMVIK (T 641/00), which recognized software inventions that produce "a further technical effect" as patentable.[191]

The present scheme is especially favourable for innovation in cybersecurity because cybersecurity technology is intrinsically related to technical issues such as data security, integrity of networks, authentication, and security of systems. Therefore, many innovations related to cybersecurity that would otherwise not succeed when patented elsewhere can be easily secured in Europe if they make a technical contribution.

The focus on technical effect by the EPO has been adopted in judicial decisions made in other countries, such as India. Given the trend of harmonization between India and Europe, an international trend towards securing patents for innovative technologies regardless of their software content may be developing.

International Obligations under TRIPS

The international patent system is also largely affected by the TRIPS Agreement. According to Article 27 of the TRIPS Agreement, the Member States shall protect inventions in all fields of technology as long as they are novel, involve an inventive step, and are industrially applicable.[192]

Despite the fact that there is no special reference to software in the TRIPS Agreement, the focus on technological neutrality in TRIPS has impacted the discussion about patenting computer-related inventions. The countries are granted the freedom of interpreting the concept of subject matter for granting patents, which results in various approaches. However, the TRIPS regime ensures minimum levels of protection and encourages international cooperation in intellectual property regulation.

For the cybersecurity innovators, international harmonization is particularly important. Since cyberattacks are usually performed from abroad and cybersecurity technologies tend to be used in the international digital environment, different patent standards increase compliance costs,

[191] *IBM/Computer Program Product* (T 1173/97) [1998] EPO; *Two Identities/COMVIK* (T 641/00) [2002] EPO.
[192] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 27.

raise legal uncertainties, and hamper the cross-border commercialization process. Harmonization of cybersecurity technology patents will boost innovation and promote better cybersecurity practices worldwide.

Comparative Assessment

Comparatively analyzing the systems, it can be seen that there is yet no perfectly designed system for dealing with cybersecurity patents. The Indian system is characterized by being very cautious about the monopoly of software while progressively identifying technological contributions. In the USA, the focus has been to prevent any claim on patents of abstract ideas; however, the resulting confusion of using the Alice rule makes it the least predictable system. The European system, on the other hand, offers a highly predictable environment because of the presence of technical effects rules and is considered the most balanced system among the three approaches.

The European approach is highly useful in dealing with cybersecurity patents due to its focus on the technical problem solved with the technology, not how it is solved. With the growing use of software in cybersecurity technology, it might prove to be highly useful for promoting innovations without any excess monopolization.

International convergence on the basis of the principles of technical effect, technological contribution, and promotion of innovations will be helpful for developing a better patent system.

Aspects	India	USA	European Union
Software Patents	Restricted under Section 3(k)	Alice Test	Technical Effect Test
Cybersecurity Patents	Technical Effect Required	Abstract Idea Analysis	Technical Contributions

AI Inventions	Developing Jurisprudence	Uncertain	Emerging Framework
Patent Predictability	Moderate	Low	High

JUDICIAL DEVELOPMENTS AND CASE LAW ANALYSIS

Patent law covering inventions in the realm of cybersecurity has largely been shaped through the courts' judicial interpretation process. The court has largely contributed in defining what constitutes the scope of patentability for software inventions as well as the definition of what constitutes technical contribution.

Ferid Allani v. Union of India

One of the landmark Indian cases involving computer related inventions is *Ferid Allani v. Union of India.*[193] In the patent application before the court, a computer-related invention was sought to be patented but had been refused under Section 3(k) of the Patents Act. The Delhi High Court observed that inventions exhibiting technical effect or technical contribution should not be precluded from patenting just because the invention involves software. This case is significant in establishing the importance of taking a technology-based approach towards Section 3(k) and continues to play a crucial role for cybersecurity innovations involving advanced software techniques.

Microsoft Technology Licensing LLC v. Assistant Controller of Patents and Designs

The case *Microsoft Technology Licensing LLC v. Assistant Controller of Patents and Designs* once again emphasized that computer-related inventions ought to be looked at in light of technical contributions made by them instead of rejecting them per se under Section 3(k).[194]

[193] *Ferid Allani v. Union of India*, W.P.(C) 7/2014, Delhi High Court.
[194] *Microsoft Technology Licensing LLC v. Assistant Controller of Patents and Designs*, C.A.(COMM.IPD-PAT) 29/2022, Delhi High Court.

Telefonaktiebolaget LM Ericsson v. Intex Technologies

The patent enforcement suit between Telefonaktiebolaget LM Ericsson and Intex Technologies related to standard essential patents regarding telecommunications technology.[195] Though the suit did not focus on cybersecurity, it was significant for the rising importance of software-centric technologies, problems pertaining to patent licensing, technological compatibility, and competition laws. It has implications for future innovations regarding cybersecurity that would require the use of standardized digital communication networks.

Given the increasing convergence of cybersecurity, telecommunication, cloud computing, and Internet of Things (IoT) technology, it is expected that SEPs will have an increasing significance in the field of cybersecurity. Security protocols in 5G communications networks and devices, as well as digital communications protocols, will increasingly fall under the category of SEPs. As such, questions surrounding the FRAND principle, interoperability, and access to technologies will be of significant importance. The legal action taken by Ericsson is a prime example of how access to technologies can be compromised through disputes involving patents and licensing agreements.

Bishwanath Prasad Radhey Shyam v. Hindustan Metal Industries

In the case of *Bishwanath Prasad Radhey Shyam v. Hindustan Metal Industries*, the Supreme Court laid down certain guidelines for determining the criteria for innovative and inventive steps.[196] The Court held that the grant of patents must be limited to inventions that possess sufficient technical superiority over previous knowledge.

Novartis AG v. Union of India

While being mainly focused on patents in the field of pharmaceuticals, *Novartis AG v. Union of India* is essential in comprehending the overall philosophy of Indian patent law. [197] In this case, the Supreme Court underscored the necessity of balancing the incentive to innovate with public policy issues. This case demonstrates the court's readiness to avoid the creation of patents that constitute monopoly without losing the incentive to innovate.

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[195] *Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd.*, 2015 SCC OnLine Del 13960.
[196] *Bishwanath Prasad Radhey Shyam v. Hindustan Metal Industries*, AIR 1982 SC 1444.
[197] *Novartis AG v. Union of India*, (2013) 6 SCC 1.

Alice Corp. Pty. Ltd. v. CLS Bank International

The decision made by the U.S. Supreme Court in *Alice Corp. v. CLS Bank International* is among the most critical decisions regarding software patentability.[198] According to the Supreme Court, the mere use of a generic computer to implement an abstract idea does not entitle someone to receive a patent. Two-step tests formulated by the Supreme Court greatly changed the way software-based patents were analyzed, especially in the cybersecurity field.

Bilski v. Kappos

The Supreme Court in *Bilski v. Kappos* considered whether a business method employing computational steps was eligible for patenting.[199] Despite denying patent protection in the case, the Court refrained from formulating the machine or transformation test as the definitive criterion for determining whether something is patentable. This ruling established crucial precedents regarding software inventions.

Diamond v. Diehr

This Supreme Court precedent confirms the patentability of computer inventions that have practical technological benefits.[200] The ruling emphasized that an entire invention had to be considered as a whole, and having an algorithm did not automatically make a creation ineligible for patenting. This precedent is valuable for the patenting of cybersecurity innovations due to their technological effects.

Enfish, LLC v. Microsoft Corp.

In its decision on *Enfish, LLC v. Microsoft Corp.,* the U.S. The Court of Appeals for the Federal Circuit ruled that software improvements to computer functions could be classified as patent-eligible subject matter under Alice.[201] As cybersecurity innovations generally enhance system operation, performance, and stability, this case holds particular relevance to their patenting.

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[198] *Alice Corp. Pty. Ltd. v. CLS Bank International*, 573 U.S. 208 (2014).
[199] *Bilski v. Kappos*, 561 U.S. 593 (2010).
[200] *Diamond v. Diehr*, 450 U.S. 175 (1981).
[201] *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016).

IBM/Computer Program Product (T 1173/97)

The groundbreaking case at the EPO, IBM/Computer Program Product, found that computer programs can potentially receive a patent where they have a technical effect other than mere computer execution itself. [202] The case is the basis of the current European technical effect requirement and sets precedent in software patent examinations.

Two Identities/COMVIK (T 641/00)

The COMVIK decision went on to further develop the European approach to assessing whether or not something qualifies as an invention.[203] Specifically, the EPO clarified that only the technical part of any particular invention is considered during the inventive step assessment. It still serves as a basis of analysis for cybersecurity inventions using both computer program components and technical security mechanisms.

DABUS Patent Applications

While not directly connected to cybersecurity, the patent application cases of DABUS, dealing with AI-created inventions, are also worth mentioning here as they set precedent for the future.[204] In different courts of multiple countries, requests to list an artificial intelligence as an inventor were rejected, and the need to establish a human author was reiterated. The importance of this matter will only increase as AI involvement in cybersecurity R&D becomes more common.

Together, all of these cases illustrate how patent laws have progressively evolved from protecting only the conventional inventions of industry to now also including those inventions involving software-based and digitally enhanced technology innovations. There appears to be growing recognition that what is essential in determining whether or not an invention is patentable is whether or not there was true innovation in the technological field and not simply in the method of implementation.

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[202] *IBM/Computer Program Product* (T 1173/97) [1998] EPO.
[203] *Two Identities/COMVIK* (T 641/00) [2002] EPO.
[204] *Thaler v. Comptroller General of Patents, Designs and Trade Marks* [2023] UKSC 49.

CHALLENGES AND THE ROAD AHEAD

A. Conceptual and Practical Challenges

Cybersecurity innovation, along with patent law, faces several issues from a conceptual standpoint, but more significantly from a practical perspective. Despite being an indispensable tool to foster innovation, the unique attributes of cybersecurity technologies pose serious challenges to existing IP laws.

One of these relates to the question of whether software-based cybersecurity technologies can be patented at all. As it is, the contemporary state of cybersecurity technology is marked by the use of sophisticated software applications, algorithms, artificial intelligence, and decision-making mechanisms. At the same time, most countries tend to remain skeptical of providing legal monopoly on software-related technologies. For instance, the provisions of the Indian Patents Act do not include any guidelines concerning the interpretation of its Section 3(k). Judicial precedents, such as Ferid Allani, have expanded protection available to computer-related inventions; however, patent laws remain ambiguous in many respects.

Another dilemma associated with patenting cybersecurity technologies concerns the principle of disclosure. The patent law system works based on the premise that inventors can obtain temporary legal monopoly over their inventions in exchange for disclosing their technologies publicly.

But cybersecurity often depends on confidentiality and selective access to technical data. Open descriptions of cybersecurity systems, methods of detection, or algorithms used in cryptography can sometimes reveal weak spots exploited by criminals.[205] Thus, patents in cybersecurity have to strike a balance between the principles of transparency and innovation in view of their significance for digital security and public safety.

[205] Dan L. Burk and Mark A. Lemley, *The Patent Crisis and How the Courts Can Solve It* (University of Chicago Press, Chicago, 2009).

Thirdly, fast technological development complicates traditional approaches to securing intellectual property rights through patents. Typically, a patent covers an invention for up to twenty years counted from the date of filing.[206] However, technologies used for detecting or neutralizing cyber threats undergo a much faster innovation cycle than that. Cybersecurity systems may become outdated after a few years of operation due to changing threats. Thus, it is worth discussing the appropriateness of patent terms in the field of cybersecurity.

Fourth, issues related to patent thickets and strategic patenting have grown increasingly important. Major technology firms tend to build large patent inventories relating to cybersecurity measures, which can present obstacles for smaller competitors and new firms entering the market. Overlapping patent ownership might lead to increased transaction costs, reduce the likelihood of market entry, and hinder collaborative efforts. Because cybersecurity is often dependent on information sharing and interoperability, concentrated patent ownership might jeopardize cybersecurity goals.[207]

A further challenge that has arisen is the dependence of cybersecurity tools and approaches on open-source systems. Open-source environments, through which many cybersecurity tools such as vulnerability detection software or cryptographic protocols are created, require collaboration among different parties. While patenting promotes private funding and technological advancement, the extensive patenting of cybersecurity technologies could possibly be incompatible with the collaborative aspect of cybersecurity. Thus, there is a need to strike a balance between both aspects when considering the patenting process of cybersecurity inventions.

Lastly, international enforcement raises additional difficulties. The use of cybersecurity technologies is often conducted using cloud computing facilities that span different countries. Patent eligibility criteria, enforcement options, and legal interpretations differ among various nations, which makes international commercialization difficult. Although international treaties

[206] The Patents Act, 1970 (Act 39 of 1970), s. 53.
[207] Michael A. Heller and Rebecca S. Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research" 280 Science 698 (1998).

set out minimum standards for protection, there are still substantial differences among various jurisdictions as to software patents.

The result of all these challenges indicates that the traditional system of patents needs constant adaptation for effective operation in the digital era. Inasmuch as modern cybersecurity technologies rely increasingly on AI and quantum computing, it is important that the patent system does not harm the general interest of society in matters of cybersecurity and availability of technological innovations.

B. Strategic Recommendations for India

Given the increasing relevance of cybersecurity innovations, it is important to have a forward-thinking patent regime that can cater to the needs of emerging technologies. While a lot has been done by India through its judicature and administrative instructions, there still remains scope for improvement.

Interpretation of Section 3(k)

It would be helpful to have legislation or administrative guidance as to what "computer programme per se" and "technical effect" mean in order to bring greater predictability into the patent regime. Clear legislative intent would help to eliminate differences of opinion at the stage of prosecution and foster innovation.

Capacity Building for Examiners

Cybersecurity patents often relate to highly technical inventions that require a high degree of specialization. It is important to have examiners who can examine such inventions in an effective manner. This can be achieved through capacity building initiatives for examiners.

Establish Specific Patent Guidelines for Cybersecurity

In order to ensure that the technical effects requirement, disclosure requirements, and general patent eligibility are clear in relation to cybersecurity patents, India's Patent Office may wish to establish specific examination guidelines for such patents.

Harmonize with International Patent Standards

India needs to play an active role in international forums relating to patenting software, artificial intelligence, and other technologies. Through greater international harmonization, patent uncertainty can be reduced and technology transfer facilitated.

Protect Competition while Encouraging Innovation

While protecting patents to promote innovation is important, mechanisms that protect competition, such as compulsory licensing or competition law scrutiny, must be implemented alongside.

Preparing for New Technologies

With the growing presence of artificial intelligence, blockchain technology, and quantum computing within cybersecurity infrastructures, it is imperative that the patent regime continuously evolve. In preparation for the future, policymakers must examine whether or not current legal doctrines cover these new innovations.

CONCLUSION

Innovation in cybersecurity has proved vital for the functioning of modern digital economies. In view of increasing numbers and complexity of cyber attacks, the importance of innovations in technology cannot be overlooked since it is crucial for securing critical infrastructures, businesses, governments, and even consumers. The role of patents in stimulating innovation by compensating the innovator, making its commercialization possible, and encouraging technology development must not be underestimated.

However, cybersecurity technology does raise several issues related to traditional concepts of patent law. Software innovations, artificial intelligence systems, blockchain technologies, and quantum cryptography systems often fail to fit into the existing definitions of what can be patented and what cannot be. Moreover, problems arise with the very idea of disclosure, conflicting with the needs of cybersecurity.

Through comparative analysis, it is evident that there are different ways in which these concerns are tackled. For instance, while the Indian courts continue to clarify the law on computer-related inventions, the US and EU offer important lessons as far as the role of technical effect and patentability is concerned. The gradual evolution of international laws indicates that innovation that involves real technological advancements should be protected regardless of whether it is in the form of software.

The future success of cybersecurity innovation efforts will depend on the ability of legal systems to balance innovation incentives, technological information, competition and security considerations. Patents that are overly restrictive in nature might have the negative consequence of limiting investments and hindering the progress of new technologies. On the other hand, excessively broad patents can reduce the level of competition and lead to a lack of access to crucial security technologies.

With the help of adaptive and innovative patenting frameworks that take into account the special nature of cybersecurity innovation, India may leverage its role as a pioneer in the field of cybersecurity through the adoption of adaptive patent policies that promote innovation without compromising on issues of competition, security, and social welfare. With cyber-threats becoming more complex and AI-based, the future success of patent laws will rest not only on their ability to protect innovations but also on ensuring a safe digital environment.

CHAPTER 7: STANDARD ESSENTIAL PATENTS (SEPs) AND FRAND COMMITMENTS IN INDUSTRY

BY : NANDANI SINGH

INTRODUCTION

Interoperability forms the backbone of today's digital economy. Smartphones can communicate via a common network (3G), and wireless devices can connect easily using Wi-Fi or Bluetooth, while also having efficient telecom systems which rely upon shared standards across manufacturers to function properly. This means that standardization is critical to both technological advancements and industrial development.

The use of technical standards provides a unified framework within which products from multiple manufacturers can successfully communicate and work together. These standards typically play an integral role in industries where network effects exist; meaning when more users adopt a particular technology, that technology becomes increasingly valuable. Examples of industries where standardization is crucial include telecom, consumer electronics, IT and digital communications. Patent holders who develop innovations that are incorporated into technical standards generally have established a unique market position through their standard essential patent (SEP) rights. If a standard requires the use of a patented technology it is classified as an SEP, and any company wishing to comply with the standard will inevitably use the patented technology. Therefore, licensing SEPs has emerged as one of the most substantial areas of modern intellectual property law[208].

Recent research into emerging technologies has shown that innovation and competition law systems need to be able to provide an integrated solution to the issues of innovative incentives,

[208] Jorge L. Contreras, "A Brief History of FRAND: Analyzing Current Debates in Standard Setting and Antitrust through a Historical Lens", 80 *Antitrust Law Journal* 39 (2015).

protection of intellectual property, and competitive structure in markets.[209]This balance can be very clearly shown by the standard-essential patent (SEP) ecosystem[210].

Understanding Standard Essential Patents

Standard Essential Patents (SEPs) are patent rights related to inventions that are crucial for setting standards, and are used in an industry-wide standardized fashion (for example, the wireless communication industry). If a necessary ingredient for compliance with the standard cannot be procured without the use of patented technology, the patent will be classified as a standard essential patent.[211]

SEPs are prevalent within the various telecommunications and wireless communication technologies, including standards such as 3G, 4G, 5G, Wi-Fi, Bluetooth, MPEG, and video encoding and decoding. The standards incorporate thousands of patents owned by companies from across the globe, and together, create the general technological base for the creation of standardized products and/or services using the various patented technologies[212].

The value of SEPs is greater than typical patent rights because, in addition to the expectation of economic returns by their owners via a royalty rate associated with the patent, SEPs generate value from their inclusion in widely used industry standards. When an industry standard has been accepted into the marketplace, manufacturers will generally not have an effective alternative to using the patented technology to bring products (that conform to the standard) to market, and as a result, many new innovations can present great opportunities and present great challenges from an innovation policy perspective.[213]

Benefits of the standardization process include:

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[209] Ashish Bharadwaj, Vishwas H. Devaiah and Indranath Gupta (eds.), *Multi-dimensional Approaches Towards New Technology: Insights on Innovation, Patents and Competition* (Springer Nature Singapore, Singapore, 2020).

[210] Mark A. Lemley, "Intellectual Property Rights and Standard-Setting Organizations", 90 *California Law Review* 1889 (2002).

[211] European Telecommunications Standards Institute (ETSI), *ETSI Intellectual Property Rights Policy*, Annex 6, ETSI Rules of Procedure (2024).

[212] World Intellectual Property Organization (WIPO), *Standard Essential Patents and FRAND Licensing* (2023).

[213] Ashish Bharadwaj, Vishwas H. Devaiah and Indranath Gupta (eds.), *Multi-dimensional Approaches Towards New Technology: Insights on Innovation, Patents and Competition* (Springer Nature Singapore, 2020).

(1) Increased interoperability between products, and as a result, improved compatibility among end user products;

(2) Reduced transaction costs and production costs through the adoption of common standards;

(3) The promotion and distribution of technology through accelerated diffusion of a high demand innovative technological product;

(4) The integration of the global marketplace;

(5) Offering convenience to the end users through greater compatibility and ease in purchasing products.

On the other hand, the standardization process has also created an opportunity for strategic behaviour by the SEPs licensors and licensees, requiring that specific licensing frameworks be created.

Standard Setting Organizations (SSOs) and Their Role

Technical standards are typically created through Standard Setting Organizations (SSOs), which serve to bring together industry members[214], technology creators and developers, as well as manufacturers and researchers to establish a common set of technical specifications.

The main SSOs include:

• Institute of Electrical and Electronics Engineers

• International Telecommunication Union

• European Telecommunications Standards Institute

The purpose of SSOs is to promote compatibility and interoperability among products and services through the standard setting process. Companies that are members of the SSOs will typically participate in the standard-setting process and disclose any patents that they will likely own which may become essential for the proposed standard. In exchange for patent holders'

[214] International Telecommunication Union (ITU), *Common Patent Policy for ITU-T/ITU-R/ISO/IEC* (2018).

patents being part of the standard, the patent holder will commit to providing their patents under FRAND conditions[215] for others who wish to use their patents with the standard.

As technological standards are commonly made with the cooperation of multiple patent owners, it has become increasingly important for SSOs to provide effective mechanisms to incorporate multiple patent owners' contributions to the standard while preserving incentives to innovate, and preventing competitors from engaging in anticompetitive behaviour.

Scholarly discussions regarding the importance of SDOs as essential components for achieving the ideal balance between protecting intellectual property and maintaining competition in the marketplace have focused on their support of the adoption of new technologies and preventing anticompetitive behaviour.[216]

Definition and Importance of FRAND Commitments

A FRAND commitment is a promise from an holder of a Standards Essential Patent (SEP) to license these patents to others based on the following criteria :

- Fair
- Reasonable
- Non-Discriminatory

The SEP holder is obligated to offer licenses for their patented technology under FRAND commitments to create an opportunity for all prospective licensees, at a fair cost, with commercially reasonable terms of use, without unfair discrimination or favouritism toward any particular group of potential licensees[217].

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[215] Jorge L. Contreras, *The New Extraterritoriality: FRAND Royalties, Anti-Suit Injunctions and the Global Race to the Bottom in Disputes over Standards-Essential Patents*, 25 Boston University Journal of Science and Technology Law 251 (2019).

[216] Mark A. Lemley, "Intellectual Property Rights and Standard-Setting Organizations", 90 California Law Review 1889 (2002).

[217] Norman V. Siebrasse and Thomas F. Cotter, "The Value of the Standard", 101 *Minnesota Law Review* 1159 (2017).

Fair: Fairness means that the SEP holder should not take advantage of the monopoly power that exists as a result of being included in a standard. It is expected that the SEP holder will negotiate licensing agreements in good faith and will refrain from using coercive licensing practices[218].

Reasonable: Reasonableness involves both the pricing of royalty fees and the terms of the licenses. Royalty fees should be based upon the intrinsic value of the patented technology, not on the strategic advantage of the technology being part of the standard[219].

Non-Discriminatory: Non-discrimination means that SEP holders should treat all similarly situated licensees equally in terms of providing access to licenses. They should not use favouritism towards certain participants in the market in a way that creates an unfair advantage for some and adversely affects competition[220].

The primary purpose of the FRAND commitment is to reconcile competing interests of rewarding inventions while also ensuring access to essential technologies for all potential licensees.

What is the FRAND Licensing Economic Foundations?

It is incorrect to interpret discussions about SEPs only in terms of patent law; economic factors also play a key role in how well licensing structures work.

The function of patent systems is to stimulate the development of new ideas by providing inventors with a limited period of exclusive ownership over their invention. This exclusive period allows inventors to make up the money they spent inventing and developing their idea through sales of their invention. However, when some other firm becomes the standard for a given market, those innovations or capabilities cannot be avoided[221] by firms wanting to participate in that market.

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[218] *Huawei Technologies Co. Ltd. v. ZTE Corp. and ZTE Deutschland GmbH*, Case C-170/13, Court of Justice of the European Union (2015).

[219] Damien Geradin, Anne Layne-Farrar and A. Jorge Padilla, *The Ex Ante Auction Model for the Control of Market Power in Standard Setting Organizations* (Competition Policy International, 2008).

[220] Norman V. Siebrasse and Thomas F. Cotter, *A New Framework for Determining Reasonable Royalties in Patent Litigation*, 68 Fla. L. Rev. 929 (2016).

[221] Anne Layne-Farrar, "Patent Holdup and Royalty Stacking Theory and Evidence", *Journal of Competition Law and Economics* (2014).

From an economic and legal perspective, FRAND conditions generally strive to create a reduction in transaction costs and thereby facilitate the efficient use of licensing while avoiding market distortions. Scholars studying the relationship between competition law, intellectual property law, and innovation policy have expressed that in order for technological advancement to occur, an appropriate trade-off must exist between exclusivity and access to those technologies.[222]

An overly low royalty structure will provide little incentive for inventors to develop new ideas; an overly high royalty structure will discourage entry into the marketplace by potential competitors, thereby placing limits on consumer access to these inventions. FRAND licensing operates as a method of maintaining a level playing field[223] in innovation systems.

Economic scholars have further articulated that FRAND licensing is specifically designed to avoid charging unreasonable royalties while at the same time providing innovator's appropriate remuneration for their technological contributions.[224]

PATENT HOLD-UP AND PATENT HOLDERS

Patent hold-up and patent holder are two of the biggest issues that are talked about in law cases.

HOLD-UP

HOLD-UP or patent holder is when someone with the patent to use a piece of technology tries to use their power to charge businesses after a company has decided to use that technology in their

[222] Matteo Sabattini, "Standards, Innovation and Intellectual Property Policy" in Ashish Bharadwaj, Vishwas H. Devaiah and Indranath Gupta (eds.), *Multi-dimensional Approaches Towards New Technology: Insights on Innovation, Patents and Competition* (Springer Nature Singapore, Singapore, 2020)

[223] Richard A. Epstein, F. Scott Kieff and Daniel F. Spulber, "The FTC, IP and SSOs: Government Hold-Up Replacing Private Coordination", 8 *Journal of Competition Law and Economics* 1 (2012).

[224] Damien Geradin, Anne Layne-Farrar and A. Jorge Padilla, *The Ex Ante Auction Model for the Control of Market Power in Standard Setting Organizations* (Competition Policy International, 2008).

products. By using their power to set a price, and/or requiring firms who use their technology to pay a fee or royalty that exceeds the actual value of the invention, they take advantage of the fact that a firm has already invested money in implementing the new standard technology for use in its product[225].

As a result of a HOLD-UP, the patent holder's actions may:

- Increase the overall cost to manufacture the product,
- Reduce the number of same-type firms,
- Restrict the entry of new or competitive firms from manufacturing or selling the same-type product,
- Decrease the welfare of consumers.

HOLD-OUT

A HOLD-OUT is the opposite of a HOLD-UP, where businesses that are manufacturing products using a new standard are delaying negotiating a license or refuse to pay for a license or continuing to manufacture their product without paying for the license to use that technology.

Both the HOLD-OUTs and HOLD-UPs will ultimately destroy the incentives for innovation and investment in research and development.

Modern FRAND agreements attempt to reduce the occurrence of both HOLD-UP and HOLD-OUT by requiring good faith behaviour by both patent holders and holders of patents who want to use the patent.

SEPs and Competition Law

What can 'competition law' do? What does 'competition law' mean?

The relationship between intellectual property law and competition law has been strengthened due to SEP disputes.

[225] Carl Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard Setting" in Adam B. Jaffe, Josh Lerner and Scott Stern (eds.), *Innovation Policy and the Economy* (MIT Press, 2001).

As a patent holder, you have exclusive patent rights. That system, however, is in conflict with the concept of competition law, which was designed to restrict the abuse of market power. Due to the unique nature of SEPs, these two types of law intersect[226].

There are several common issues that arise relating to abuse of a dominant market position by an SEP :

- Charging too much in royalties;
- Refusal to license out essential technology;
- Discriminatory licensing practices;
- Seeking an anti-competitive injunction, or
- Abuse of a dominant market position[227];

Competition authorities acknowledge that patents serve to encourage innovation; however, incorrectly exercised conduct can hinder competition. The challenge of competition authorities is the balancing of proprietary rights with ease of access to the market. If you excessively intervene with proprietary rights then you will take away the incentive for innovation to occur, but if the law is not properly enforced, then anti-competitive conduct will occur.

What are the Global legal principles on FRAND License ?

The SEPs and FRAND legal principles as established by the Courts in a number of jurisdictions have all played an important role in developing SEP and FRAND legal principles.

One of the most important cases was the case of Huawei Technologies Co. Ltd. v. ZTE Corp. which was decided by the European Court of Justice. This case laid out the guidelines for how SEP holders and the implementers should act while negotiating licenses.

In that case, the Court identified:

- The need for good-faith negotiations;
- The requirement for transparency with respect to license offers;
- The need for proportionality regarding enforcement;
- The need to balance between patent rights and the public interest in competition;

[226] OECD, *Patents and Standards: A Modern Framework for Innovation Policy* (OECD Publishing, Paris, 2014).

[227] European Commission, *Guidelines on Horizontal Cooperation Agreements*, OJ C11/1 (2011).

Litigation around the world with companies like Ericsson, Qualcomm, Nokia, Huawei and Samsung Electronics has also played an important role in developing the principles of FRAND.[228]

RELATED CASE LAWS

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1. Court of Justice of the European Union (Fifth Chamber) [2015]: Huawei Technologies Co. Ltd v ZTE Corp. and ZTE Deutschland GmbH, Case No. C-170/13, WIPO Lex[229]

The Delhi High Court decision in Inter Digital Technology Corporation v. Xiaomi Corporation is a good example of two important features of Standard Essential Patent ("SEP") licensing:

(1) issues related to framework for licensing under Fair, Reasonably and Non-Discriminatory ('FRAND') terms; and

(2) anti-anti-suit injunctions. In this case, the plaintiff Inter Digital contended that the defendant Xiaomi was using technology covered by Inter Digital's portfolio of Standard Essential Patents (SEPs) without obtaining an appropriate FRAND licence.

During the course of these proceedings, there were also concerns raised regarding parallel litigation in various jurisdictions and restriction of enforcement actions in those jurisdictions. The Delhi High Court acknowledged the importance of protecting Indian court jurisdiction with respect to SEP matters and provided appropriate relief to protect existing actions before those courts.

The ruling created a formal system for regulating how SEPs are licensed and has been an essential part of worldwide FRAND law and has therefore had a huge impact on later cases discussing issues such as patent hold-up, patent hold-out, and competition law in the context of markets using standardized technologies.

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[228] Mark A. Lemley and Carl Shapiro, "A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents", 28 Berkeley Technology Law Journal 1135 (2013).

[229] Huawei Technologies Co. Ltd. v. ZTE Corp. and ZTE Deutschland GmbH, Case C-170/13, Court of Justice of the European Union (2015).

2. Unwired Planet v Huawei [2020], United Kingdom[230]

The UK Supreme Court's ruling on the issue of FRAND obligations associated with Standard Essential Patents (SEPs), including how to enforce FRAND obligations against foreign SEPs, is of high importance. Unwired Planet owned a portfolio of telecommunications patents containing SEPs and stated that Huawei has an interest in telecoms software that infringes upon SEPs and is unable to acquire a license for such use on FRAND terms. One of the main considerations for the UK Supreme Court was whether a court in any particular territory may determine the terms for a Global FRAND License, even if patent rights exist only in the country where the patent is registered.

The Supreme Court has ruled that FRAND commitments might support awarding a worldwide license based on both parties having an international nature of commercial activities and their SEP Portfolio. Furthermore, if an Implementer refuses to accept the FRAND terms set out in the Court, then the SEP Holder may be able to seek an injunction against the Implementer. The Court also found that the purpose of FRAND licensing is twofold, i.e., to incentivize innovation and promote efficient access to standardized technical solutions and to avoid having fragmented or disparate litigation in many different jurisdictions. This ruling greatly expands the involvement of the courts in determining the amount of FRAND royalties as well as eliminating some uncertainty regarding the global framework for licensing SEPs; therefore, it is widely considered to be one of the most significant and impactful modern rulings regarding the enforcement of SEPs and obligations in relation to FRAND.

Indian Perspective On SEPs and FRAND

India is fast becoming a significant jurisdiction regarding certain essential patents (SEP) litigation, as its telecommunications and smartphone sectors continue to develop rapidly. The courts in India have started to hear more cases regarding the licensing of SEPs and licensing royalties; many have been the subject of lawsuits relating to the Competition Act as it affects the licensing of SEPs. Some cases that have been brought to court include:

[230] *Unwired Planet International Ltd. v. Huawei Technologies Co. Ltd.*, [2020] UKSC 37 (United Kingdom Supreme Court). https://www.wipo.int/wipolex/en/judgments/details/1521

- **Telefonaktiebolaget LM Ericsson v. Micromax Informatics Ltd.**[231]

The Delhi Court in India decided one of the first and very important cases relating to Standard Essential Patents and Fair, Reasonable and Non-discriminatory (FRAND) licensing. Ericsson, a known telecommunications technology company, said that the defendant, Micromax, had manufactured and sold mobile devices which employed patented technologies owned by Ericsson regarding 2G, 3G and EDGE, without having a valid licence. Ericsson said the patents are necessary to meet international standards in telecommunications and so Micromax was forced to take a licence on FRAND terms. Micromax denied using Ericsson's technology without a license and said the royalty fee charged by Ericsson was exorbitant under the FRAND standard. This dispute highlighted critical issues about the standards for calculating FRAND royalties and the patent holder's rights versus the implementer of the technology's obligations.

Ultimately, the Delhi High Court considered both parties' interests and directed Micromax to pay Ericsson interim royalties, while stressing the need to balance patent rights against access to standardized technology. The case is widely regarded to be a landmark ruling by the Indian courts in relation to SEPs as it raised many of the same complex issues of patent licensing, standardization, and competitive behaviour that are at the forefront of telecommunications cases throughout the world today.

- **Telefonaktiebolaget LM Ericsson v. Intex Technologies** [232]

A major step forward for Indian law concerning essential patented technologies occurred in the case of *Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd.* In this case, Ericsson alleged that Intex had continued to use various technologies protected by one or more of Ericsson's essential patented technologies, without entering into a negotiated licensing arrangement with respect to said technological applications. The issues in dispute primarily concerned the obligations of both parties under FRAND (fair, reasonable, and non-discriminatory) requirements, how to value the royalties associated with using said standard essential patents, and expected behaviours of both parties who are involved in the negotiation of a licensing agreement concerning said standard essential patents.The Delhi High Court clarified

[231] *Telefonaktiebolaget LM Ericsson v. Micromax Informatics Ltd.*, CS(OS) No. 442/2013 (Delhi High Court),

[232] *Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd.*, CS(OS) No. 1045/2014 (Delhi High Court),

the respective duties of both standard essential patent ("SEP") owners as well as manufacturers who implement the use of technologies for which there may be SEPs. The High Court found that SEP owners must provide licenses to manufacturers in FRAND terms, and that manufacturers must negotiate in good faith for a licensing agreement and must be able to fulfill their obligation to offer a good faith licensee arrangement with a SEP owner. The Court noted that the concern of manufacturers using patented/standard essential technologies while at the same time refusing to finalize a licensing agreement with the SEP owner, constituted an example of "patent hold-out." The judgment reinforced the importance of good faith negotiations in offering licenses for the use of technologies covered by standard essential patents, and provided important precedent for the developing legal principles in India relating to the interplay among intellectual property rights, standardization and competition law.

These cases highlighted issues relating to royalty calculations, confidentiality agreements, injunctions, and FRAND obligations. The Indian regulators have also focused on examining whether the implementation of the licensing of SEPs constitutes an abuse of a dominant position under the Competition Act (which may affect the licensing of SEPs). Given the increased use of digital technologies and telecommunications infrastructures, regulation of SEPs will continue to play a significant role in the Indian intellectual property law.

FUTURE CHALLENGES AND TECHNOLOGY GOVERNANCE INNOVATION

5G technology, Internet of Things (IoT), AI systems, smart manufacturing and digital infrastructure will significantly increase the value of standard essential patents (SEPs).[233]

There are many existing issues that must still be addressed:

- No universal methodology on how to calculate Fair, Reasonable and Non-Discriminatory (FRAND) royalties[234].

[233] World Intellectual Property Organization (WIPO), *Standard Essential Patents and the Internet of Things* (2022).

[234] Mark A. Lemley and Carl Shapiro, "A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents", 28 *Berkeley Technology Law Journal* 1135 (2013).

- Litigation would occur across multiple jurisdictions for international licensing disputes.[235]
- The ever-increasing complexity of patent portfolios[236].
- The need to allow for innovation incentives with competitive pressure.
- The need to provide transparency in the negotiations over licenses.
- Adapting FRAND principles to new technologies.

Current academic literature indicates that an integrated, multi-faceted approach of intellectual property protection, market regulation and public interest needs to be applied in order for effective governance of technology[237]. The future viability of the SEP framework will hinge upon its ability to accommodate both new technology and competitive market structures.

CONCLUSION

The conclusion to this article is that standard essential patents (SEPs) are in a unique position in current laws regarding intellectual property as they incorporate the exclusivity found in patents and combined with how essential the technological standard is. SEPs are important, granting patent owners a monopoly-type (long-term) right as needed to expect inventors to be rewarded for their investment into creating innovation, while also creating an opportunity to abuse that market power, thereby posing an anticompetitive threat.

FRAND commitments (fair, reasonable, and non-discriminatory) are viewed as a necessary tool for harmonizing the interests of innovation and competition as industries become more reliant on interconnected technologies and global standardization[238]. As such, the ongoing sound regulation

[235] Jorge L. Contreras, "The New Extraterritoriality: FRAND Royalties, Anti-Suit Injunctions and the Global Race to the Bottom in Disputes over Standards-Essential Patents", 25 *Boston University Journal of Science and Technology Law* 251 (2019).

[236] World Intellectual Property Organization (WIPO), *Standing Committee on the Law of Patents: Standard Essential Patents* (2023).

[237] Dina Kallay, "Competition Law and Standard Essential Patents" in Ashish Bharadwaj, Vishwas H. Devaiah and Indranath Gupta (eds.), Multi-dimensional Approaches Towards New Technology: Insights on Innovation, Patents and Competition (Springer Nature Singapore, Singapore, 2020).

[238] Norman V. Siebrasse and Thomas F. Cotter, "The Value of the Standard", 101 Minnesota Law Review 1159 (2017).

of SEPs will continue to be critical to technological advancement, consumer welfare, and the sustainable growth of the economy.[239]

[239] Jorge L. Contreras, "A Brief History of FRAND: Analyzing Current Debates in Standard Setting and Antitrust through a Historical Lens", 80 Antitrust Law Journal 39 (2015).

CHAPTER 8: OPEN INNOVATION VS. PROPRIETARY RIGHTS: STRATEGIC CHOICES FOR FIRMS

BY ANUSHKA SHARMA

INTRODUCTION

On June 12, 2014, Elon Musk released a blog post with a title that almost seemed ridiculous for an up-and-coming tech giant: "All Our Patents Are Belong to You." In its "patent pledge," Tesla declared that the company would not sue anyone who used its technology relating to electric vehicles in good faith.[240] It came as a shock to the world. What was the point of spending millions on researching technology if it was just going to be given away? The patent system had always been built on the idea of exclusivity being the incentive to innovate. The boundary around innovation was everything. But now Tesla is doing the unthinkable.

What is even more shocking about the decision was the reason behind it. The decision was not taken out of necessity but out of strength. It was a case where the company had grown in stature in the field of electric vehicles, and the decision was taken after thorough analysis. The company realized that the biggest risk that it faced did not come from any imitation of its products, but from the fact that the market for electric vehicles could become stagnant due to a lack of charging stations and infrastructure and consumer adoption.

At its core, this case presents a much deeper dilemma regarding the nature of patents in today's world. The very premise of patent regimes was that innovation would thrive on exclusivity – that the act of invention required temporary monopolies in return for revealing those inventions to the world. However, in light of the current realities of open innovation, platform-based economies, and collaborative technology environments, this premise is increasingly being questioned. More

[240] Elon Musk, "All Our Patents Are Belong to You", Tesla Blog, June 12, 2014, available at: <https://www.tesla.com/blog/all-our-patent-are-belong-you> (last visited on May 11, 2026).

and more of today's successful firms have come to learn that controlled openness often results in higher strategic value than exclusivity alone. Hence, the ultimate dilemma facing us today is whether the role of intellectual property in business has shifted from being a means of protecting invention to becoming a means of strategic advantage. Or, put another way, does a patent always represent a strategic asset or can it, in some cases, be a strategic liability? These questions form the foundation of this chapter where we will examine the relationship between open innovation, proprietary rights, and corporate strategy in today's economic world.

OPEN INNOVATION: WHAT IT IS AND HOW IT WORKS?

Open innovation, a term coined by Henry Chesbrough in 2003, describes the use of external knowledge flows in addition to internal flows to accelerate innovations and increase markets.[241] It stands in contrast to the long-held assumption that innovation had to be wholly contained within the corporate boundaries. According to Chesbrough, it was common for organizations to be more innovative by blending their strengths with external knowledge, technologies, and partnerships.[242]

Inbound open innovation entails incorporating external knowledge, technologies and ideas to enhance their internal product and processes.[243] A prime example would be the Connect + Develop program launched by Procter & Gamble, in which the corporation tapped external inventions from universities, suppliers, and individual inventors.[244] In this case, firms maintain their intellectual property rights but license or acquire technology from other firms. Licensing agreements play a strategic role in the legal aspects of inbound open innovation.

The second approach is outbound open innovation, whereby companies consciously share or limit their enforcement of proprietary rights to affect market behaviour or facilitate the widespread use of technologies.[245] One such approach includes the open-source approach, under

[241] Henry Chesbrough, Open Innovation: The New Imperative for Creating and Profiting from Technology 43 (Harvard Business School Press, Boston, 2003).
[242] Henry Chesbrough, Open Innovation: The New Imperative for Creating and Profiting from Technology 24 (Harvard Business School Press, Boston, 2003).
[243] Henry Chesbrough, Wim Vanhaverbeke and Joel West (eds.), Open Innovation: Researching a New Paradigm 1-14 (Oxford University Press, Oxford, 2006).
[244] Procter & Gamble, Connect + Develop Program, available at: <https://www.pgconnectdevelop.com> (last visited on May 13, 2026).
[245] Henry Chesbrough, "Business Model Innovation: Opportunities and Barriers" 43 Long Range Planning 354 (2010).

which, software is distributed under licenses that allow anyone to access and modify them. Another variant of this strategy includes the open core approach, adopted by companies like MongoDB, which uses an open-source platform for its base technology but keeps advanced features and services proprietary.

Another important tool in this category is defensive publication that involves publication of inventions instead of filing patents to create prior art and prevent others from patenting them.[246] This was extensively done by IBM through its Technical Disclosure Bulletin.[247] Another form of this category includes patent pledges, where companies agree not to enforce their patents against the infringers under certain conditions. In 2014, Tesla decided not to pursue lawsuits against those using its EV technology in good faith because it believed that the more the EV ecosystem grew, the better it would be for the company.[248]

Another way of cooperating is through patent pools and cross-licensing.[249] The MPEG LA patent pool helped in simplifying licensing of video compression technologies as manufacturers could now access it through a single contract.[250] Similar cooperation has been seen among competing companies like Samsung and Apple because they realize that modern technologies depend on overlapping patents.

Lastly, there is coupled open innovation, which involves collaborating firms contributing and sharing knowledge through alliances or research consortia.[251] This type of collaboration was evident when competing chip manufacturers got together in the SEMATECH consortium including companies like Intel, AMD, and IBM to carry out pre-competitive research into semiconductors.

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[246] Andrew Watson, "Defensive Publication as a Patent Strategy" 32 Journal of Intellectual Property Law and Practice 120 (2017).
[247] IBM, Technical Disclosure Bulletin: History and Overview, available at: <https://www.ibm.com/ibm/history/ibm100/us/en/icons/tdisclose/> (last visited on May 14, 2026).
[248] Elon Musk, "All Our Patents Are Belong to You", Tesla Blog, June 12, 2014, available at: <https://www.tesla.com/blog/all-our-patent-are-belong-you> (last visited on May 14, 2026).
[249] Carl Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting" 1 Innovation Policy and the Economy 119 (MIT Press, Cambridge, 2001).
[250] Jorge Contreras, "Patent Pledges" 47 Arizona State Law Journal 543 (2015).
[251] Wesley Cohen, Richard Nelson and John Walsh, "Protecting Their Intellectual Assets: Appropriability Conditions and Why US Manufacturing Firms Patent (or Not)" NBER Working Paper No. 7552 (National Bureau of Economic Research, Cambridge, 2000).

Finally, it is clear that open innovation shows that intellectual property can be used not just as a means of exclusion but also as a strategy for collaboration and market growth. It also highlights the strategic choices available to firms in balancing intellectual property exclusivity with open innovation through various means.

LEGAL FRAMEWORK GOVERNING PATENT RIGHTS: INDIA AND BEYOND

The legal regime regarding patents is always changing according to changes in business strategy and innovation practices. The regime of patents in India includes the Patents Act, 1970[252] and Patent Rules, 2003[253] that define procedure for filing, examination, grant and other issues related to the protection of patents. Both documents have undergone several amendments since their adoption aiming at making the patent regime in India comply with international requirements. India joined the World Trade Organization in 1995 and ratified the TRIPS Agreement.[254] India is a party to several international treaties, such as the Paris Convention[255] and the Patent Cooperation Treaty (PCT).[256]

According to Indian law, an invention should meet three key requirements to be protected by a patent: novelty, inventive step (non-obviousness), and industrial applicability. It should also be noted that the invention cannot belong to non-patentable subjects provided by Sections 3 and 4 of the Act: mathematical methods; business methods; algorithms; treatment procedures; discoveries of scientific principles; atomic energy inventions.[257] Patent owners are given exclusive rights regarding both products and processes due to Section 48.[258] According to Section 53, protection lasts for 20 years.[259] The right of patentee to enjoy his monopoly is not without

[252] The Patents Act, 1970 (Act 39 of 1970).
[253] The Patents Rules, 2003.
[254] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 27.
[255] Paris Convention for the Protection of Industrial Property, 1883.
[256] Patent Cooperation Treaty, 1970.
[257] The Patents Act, 1970 (Act 39 of 1970), ss. 3, 4.
[258] The Patents Act, 1970 (Act 39 of 1970), s. 48.
[259] The Patents Act, 1970 (Act 39 of 1970), s. 53.

exceptions, such as the exception for research purpose, exception to the Bolar doctrine,[260] and Section 84 on compulsory licensing.[261]

Treaties at the international level aid in cooperation and international protection of patents. WIPO administers international treaties for intellectual property and helps in harmonizing intellectual property laws internationally. The PCT allows inventors to apply for patents from various countries using a single application process. Patents in the end are awarded by national intellectual property offices. The TRIPS Agreement sets out minimum intellectual property standards for all WTO members and also allows for flexibilities, notably compulsory licensing under the Doha Declaration on Public Health (2001).[262]

The differences in foreign jurisdictions with India in their respective patent laws are minimal in that all jurisdictions require patent applicants to satisfy requirements of novelty, inventive step, and industrial applicability, granting patents for twenty years. The difference comes in the fact that India takes a more rigorous approach to the concept of public interest as against the American and European patent jurisdictions.

PROBLEMS FACED BY FIRMS

Mutual value usually comes into conflict with the reality of operations, laws, and strategy making. The challenges faced by companies in any industry can make the balance of openness versus protection really complex and difficult to navigate.

The first one is the keep-or-sell issue. It deals with what should be done when a company comes up with an invention or patent. Should it exploit the invention, license, sell, or collaborate? This choice involves and affects profit, risk, and control in varying amounts. Some companies have succeeded with a licensing model based on patents, but such business models often find themselves involved in lengthy antitrust investigations.

The second issue has to do with inadequate return from investing in research and development. Companies spend millions on innovations but still cannot benefit from the results of their work.

[260] The Patents Act, 1970 (Act 39 of 1970), s. 107A.
[261] The Patents Act, 1970 (Act 39 of 1970), s. 84.
[262] Doha Declaration on the TRIPS Agreement and Public Health, WT/MIN (01)/DEC/2 (Nov. 20, 2001).

A very famous example of this is Xerox. Its researchers invented things like graphical user interface, the mouse, and Ethernet, but the company could not capitalize on the inventions. Others, like Apple, managed in a better way.

The problem of free-riding is another reason why collaboration may prove challenging since once knowledge gets into a collaborative environment; competitors will have access to the knowledge but may not contribute enough in return. Small businesses and open-source software developers claim that large companies benefit from their inventions by using them in proprietary products without giving any credit or reward.

Related to this problem are patent thickets, which commonly occur in industries like semiconductor or smartphones where there is an overlap of thousands of patents. Companies need to get permission from a number of right-holders before launching their product in the market as seen in the disputes between Apple, Samsung, Google, and Nokia regarding smartphones.

Another problem is that of IP ownership within collaborative work as joint ventures are prone to creating new inventions, which may be difficult to own as agreements may not clearly state who owns the rights to derivative inventions or improvements.

However, for Indian entrepreneurs, issues related to costs and availability pose additional challenges. The process of obtaining and enforcing patents before the Indian Patent Office takes time and money and thus cannot be afforded by a great many entrepreneurs. Meanwhile, practices like evergreening, defensive patenting, and misuse of standard essential patents help major companies maintain their control and exclusivity. Lastly, international disparity suggests that solutions which might work well in Silicon Valley would be unaffordable in countries where enforcement of IP rights is poor.

ANALYSIS THROUGH CASE STUDIES

The management of intellectual property strategy can be effectively analysed by the use of practical examples where companies try to find a balance between innovation, competition, cooperation, and regulation under commercial pressure. Examples like this one will help to

understand that intellectual property is much more than just legal protection since it is also shaped by the economy and politics of the country.

A significant example here is the story of Tesla Motors and its policy regarding its electric vehicles' patents announced in 2014.[263] Tesla Motors realized that patents were not enough to build a profitable market of electric vehicles. The lack of proper infrastructure, suppliers, and consumer base posed serious obstacles for developing the whole industry sector. By releasing its patents, the company hoped to increase the development of the ecosystem and investment in the market as a whole. This policy was successful for Tesla Motors since it was less dependent on patents but rather on manufacturing ability, reputation, and supply chain effectiveness.

However, in Qualcomm's case, a more proprietary license scheme was chosen. Instead of selling products exclusively, the company made a significant amount of money from licenses for patents of mobile communication technology. While being commercially lucrative, the model has faced a lot of regulation and criticism from the governments of several states, namely the USA, Europe, South Korea, and India. The conflict is associated mainly with Qualcomm's violation of the FRAND conditions of license contracts for standard-essential patents.[264]

IBM can be mentioned as another example of a large player using both models simultaneously.[265] In this case, we have one of the largest patent libraries worldwide but also active participation in open-source software like Linux. As seen from this example, there is no contradiction between an open strategy and an exclusive one.

The proliferation of Linux[266] and Android[267] provides another example of collaborative innovation. Although there were intellectual-property issues brought up by companies like Microsoft, the open-source platforms developed rapidly since innovation through collaboration globally can sometimes develop faster than innovation through closed systems.

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[263] Elon Musk, "All Our Patents Are Belong to You", Tesla Blog, June 12, 2014, available at: <https://www.tesla.com/blog/all-our-patent-are-belong-you> (last visited on May 16, 2026).
[264] Qualcomm Inc. v. Federal Trade Commission, 969 F.3d 974 (9th Cir. 2020); European Commission Decision (Qualcomm Predatory Pricing), Case AT.39711, ECLI:EU:C:2019:203 (March 18, 2019).
[265] IBM, Annual Report 2022, available at: <https://www.ibm.com/annualreport> (last visited on May 17, 2026).
[266] Linus Torvalds, Linux Kernel, available at: <https://www.kernel.org> (last visited on May 18, 2026).
[267] Google Inc., Android Open-Source Project, available at: <https://source.android.com> (last visited on May 18, 2026).

Moreover, the decision given by the Supreme Court of India in the case of Novartis v. Union of India[268] reiterated the limitations of pharmaceutical evergreening under Section 3(d) of the Patents Act,[269] placing public access to medicine above all other concerns.

Finally, the issue of DABUS and the inventions created with the help of artificial intelligence tells us about some uncertainties around intellectual property law. In each jurisdiction where patents for innovations created using DABUS were applied, the courts dismissed the application due to the absence of an inventor in the traditional sense of the term.[270]

THE INDIAN LANDSCAPE

The Indian enterprises have a far more difficult choice when it comes to choosing whether to adopt an open or a proprietary system compared to their western peers. This is due to expensive filing procedures, long legal battles that could take several years, limited number of IP attorneys available away from the big cities, and court proceedings that could drag on for decades.

The patent system in India is purposefully constructed to restrict monopoly rights. Under Section 3(d) of the Patents Act of 1970,[271] patents for new forms of already-known substances lacking proof of enhanced efficacy cannot be issued and this is an effective deterrent to evergreening. In Novartis AG v. Union of India,[272] The Supreme Court denied the grant of a patent by Novartis for the beta-crystalline form of imatinib (Gleevec), reasoning that any slight difference without additional therapeutic benefits will not fulfil India's test. This left no room for ambiguity about the importance accorded to access to medicines under the law.

Nothing exemplifies this principle more than *Natco Pharma Ltd. v. Bayer Corporation*.[273] Bayer's cancer medicine Nexavar was priced at ₹2.8 lakh per month while Natco's version came at ₹8,800 per month. In seeking a compulsory license, Natco successfully argued unavailability

[268] Novartis AG v. Union of India [2013] 6 SCC 1.
[269] The Patents Act, 1970 (Act 39 of 1970), s. 3(d).
[270] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022) (United States of America); Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49 (United Kingdom); Thaler v. Commissioner of Patents [2021] FCA 879 (Australia).
[271] The Patents Act, 1970 (Act 39 of 1970), s. 3(d).
[272] Novartis AG v. Union of India [2013] 6 SCC 1.
[273] Natco Pharma Ltd. v. Bayer Corporation, CLA No. 1 of 2011 (Controller General of Patents, India, March 9, 2012).

due to non-availability at reasonable rates, as provided under Section 84 of the Act.[274] Patent exclusivity in India's pharmaceutical industry, it may now safely be concluded, is contingent rather than absolute.

This approach has been applied by courts even to orders for injunctions. The case of *F. Hoffmann-La Roche v. Cipla*[275] is one such case where the Delhi High Court did not restrain Cipla from manufacturing the generic erlotinib, giving importance to access to medicine while balancing convenience.

The growth trajectory of India's IT companies was based on the services, not product, model. There was little need for patent protection because the client held the code anyway. This is changing as platforms and artificial intelligence are being looked at by Tata Consultancy Services (TCS), Infosys and Wipro. Patent applications have increased; mostly in the US where there is better predictability. The landmark case of *Ericsson v. Intex Technologies*[276] saw the Delhi High Court rule that Indian manufacturers could not avoid FRAND royalties for standard essential patents.

When there are fundamental barriers to protecting innovations, firms are forced into an open strategy without making any deliberate decision about it. This distinction is crucial. India's intellectual property regime works best when it strikes a balance between innovation and public interest. But at its worst, it is a boon for those who have enough know-how to operate within the regime and inadvertently shuts out others from the choice. Real optionality is the ability to protect innovations effectively, which requires faster prosecution processes and better accessibility for all firms, big or small.[277]

CRITICAL COMMENTARY

The open vs. closed binary masks far more than it illuminates. Before we can apply any theory to it, the paradigm should be questioned.

[274] The Patents Act, 1970 (Act 39 of 1970), s. 84(1).
[275] F. Hoffmann-La Roche v. Cipla, AIR 2009 Delhi 16.
[276] Ericsson v. Intex Technologies, CS(OS) 1045/2014 (Delhi High Court, March 13, 2015).
[277] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 7.

Open innovation does not necessarily equal democracy. The notion of openness implies something democratic sharing, collaboration, dissemination of information. Using this paradigm for corporate strategy is misleading. Tesla was able to open up its patents in 2014, because patents have never been its competitive advantage. What made the company different was the Supercharger network, manufacturing capacity, battery logistics, and software development capabilities. Any competitor could access Tesla's patents, but none could copy anything else that Tesla had. This was not charity; it was a business strategy. The same applies to IBM, which files roughly 9,000 patents per year and collects more than $1 billion per year through licensing patents while making the largest contribution to the Linux kernel project.

This option can only be afforded by companies that have enough resources to execute both initiatives simultaneously. Small companies that open up their innovations find themselves competing with larger companies whose innovations they have helped to strengthen. This is a false binary for small companies; instead of considering whether they would rather go open or proprietary, the option is usually a question of whether they will go open or not protected at all.

The discourse of open innovation can also be co-opted for the purpose of value extraction. Technology companies may release technologies into an open-source community after having exhausted their strategic utility in order to gain the benefit of having a community of developers refine their technology for free while sitting atop a foundation created using their own resources. The Google TensorFlow open-source release is a case in point: it standardized machine learning algorithms based on approaches which fit easily within the paradigm of Google's cloud computing services. Nothing about this makes open-source releases bad; it just means that openness should not become a replacement for structural analysis of value extraction.

The patenting regime has not adapted to the realities of incremental innovations. Patent laws were designed in a time of discrete innovations occurring relatively slowly. It is ill-suited to software and artificial intelligence where innovations are incremental, collaborative, and move much faster than the process of patent prosecution. Patent law disputes around smartphones alone saw the expenditure of about USD 20 billion in legal fees between 2010 and 2015; this was not to reward inventors but companies with the largest number of patents and ability to engage in

protracted litigation processes.[278] In *Alice Corp. v. CLS Bank International,*[279] Many software patents were declared invalid due to their long-standing use as leverage in legal disputes, with the costs incurred by smaller businesses unable to contest them being very significant. In artificial intelligence, in DABUS cases brought in parallel in five jurisdictions,[280] it became apparent that there was still no legal regime that clearly defines who owns the intellectual property associated with inventions generated by the use of AI.

The Global South component cannot simply be glossed over. The options open to a firm based in Germany or California are not the same options open to a firm in Pune or Nairobi. The process of obtaining a patent in India can stretch out to seven years. The cost of filing can exceed several lakh rupees per application, with no guarantee of success. Legal expertise for intellectual property issues in India is not widely available outside of the main urban centers. For many startup firms in India, this choice is not a matter of strategy; it is a structural barrier. In this context, the bargain of the TRIPS agreement that IP protection will be rewarded with technology transfer has largely proven to be unfulfilled.[281] India's response to date, which involves using compulsory licenses such as those used against Bayer in 2012,[282] and its active participation in international negotiations through WIPO and the WTO, has shown serious intent to transform the system from within.

CONCLUSION

There is no clear victor between the open and proprietary approaches. This is not a problem of poor analysis, but an honest evaluation of the situation.

What the chapter reveals is that even the framing of the discussion is outdated.[283] The most advanced companies do not favor either option anymore. They use patents in a defensive way to

[278]Colleen Chien, "Patent Assertion and Startup Innovation" 5 Nature Biotechnology 52 (2014).
[279]Alice Corp. v. CLS Bank International, 573 US 208 (2014).
[280] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022) (United States of America); Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49 (United Kingdom); Thaler v. Commissioner of Patents [2021] FCA 879 (Australia).
[281] Doha Declaration on the TRIPS Agreement and Public Health, WT/MIN (01)/DEC/2 (Nov. 20, 2001).
[282] Natco Pharma Ltd. v. Bayer Corporation, CLA No. 1 of 2011 (Controller General of Patents, India, March 9, 2012).
[283] Henry Chesbrough, Open Innovation: The New Imperative for Creating and Profiting from Technology 3 (Harvard Business School Press, Boston, 2003).

prevent any legal actions against them; they collaborate openly to foster ecosystems; they license out their patents to make money; and sometimes, when it is in their best interest, they drop protection for openness. This is not an example that demonstrates the supremacy of one approach or the other. Instead, it means that the game has fundamentally shifted.

It is in that final assumption that the analysis hits a sour note. The flexibility enjoyed by large firms due to their financial resources and strategic capabilities is not universally accessible. The reality is that when facing the seven-year process involved in obtaining a patent, the associated high costs of applying, and a shortage of specialists, the advanced hybrid strategy remains largely out of reach of an Indian startup. The law, as it exists, does not provide equal opportunity to make intelligent choices. Some firms have choices, while others have restrictions.

The important issues that remain open include questions about the necessary institutional conditions that would have to be altered in order for there to be a meaningful choice between an open and proprietary strategy. These would require examining the processes in patent offices, legal institutions, educational institutions, and financial systems. Is the current framework of Indian intellectual property policy serving the needs of its intended beneficiaries?[284]

And then there are the boundary issues the chapter simply raises. If an invention arises by way of AI without any human involvement, the whole regime developed through many years becomes strained.[285] If a health crisis meets a pharmaceutical industry that operates exclusively, exclusivity is a matter of life and death rather than competition.[286] These are not imaginary threats; they already exist.

If students walk away from the chapter without feeling at all uncomfortable with the knowledge learned, they will miss its entire purpose.[287] It is a contested system; it is far from perfect; it matters greatly. To understand it requires not only grasping its workings but recognizing why it so often fails to achieve what it should.

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[284] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 31.
[285] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022) (United States of America); Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49 (United Kingdom); Thaler v. Commissioner of Patents [2021] FCA 879 (Australia).
[286] Novartis AG v. Union of India [2013] 6 SCC 1; Natco Pharma Ltd. v. Bayer Corporation, CLA No. 1 of 2011 (Controller General of Patents, India, March 9, 2012).
[287] Natco Pharma Ltd. v. Bayer Corporation, CLA No. 1 of 2011 (Controller General of Patents, India, March 9, 2012).

CHAPTER 9: THE ROLE OF PATENTS IN VENTURE CAPITAL & INVESTMENT DECISIONS

BY ABHIROOP

INTRODUCTION

Patents inhabit a multifaceted role in the field of venture capital, they function both as the signals of technological quality and as a legal apparatus of competitive exclusion. This chapter examines this dual role and analyses the multilateral relationship of patent portfolios and venture capital (VC) investments decisions in emerging market jurisdictions, with the foci-point being India. Vast amount of existing literature deals with United States and Western European biotechnological and software startups which leaves significant questions on how patents operate in legally weaker, institutionally evolving and Intellectual property infrastructure deficit markets unanswered. The paper puts forth a detailed research outline evaluating whether and how patent fillings under the Indian Patents Act, 1970, and its subsequent TRIPS – compliant agendas, influence early-stage VC investment decisions in the Indian technological startup environment. This gap further argues to be academically important and practically urgent provided the emergence of India as the world's third largest startup ecosystem with the dissemination of over $11 billion in VC in 2025[288].

[288] Press Information Bureau, Government of India, "India Crosses One Lakh Patent Grants for the First Time in a Calendar Year" available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2093125&reg=48&lang=2 (last visited on June 10, 2026)

INTERSECTION OF IP LAW AND ENTREPRENEURIAL FINANCE: THE RELATIONSHIP AND CHALLENGES

The intersection of Intellectual Property (IP) law and entrepreneurial finance portrays one of the most substantial, yet under-theorised, relationships of contemporary economic jurisprudence. An economy largely driven by knowledge assets such as the patents, i.e. a state generated monopoly over a novel invention, has in recent times come to operate not merely as a legal protection against imitations, but as a credentialing tool in the high-stakes dome of startup financing. Venture Capitalists (VCs), as the most prominent primary financers of early stage, high risk innovation, operate under the blanket of heavy informational uncertainty. The VCs and investors therefore must assess the viability of advancing firms whose core assets that usually involve the quality of their technology, the commercial prospects of their products, the competence of their founders which are entirely unobservable at the time of investment.

Into this knowledge vacuum, patents have come up as one of the most tangible and credible signals available to impending investors. A patent filing, and more so patent grant, discloses that a firm is pursuing innovation of adequate novelty and ingeniousness to merit state recognition, which otherwise remain as unverifiable attributes. Further it also portrays the firm's determination to incur expensive and sophisticated procedural effort in the application process and it enjoys a minimum level of technical believability that subsisted the expert examination. These qualities, obtained from Spencean framework of costly signalling (Spence, 1973)[289], positions patents at the very core of the information structure of venture financing.

However, the relationship between patents and VC investment is neither simple nor univocal. Patents simultaneously operate as signals, valuable assets that generate licensing revenues, deterrents against competitive entries and as a source of legal accountability. The so called 'dark side' of patents, whereby filling for a revolutionary invention subsequently attracts and repels different categories of investors (Colombo and Guerini, 2023)[290], muddles any colossal account of their role. Moreover, the empirical evidence remains deeply contested on whether patents

[289] Michael Spence, "Job Market Signalling" 87 The Quarterly Journal of Economics 355, 360 (1973).
[290] Massimo Colombo and Massimiliano Guerini, "The Dark Side of Signals: Patents Protecting Radical Inventions and Venture Capital Investments" 52 Research Policy 104698 (2023).

increase VC funding, or whether VC investments increase patenting, with most of the methodologically painstaking studies (Conti, Rothaermel, and Thursby, 2013[291]; Engel and Keilbach, 2007[292]) finding that the connectedness primarily arises from patents to VC rather than the reverse.

SIGNALLING THEORY AND INFORMATION ASYMMETRY

The most substantial and foundational theoretical lens through which the patent-VC relationship can be understood is the 'Signalling theory', developed most rigorously Michael Spence (1973)[293] in the labour market atmosphere & further popularised in the economic context. The fundamental idea talks about a market where buyers (here, investors) are unable to observe the seller quality (here, startup potentials), advanced quality sellers have promulgated sending costly signals - actions whose costs are sufficiently excessive for low-quality sellers to make sure that replication of any kind is unprofitable, therefore achieving a separating equilibrium.

Patents seem to fit this framework meticulously. The procedure that's followed to obtain a patent as per the Patents Act, 1970[294] and the Patents Rules, 2003[295], which requires drafting detailed claims, navigating prior art searches, subsisting examination, and paying filling and maintenance fees, are legitimately expensive. Furthermore, firms with weak technological assets, the chances of obtaining a patent successfully remain lower, thus making the signal a credible source (Long, 2002)[296]. Hsu and Ziedonis (2008)[297] formalised this to demonstrate that doubling the pre-funding patent holdings of a startup was associated to a 28% appraisal in pre-money valuation in VC deals, and that the signalling premium was pronounced mostly in the earlier rounds – specifically the rounds where information asymmetries are most acute.

[291] Annamaria Conti, Jerry Thursby and Frank T. Rothaermel, "Show Me the Right Stuff: Signals for High-Tech Startups" 22 Journal of Economics & Management Strategy 341 (2013)
[292] Dirk Engel and Max Keilbach, "Firm-Level Implications of Early-Stage Venture Capital Investment: An Empirical Investigation" 14 Journal of Empirical Finance 150 (2007)
[293] Michael Spence, "Job Market Signalling" 87 The Quarterly Journal of Economics 355, 360 (1973).
[294] The Patents Act, 1970 (Act 39 of 1970).
[295] The Patents Rules, 2003.
[296] Clarisa Long, "Patent Signals" 69 University of Chicago Law Review 625 (2002).
[297] David H. Hsu and Rosemarie H. Ziedonis, "Resources as Dual Sources of Advantage: Implications for Valuing Entrepreneurial-Firm Patents" 34 Strategic Management Journal 761 (2013).

Information asymmetry, as formally laid down by Akerlof (1970)[298] under his 'market for lemons' model, gives us a demand-side rationale. VCs must distinguish between ventures that have genuine technological prospects and those without it, as they continuously face adverse selection risks, patent portfolios become a significant tool that act as independent third-party certification of technological novelty which reduces the adverse selection problem. In sectors like biotechnology, this is specifically essential because the core assets here are wholly intangible and the underlying science makes direct due diligence with non-expert investors extremely challenging.

FUNCTIONS & BENEFITS OF PATENTED ASSETS

A. Productive Function

Beyond the purview of signalling, patents also serve direct productive functions that are independently related to investment decisions. A granted patent provides for an exclusive right – the right to prevent others from making, using or selling the patented invention – which can be monetised by licensing, cross-licensing or through the generation of monopoly returns from commercialisation. Hall and Ziedonis (2001)[299] showcased that the semiconductor industries use patent portfolios known as 'bargaining chips' in cross-licensing negotiations with incumbents, this function is directly relevant for startup survival in a sector dense with patents.

The appropriability value of patents i.e. the ability of patents to procure the returns on R&D investments from imitation, plays a critical role in the VC investment calculus. Cohen, Nelson and Waish (2000)[300] found that industries with a more effective applicability mechanism, such as the pharmaceuticals and chemicals, VC investment becomes more favourable to patent holdings. This creates a sector-specific diversity between the patent-VC relationship that most of the existing literature fails to take into account.

[298] George A. Akerlof, "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism" 84 Quarterly Journal of Economics 488 (1970)
[299] Bronwyn H. Hall and Rosemarie H. Ziedonis, "The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995" 32 RAND Journal of Economics 101 (2001)
[300] Wesley M. Cohen, Richard R. Nelson and John P. Walsh, "Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)" NBER Working Paper No. 7552 (2000).

B. Lowers Transaction Cost & Hold Up Risks

Patents have also reduced the transaction cost under the VC-startup relationship in ways that remain theoretically underexplored. VC financing is structured in a very specific manner – investors devote capital during successive rounds, contingent on performance milestones, precisely to preserve options and restrict exposure (Sahlman, 1990)[301]. In this framework, patents serve a multi-faceted role over the financial cycle, first, as quality signals in early rounds, and secondly, as tangible assets safeguarding the VCs position for the later rounds. Although the function of patents as signals diminishes gradually, their value as a collateral and exit-facilitating tool increases (Block, De Vries, Schumann, and Sandner, 2014)[302].

Furthermore, patents lower hold-up risks in the VC relationship. A startup's fundamental Intellectual Property (IP) instrument – patents – if kept unprotected, can be misused by employees, co-founders, or acquiring incumbents, reducing the return on investment (ROI) for the venture capitalist. By the codification of inventive knowledge which legally protects patents, the VC investment becomes less vulnerable to opportunistic appropriation, lowering agency costs and supporting appraisal in valuations.

C. Improved Reputation

Patents help in improving reputation. An Indian case studies report portrays that at least one startup saw an improvement in its brand reputation in the aftermath of patenting and was also able to license technology for royalty[303]. Though small but important, this function of patent helps businesses attain market-facing credibility as it tries to scale itself from prototype to a corporate entity.

D. Better Exit Prospects

Patents shape exit prospects. Global evidence provides that patent-backed startups are more likely to IPO and less likely to fail, however they are less likely to be acquired than non-patented

[301] William A. Sahlman, "The Structure and Governance of Venture-Capital Organizations" 27 Journal of Financial Economics 473 (1990)
[302] Jörn H. Block, Geert De Vries, Jan Hendrik Schumann and Philipp Sandner, "Trademarks and Venture Capital Valuation" 29 Journal of Business Venturing 525 (2014)
[303] CUTS Institute for Regulation and Competition, Technology Start-ups and Patent Protection in India: Case Studies (CIRC, New Delhi, 2020)

counterparts. For VCS, this becomes crucial as the exit quality acts as the 'final scoreboard' in the financing rounds. Therefore, a patent acts not only as a legal artifact but also widens the set of exit paths[304].

PATENTS AS DETERMINANTS OF VC FINANCING PROBABILITY & AMOUNT: REVIEW OF AN EXISTING LITERATURE

The empirical literature on patents and VC financing has evolved substantially since the early 2000s, with a prominent concentration on biotechnology and software sectors in the United States and Germany. Several major empirical sequences can be identified.

Haeussler, Harhoff, and Mueller (2012, 2014)[305], using vast rate analysis on samples of British and German biotechnological firms, provided us with one of the most prominent and methodologically rigorous research studies on the patent-VC relationship. Their findings showcase that the mere existence of patent applications – prior to grant – caused VCs to finance firms earlier, suggesting that investors react to the signal of application rather than waiting for the certainty of the legal grant. This is a theoretically significant finding as it puts forth the view that signalling occurs even before the certain legal grant, through acts of filling the patents, which communicates the VCs and investors the presence of an innovative activity in the firm, rather than through the legal monopoly which is conferred by a granted patent. Furthermore, they also found that VCs also exhibit patent-reading expertise i.e. they differentiate between high-quality and low-quality patents, financing those ventures faster whose applications have less objections and wider claims.

Mann and Sager (2007)[306] examined the software startup sector and noted that patent portfolios were associated with higher total VC financing and more subsequent financing rounds, however the strategic standing of the firm in the technological space mattered more than the sheer number

[304] Jerry X. Cao and Po-Hsuan Hsu, The Role of Patents in Venture Capital Financing and Performance (Working Paper, Singapore Management University and University of Connecticut, 2010).
[305] Carolin Haeussler, Dietmar Harhoff and Elisabeth Mueller, "How Patenting Informs VC Investors: The Case of Biotechnology" 43 Research Policy 1286 (2014)
[306] Ronald J. Mann and Thomas W. Sager, "Patents, Venture Capital, and Software Start-Ups" 36 Research Policy 193 (2007)

of patents. Baum & Silverman (2004)[307], analysing Canadian biotechnological firms, found that patent quality directly affected both the probability of VC investment and the valuation established at the first round, but also highlighted that VC investors used patents as indirect indicators rather than engaging in penetrative patent quality assessment.

More recently, Farre-Mensa, Hegde, and Ljungqvist (2020)[308] examined the quasi-natural alterations in patent grant timing so as to establish a clear and casual estimate, finding that patent grants led to a substantial increase in VC financing and startup performance outcomes. Their identification strategy is a unique one as it excludes exogenous variations in grant decisions, this represents a methodological advancement over prior observational studies and also provides robust evidence for the claim that 'patents drive VC investment' rather than vice versa.

Study	Key Finding
Haeussler, Harhoff & Mueller (2012)	Patent applications accelerate VC financing; VCs read patent quality signals
Hsu & Ziedonis (2008)	Doubling patent stock raises pre-money VC valuation by 28%; effect strongest in early rounds
Mann & Sager (2007)	Software startups with patents secure more VC rounds and higher total investment
Baum & Silverman (2004)	Patents act as screening proxies for VC investors in Canadian biotech sector
Farre-Mensa et al. (2020)	Causal evidence: patent grants increase VC investment and startup performance

[307] Joel A.C. Baum and Brian S. Silverman, "Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups" 19 Journal of Business Venturing 411 (2004)

[308] Joan Farre-Mensa, Deepak Hegde and Alexander Ljungqvist, "What is a Patent Worth? Evidence from the U.S. Patent 'Lottery'" 75 Journal of Finance 639 (2020)

Drawbacks the of Existing Literature

The problem with the existing literature is its near-exclusive focus on the Western world such as the USA, Canada, Germany, etc. The most prominent empirical studies reviewed and categorised are drawn overwhelmingly from US VC transactions (Farre-Mensa et al., 2020[309]; Hsu and Ziedonis, 2008[310]; Mann and Sager, 2007[311]), German biotechnology (Haeussler et al., 2012), and broader European samples (Hoenig and Henkel, 2015[312]; Colombo and Guerini, 2023[313]).

Such a geographical concentration creates a fundamental problem that the findings of these studies can be applied, mostly, in jurisdictions that share similar institutional characteristics – a well-developed patent analysis infrastructure, a strong VC investment ecosystem with proper due diligence norms in place, a steadfast legal institution for IP enforcement, and a large pool of technologically mature investors. The role and influence of patents in a developing country's patent regime – specifically India which is TRIPS-compliant while being an institutionally restricted system – on VC investment decisions, remains largely unexplored.

However, in the remaining chapter we shall try to construct a study which encapsulates the role of patents in influencing venture capital (VC) and investment decisions in a jurisdiction like that of India.

PATENTS, VENTURE CAPITAL & INVESTMENT- AN INDIAN OVERVIEW

As of FY26, patent fillings in India have hit a record high number by reaching 1.43 lakh fillings, marking a 30.2% increase from last year. With 69% of the fillings being domestic in

[309] Joan Farre-Mensa, Deepak Hegde and Alexander Ljungqvist, "What is a Patent Worth? Evidence from the U.S. Patent 'Lottery'" 75 Journal of Finance 639 (2020)

[310] David H. Hsu and Rosemarie H. Ziedonis, "Patents as Quality Signals for Entrepreneurial Ventures" Academy of Management Proceedings (2008)

[311] Ronald J. Mann and Thomas W. Sager, "Patents, Venture Capital, and Software Start-Ups" 36 Research Policy 193 (2007)

[312] Daniel Hoenig and Joachim Henkel, "Quality Signals? The Role of Patents, Alliances, and Team Experience in Venture Capital Financing" 44 Research Policy 1049 (2015)

[313] Massimo Colombo and Massimiliano Guerini, "The Dark Side of Signals: Patents Protecting Radical Inventions and Venture Capital Investments" 52 Research Policy 104698 (2023).

jurisdiction[314]India's patent landscape has reached immense growth & when combined with investments by venture capitalists (VCs) can contribute appreciably towards the growth of India's MSME, SME and startup sectors. For startups, VCs contribute not only financially but also provide intangible support by offering valuable industrial insight, strategic guidance and access to networks that help scale a nascent business into new heights of progress.

Patents, in this chemistry, play a significant role. They offer startups a tangible measure of their technological potential and innovation capabilities, serving as an encouraging factor towards their commitment to novel inventions as aforementioned. In order to understand the patent-VC investment relationship in India, the chapter uses case studies and examples below to have a deeper understanding of the influence of patents in VC & investment decisions in a tech-infra weak jurisdiction as that of India.

THE PATENT- VC NEXUS: CONTEMPORARY CASE ANALYSIS

Case Study I: - Connected!

"Connected!", is a startup founded in 2012 which offers a cost effective, efficient and innovative technological solution to address the issue of low internet penetration in India. The startup filed patent applications in India, U.S. and Europe. It was granted protection for all three patents filed within India. Further, among the three patent applications filed in the US during 2015 and 2018, two patents are granted protection in 2019.

However, the startup started to face difficulties in manufacturing the devices it mainly produced as most of the manufacturers took only bulk orders and demanded upfront payment. Hence, the startup decided to license its patent to a manufacturing company.

Case Study II: - Un-reality

The startup was launched in 2016 as a private company. The main objective of the startup was to build a novel form of interactive digital experience through virtual reality (VR) setups. The startup had filed for the provisional patent, but was unable to file for a non-provisional patent owing to the limited amount of funds.

[314] Zee News, "India's Patent Filings Hit Record 1.43 Lakh in FY26, Up 30.2%: Piyush Goyal", available at: https://zeenews.india.com/economy/indias-patent-filings-hit-record-1-43-lakh-in-fy26-up-30-2-piyush-goyal-3036487.html (last visited on June 10, 2026)

This lack of risk capital became the biggest issue faced by the startup, since most of the investors were not inclined to the ideas which did not guarantee quick returns. Therefore, they had to battle with crippling funds and limited resources for a long time until they found investors who were willing to back them up.

Case Study III: - Well placed

The startup was launched in 2017 as a digital learning platform and started its operation with this app in June 2018. The main product of the app was an online application which helped students – usually engineering undergraduates – prepare for examinations like GATE, CAT, GRE, etc. The startup had not filed for a patent in India or in any other jurisdiction as the founder lacks the awareness about patents. However, the founder highly believed that VCs and angel investors could easily help them attain tax exemptions and capital support if they agreed to do so[315].

Observations

The global evidence as discussed above stands relatively clear. In the US and parts of Western Europe, patents are associated with stronger venture backing, higher valuations, more prominent investors, and improved startup performance. One of the most important findings being that investors react to patent applications even before patents are officially granted in a legal sense, therefore, stating that VCs act swiftly and not wait for perfect certainty, India, looks different in this regard.

The CIRC case-study report on technology startups we used above[316], found that investors initially prioritised funding, infrastructure, and market access and patents were important in the long run. Investors in India focus mostly on profits and traction than on the patent counts a firm may have. Many incumbents outsourced the patent fillings to law firms or independent agencies; this suggests that patenting is usually treated as specialist compliance rather than as core startup culture in India.

[315] CUTS Institute for Regulation and Competition, Technology Start-ups and Patent Protection in India: Case Studies (CIRC, New Delhi, 2020), available at: https://circ.in/pdf/Report-Technology-startups-and-patent-protection-in-India-case-studies.pdf (last visited on June 10, 2026

[316]CUTS Institute for Regulation and Competition, Technology Start-ups and Patent Protection in India: Case Studies (CIRC, New Delhi, 2020), available at: https://circ.in/pdf/Report-Technology-startups-and-patent-protection-in-India-case-studies.pdf (last visited on June 10, 2026)

The very same report also found that startups that had prior patenting experience were more likely to file for patent protection earlier in the life of the next innovation[317]. This embodies a distinctly core Indian behavioural pattern that is worth noticing – patent awareness appears to be cumulative. Once a founder navigates a system once, the patenting is more likely for the next venture as well. The borderline here is that it is mainly experience which shapes IP behaviour, not the law.

However, one thing found in common in all the three case studies discussed above is the lack of risk capital and limited collaboration with VCs and angel investors. While most of the startups were enrolled under government schemes such as Atal Innovation Mission, NASSCOM, etc or was registered under the DPIIT, these startup firms still noted a lack of risk funding and tax exemptions because of the cumbersome processes[318]. Collaboration with the VCs and investors can help mitigate the problem of lack of funding and resources as they not only provide tangible assets but also provide support for insights about the field, strategy planning and encouragement to innovation.

For the VCs and investors of India, a shift in their focus from primary priority being profits and traction to patent applications filled and patents owned can substantially benefit both VCs and the firms. As the primary priority of investors focuses on patented assets, the capital provided would help these nascent firms scale their innovations to significantly higher magnitudes because the legal monopoly achieved by receiving the patent grants makes them more attractive to other investors and VCs.

DRAWBACKS AND PROBLEMS OF THE PATENTS IN INDIA

Although India recently recorded a meteoric rise in its patent fillings for FY25 – 26, the patent culture in India still has its own drawbacks.

[317]CUTS Institute for Regulation and Competition, Technology Start-ups and Patent Protection in India: Case Studies (CIRC, New Delhi, 2020), available at: https://circ.in/pdf/Report-Technology-startups-and-patent-protection-in-India-case-studies.pdf (last visited on June 10, 2026)

[318]CUTS Institute for Regulation and Competition, Technology Start-ups and Patent Protection in India: Case Studies (CIRC, New Delhi, 2020), available at: https://circ.in/pdf/Report-Technology-startups-and-patent-protection-in-India-case-studies.pdf (last visited on June 10, 2026)

1. Expensive cost for filling patents – Patenting is highly costly in relation to the budget of early startups, especially in the Indian jurisdiction where incumbents spend minute resources on product building, hiring people and market outreach. In such a situation the decision to file for a patent application competes with the subsistence spendings.
2. Delay and Uncertainty – In a jurisdiction like that of India, even a good patent application can take a lot of time due to lack of R&D spending and infrastructure. For startups which usually run on a race against its rivals and cash burns, this delay can cause a major blunder in the signalling value of patents.
3. Uneven literacy of investors – Some investors understand patents well, while others treat them as a decorative legal artifact. The CIRC case studies (as also discussed above) shows that Indian VCs often prefer traction over patents, which means that a good invention can be sidelined if not paired with market evidence.
4. Sectoral Mismatch – Not every business can be evaluated on the same IP yardstick. In some consumer and platform models, patents might not have much competitive relevance, while in fields such as pharma, software and deep-tech, patent strength is very decisive. Taking a one-size-fits-all approach through an investment lens can therefore misread the situation.
5. Risk of Overstatement – Patents can be a very helpful tool when it comes to attracting investments and measuring the tech capabilities of a startup, however a firm may still fail while it has a patent. Therefore, the most mature investment culture of India must treat patents as a single instrument of a large orchestra, not as a conductor which acts as a driving factor.

KEY POLICY RECOMMENDATIONS & SUGGESTIONS

So, if India wants its patents to play a more substantial role in VC financing, it must carve out policy responses that are practical & cohesive rather than being ceremonial. The end result shall focus more on making patent strategy intelligible, affordable, and more investment-relevant, rather than creating a hoax of forcing startups into patenting.
Some key policy recommendations & suggestions are as follows –

1. Strengthen patent education – Students & founders-to-be must learn why patenting matters and how prior-art searches work, and how to time fillings prior to commercial launch.
2. Expand IP facilitation support – Educational institutions, innovation cells, and incubators should provide affordable access to drafting, search support, and filling guidance so that patenting does not become a privilege for the bourgeois class.
3. Construct a vigilant patent-aided financial culture – Specialised banks, funds, and government programmes must delve into credit systems and investment models that recognize patented assets, especially for deep-tech and industrial startups.
4. Improve speed and precedency of patent evaluation – In a jurisdiction like that of ours, where examination delays are very long, patents lose their signalling value. Faster, clearer and more transparent processing can help curb this problem with more investment in infrastructure and R&D prospects.
5. Promulgation of an IP marketplace – A systematic platform for licensing and technology transferability will allow patented assets to be circulated more easily, turning these decorative legal protections to commercially viable assets.

CONCLUSION

Patents matter in the venture capital sphere as they lower uncertainty, reek efforts, and protect value. But in India, the influence of patents remains substantially low because of its cost sensitivities, differentiating enforcement confidence, sector differences, and investor preferability for traction over abstract legal monopoly.

The most accurate conclusion is therefore a balanced one. While investors abroad, especially in the West, are much more mature and aware about the patent-VC nexus, investors in India are yet to be made aware of the interconnectedness between the two. However, India does not need to copy the patent dynamics of the U.S. or Europe. It needs a model of its own that encapsulates curbs the issues not only at face value but to the core. Therefore, in India, patents are not mere protection to novel innovations, when combined with proper VC collaborations, help innovation become investable.

CHAPTER 10: BALANCING PATENT RIGHTS AND PUBLIC HEALTH: LESSONS FROM PHARMACEUTICAL PATENTS

BY ANANYA MUKHERJEE

INTRODUCTION

The combination of patents and public health is a very important issue in modern law. The patent system gives inventors a period during which they are the only ones who can sell their products. On the other hand, public health needs require that people have access to life-saving medicines at prices they can afford. In areas, the costs of having a monopoly are spread out among many people. In the case of pharmaceuticals, these costs affect specific patients who cannot afford the treatment. For these patients, the cost of medicines is a matter of life and death, not convenience.

The Agreement on Trade-Related Aspects of Intellectual Property Rights, or TRIPS[319] changed the balance between patents and public health worldwide in 1994. This agreement required countries that are part of the World Trade Organisation, including India, to give patent protection to pharmaceutical compounds. India did not agree with this requirement for over ten years. However, the *Patents Amendment Act of 2005*[320] marked the end of India's resistance. Instead of just following the rules, India created its own system to ensure public health needs were met. India used laws, court decisions and institutions to make the most of the flexibility allowed by TRIPS. This chapter looks at this system. Argues that India's approach after 2005 is the best response to the problem of balancing access to medicines and innovation. India's system is based on the standard set by Section 3(d), which prevents companies from extending patents and allows compulsory licensing, which allows other companies to produce generic versions of patented medicines. India has also resisted pressure to adopt patent rules. The main question guiding this discussion is: who pays the cost of granting patents to inventors? The patent system

[319] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, available at: https://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm (last visited on May 12, 2026).
[320] The Patents (Amendment) Act, 2005 (Act 15 of 2005).

rewards inventors. At whose expense is this reward given? The answer to this question is important for understanding the impact of patents on public health. India's post-2005 framework, built around pharmaceutical patents, is an example of how to balance the needs of inventors and patients. Pharmaceutical patents are an issue, and India's approach to pharmaceutical patents is worth examining.

THE INTERNATIONAL FRAMEWORK: TRIPS, DOHA, AND THE FLEXIBILITIES

TRIPS and the Globalisation of Pharmaceutical Patents

The TRIPS agreement changed the rules on intellectual property worldwide. Article 27(1) says that countries that are part of the WTO must grant patents to people who invent things across all areas of technology. This meant that many developing countries could no longer refuse to grant patents for medicines.

This change had an impact on public health right away. When someone has a patent for a medicine, they can decide how much it costs. That cost is often a lot more than it costs to make the medicine. This means that people in developing countries often cannot afford the medicines they need to stay alive.

Article 27(1)[321] The TRIPS agreement says that all areas of technology must be treated the same when it comes to patents. It does not say what makes an invention good enough to get a patent. India used this lack of rules to its advantage. In India a law called the Patents Act says that if someone finds a way to make a medicine that is already known but the new way does not make the medicine work any better then it is not a new invention that can be patented. The law also says that things like salts or new combinations of medicines are not considered new inventions unless they work better than the old version.

[321] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994 (Annex 1C to the Marrakesh Agreement Establishing the World Trade Organisation), art. 27(1).

The important thing here is whether the new medicine works better, not just whether it is new or different. This is a standard that many other countries have and it was done on purpose. Someone named Correa has written about the problem that this law is trying to fix. In countries the people who give out patents often give them to companies, for new versions of medicines that are not really any better just so the companies can keep making money from the medicine for a longer time. This is called evergreening. It means that the companies can keep their control over the medicine market for a long time without actually making any new and better medicines.

Section 3(d) relocates the scrutiny upstream, at the grant stage, where it can prevent the problem rather than requiring access mechanisms to remedy it after the fact.[322]

Mueller's landmark account of India's patent transformation contextualises these concerns within the specific political economy of a country that built a world-class generic pharmaceutical industry precisely because it was insulated from product patent obligations.[323] Before 2005, India's domestic patent framework facilitated its emergence as the "pharmacy of the developing world". This regime enabled the domestic industry to supply generic antiretroviral therapies to patients affiliated with HIV/AIDS across the African Continent, provide cost-effective oncology therapeutics to developing nations, and manufacture essential medicines for international procurement agencies.[324] Consequently, the contemporary, post-2005 legal debate is fundamentally animated by a critical tension: how to preserve this access-enabling capacity while strictly adhering to a TRIPS- compliant legal framework.

Bhattacharyya et al. have demonstrated through a systems-analytical approach that India's pharmaceutical exports and domestic patent activity are not straightforwardly correlated, indicating that the generic export model and domestic patenting operate as partially distinct systems.[325] So having strong patent laws in our country does not mean that we will automatically be better at selling things to other countries. We need to look at how patent laws affect our ability

[322] Carlos Correa, *Guidelines for the examination of pharmaceutical patents: developing a public health perspective* (ICTSD, WHO and UNCTAD, 2007), available at: https://ipaccessmeds.southcentre.int/wp-content/uploads/2020/02/PharmaceuticalPatentsGuidelines2007.pdf (last visited on May 13, 2026).
[323] Janice M. Mueller, *The Tiger Awakens: The Tumultuous Transformation of India's Patent System and the Rise of Indian Pharmaceutical Innovation,* 68 University of Pittsburgh Law Review 491 (2007).
[324] Waning B. Diedrichsen E, et. Al., *A Lifetime To Treatment: The Role of an Indian Generic Manufacturers in Supplying Antiretroviral Medicines to Developing Countries,* 13 Journal of International AIDS Society, 35 (2010).
[325] Souvik Bhattacharyya, Bidisha Roy Chaudhuri, Susmita Chatterjee and Dhruba Chakraborty, *Pharmaceutical Exports and Patents in India – A Systems Approach*, 17(3) Indian Growth and Development Review 341 (2024).

to get access to things separately from how they affect the creation of things. Patent laws are really important for patent protection and the people who make things need to think about this when they are coming up with ideas and products, like domestic patent protection.

The Doha Declaration and the Normative Reframing of TRIPS

The Doha Declaration changed how people think about the relationship between intellectual property and public health in International Law. As an affirmation, it states that intellectual property and public health are connected. This is what the Doha Declaration is about. The main idea of the Doha Declaration is that it changed how people understand the relationship between property and public health in International Law. Hence, establishing the importance of the declaration.

The Agreement must be interpreted and implemented in a manner supportive of WTO members' right to protect public health, establishing public health as a co-equal object of international legal ordering alongside trade and intellectual property protection.[326] The Declaration explicitly confirmed the right of members to grant compulsory licenses and to determine the grounds on which such licenses are granted, the right to determine what constitutes a national emergency, and the autonomy to determine their own policies regarding the exhaustion of rights.

The Declaration's operative language makes its *normative ambition explicit*. Paragraph 4[327] states that the TRIPS Agreement does not and should not prevent members from taking measures to protect public health, and that the Agreement should be interpreted and implemented in a manner supportive of WTO members' right to protect public health and, in particular, to promote access to medicines for all. Paragraph 5[328] then confirms, as a matter of authoritative collective interpretation, that each member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted, the right to determine what constitutes a national emergency or other circumstances of extreme urgency, and the freedom to establish its own regime for the exhaustion of intellectual property rights. These were not new

[326] World Trade Organisation, *Doha Ministerial Declarations on the TRIPS Agreements and Public Health,* WTO Doc WT/MIN(01)/DEC/2 (Nov.14,2001).
[327] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, para. 4.
[328] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, para. 5.

rights invented by the Declaration; they were already latent in TRIPS. What the Declaration accomplished was to settle, at the level of formal multilateral consensus, that the *access-protective reading of TRIPS was legitimate and that developing countries invoking it were not acting in bad faith.* Helfer has placed this achievement within a picture of competing international legal systems. He argues that the Declaration was a challenge to the dominant system that protects intellectual property. It introduced a way of thinking about human rights and public health into an area that was previously controlled by trade and investment.[329]

The importance of the Declaration was not about the rules. About politics. It changed the way people talked about access to medicines. It made it harder for governments of developed countries and industries to say that compulsory licensing was not normal. The Declaration drew on the work of developing countries, civil society organisations and international health bodies. They had created a way of thinking about access to medicines. They believed that access to medicines was a human right that was not less important than patent protection. It was a right that needed to be part of the intellectual property system.

Igbokwe and Tosato have looked at why *TRIPS Article 31bis*[330] not used very much. The article was changed in 2017 to allow countries that cannot make their own medicines to import medicines made under special licenses. However the authors say that the process is too complicated. They also say that developed countries use their power to stop countries from using this system. This has greatly reduced the mechanism's effectiveness. Their analysis reveals that, despite the normative achievement of the Doha Declaration, translating its commitments into effective access outcomes has been partial and contested, particularly in countries most dependent on external generic supply.[331]

The Primary Objective of Article 31 of the TRIPS Agreement remains to be flexibility, establishing the conditions under which compulsory licenses can be issued, including the requirements of prior negotiations with the Patent holder, payment of adequate remuneration, and limitations on scope and duration.[332] Member states retain broad regulatory latitude to define

[329] Helfer has placed this achievement within a picture of competing international legal systems. He argues that the Declaration was a challenge to the dominant system that protects intellectual property. It introduced a way of thinking about human rights and public health into an area that was previously controlled by trade and investment.
[330] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.31bis.
[331] E.M. Igbokwe and A. Tosato, *Access to Medicines and Pharmaceutical Patents: Fulfilling the Promise of TRIPS Article 31bis,* 91 Fordham Law Review, (2023).
[332] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.31.

autonomous legal standards such as "national emergency", "extreme urgency", and "adequate remuneration," thereby facilitating divergent domestic implementations. As exemplified by the landmark *Bayer Corporation v. Natco Pharma Ltd.*[333] In litigation, India has leveraged this statutory discretion more proactively than most comparable developing countries.[334]

INDIA'S STATUTORY FRAMEWORK

The Patents Act, 1970 and the 2005 Amendment

The original Patents Act, 1970[335] was the product of a deliberate policy judgment, shaped by the Ayyangar Committee Report[336] and the Bakshi Tek Chand Committee's[337] earlier deliberations, that India's Pharmaceutical Sector could best serve public health and national development by permitting process but not product patents for medicines. This decision made it possible for a domestic generic medicine industry to start and grow. The generic medicine industry became very important around the world. It made medicines for a lot more money than the original companies that made them. The domestic generic industry sold these medicines to people in their country and to other countries that needed them. The generic medicine industry helped a lot of people get the medicines they needed at prices they could afford.

The Patents (Amendment) Act, 2005,[338] introduced product patents for pharmaceutical compounds, in compliance with India's TRIPS obligations. The amended Act, however, incorporates vital public health safeguards introduced by the legislature. These safeguards reflect a deliberate policy choice to exercise the full range of flexibilities TRIPS permits rather than to adopt a minimalist compliance posture. Sections 3(d) (the pre- and post-grant opposition

[333] Bayer Healthcare LLC v. Natco Pharma Ltd., 2023 SCC OnLine Del 3921.
[334] E.M. Igbokwe and A. Tosato, *Access to Medicines and Pharmaceutical Patents: Fulfilling the Promise of TRIPS Article 31bis,* 91 Fordham Law Review, (2023).

[335] The Patents Act, 1970 (Act 39 of 1970).
[336] Government of India, *Report on the Revision of The Patents Law, 9 September 1959),* available at: https://spicyip.com/wp-content/uploads/2013/10/ayyangar_committee_report.pdf (last visited on May 13, 2026).
[337] Government of India, *Report of the Patents Enquiry Committee, 1948-50,* (1950), available at: https://archive.org/details/dli.csl.1934/page/4/mode/2up (last visited on 13 May 2026).
[338] The Patents (Amendment) Act, 2005 (Act 15 of 2005).

provisions) and the compulsory licensing regime under Sections 84[339] and 92[340] constitute the principal statutory instruments through which this balance is maintained.

Dash, Vaiswade and Gupta have observed that the post-2005 Indian patent system operates through a layered architecture in which the general patentability criteria of novelty, inventive step, and industrial applicability are supplemented by pharmaceutical-specific restrictions that substantially tighten the standard for granting secondary patents.[341] Indian courts have consistently upheld the legislature's health-focused design choices against legal challenges from original medicine manufacturers, reinforcing a structure specifically built to protect the public from harm.

Section 3(d) of The Patents Act, 1970: Anti-Evergreening Provision

Section 3(d) of the Patents Act, 1970, as amended in 2005, provides that the "mere discovery of a new form of a known substance which does not result in the enhancement of the known efficacy of that substance" shall not be treated as an invention.[342] Its explanation clarifies that salts, ethers, polymorphs, metabolites, pure forms, particle sizes, isomers, mixtures of isomers, complexes, combinations, and other derivatives of known substances shall be considered the same substance unless they differ *significantly* in properties concerning efficacy.

This provision directly targets the most common forms of evergreening by establishing a heightened, therapeutic-efficacy-centred patentability standard for secondary pharmaceutical patents. As Correa's guidelines have documented, patent offices in many jurisdictions have historically allowed secondary patents on polymorphs, new salt forms, and formulations without adequate scrutiny of therapeutic gains.[343] Section 3(d) of the Patents Act mandates rigorous scrutiny, positioning India within a distinct minority of major patent jurisdictions that explicitly utilise patentability criteria as an instrument of public health.

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[339] The Patents Act, 1970 (Act 39 of 1970), §84.
[340] The Patents Act, 1970 (Act 39 of 1970), §92.
[341] Deepak Kumar Dash, Riya Vaiswade and Gayatri Gupta, *A Review on the Indian Patent System and its Implication on the Pharmaceutical Industry*, 41(3) Journal of Health Science and Medical Research 2023926 (2023).
[342] The Patents Act, 1970 (Act 39 of 1970), § 3(d), as amended by the Patents (Amendment) Act, 2005.
[343] Carlos Correa, *Guidelines for the examination of pharmaceutical patents: developing a public health perspective* (ICTSD, WHO and UNCTAD, 2007), available at: https://ipaccessmeds.southcentre.int/wp-content/uploads/2020/02/PharmaceuticalPatentsGuidelines2007.pdf (last visited on May 14, 2026).

Novartis challenged the Constitutional Validity of Section 3(d) before the Madras High Court in May 2006, which subsequently rejected the challenge in the 2013 judgment, concluding that the provision was consistent with TRIPS and not impermissibly vague.[344] Subsequent judicial interpretation by the Supreme Court has further clarified the scope of the provision, establishing that therapeutic efficacy, not mere physicochemical advantage, is the operative standard. This interpretation has been foundational to India's ability to maintain a public health-sensitive patent system within the WTO framework.

Compulsory Licensing and Related Mechanisms

Section 84 of the Patents Act, 1970 empowers any interested person to apply to the Controller General of Patents for a compulsory licence three years after the grant of a patent on any of three grounds: that the reasonable requirements of the public with respect to the patented invention have not been satisfied; that the patented invention is not available to the public at a reasonably affordable price; or that the patented invention is not worked in the territory of India.[345] Section 92 permits the Central Government to issue compulsory licences *suo motu* in circumstances of national emergency or extreme urgency, including public health crises.

Section 92A, introduced by the 2005 amendment[346], implements TRIPS Article 31bis[347] by providing for the grant of a compulsory license for the export of pharmaceutical products to countries with insufficient or no manufacturing capacity. Gupta and Raza have traced the evolution of compulsory licensing in Indian Law from its origins in the Patents and Designs Act, 1911[348], through to the post-2005 framework, documenting both the theoretical promise of the mechanism and its practical underutilisation, including its failure to be deployed during the COVID-19 pandemic, *despite* evident public health needs.[349]

The pre-grant and post-grant opposition mechanisms established under Section 25(1)[350] and 25(2)[351] of the Patents Act, respectively, constitute an administrative layer of quality control.

[344] Novartis AG v. Union of India and Others, (2013) 6 SCC 1, para. 102.
[345] The Patents Act, 1970 (Act 39 of 1970), §84.
[346] The Patents (Amendment) Act, 2005 (Act 15 of 2005), § 92A.
[347] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.31bis.
[348] The Patents and Designs Act, 1911 (Act 2 of 1911).
[349] A. Gupta and A. Raza, *Patent law and compulsory licensing: Indian Perspective,* 29, Journal of Intellectual Property Rights 5, (2023).
[350] The Patents Act, 1970 (Act 39 of 1970), §25(1).
[351] The Patents Act, 1970 (Act 39 of 1970), §25(2).

These statutory provisions empower external stakeholders, including civil society patient coalitions and generic manufacturers, to litigate the validity of pharmaceutical patent applications, both before and after issuance. Correa has highlighted pre- and post-grant opposition as among the most effective institutional mechanisms for preventing the grant of weak or evergreen patents.[352] India's active use of these procedures has contributed to a higher quality of pharmaceutical patent examination than in many other jurisdictions.

JUDICIAL AND ADMINISTRATIVE PRACTICE: KEY CASE STUDIES

Novartis AG v. Union of India: Section 3(d) before the Supreme Court

The Supreme Court's decision in *Novartis AG v. Union of India*[353] is the most consequential pharmaceutical patent judgment in Indian jurisprudence and a seminal ruling globally. Novartis sought a patent on the beta-crystalline polymorph of imatinib mesylate, marketed as Glivec for chronic myeloid leukaemia, claiming approximately 30 per cent greater bioavailability over the known compound. The Indian Patent Office refused under Section 3(d) for want of enhanced therapeutic efficacy. The Supreme Court upheld this refusal in its April 2013 judgment, holding that "efficacy" within Section 3(d) means therapeutic efficacy, and that improved bioavailability alone, absent clinical evidence of better treatment outcomes, is insufficient.[354]

The Court articulated the legislative purpose of Section 3(d) with clarity: the provision was enacted to prevent the repetitive patenting of pharmaceutical compounds and to maintain a meaningful distinction between genuine pharmaceutical innovation warranting patent protection and incremental modifications that merely extend market exclusivity.[355] The judgment established an authoritative interpretive framework that has since governed the examination of all secondary pharmaceutical patent applications in India, maintaining a significantly higher threshold than prevails in most other major patent jurisdictions.

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[352] Carlos Correa, *Guidelines for the Examination of Pharmaceutical Patents: Developing a Public Health Perspective* (ICTSD, UNCTAD, WHO Working Paper, 2007). available at: https://ipaccessmeds.southcentre.int/wp-content/uploads/2020/02/PharmaceuticalPatentsGuidelines2007.pdf (last visited on May 14, 2026).
[353] *Novartis AG v. Union of India,* 6 SCC 1.
[354] *Novartis AG v. Union of India,* 6 SCC 1, para 190.
[355] *Novartis AG v. Union of India,* 6 SCC 1, para 180.

Mueller had anticipated the significance of such a judicial confrontation, noting in her foundational account of India's patent transformation that the interpretation of Section 3(d) would be determinative for the balance between the originator and generic pharmaceutical sectors in the post-2005 regime.[356] The Novartis judgment validated the legislature's design choices and demonstrated that domestic courts could maintain public health-sensitive patent standards against well-resourced international litigation. The decision attracted sharp criticism from the United States Trade Representative and industry bodies, but was widely welcomed by civil society organisations, public health advocates, and governments of developing countries.

Natco Pharma Ltd. v. Bayer Corporation (2012)

The grant of India's first compulsory license in Natco Pharma Ltd. v. Bayer Corporation[357] On March 9, 2012, it provided an equally important demonstration of India's willingness to operationalise statutory access mechanisms. The case concerned sorafenib tosylate, a tyrosine kinase inhibitor used to treat advanced renal cell carcinoma and hepatocellular carcinoma, marketed by Bayer under the brand name Nexavar. Bayer held a valid Indian patent for the compound. The drug's price in India was approximately INR 2,80,428 per month (roughly USD 6,000), placing it entirely beyond the reach of the vast majority of Indian Cancer Patients.

Natco Pharma first sought a voluntary licence from Bayer to produce a generic version at an affordable price; Bayer declined. Natco then applied to the Controller General under Section 84(1) of the Patents Act.[358] The evidentiary record before the Controller established that all three statutory prerequisites for the issuance of a compulsory license had been satisfied. Specifically, the patentee supplied the therapeutic to approximately 200 patients annually, against an estimated eligible population of 8,842; the drug was not accessible at a reasonably affordable price; and local manufacturing within the territory of India had not commenced. Consequently, the Controller granted a non-exclusive, non-assignable compulsory license, stipulating a retail

[356] Janice M. Mueller, *The Tiger Awakens: The Tumultuous Transformation of India's Patent System and the Rise of Indian Pharmaceutical Innovation,* 68 University of Pittsburgh Law Review 491 (2007).
[357] *Natco Pharma Ltd. v. Bayer Corporation,* Compulsory Licence Application No. 1 of 2011 (Controller General of Patents, Designs and Trade Marks, March 9, 2012).
[358] The Patents Act, 1970 (Act 39 of 1970), § 84(1).

price cap of INR 8,800 per month, representing a nominal reduction of approximately 97 per cent, subject to a 6 per cent royalty rate payable to Bayer.[359]

Bayer challenged the order before the Intellectual Property Appellate Board and subsequently the Bombay High Court, both of which upheld the Controller's decision.[360] The Supreme Court ultimately dismissed Bayer's appeal. The case established authoritative precedent that India's compulsory licensing framework would be interpreted to address access failures meaningfully, and that the statutory grounds of reasonable requirements, affordable price, and local working would be assessed against the realities of patient need rather than narrow commercial criteria.

Gupta and Raza have observed that despite the doctrinal strength of the Natco-Bayer precedent, compulsory licensing has remained exceptional in India rather than becoming a routinely deployed tool. The COVID-19 pandemic, in particular, revealed the limitations of relying on compulsory licensing as the primary mechanism of pharmaceutical access when institutional and political constraints prevent its timely invocation.[361] Bonadio and Solanki have situated this experience within a broader argument about the reassertion of state sovereignty in pharmaceutical intellectual property, contending that governments must reclaim interpretive authority over access mechanisms from the expansionist pressures of international IP regimes.[362]

THE EMERGING INDIAN INNOVATOR PARADIGM: PROMISE AND STRUCTURAL UNCERTAINTY

While the *Novartis*[363] and *Natco-Bayer*[364] cases illustrate India's defensive use of patent law, a shield against failure, a structurally different question has begun to emerge: what happens when

[359] Controller General of Patents, Designs and Trade Marks, *Natco Pharma Ltd. v. Bayer Corporation,* 14(b), para. (c) (March 9, 2012), available at: https://www.globalhealthrights.org/wp-content/uploads/2015/11/Natco-v-Bayer.pdf (last visited on May 14, 2026).
[360] *Bayer Corporation v. Union of India,* Writ Petition No. 1323 of 2013 (Bombay High Court, 2014).
[361] A. Gupta and A. Raza, *Patent law and compulsory licensing: Indian Perspective,* 29, Journal of Intellectual Property Rights 5, (2023).
[362] E. Bonadio and A. Solanki, *Compulsory Licensing of Patents, Government Use and the Reassertion of State Sovereignty in Pharmaceutical Intellectual Property*, in Research Handbook on Sovereignty in Intellectual Property Rights (Edward Elgar, forthcoming 2026).
[363] *Novartis AG v. Union of India,* 6 SCC 1.
[364] *Natco Pharma Ltd. v. Bayer Corporation,* Compulsory Licence Application No. 1 of 2011 (Controller General of Patents, Designs and Trade Marks, March 9, 2012).

India is no longer only a generic producer seeking access to patented drugs, but increasingly a patentee nation with its own innovation interests to protect?

The data suggest that a transition is underway, though its depth remains contested. India recorded the fastest patent application growth rate of 15.7 per cent among the top twenty filing countries in 2023, and for the first time, resident filings exceeded half of all applications submitted to the Indian Patent Office, a threshold that no previous year had crossed. The *Press Information Bureau's* report on India's WIPO 2024 rankings confirms this trajectory, placing India among the top ten countries in patents, trademarks, and industrial designs for the first time.[365] *The Observer Research Foundation* has corroborated the directional trend while noting India's continued lag behind China, the United States, and Japan in absolute filing volume, a caution against overstating the pace of transition.[366]

The Government has moved institutionally to consolidate this momentum. The ICMR's *Medical Innovations Patent Mitra* initiative, launched in 2025 under the guidance of NITI Aayog and in partnership with the *Department of Pharmaceuticals*, is designed specifically to translate biomedical research outputs into patent-protected commercial exploitation.[367] Its existence reflects a qualitatively different policy ambition from the defensive access posture that characterised the post-2005 period: the state is now actively encouraging domestic researchers and institutions to become patentees, not merely users of patented technology.

Whether this translates into a sustained innovation pipeline is, however, genuinely uncertain. Danish et al.'s analysis of patent mortality rates across technology fields in India reveals that pharmaceutical patents lapse at higher rates than patents in most other sectors, suggesting that growth in filings has not yet produced proportionate growth in commercially exploited innovation.[368] Bhattacharyya et al.'s systems-analytical work adds a further complication: domestic patenting activity and pharmaceutical export performance appear to operate as partially

[365]Press Information Bureau, Ministry of Commerce & Industry, *India Secures Position in Top 10 Countries in Patents, Trademarks, and Industrial Designs: WIPO 2024 Report* (Nov. 12, 2024), available at: https://pib.gov.in/PressReleasePage.aspx?PRID=2072706 (last visited on May 15, 2026).
[366] Observer Research Foundation, *Current Trends in India's Patenting Landscape,* (ORF Issue Brief No. 806, 2025), available at: https://www.orfonline.org/research/current-trends-in-india-s-patenting-landscape (last visited on May 15, 2026).
[367] Medical Innovations Patent Mitra: Patent and Technology Transfer Enabler, NITI Aayog and Indian Council of Medical Research, available at: https://patentmitra.icmr.org.in/ (last visited on May 15, 2026).
[368] M.S. Danish, P. Ranjan and R. Sharma, *Analysis of Patent Mortality Rate Across Different Technology Fields in India*, 32(1) Asian Journal of Technology Innovation 83 (2024).

distinct systems, meaning that stronger domestic patent protection does not automatically generate enhanced export competitiveness, and that the access implications of patent policy cannot simply be read off from its effects on innovation output.[369]

The emerging innovator paradigm, therefore, does not displace the access imperative- it reframes it. A country with growing domestic pharmaceutical patent rights has interests on both sides of the access-innovation divide. The challenge this transition poses for India's legal architecture is not choosing between innovation and access, but whether a framework designed primarily for the defensive era can be actively recalibrated to serve both. That question does not yet have an answer, but it is the question that the next decade of Indian pharmaceutical patent law will have to confront.

COMPARATIVE ANALYSIS: MANAGING THE ACCESS- INNOVATION TENSION ACROSS JURISDICTIONS

This section examines how South Africa, Canada, and Australia have used domestic legal tools to manage the access-innovation tension in pharmaceutical patent law, and how India's experience compares with theirs. A legal architecture is coherent, for present purposes, when it addresses the access-innovation tension at multiple stages simultaneously, at the patentability threshold, through licensing mechanisms, and at the level of trade negotiations, rather than concentrating the entire burden of access on a single downstream remedy. The sections that follow evaluate each comparator against that standard, identifying the specific stage at which its architecture fails and the structural lesson that failure yields for the Indian model.

South Africa: The Cost of Deferred Examination

South Africa faced the same TRIPS transition pressure as India, but amid a far more acute HIV/AIDS crisis. The *Medicines and Related Substances Control Amendment Act of 1997*[370]

[369] Souvik Bhattacharyya, Bidisha Roy Chaudhuri, Susmita Chatterjee and Dhruba Chakraborty, *Pharmaceutical Exports and Patents in India – A Systems Approach*, 17(3) Indian Growth and Development Review 341 (2024).

[370] The Medicines and Related Substances Control Amendment Act, 1997 (Act 90 of 1997) (South Africa), available at: https://www.gov.za/sites/default/files/gcis_document/201409/a90-97.pdf (last visited on May 15, 2026).

authorised parallel importation and compulsory licensing, triggering litigation by thirty-nine multinational companies, which ultimately withdrew under global civil society pressure. South Africa had been compelled to defend access mechanisms through adversarial litigation rather than deploying them as routine policy. The intervening catalyst was domestic litigation: in *Minister of Health v. Treatment Action Campaign* (2002)[371]The Constitutional Court held that the government's refusal to provide nevirapine to prevent mother-to-child HIV transmission violated the constitutional right of access to healthcare, reframing pharmaceutical access as a justiciable constitutional obligation and galvanising the political pressure that eventually produced structural patent reform.

The episode revealed a deeper structural failure: South Africa's registration-only patent system *admitted* evergreened secondary patents without substantive examination, overburdening downstream access mechanisms with work they could not realistically perform. Substantive examination was introduced only in 2018.[372] The 2018 reform introduced substantive examination for *novelty and inventive step*, meaningfully departing from the prior registration-only model; it does not, however, incorporate a therapeutic-efficacy standard equivalent to Section 3(d), meaning that secondary pharmaceutical patents on new forms of known compounds remain patentable in South Africa provided they satisfy general inventive step criteria, the precise gap that India's provision was designed to close upstream.

India, by contrast, embedded the anti-evergreening standard of Section 3(d)[373] of the Patent Act, 1970, at the patentability stage, addressing upstream what South Africa was forced to contest, expensively, through reactive litigation. The lesson is clear: where patent examination is lenient, access methods become overwhelmed. No compulsory licensing arrangement, no matter how well-designed, can make up for a system that automatically accepts weak pharmaceutical patents.

Canada: The Procedural Complexity Trap

Rather than demonstrating weak evaluation standards, the Canadian case highlights a distinct structural failure: a procedural architecture that effectively paralyses access mechanisms. The

[371] *Minister of Health v. Treatment Action Campaign* (2002) 5 SA 721 (CC).
[372] Department of Trade and Industry, Republic of South Africa, *Intellectual Property Policy of the Republic of South Africa Phase I* (2018), available at: https://www.gov.za/sites/default/files/gcis_document/201809/ip-policy11septemberlow.pdf.
[373] The Patents Act, 1970 (Act 39 of 1970), § 3(d), as amended by the Patents (Amendment) Act, 2005.

Access to Medicines Regime (CAMR)[374], enacted in 2004 to implement TRIPS Article 31bis[375], was intended to mobilise Canadian generic manufacturing capacity for export to least-developed countries. In over two decades, it has been used exactly once- Apotex's 2007–2008 supply of an antiretroviral to Rwanda, after which Apotex publicly declared the process too cumbersome to repeat.[376] Onerous pre-specification requirements, per-patent licensing obligations, and narrow eligibility criteria collectively strangled the mechanism. This complexity was not inadvertent: the procedural architecture of CAMR reflected sustained lobbying by Canada's brand-name pharmaceutical industry during the legislative drafting process, which *successfully introduced* per-patent licensing requirements and pre-specification obligations that made the regime structurally unworkable for generic exporters, a reminder that access mechanism design is as much a product of domestic political economy as of international legal obligation.

Igbokwe and Tosato confirm that this is not a Canadian idiosyncrasy but a systemic failure replicated across all Article 31bis implementations.[377] The comparison with India is pointed: India's domestic compulsory licensing under Section 84[378] has at least been used once to meaningful effect, yet its export equivalent under Section 92A[379] remains entirely dormant. Both countries demonstrate that legal availability without procedural simplicity produces non-utilisation, but the Indian case carries a particular irony: Section 92A has never once been invoked despite India possessing precisely the generic manufacturing capacity that CAMR was internationally designed to mobilise, suggesting that the problem is not legal design alone but the political will to deploy mechanisms against the resistance of originator industries and their diplomatic sponsors.

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[374] Government of Canada, "Canada's Access to Medicines Regime (CAMR)", available at: https://www.canada.ca/en/health-canada/services/canada-access-medicines-regime.html last visited on May 15, 2026).

[375] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.31bis.

[376] A. Weber and L. Mills, 'A One-Time-Only Combination: Emergency Medicine Exports and the TRIPS Agreement under Canada's Access to Medicines Regime' (2010) 12 Health and Human Rights 109, 114–116 (documenting Apotex's public statement that the CAMR process was too administratively burdensome to repeat and its decision to cease further export applications thereafter).

[377] E.M. Igbokwe and A. Tosato, *Access to Medicines and Pharmaceutical Patents: Fulfilling the Promise of TRIPS Article 31bis,* 91 Fordham Law Review (2023).

[378] The Patents Act, 1970 (Act 39 of 1970), §84.

[379] The Patents (Amendment) Act, 2005 (Act 15 of 2005), § 92A.

Australia: The TRIPS-Plus Erosion of Domestic Flexibility

Australia offers a *third* diagnostic: the erosion of domestic policy space through TRIPS-plus obligations in bilateral trade agreements. The *Australia-United States Free Trade Agreement of 2004*[380] introduced data exclusivity and patent term extensions that go materially beyond TRIPS minimum standards, narrowing Australia's legislative flexibility without commensurate public health justification. Data exclusivity, in particular, prevents generic manufacturers from relying on an originator's clinical trial data for a defined period independently of patent status, creating a distinct barrier to generic entry that operates even where a patent has expired, been invalidated, or was never granted, an encroachment on access space that TRIPS itself does not require and that bilateral agreements have quietly normalised.

At the patentability level, Australia maintains *no equivalent* of Section 3(d). Australia's *Raising the Bar Act 2012*[381] did tighten inventive step and utility requirements, raising the general patentability threshold meaningfully; it does not, however, incorporate a therapeutic-efficacy standard, meaning that secondary pharmaceutical patents on new salt forms, polymorphs, and formulations remain patentable provided they satisfy the general inventive step criterion, the precise category of evergreening that Section 3(d) was enacted to foreclose.

[382]The Patents Act 1990 applies standard novelty and inventive step criteria to pharmaceutical compounds, permitting the precise evergreening that India's provision was designed to prevent. The *Pharmaceutical Benefits Scheme*[383] negotiates prices and has delivered comparatively affordable access to medicine within Australia's high-income context- it is, on its own terms, one of the more effective drug pricing mechanisms in the developed world. That success is not, however, replicable in developing country contexts where public procurement budgets are constrained and where downstream price negotiation cannot substitute for upstream prevention of weak patent grants; it is precisely because India cannot rely on a PBS-equivalent that upstream gatekeeping through Section 3(d) carries the access burden that Australia's system distributes differently.

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[380] The Australia-United States Free Trade Agreement, 2004, available at: https://ustr.gov/trade-agreements/free-trade-agreements/australian-fta (last visited on May, 15, 2026).
[381] The Intellectual Property Laws Amendment (Raising the Bar) Act, 2012.
[382] The Patents Act, 1970 (Act 39 of 1970), § 3(d), as amended by the Patents (Amendment) Act, 2005.
[383] Department of Health and Aged Care (Australia), "Pharmaceutical Benefits Scheme (PBS)", available at: https://www.pbs.gov.au/pbs/home (last visited on May, 15, 2026).

India has thus far resisted identical demands, most pointedly in EU negotiations, and Australia's experience demonstrates what is conceded when that resistance fails: a narrower toolkit, greater pricing power for originators, and reduced capacity to respond to future access emergencies.[384]

Why the Indian Comparison Matters

The three comparators expose recurring failure modes in managing the access-innovation tension. South Africa shows the cost of permissive examination: compulsory licensing is overburdened as the first line of defence. Canada shows the cost of procedural complexity: legal availability produces no practical utilisation. Australia shows the cost of TRIPS-plus erosion: patentability standards weaken, and legislative flexibility is permanently surrendered.

India has avoided each failure mode, not by accident, but through a policy orientation traceable to the *Ayyangar Committee Report of 1959*, which established that India's patent system should serve developmental and public health objectives rather than replicate the maximalist IP standards of industrialised countries.[385] That foundational choice shaped the post-2005 architecture: Section 3(d) supplies the upstream gatekeeping South Africa lacked; *Natco-Bayer* demonstrates that India's compulsory licensing mechanism is more than aspirational, unlike CAMR; and sustained resistance to TRIPS-plus demands has preserved the legislative space Australia relinquished. The result is the most coherent architecture among the four jurisdictions, coherent not because it has produced perfect outcomes, but because it addresses the access-innovation problem simultaneously at the patentability, licensing, and trade negotiations stages rather than relying on any single remedy to carry the full burden.

Yet vulnerabilities remain. COVID-19 exposed a deficit in political will that legal architecture alone cannot supply, and Section 92A has never been used.[386]

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[384] Pratyush Nath Upreti, 'TRIPS-Plus Provisions in EU Free Trade Agreements and Their Impact on Access to Medicines in Developing Countries' (2016) 19 Journal of World Intellectual Property 308, 312–318 (documenting the data exclusivity and patent linkage demands advanced by the EU in its negotiations with India and India's sustained resistance to their incorporation).

[385] Government of India, *Report on the Revision of The Patents Law, 9 September 1959),* available at: https://spicyip.com/wp-content/uploads/2013/10/ayyangar_committee_report.pdf (last visited on May 13, 2026).

[386] The Patents (Amendment) Act, 2005 (Act 15 of 2005), § 92A.

LESSONS, INSTITUTIONAL DEVELOPMENTS, AND THE ROAD AHEAD

India's experience with pharmaceutical patents over two decades yields three lessons that speak beyond its borders.

The first concerns patentability standards as *health policy instruments*.[387] Section 3(d) demonstrates that the choice of patentability threshold, specifically, whether therapeutic efficacy or mere physicochemical novelty is the operative standard, has direct and measurable consequences for the affordability of medicine. This is not a technical IP question; it is a public health decision embedded in statutory language. Other developing countries operating within TRIPS retain the same legislative space India used; Section 3(d) is proof that it can be occupied without violating WTO obligations.

The *Natco-Bayer*[388] precedent functions partly as a deterrent, signalling to originator companies that Indian courts will not protect patents that fail the access test. Yet the mechanism's value as a signal depends on its credibility as a remedy, and credibility requires demonstrated political will to deploy it. Between 2020 and 2022, no compulsory licence was issued under either Section 84 or Section 92 of the Patents Act in respect of any COVID-19 therapeutic or vaccine, despite documented pricing barriers on remdesivir, where Gilead's voluntary licence excluded several middle-income countries, and despite the Indian government's own repeated public statements about affordable access. Section 92[389], which permits the Central Government to issue compulsory licences suo motu in circumstances of national emergency without the three-year waiting period required by Section 84[390], was precisely the instrument available for this situation. It was not used. Gupta and Raza's characterisation of the provisions as having 'remained a dead letter' during the pandemic is the sharpest available critique of the distance between legal

[387] Laurence R. Helfer, *Pharmaceutical Patents and the Human Right to Health: The Contested Evolution of the Transnational Legal Order on Access to Medicines*, in Terence C. Halliday and Gregory Shaffer (eds.), Transnational Legal Orders, 311 (Cambridge University Press, New York, 2015).
[388] *Natco Pharma Ltd. v. Bayer Corporation,* Compulsory Licence Application No. 1 of 2011 (Controller General of Patents, Designs and Trade Marks, March 9, 2012).
[389] The Patents Act, 1970 (Act 39 of 1970), §92.
[390] The Patents Act, 1970 (Act 39 of 1970), §84.

architecture and political practice- the legal structure was functional, the public health need was acute, and the mechanism was not invoked.[391]

Bonadio and Solanki's argument about the reassertion of state sovereignty offers a structural explanation: exercising TRIPS flexibilities requires resisting sustained diplomatic and trade pressure from developed countries whose pharmaceutical industries bear the cost. It also identifies the core vulnerability: a legal framework is only as strong as the political will to enforce it.[392]

The third lesson is that *domestic reform*, however well-designed, is insufficient on its own. Helfer's framework of competing transnational legal orders explains why: the IP-protection order continues to exert pressure through bilateral trade agreements, TRIPS-plus provisions, and diplomatic channels that operate outside the WTO's multilateral framework.[393] Igbokwe and Tosato's analysis of *Article 31bis*[394] demonstrates the same point from the export side, the international mechanism designed to help countries *without* manufacturing capacity has been used so rarely as to constitute a structural failure.[395] India has resisted TRIPS-plus demands better than most developing countries; the pressure nonetheless remains a constant constraint on domestic policy space.

Against this backdrop, India's institutional trajectory adds complexity. India recorded the fastest patent application growth rate- 15.7 per cent, among the top twenty filing countries in 2023, with resident filings exceeding half of all applications for the first time.[396] The ICMR's *Medical Innovations Patent Mitra initiative*[397]*,* launched in 2025 under the guidance of NITI Aayog and in partnership with the Department of Pharmaceuticals, reflects an institutional commitment to

[391] A. Gupta and A. Raza, *Patent law and compulsory licensing: Indian Perspective,* 29, Journal of Intellectual Property Rights 5, (2023).
[392] E. Bonadio and A. Solanki, *Compulsory Licensing of Patents, Government Use and the Reassertion of State Sovereignty in Pharmaceutical Intellectual Property*, in Research Handbook on Sovereignty in Intellectual Property Rights (Edward Elgar, forthcoming 2026).
[393] Laurence R. Helfer, *Pharmaceutical Patents and the Human Right to Health: The Contested Evolution of the Transnational Legal Order on Access to Medicines*, in Terence C. Halliday and Gregory Shaffer (eds.), Transnational Legal Orders, 311 (Cambridge University Press, New York, 2015).
[394] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.31bis.
[395] E.M. Igbokwe and A. Tosato, *Access to Medicines and Pharmaceutical Patents: Fulfilling the Promise of TRIPS Article 31bis,* 91 Fordham Law Review, (2023).
[396] Press Information Bureau, Ministry of Commerce & Industry, *India Secures Position in Top 10 Countries in Patents, Trademarks, and Industrial Designs: WIPO 2024 Report* (Nov. 12, 2024), available at: https://pib.gov.in/PressReleasePage.aspx?PRID=2072706 (last visited on May 15, 2026).
[397] Medical Innovations Patent Mitra: Patent and Technology Transfer Enabler, NITI Aayog and Indian Council of Medical Research, available at: https://patentmitra.icmr.org.in/ (last visited on May 15, 2026).

translating biomedical research into patent-protected commercial exploitation, a qualitatively different ambition from the defensive access posture of the post-2005 period. India is no longer solely a generic producer seeking access to patented drugs; it is increasingly a patentee with its own innovation interests to protect.

Danish et al. 's patent mortality data introduces a note of caution: pharmaceutical patents in India lapse at higher rates than patents in other technology sectors, suggesting that the growth in filings has not yet translated into a sustained commercial innovation pipeline.[398] The access imperative does not disappear as India innovates; it changes shape. A country with growing domestic pharmaceutical patent rights has interests on both sides of the access-innovation divide, and a legal framework designed primarily for the defensive era will require active recalibration to serve both.

CONCLUSION

Returning to the opening question, rewarded at whose expense? India's experience answers: it depends on legal design, institutional capacity, and political will. Section 3(d), compulsory licensing, and resistance to TRIPS-plus demands together constitute a coherent access architecture, imperfect but functional. As India transitions toward an innovator nation, sustaining that architecture will require active commitment rather than institutional inertia. The multilateral problems, Article 31bis's failures, TRIPS-plus erosion, ultimately require multilateral solutions, and India's domestic experience positions it well to lead that conversation.

[398] M.S. Danish, P. Ranjan and R. Sharma, *Analysis of Patent Mortality Rate Across Different Technology Fields in India*, 32(1) Asian Journal of Technology Innovation 83 (2024).

CHAPTER 11: COMPULSORY LICENSING AND ACCESS TO MEDICINES: A GLOBAL PERSPECTIVE

BY PARTHEEV S NAIR

INTRODUCTION

Right to health is a basic human right of all human beings in the world. This right is enshrined in the Article 25 of Universal Declaration of Human Rights. Article 25 provides that everyone has a right to access medical care, to lead a healthy life[399]. But to make healthcare accessible to all, it should be made affordable. But due to the TRIPS Agreement, all the signatories have to grant patents to pharmaceutical companies, resulting in an increase of medicine prices. This made medical care inaccessible to a vast number of poor people, especially in the developing countries.

HIV/AIDS medicines pricing report shows how patenting is affecting the access to healthcare. The yearly treatment cost of AIDS ranges between US$10,000 and US$15,000 according to the report but the per capita GDP of developing countries ranges from US$140 to US$6,190, which literally means that the healthcare is not accessible to vast majority of the people because of high cost of treatment, which is beyond their means. Primary reason for this high cost of treatment is that the price of the medicines is very expensive because of the patent protections[400]. The patents of drugs like Biktarvy and Dolutgravir which are used to treat AIDS are held by Multinational Companies like Gilead Sciences Inc. and ViiV Healthcare[401], who provide this drug at high cost. The cost of production and to buy raw chemicals to produce these drugs only costs a few dollars

[399] Universal Declaration of Human Rights, GA Res 217A (III), UNGAOR, 3rd Sess, UN Doc A/RES/217A(III) (10 December 1948), art 25.

[400] C Pérez-Casas, D Berman, P Chirac, T Kasper, B Pécoul, I de Vincenzi and others, HIV/AIDS Medicines Pricing Report: Setting Objectives—Is There a Political Will? (Campaign for Access to Essential Medicines, Médecins Sans Frontières, Geneva, 2000).

[401] GlaxoSmithKline plc (GSK), 'GSK Announces Settlement Between ViiV Healthcare and Gilead Sciences, Inc. Resolving Litigation Relating to Biktarvy and ViiV's Dolutegravir Patents and Entry into a Patent Licence Agreement' (Press Release, 1 February 2022), available at https://viivhealthcare.com/hiv-news-and-media/news/press-releases/2022/january/gsk-announces-settlement-between-viiv-healthcare-and-gilead-sciences/ accessed 14 June 2026

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per bottle but they sell it for around US$140, which is inaccessible to poor people. The situation regarding many medicines including some basic medicines are similar. To tackle this problem, the way forward is to allow compulsory licensing of essential medicines.

By compulsory licensing, the government lets third parties manufacture medicines without the permission of the patent holders. But giving compulsory licensing to all medicines violates the patent rights of the holder, and will negatively impact further development in the pharmaceutical sector, because the private sector may back down from investing in the sector. This paper examines the legal backup of compulsory licensing of medicines, and how to balance patent rights of holders with the right to affordable medicines.

IMPORTANCE OF COMPULSORY LICENSING OF MEDICINES

Parental protection provides monopoly of the drugs to the pharmaceutical companies that developed it. So, when they sell their product, they are not only trying to recover the cost of production of the medicine but also the high cost incurred to research, develop, test and market the drug. It is estimated that it cost about 5Billion US dollars to develop a new medicine[402]. So, even for drugs and medicines for which the production cost is much lower, the cost of the brand medicine would be much higher with the accumulation of these other expenses. But in case of many drugs like Biktarvy, generic counterparts are available for much lower rate[403]. Generic medicines are medicines containing the same active substance as that of original brand medicines produced by another company after authorization from appropriate authority. But to authorize generic medicines, the active patent period of the drug should expire[404]. Most of the recent developments in pharmaceuticals are protected by active patents. This includes drugs that could cure life ending health conditions suffered by people, like Keytruda which can cure certain early

[402] Dr Sujit Paul, 'Why Do Branded Medicines Cost 30%-90% More than Generic Medicines?' *ETHealthworld* (19 June 2018) https://health.economictimes.indiatimes.com/news/pharma/why-do-branded-medicines-cost-30-90-more-than-generic-medicines/64644960 accessed 17 June 2026.
[403] Ana Goios, 'Biktarvy Price in India 2026: $91/Month Generic — Is It Safe?' *Sunny Pharma*, 9 June 2026 https://sunnypharma.info/hiv-medications/biktarvy-price-in-india/ accessed 17 June 2026.
[404] European Medicines Agency, 'Generic and Hybrid Medicines', *European Medicines Agency* (EMA) https://www.ema.europa.eu/en/human-regulatory-overview/marketing-authorisation/generic-hybrid-medicines accessed 17 June 2026.

stage and advanced cancers[405]. So, for such drugs only the original brand drugs are available which is very expensive and therefore not accessible to a vast majority. A study by the West Health Policy Centre in 2020 estimated that more than 1.1 million people may die in the next decade because they cannot afford medications. The study attributed the reason to the current drug pricing trends[406].

Governments providing compulsory licenses to medicines, so that third parties can manufacture medicines and sell it at much lower price is a much-discussed solution to the problem. On the 30th session of World Intellectual Property Organization on Law of Patents, the developing countries asserted that the compulsory licensing is an essential part of patent law to control price of essentials such as medicine[407]. During the Covid 19 pandemic multiple countries authorized compulsory licensing of certain drugs as measures to prevent the spread of the disease and to provide affordable medication to those who are affected, including Hungary and Russia issuing compulsory license for production of Remdesivir[408]. The World Trade Organization adopted a scheme called TRIPS waiver which was proposed by India and South Africa. By this scheme, the IP protection over covid 19 vaccines and medications were temporarily suspended so that to make production and distribution of it accessible to all[409]. Due to making medicine available to everyone through compulsory licensing, the governments around the globe were able to prevent the pandemic to become the end of human kind. The provisions regarding compulsory licensing are regulated by international agreements and declarations.

INTERNATIONAL FRAMEWORKS

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[405] Merck & Co., Inc., 'KEYTRUDA® (pembrolizumab) & KEYTRUDA QLEX™ (pembrolizumab and berahyaluronidase alfa-pmph) – Official Site', *KEYTRUDA Official Website* https://www.keytruda.com/ accessed 17 June 2026.

[406] Tiffany Yu, 'New Study Predicts More Than 1.1 Million Deaths Among Medicare Recipients Due to the Inability to Afford Their Medications', *West Health*, 19 November 2020 https://westhealth.org/news/new-study-predicts-more-than-1-1-million-deaths-among-medicare-recipients-due-to-the-inability-to-afford-their-medications/ accessed 17 June 2026.

[407] Prathibha Sivasubramaniam and Sangeeta Shashikant, 'WIPO: Compulsory License a Crucial Public Policy Tool, Say Developing Countries', *Third World Network (TWN) Info Service on Intellectual Property Issues*, 5 July 2019 https://www.twn.my/title2/health.info/2019/hi190702.htm accessed 17 June 2026.

[408] Zhanpeng Li and Peng Guo, 'Compulsory Licensing of Pharmaceuticals During Public Health Crisis: A TRIPS Framework Analysis' (2025) *13 Frontiers in Public Health*, DOI: 10.3389/fpubh.2025.1630586, available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC12463931/ accessed 17 June 2026.

[409] Eric Chin-Ru Chang, 'The WTO Waiver on COVID-19 Vaccine Patents' (2022) 70 *UCLA Law Review Discourse* 74 https://www.uclalawreview.org/the-wto-waiver-on-covid-19-vaccine-patents/ accessed 17 June 2026.

Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)

TRIPS is a comprehensive multilateral agreement on Intellectual Property administered by World Trade Organization[410]. It introduced IP rules into multilateral trading system for the first time[411]. Article 31 of the TRIPS provides provision regarding compulsory licensing. By virtue of Article 31 government or third parties authorized by government can use and manufacture subject matter of the patent without the authorization of the right-holder[412]. But to permit such use, the user should have approached the right holder for authorization on reasonable terms and it has not been successful within a reasonable time period. This provision can be overridden if there is a matter of national emergency or other circumstances of extreme urgency necessitating the use of the patent[413]. Article 31 imposes many limitations upon compulsory licensing. The authorization should be strictly limited for the supply in the domestic countries[414]. The right holder should be informed regarding the authorization. Also, adequate remuneration should be paid to the right holder after taking into consideration, the economic value of authorization[415]. The authorization should be terminated upon the end of circumstances which made the authorization necessary cease to exist[416]. Also, the grant of compulsory license would be non- exclusive[417] and non-assignable[418]. Article 30 of the agreement also provide member nations to provide limited exception to patent rights without unreasonable exploitation of the patent[419].

By invoking the provision of Article 31, the countries like Russia and Hungary issued compulsory licenses of drugs like the Remdesivir during the covid time. Even before covid,

[410] World Trade Organization, 'Intellectual Property (TRIPS) – Gateway', *World Trade Organization* https://www.wto.org/trips accessed 17 June 2026.
[411] World Trade Organization, 'Understanding the WTO – Intellectual Property: Protection and Enforcement', *World Trade Organization* https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm accessed 17 June 2026.
[412] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31.
[413] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(b).
[414] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(f).
[415] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(h).
[416] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(g).
[417] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(d).
[418] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 31(e).
[419] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization, 1869 UNTS 299, art 30.

many countries have invoked this provision. In 2014, India issued compulsory license to produce Nexavar, a lifesaving kidney and liver cancer drug[420]. It is the first compulsory license granted in its real sense. The basis behind the TRIPS scheme adopted by the World Trade Organization is the provision of Article 31.

Canada- Patent laws were scrutinized by the WTO due to complaints by the European Communities and their member states. WTO concluded after scrutiny that section 55.2(1) and section 55.2(2) are not in conformity with the provisions in Article 27 and 28 of TRIPS related to patent protection and do not come under the armpit of Article 30 and 31. Section 55.2(1) and section 55.2(2) contained provisions to legalize the production and stockpiling of certain articles by third parties without any authorization. WTO requested Canada to amend the law in conformity to TRIPS agreement[421]. This established strict adherence to Article 30 and 31 of the agreement for authorizing use of patents to third parties by member nations.

Doha Declarations on the TRIPS Agreement and Public Health

It was adopted on fourth session of the Ministerial Conference of World Trade Centre[422]. In the declaration WTO recognized the concerns over high price of medicines and drugs due to intellectual property protection and emphasized that the TRIPS Agreement should be implemented in support of member nations' right to protect public health and particularly to promote access of medicines to all. Under the declaration the member nations were given the right to grant compulsory license of medicines during health crises[423]. The determination of ground to grant compulsory license is under the discretion of the member states. 6th paragraph in the declaration directs member states to find amicable solution to help countries which are not able to make use of compulsory license provision due to lack of manufacturing capability in pharmaceutical sector[424]. In follow up of para 6, a solution was reached, by which the countries lacking manufacturing capabilities will be classified as 'eligible importing member' and they can

[420] Feroz Ali, 'The First Market-Initiated Compulsory Licence' (2016) 9 *NUJS Law Review* 229–258.
[421] World Trade Organization, Canada – *Patent Protection of Pharmaceutical Products*, Panel Report, WT/DS114/R, adopted 7 April 2000, https://www.wto.org/english/tratop_e/dispu_e/7428d.pdf accessed 17 June 2026.
[422] World Trade Organization, *Declaration on the TRIPS Agreement and Public Health*, WT/MIN(01)/DEC/2 (14 November 2001).
[423] World Trade Organization, *Declaration on the TRIPS Agreement and Public Health*, WT/MIN(01)/DEC/2 (14 November 2001), paras 3–4.
[424] World Trade Organization, *Declaration on the TRIPS Agreement and Public Health*, WT/MIN(01)/DEC/2 (14 November 2001), paras 6.

import medicines produced by compulsory pricing, in situations of national emergency or circumstances of extreme urgency[425]. This provision removed the barrier placed by Article 31(f) on least developed countries.

The 2030 Agenda for Sustainable Development

This agenda provides an action plan for the people, planet and prosperity, and seeks universal peace. In the agenda 17 goals and 169 agendas were set to realize human rights and to achieve gender equality[426]. 3rd goal of the agenda is to ensure healthy lives to all[427]. Part 3.8 of the 3rd goal put forward that the universal health coverage should be achieved through providing access to quality essential health-care facilities, and access to safe, effective and affordable essential medicines and vaccines to all[428]. Part 3.b state that the provisions of Doha declaration on the TRIPS Agreement and Public Health should be affirmed through providing affordable essential medicines and vaccines in accordance with the Declaration[429]. The 2030 Agenda for Sustainable development affirms the Compulsory Licensing of medicines.

STATUS OF COUNTRIES REGARDING COMPULSORY LICENSING OF MEDICINES

United States of America

In the United States, the compulsory licensing does not have legal sanction[430]. The closest thing to compulsory licensing in the USA is March-in Rights provided in the Bayh-Dole Act. By virtue

[425] World Trade Organization, *Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health*, WT/L/540 (30 August 2003) https://www.wto.org/english/tratop_e/trips_e/implem_para6_e.htm (last visited 17 June 2026).
[426] United Nations General Assembly, *Transforming Our World: The 2030 Agenda for Sustainable Development*, UN Doc A/RES/70/1 (25 September 2015).
[427] United Nations General Assembly, *Transforming Our World: The 2030 Agenda for Sustainable Development,* UN Doc A/RES/70/1 (25 September 2015), Goal 3.
[428] United Nations General Assembly, *Transforming Our World: The 2030 Agenda for Sustainable Development*, UN Doc A/RES/70/1 (25 September 2015), Goal 3.8.
[429] United Nations General Assembly, *Transforming Our World: The 2030 Agenda for Sustainable Development*, UN Doc A/RES/70/1 (25 September 2015), Goal 3.b.
[430] Radhi Shah, 'Compulsory License: United States of America', *Kluwer Patent Blog*, 23 August 2021 https://patentblog.kluweriplaw.com/2021/08/23/compulsory-license-united-states-of-america/ accessed 17 June 2026.

of section 203 of Bayh-Dole Act, March-in Rights allow federal government to grant licenses regarding the privately owned patents to third parties if the invention was developed with federal funding[431]. This provision was formulated to ensure that the results of research and development conducted through the money of citizens should be accessible to citizens. Section 203(1)a of the act allows the government to utilize the power of March-in Rights to alleviate the health and safety needs[432]. But till date no agency has invoked this provision to issue licenses. But it was used by the government to negotiate and reduce the price of drugs.

Also, section 28 US code section 1498, provides immunity to the government regarding patent and copyright infringement. Under this provision, the government can produce inventions that are protected through Intellectual Property laws. The right holders cannot sue to stop production but under section 1498, they can sue for complete compensation for such infringement[433]. Even though such provisions exist, US is generally hostile towards compulsory licensing and usually opt price negotiation[434].

Brazil

Section III of Brazil's Industrial Property Law deals with compulsory licenses. Article 71 of the act legalizes compulsory licensing of patents under certain circumstances. By Article 71 government can provide license of a private patent during national emergency or declared public interest, if the patent holder failed to satisfy his needs[435]. The act provides some safeguards in the interest of the patent holder. By virtue of Article 72, sublicensing is not allowed and exclusive right cannot be granted while giving compulsory license[436]. Also, the patent holder has the right to remuneration.

During the covid 19 pandemic, Brazil granted license of many drugs, as an effort to reduce the spread of virus, by giving medications accessible to all. In 2021, the Brazilian senate introduced bill (law 14,200 of 2021) that would enable government to grant compulsory license of all covid

[431] Bayh-Dole Act, 35 USC § 203.
[432] Bayh-Dole Act, 35 USC § 203(1)a.
[433] 28 USC § 1498, Patent and Copyright Cases (United States).
[434] Justin Culbertson and Jason J Jardine, 'Compulsory Patent Licensing in the Era of Pandemic', *International Bar Association*, 30 June 2020 https://www.ibanet.org/article/36a60309-5a33-4891-8624-86a6d89a251e accessed 17 June 2026.
[435] Brazil, Industrial Property Law (Law No. 9,279 of 14 May 1996), art 71.
[436] Brazil, Industrial Property Law (Law No. 9,279 of 14 May 1996), art 72.

19 vaccines and technologies[437]. The bill was passed by both the houses of congress. Even though the bill was enacted, the far- reaching provisions of the bill was never invoked by the government[438].

India

The provisions regarding the patent are governed by the Patent Act, 1970 in India. Section 84 of Patent Act provides provisions related to granting of compulsory license[439] and section 88 elucidate the power of controller of patent to grant compulsory license[440]. By virtue of section 84, any person interested can file application to controller for granting of compulsory license after 3 years from the grant of patent rights under any one of the following 3 conditions;

a) The requirement of the public related to the patent is not satisfied, or[441];
b) The patented invention is not available to public at reasonable price, or[442];
c) The patented invention is not available in India[443].

By section 84(4), if the controller of patent is satisfied regarding any of the following 3 grounds, he can grant compulsory right to the applicant[444]. Section 92 of the act provide the central government the power to issue compulsory license regarding privately owned patents during national emergencies or in circumstances of extreme urgency or in case of non-commercial use, after making a declaration regarding it and publishing an official notification in the gazette[445].

The provisions of the act are used only one time to provide compulsory license only one time. It led to the case of Bayer Corporation v Union of India and Others. In 2012, the Controller of Patent issued compulsory license of Nexavar, a drug used for kidney and liver cancer, to Natco pharma citing that the drug was not available to the public at affordable price. It was done in accordance with the provision of section 84(1). The patent of the Nexavar was owned by Beyar

[437] Brazil, Law No. 14,200 of 2 September 2021.
[438] Daniel Law, 'Compulsory Licensing – A Synopsis of What's Been Happening in Brazil and Abroad', *Daniel Law Blog,* 5 October 2022 https://www.daniel-ip.com/en/blog/compulsory-licensing-a-synopsis-of-whats-been-happening-in-brazil-and-abroad/ accessed 17 June 2026.
[439] The Patents Act, 1970, s 84.
[440] The Patents Act, 1970, s 88.
[441] The Patents Act, 1970, s 84(1)a.
[442] The Patents Act, 1970, s 84(1)b.
[443] The Patents Act, 1970, s 84(1)c.
[444] The Patents Act, 1970, s 84(4).
[445] The Patents Act, 1970, s 92.

Corporation. Beyar Corporation moved to the court against the issue of compulsory license by the controller, citing that the provision is inconsistent with the international patent system and thus infringes his patent rights. The Court upheld the provision of 84(1) in the judgement and confirmed the decision of the controller to grant compulsory license. Thus, the judiciary affirmed the compulsory licensing in India[446]. Provisions of compulsory licensing are rarely invoked in India.

CHALLENGES IN COMPULSORY LICENSING OF MEDICINES

Derailing Development in Pharmaceuticals

Researching, developing and testing drugs cost billions of dollars. Pharmaceutical companies take up this endeavor with the intention of gaining huge revenue once the drug is developed. Their intention is at most of the time purely entrepreneurial, not helping people or protecting the health of people by providing them with more safe and effective medications. Big companies and corporations are attracted to invest in pharmaceuticals by the prospect of gaining huge profit after development of the drugs. If governments around the globe adopt compulsory licensing as policy, then the corporations and companies would be reluctant to invest in pharmaceuticals since the profit from pharmaceuticals would be significantly reduced by the production of low-priced bio-equivalence of their drugs by the licensee companies. This can significantly reduce the investment in the pharmaceutical sector and thus, can result in derailing further development in the pharmaceutical sector.

Inherent Defect of Creating Bioequivalence

The compulsory licensee produces and distributes bioequivalence of drugs. The creation of bioequivalence original recipe includes identification of active pharmaceutical ingredients of the original drug, finding composition of ingredients and process employed for production, tackling clinical study design and going through a complex testing process. Even a slight difference in any one step may result in grave consequences. If there are API-API compatibility issues, the formulation of the drug would be complex and in case of composition of insoluble compounds

[446] Bayer Corporation v Union of India and Others, 2014 (60) PTC 277 (Bom).

involve development of enabled formulations involving solubilization technology[447]. This formulation complexities and grave consequences of mishap make companies reluctant to apply for compulsory license. In case of complex drugs, to create a bioequivalence is difficult to achieve[448]. To adhere to the bioequivalence test requirement is very difficult to achieve also.

Developed Countries' Reluctance to adopt Compulsory Licensing

Developed Countries like America are reluctant to adopt compulsory licensing of medicines. They are more inclined towards reducing the price of essentials including medicines through negotiation. Let's take the case of America itself. They still did not provide legal sanction to Compulsory Licensing. They also did not invoke the substitute provisions such as March-in Rights. They have always relied on negotiation as a capitalist country. Also, developed countries have advocated against compulsory licensing in international stages. Developed countries advocated against TRIPS Waiver when India and South Africa proposed it in the World Trade Centre which resulted in delaying the adoption of the scheme for two years. This reluctant policy taken by developed countries negatively impacted least developed countries with no manufacturing capability in pharmaceuticals to produce drugs themselves.

AMICABLE SOLUTIONS

Federal funding in pharmaceuticals

Many privately owned patents in pharmaceuticals around the world are developed with the help of funding from the state. Also, the governments around the globe invoke the provision of compulsory license only on rare instances of national emergency such as health crises or in circumstances of extreme urgency or for non-commercial use. Clear provisions like in the statute of Brazil should be adopted by world countries to terminate the compulsory license upon the cease of existence of circumstances which rendered it necessary to grant compulsory license.

[447] Amitava Mitra and Yunhui Wu, 'Challenges and Opportunities in Achieving Bioequivalence for Fixed-Dose Combination Products' (2012) 14(3) *The AAPS Journal 646–655* https://pmc.ncbi.nlm.nih.gov/articles/PMC3385830/ accessed 17 June 2026.
[448] European Medicines Agency, Guideline on the Investigation of Bioequivalence (Rev. 1), CPMP/EWP/QWP/1401/98 Rev. 1 (2010), https://www.ema.europa.eu/en/documents/scientific-guideline/guideline-investigation-bioequivalence-rev1_en.pdf accessed 17 June 2026.

Also, provisions regarding remuneration to the patent holder should be made clear in the international treaties and national statutes of various countries. These regulations would reduce the loss sustained by pharmaceutical companies due to compulsory licensing by large margin and encourage them to invest more for further research in prospect of huge profit that they can gain in comparison to the minor loss that may be sustained in rare circumstances. These provisions would bring much needed balance between Intellectual property rights and right to access to affordable medicines.

Focus on essential medicines

The government should focus on providing compulsory licenses only to essential medicines rather than on all medicines. This would make compulsory licensing of medicines more effectives. The governments around the world through official notification should list down the medicines that are essential. The government should negotiate with the patent holder to make these essential medicines affordable to people. If the negotiation fails, then only the government should grant compulsory licenses to the third parties. Prior notice should be given to the patent holders before granting compulsory license to third parties. If prior notice is not given, then the granting of compulsory license by the government would stand void. Also, only after 60 days from the receival of notice by patent holder regarding compulsory license, the license should be granted and during this period patent holder should be able restart the negotiation with government but the negotiation should end within this period itself. The government should update the list from time by time. During health crises, compulsory licenses should be granted only to the medicines, drugs, treatments and equipment which are necessary to control the health crisis. During a health crisis, the provision regarding prior notice can be overridden to grant compulsory license considering the emergency of the situation. These compulsory licenses should be terminated once the health crisis ends. By this measure, the world nations can focus on providing basic medications to all.

Sharing of data by original patent holder

During a health crisis, the original patent holder should share data related to the formulation, composition, testing etc. of the drugs to the person to whom the government has granted compulsory license. After the cease of existence of the health crisis, the data would be returned to the original patent holder. If the patent holder is reluctant to share the information to third

parties, then they should be able to avail that in lieu of the third parties, they would share the data with the government, who themselves should produce the medicines or drugs. But this should avail before the granting of compulsory license. If the patent holder is reluctant to share the data with third parties or government, then in alternative to sharing data, they can provide professionals having knowledge of the data, employed by them, to the licensee or government so that until the cease of existence of the health crisis, the government or third party can produce the medicine, drug or treatment equipment. After the health crisis ceases to exist, the patent holder can retake the profession.

CONCLUSION

The compulsory licensing of medicines is a solution to ensure the right to health of everyone as elucidated in the Universal Declaration of Human Rights by ensuring access to affordable medicines. Compulsory licensing got legal backing through TRIPS agreement, Doha declaration and statutes of various countries. But there is a need to balance between the intellectual property right and right to access affordable medications. This can be achieved through making provisions in compulsory licensing to safeguard the interest of patent holders and by focusing on essential medicines. This can be fully integrated only by the cooperation and co-ordination of world countries.

CHAPTER 12: TRIPS AGREEMENT AND THE EVOLUTION OF INTERNATIONAL PATENT NORMS

BY DHANVI

INTRODUCTION

Few legal instruments have reshaped international intellectual property as decisively as the TRIPS Agreement.[449] Signed in 1994 at the close of the Uruguay Round, it took what had long been a loose collection of national patent systems, each answering to local policy and each stopping at its own borders, and drew them into the framework of world trade. Much of what follows in this chapter turns on the contrast with the older Paris Convention. Paris had let member states settle their own substantive standards; TRIPS set a binding minimum. States were no longer merely encouraged to protect intellectual property in whatever manner suited them, but obliged to write specific standards into their own law. Article 33 fixed a single patent term of twenty years from filing, and Article 27 opened patentability to inventions in virtually every field of technology, removing the exclusions that many developing countries had kept for medicines and agricultural chemicals. With those exclusions gone, the room that generic manufacturers had once used to copy and reverse-engineer protected products largely disappeared. What made these obligations bite was their link to the WTO's enforcement system. Once patents fell within the Dispute Settlement Understanding, treaty language that might otherwise have stayed hortatory became something a state could be held to account for, ultimately under threat of trade retaliation. Harmonisation, however, did not end the underlying quarrel; it sharpened it. Whether knowledge is private property to be owned or a public good to be shared has never been settled, and it is that open question the chapter sets out to examine.

[449] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization.

The argument is conducted between the exclusivity of the patent owner and the possible flexibility of the state in enforcing it. These include compulsory licensing under Article 31 of the Agreement and parallel imports resulted from the Agreement's exhaustion principle of article 6. A few limited exceptions are also available. In order to understand how these conflicting rules and principles can be applied, the chapter examines the cases that triggered them. First, the 2001 Doha Declaration on TRIPS and Public Health was issued, which recognized that the Agreement's obligations should not prevent states from taking measures to protect public health, and in particular, to ensure access to medicines. Thus, health needs are prioritized over the exclusivity of the patent owners. Next, the debate on technology transfer was examined, as well as the failed attempts to establish a waiver of intellectual property rights during the COVID-19 pandemic.Read together, these episodes make the chapter's central point: TRIPS is not a fixed rulebook but a living, much-litigated regime, reworked again and again at the awkward junction of commercial monopoly and human welfare.

THE PRE- TRIPS PERIOD: THE GRADUAL CRYSTALLISATION OF INTERNATIONAL PATENT NORMS

Long before the TRIPS Agreement linked intellectual property to international trade, various methods of protecting inventions were developed independently and separately, each responding to specific commercial needs. The process was not systematic but cumulative, with different treaties and organizations contributing to the development of a comprehensive system for protecting intellectual property. A Renaissance law laid the groundwork for modern patents, a nineteenth-century agreement gave them international recognition, a twentieth-century organization provided a permanent home for their oversight, and a procedural treaty streamlined their administration. Taken together, these measures demonstrate the degree of preparation for the TRIPS Agreement.

The Venetian Patent Statute (1474)

The Venetian Statute of 1474 is generally recognized as the first patent law, and it is difficult to disagree with this assessment.[450] Passed by the Senate of the Republic of Venice, it contained, in a few lines, almost everything a modern patent lawyer would look for: protection for genuinely new and useful devices, a requirement that the invention be built and put to work for the good of the community, a fixed period of exclusive rights, and a penalty for anyone who copied without leave. In doing so it recast the patent as a bargain rather than a gift of the sovereign: limited exclusivity in return for disclosure and useful effort.

No Venetian case records survive to show the statute at work, and it would be a mistake to invent litigation for it. Its influence is easier to follow through the English common law that took up the same ideas and gave them shape. The turning point was the Case of Monopolies, *Darcy v. Allein*,[451] in which the Court of King's Bench struck down a royal grant handing a single courtier the exclusive right to import and sell playing cards. Such monopolies over ordinary articles of trade, the court reasoned, drove up prices, lowered quality and put honest craftsmen out of work, and so could not stand. The judges did, however, keep back one exception: where someone brought forward a genuinely new and previously unknown invention, the Crown might grant exclusive rights for a limited time so that the inventor could be rewarded for the benefit conferred on the public. That line, between an unlawful monopoly over existing trade and a lawful, time-bound reward for novelty, is the Venetian principle in English dress, and Parliament wrote it into the Statute of Monopolies of 1624.

The Paris Convention for the Protection of Industrial Property (1883)

By the end of the nineteenth century the patent had outgrown the single state. An inventor who wanted protection abroad faced a different set of rules in every country and, worse, risked losing novelty in one country simply by filing first in another. The Paris Convention of 1883[452] answered that difficulty with two lasting ideas. The first was national treatment: each member had to give foreign applicants the same protection it gave its own nationals. The second was the

[450] The Venetian Patent Statute, 1474 (Republic of Venice).
[451] Darcy v. Allein, (1602) 77 ER 1260 (KB).
[452] The Paris Convention for the Protection of Industrial Property, 1883.

right of priority, which allowed an applicant who had filed in one member state to claim the same filing date in the other states for a limited period, so that a single initial filing could form the basis of a family of applications. Paris did not, however, intervene in the substantive law, leaving it to individual countries to decide what could and could not be patented, and for how long.

Since questions of priority tend to be fought out in patent offices rather than in courts, litigation on the law governing the Paris Convention was relatively rare. Nonetheless, the rules on this score too were clarified in subsequent practice, most notably by the Enlarged Board of Appeal of the European Patent Office in its G2/98 decision[453], which interpreted one of the vaguest formulations in the Convention – the requirement that the subject-matter of the later application be "the same invention" as the prior one in order to secure priority. The board concluded that to meet this test, the subject-matter of the later application must consist of information deriving directly and unambiguously from the earlier application as a whole by virtue of common general knowledge. The question of the different kinds of priority was taken up again in the G1/15 decision[454], which showed how the principles laid out in the Paris Convention of 1883 continued to influence practice today.

The Berne Convention for the Protection of Literary and Artistic Works (1886)

The Berne Convention is concerned with copyright rather than patents, and is mentioned here only because it was negotiated three years after the Paris meeting and follows a similar pattern of national treatment.[455] It goes beyond the Paris Convention, however, in that it covers automatic copyright protection, whereas copyright was still optional for patent law. Before long the two conventions were run together through a single international bureau, and that shared administration is the direct ancestor of WIPO and, further down the line, of the combined intellectual property system that TRIPS would eventually take in. For a study concerned with patents, then, Berne matters as scaffolding and as a point of comparison; its own doctrines, and the copyright cases interpreting them, lie outside this inquiry and are noted only to mark the parallel growth of the field.

[453] G 2/98 (Requirement for Claiming Priority of the "Same Invention"), Enlarged Board of Appeal, European Patent Office, OJ EPO 2001, 413.
[454] G 1/15 (Partial Priority), Enlarged Board of Appeal, European Patent Office, OJ EPO 2017, A82.
[455] The Berne Convention for the Protection of Literary and Artistic Works, 1886.

The World Intellectual Property Organization (1967)

WIPO, Geneva. If Paris and Berne gave substance to the treaties, WIPO gave them institutional heft. Created by the convention of Stockholm, 14 July 1967[456], which came into force in 1970, WIPO took over from the mixed commissions (Birpi, BIRPI) which administered the Paris and Berne unions and, in 1974, became a specialized agency of the United Nations, with an essentially administrative, not judicial, brief. By handling the big treaties, serving as their secretariats, and promoting the uniformity of registration practices, WIPO facilitated the harmonization process. It is important to note that WIPO is an intergovernmental organization, not a court, and that it cannot require any government to interpret its patent laws in a particular way. This distinction has implications for the discussion in this chapter, since one of the reasons why the framers of TRIPS chose the WTO as the location for the new international property regime was precisely because they felt that the international treaties administered by WIPO did not go far enough in ensuring a uniform and enforceable international property regime. The dispute settlement mechanism under the WIPO treaties, administered by WIPO's Arbitration and Mediation Center, deals only with domain names and specific issues of contract law.

The Patent Cooperation Treaty (1970)

A law which was signed in Washington on 19 June 1970 and officially came into force in 1978[457] was aimed at solving not doctrinal but a practical problem. According to the patent cooperation treaty, an inventor who wanted to protect his invention in numerous countries had to file patent applications in each country in question. These applications had to be made in different languages and in various forms at approximately the same time. The PCT replaced that scramble with a single international application which, once filed, undergoes an international search and, if the applicant wishes, a preliminary examination, before the applicant decides which national or regional offices to enter. It is important that the PCT grants nothing: it creates no international patent, and the decision to grant stays with each designated office applying its own law. The treaty streamlines the procedure and postpones the cost; it does not harmonise the substance.

[456] The Convention Establishing the World Intellectual Property Organization, 1967.
[457] The Patent Cooperation Treaty, 1970.

For that reason the disputes it produces are almost all procedural: the timing of national-phase entry, the restoration of a lost priority, or the consequences of a missed deadline. These are adjudicated in national courts by their own procedures, not by a supervisory tribunal authorized by the PCT. Thus, by practice rather than by language, the treaty itself provided an early model of regulatory cooperation in the area of intellectual property law; it demonstrated that states could devise detailed procedures for the mutual regulation of intellectual property even when they were highly unlikely to reach agreement on substantial issues. In short, the PCT provided a model for TRIPS by which intellectual property laws around the world would converge.

From Coexistence to Convergence

Taken as a whole, this system was, by the early 1990s, wide but shallow. It coordinated filing, guaranteed equal treatment and built lasting institutions, yet it set almost no binding floor on the content of protection and gave no real way of enforcing the obligations it did create. Every member stayed free to adjust the scope, length and exceptions of its patents to suit its own stage of development. It was this mix of broad membership, thin substance and weak enforcement that TRIPS was built to overturn, and only against that background does its forceful harmonisation make sense.

TRADE- RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (1994)

The Landscape

The TRIPS Agreement, concluded at Marrakesh[458] as the intellectual property pillar of the Uruguay Round and in force from 1 January 1995, did something no earlier instrument had tried: it fixed a binding substantive floor beneath the patent laws of almost every trading nation. Where

[458] The Marrakesh Agreement Establishing the World Trade Organization, 1994.

the Paris Convention[459] had harmonised only the rules of access, TRIPS[460] reached into the content of protection itself. It mandated protection for patents in all fields of technology (Article 27), specified that the minimum period of patent protection should be twenty years from the date of filing (Article 33), and established the rights that a patent grants (Article 28). At the same time, however, TRIPS elaborated a carefully measured set of exceptions to these strong protections: limited exemptions under Article 30, compulsory licensing and other forms of authorized use under Article 31, and the flexibility on the exhaustion of rights that constitutes the basis for parallel importation under Article 6. Overall, TRIPS created a largely standardized set of patent laws around the world (with some notable divergences in the developing world as outlined in Section 3). This standardized set of laws granted patent owners consistent rights while leaving room for variation at the national level in the implementation of those rights.

The Articles at the Heart of Global Patent Law

The substantive patent law of TRIPS is located in Part II, Section 5 (Articles 27-34). It is guided by the general objectives formulated in Articles 7 and 8, complemented by the exhaustion principle in Article 6 and by the transitional provisions, subject-matter and implementation rules in Articles 65, 66 and 70. Together these are the working core from which nearly every modern patent dispute begins.

The interpretive frame comes first. Article 7 states that the protection of intellectual property should serve technological innovation and the transfer and spread of technology, to the mutual benefit of producers and users and in a way that supports social and economic welfare. Article 8 then preserves each member's right to take the measures it needs to protect public health and nutrition and to advance the public interest in sectors of vital importance, so long as those measures stay consistent with the Agreement. These articles are not decoration. They supply the object and purpose against which the operative provisions are read, and tribunals have leaned on them when deciding how much room Article 30 leaves.

[459] The Paris Convention for the Protection of Industrial Property, 1883.
[460] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization.

Article 27 is the keystone. It requires patents to be available for any invention, whether a product or a process, in all fields of technology, provided the invention is new, involves an inventive step and can be applied in industry, and it requires that patent rights be enjoyed without discrimination as to the field of technology or as to whether the product is imported or made locally. It was Article 27 that ended the old national exclusions for pharmaceutical and agrochemical products, and it was the lack of a proper filing route for such inventions that India was found to have breached in India – Patents (US).[461] The same article also marks out what may be excluded: Article 27.2 lets a member refuse a patent where it must stop commercial exploitation to protect ordre public or morality, and Article 27.3(b) lets it exclude plants and animals (other than micro-organisms) and essentially biological processes while still requiring some protection for plant varieties: the very boundary fought over in Monsanto Technology LLC v. Nuziveedu Seeds Ltd[462] under Section 3(j) of the Indian Act. Within these limits members keep real discretion over how they define patentability, the space India used for its anti-evergreening rule in Novartis AG v. Union of India.[463]

Articles 28 and 29 set out what a patent gives and what it demands. Article 28 grants the exclusive rights to make, use, offer for sale, sell and import the patented product, and to use a patented process and deal in whatever it directly yields, along with the right to assign and license. Article 29 imposes the answering duty of sufficient disclosure: the price the patentee pays for exclusivity, and the same bargain first struck in the Venetian statute.[464]

After the rights come the flexibilities, and it is here that sovereignty reasserts itself. Article 30 allows limited exceptions to the exclusive rights, subject to a three-part test: the exception must be limited; it must not unreasonably conflict with the normal exploitation of the patent; and it must not unreasonably prejudice the legitimate interests of the patentee. The leading reading is still Canada – Pharmaceutical Products,[465] which upheld a regulatory-review exception but struck down an open-ended stockpiling provision under the same test. Article 31 governs use of a patent without the holder's authorisation, or compulsory licensing, and lays down the conditions for it:

[461] India – Patent Protection for Pharmaceutical and Agricultural Chemical Products (Complaint by the United States), WT/DS50/AB/R (Appellate Body Report, 1998).
[462] Monsanto Technology LLC v. Nuziveedu Seeds Ltd., (2019) 3 SCC 381.
[463] Novartis AG v. Union of India, (2013) 6 SCC 1.
[464] The Venetian Patent Statute, 1474 (Republic of Venice).
[465] Canada – Patent Protection of Pharmaceutical Products, WT/DS114/R (Panel Report, 2000).

each case decided on its own facts, prior efforts to obtain a voluntary licence (which may be waived in a national emergency or for public non-commercial use), supply predominantly for the domestic market, adequate remuneration, and judicial review. This was the provision India relied on in Bayer Corporation v. Union of India.[466] Article 31bis, added by the 2017 amendment,[467] gave permanent form to the 2003 waiver that had grown out of the Doha Declaration,[468] loosening the domestic-supply condition so that medicines could be exported to members without the capacity to make them.

The remaining articles complete the core. Article 32 guarantees judicial review of any decision to revoke or forfeit a patent. Article 33 sets the minimum term at twenty years from filing, the standard enforced in Canada – Term of Patent Protection.[469] Article 34 eases the enforcement of process patents by shifting the burden of proof in certain infringement actions, so that the defendant must show an identical product was made by a different process. Article 6, standing apart, leaves the exhaustion of rights to national law and so permits, without requiring, the parallel importation that is one of the main access-oriented flexibilities. Finally, the transitional scheme of Articles 65 and 66, together with the subject-matter rules of Article 70, set the pace at which these standards came to bind different groups of members.

The Bargain Behind the Consensus

This near-universal agreement did not appear on its own; it was the product of a negotiated bargain. The developed economies, led by the United States and the European Communities, wanted enforceable global standards. Developing and least-developed countries, wary of locking in monopolies over essential goods, won concessions in return: above all, time. Article 65 gave developing countries until 2000, with a further window to 2005 for product patents in fields such as pharmaceuticals, to bring their laws into line, and Article 66 gave least-developed countries longer still. This staged deal, stronger intellectual property in exchange for access to agricultural and textile markets, and time to adjust, is what secured almost universal accession. How much was at stake is visible in the litigation that followed: when Canada's pharmaceutical patent rules

[466] Bayer Corporation v. Union of India, (2014) 245 Bom LR 551 (Bom).
[467] The Protocol Amending the TRIPS Agreement, 2005 (in force Jan. 23, 2017).
[468] World Trade Organization, Declaration on the TRIPS Agreement and Public Health, WT/MIN(01)/DEC/2 (Nov. 14, 2001).
[469] Canada – Term of Patent Protection, WT/DS170/AB/R (Appellate Body Report, 2000).

were challenged, a long list of states, among them Australia, Brazil, Cuba, India, Japan, Switzerland and Thailand, joined as third parties, a fair measure of how seriously members took the new common standard.

Enforcement: What Set TRIPS Apart

What really set TRIPS apart from what came before was that its rules could be enforced. By folding intellectual property into the WTO's Dispute Settlement Understanding, the Agreement[470] made patent obligations justiciable, and the earliest disputes did much to fix how those obligations are now understood.

The first serious test came against India. In India – Patent Protection for Pharmaceutical and Agricultural Chemical Products, brought by the United States,[471] The complaint was that India had failed to provide a secure "mailbox" for filing pharmaceutical patent applications during its transition period and had not made exclusive marketing rights available. The Appellate Body thus sustained the panel's conclusion that India has failed to comply with paragraphs 70.8 and 70.9.[472] Indeed India did not establish a filing procedure that assures preservation of novelty and priority and did not provide for exclusive marketing rights. The Appellate body also sustained the like finding made by the panel in respect of the parallel complaint by the European Communities.[473] Thus it was made clear that even the transitional requirements were binding obligations for Members.

At the same time, the patentability of AI inventions, the ambiguities regarding the subject matter of biotech innovations, and the patent office's backlog of applications require a thorough review. In Canada – Patent Protection of Pharmaceutical Products[474] The panel examined two provisions of Canada's Patent Act.[475] It held that the regulatory-review exception (the so-called "Bolar" exception, which lets generic firms use a patented invention to prepare for marketing approval)

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[470] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization.
[471] India – Patent Protection for Pharmaceutical and Agricultural Chemical Products (Complaint by the United States), WT/DS50/AB/R (Appellate Body Report, 1998).
[472] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, arts. 70.8, 70.9.
[473] India – Patent Protection for Pharmaceutical and Agricultural Chemical Products (Complaint by the European Communities), WT/DS79/R (Panel Report, 1998).
[474] Canada – Patent Protection of Pharmaceutical Products, WT/DS114/R (Panel Report, 2000).
[475] The Patent Act, R.S.C. 1985, c. P-4 (Canada).

was a legitimate limited exception under Article 30, but that the stockpiling provision was not, because its open-ended scope cut too far into the patentee's exclusivity. The ruling became a reference point worldwide for how far a government may go in carving out exceptions. Soon after, in Canada – Term of Patent Protection,[476] The Appellate Body held that Canada's seventeen-year term for older patents fell short of the twenty-year minimum in Article 33 and rejected the argument that procedural delays made the shorter term equivalent. Between them, these decisions turned the words of TRIPS into binding doctrine on both terms and exceptions.

Implementation and Contestation: The Developing-World Experience

If the WTO disputes show TRIPS imposing discipline from above, Indian case law shows how a large developing economy took on those obligations while holding on to the flexibilities the Agreement preserved, and it is here that the present shape of global patent norms is most openly contested.

The landmark is *Novartis AG v. Union of India*,[477] in which the Supreme Court of India upheld the refusal of a patent on the cancer drug Glivec. The Court held that the beta crystalline form of imatinib mesylate does not have the improved therapeutic efficacy required by the Patent Act, Section 3(d)[478], which seeks to prevent "evergreening" and promote access to affordable medicines. By interpreting Section 3(d) as a legitimate exercise of the flexibility under Art 3(d) TRIPS, the Court indicated that a country is not obliged to adopt the most liberal possible interpretation of patentability. The same balancing runs through India's first compulsory licence. In *Bayer Corporation v. Union of India*[479] The courts upheld a licence granted to a generic maker of the anti-cancer drug Nexavar (sorafenib). The licence had issued because the patentee supplied the drug to only a small fraction of those who needed it, priced it beyond ordinary reach and had not adequately worked the patent in India; the Bombay High Court affirmed it in 2014, and the Supreme Court later declined Bayer's special leave petition, settling compulsory licensing as a working instrument of access policy. It is a textbook use of the Article 31 flexibility that TRIPS expressly keeps.

[476] Canada – Term of Patent Protection, WT/DS170/AB/R (Appellate Body Report, 2000).
[477] Novartis AG v. Union of India, (2013) 6 SCC 1.
[478] The Patents Act, 1970 (Act 39 of 1970), s. 3(d).
[479] Bayer Corporation v. Union of India, (2014) 245 Bom LR 551 (Bom).

The tension is evident even in infringement litigation. *F. Hoffmann-La Roche Ltd. v. Cipla Ltd.*[480], the first ever challenged pharmaceutical patent case in India (since the amendment to the Indian Patent Act in 2005 which allowed for product patents) ended with the sole judge denying an interim injunction on a generic version of the cancer drug Tarceva (erlotinib), based on his assessment of the public interest and the drug's life-saving potential, with the Division Bench upholding the decision; the dispute was eventually concluded in 2012. The case established that in India the public interest in access can outweigh a patentee's presumptive right to an injunction.

Finally, the reach of TRIPS beyond medicines appears in *Monsanto Technology LLC v. Nuziveedu Seeds Ltd*,[481] which concerned patent claims over genetically modified cotton technology. The Supreme Court set aside a Division Bench ruling that had summarily treated the technology as unpatentable under Section 3(j) of the Patents Act[482] and sent the matter back for a full trial on patentability. The dispute shows how unsettled the line still is between patentable inventions and excluded biological subject matter, an area TRIPS leaves partly to national law under Article 27.3(b).[483]

ARTIFICIAL INTELLIGENCE & GAPS IN TRIPS

TRIPS was drafted before the age of generative artificial intelligence, and it shows. Article 27's promise of patentability across "all fields of technology" quietly assumes that the inventor is a human being; it says nothing about inventions conceived by a machine acting on its own. The United Kingdom Supreme Court in *Thaler v. Comptroller-General*[484] has ruled that a natural person must be appointed inventor, deeming an application with the AI system as inventor abandoned, echoing the US decision in *Thaler v. Vidal.*[485] Thus, the same problem was solved in two different jurisdictions by the two countries' supreme courts, but the decisions contradict each other because they are based on their respective legislation, not a common TRIPS standard. This outcome undermines the ability to harmonize different approaches because it creates a patchwork

[480] F. Hoffmann-La Roche Ltd. v. Cipla Ltd., 148 (2008) DLT 598 (Del).
[481] Monsanto Technology LLC v. Nuziveedu Seeds Ltd., (2019) 3 SCC 381.
[482] The Patents Act, 1970 (Act 39 of 1970), s. 3(j).
[483] The Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art. 27(3)(b).
[484] Thaler v. Comptroller-General of Patents, Designs and Trade Marks, [2023] UKSC 49.
[485] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).

framework instead of relying on uniform standards. The silence on the issue has already led to the kind of differentiation between nations that the Agreement was intended to eliminate. Enforcement makes the problem worse. In theory the Dispute Settlement Understanding[486] turns treaty commitments into obligations a state can be held to, backed by the threat of retaliation. In practice the WTO's Appellate Body has been unable to function since December 2019, because members have blocked the appointment of new adjudicators, and binding appellate review has effectively stalled, leaving disputing states to fall back on uneven, diplomatic settlement. Add to this that TRIPS has no direct effect and is not self-executing in many jurisdictions, and the Agreement's enforcement machinery looks increasingly ill-suited to the pace of frontier technology.

CONCLUSION

Taken together, these authorities trace the two sides of the Agreement's character. Through the Dispute Settlement Understanding, TRIPS hardened treaty text into enforceable global doctrine on term, exceptions and transitional duties; through national implementation, it left states a contested but genuine space to give priority to public health and to their own development. The structure of the substantive law makes the division of labour clear: Article 27 fixes what may be patented, Articles 28 and 29 set out what the patent grants and requires, Articles 30 and 31 mark out what a state may take back in the public interest, and Articles 32 to 34, together with Article 6, supply the surrounding guarantees, each provision anchoring a concrete line of global case law. The result is not a static code but a living standard, read and re-balanced again and again at the meeting point of private exclusivity and public welfare, the dynamic the rest of this study takes up through the Doha Declaration and the pandemic-era waiver debates.

India's experience with the TRIPS Agreement is a model of how a developing country economy could integrate itself in the international patent ecosystem while still retaining its constitutional promise to deliver public welfare. The series of amendments made to the Indian Patents Act, 1970, culminating in the introduction of product patents in 2005, have been made in a manner

[486] The Understanding on Rules and Procedures Governing the Settlement of Disputes, 1994, Annex 2 to the Marrakesh Agreement Establishing the World Trade Organization.

that brings Indian law in conformity with TRIPS while at the same time retaining the flexibilities provided under the agreement. The combination of Section 3(d) and its rigorous definition of enhanced efficacy, the broad opposition remedies available both before and after grant of patent, and the compulsory licensing regime provided under Sections 84 to 92, have created a unique set of circumstances where public health welfare takes precedence over intellectual property rights. The interpretation of Indian Courts while adjudging the cases of *Novartis and Bayer*[487]*, Roche vs Cipla*[488]*, Monsanto vs Nuziveedu* have all demonstrated its propensity to use the various built in flexibilities as tools to serve the larger public interest by treating the patent granted as a right that comes with responsibilities.

The road ahead is not free of tension. Mounting "TRIPS-plus" pressures, pushed through bilateral and regional free-trade negotiations, threaten to erode these flexibilities through data exclusivity, patent-term extension and patent linkage. At the same time, the patentability of AI inventions, the ambiguities regarding the subject matter of biotech innovations, and the patent office's backlog of applications require a thorough review.

The sensible course to pursue is to build examination capability, to bite the bullet on issues where India's obligations exceed India's interest, and to ensure that innovation incentives are balanced by accessibility to meet India's developmental and humanitarian needs, all of which would make India a TRIPS-compliant but a development-friendly nation.

[487] Novartis AG v. Union of India, (2013) 6 SCC 1. Bayer Corporation v. Union of India, (2014) 245 Bom LR 551 (Bom).
[488] F. Hoffmann-La Roche Ltd. v. Cipla Ltd., 148 (2008) DLT 598 (Del).

CHAPTER 13: THE PATENT LAW AND CLIMATE CHANGE: GREEN TECHNOLOGY AND SUSTAINABILITY

BY RUCHITA YADAV AND SHASHANK SINGH THAKUR

INTRODUCTION

Climate change represents one of the most profound challenges facing the contemporary world. Accelerating rates of industrialization and urbanization, ever-increasing reliance on fossil fuels, unsustainable production methods, and rising greenhouse gas emissions have caused environmental degradation on a scale and at a speed previously unheard of. Now, higher global temperatures, changing weather patterns, a loss of biodiversity, the acidification of the oceans, and a rise in the frequency of natural disasters have transformed climate change from being purely a scientific problem into a legal, economic, political, and social one.The impacts of climate change extend beyond environmental concerns and affect economic development, public health, food security and social stability[489].

In order to respond to the threat of climate change, both legal and policy changes, coupled with environmental regulation, are necessitated. Moreover, it is becoming ever increasingly clear that technological innovation will play a critical role in mitigating greenhouse gas emissions and safeguarding the environment in the long term; sustainable technological development is now seen as an essential tool in combating climate change. Governments around the globe have

[489] United Nations Framework Convention on Climate Change (UNFCCC) adopted on 9 May 1992, 1771 UNTS 107 ,(entered into force 21 March 1994).https://www.wipo.int/publications/en/details.jsp?id=4680&plang=EN

therefore focused attention on the encouragement of environmentally sound technologies, colloquially referred to as green technologies.

The range of green technologies is vast, and it encompasses technologies in areas such as renewable energy, carbon capture systems, environmentally sustainable transportation, energy-efficient manufacturing technologies, green infrastructure, environmentally sound agriculture, waste treatment technology and so forth[490].These technologies often require large financial investments and extensive scientific and commercial effort in order to achieve commercialization.

It is in this arena that patent law has a crucial role to play. Patent law is an aspect of intellectual property law and acts as a means of promoting innovation by granting inventors exclusive rights to their inventions for a certain period of time, thereby encouraging investment in research and development[491]. This approach will, therefore, further technological advancements.

However, issues arise in the context of applying patent law to climate change technologies:
Climate change is a global problem and requires widespread solutions rather than isolated ones confined to a few developed countries or private entities[492]. However, restricting access to green technologies will discourage innovation. Weakening IPR may disincentivise investment in clean technologies.

CONCEPTUAL UNDERSTANDING

Meaning and Nature of Patent Law

[490] United Nations, Transforming Our World: The 2030 Agenda for Sustainable Development,UN Doc A/RES/70/1 (2015).https://digitallibrary.un.org/record/3923923
[491] The Patent Act ,1970,No. 39 of 1970, Indiahttps://www.indiacode.nic.in/handle/123456789/1392?sam_handle=123456789/1362
[492] John H. Barton, "Intellectual Property and Access to Clean Energy Technologies" (2010) 2 *Climate Law Review* 15.https://ili.ac.in/pgl.pdf

Patent law refers to the legal system which gives to inventors a right to prevent the unauthorized manufacturing, use, or sale of their inventions, and therefore protects their invention from being utilized by the others for the limited time granted by the law[493].

Climate Change

Climate change involves long term shifts in the Earth's atmospheric and oceanic temperatures due to changes in climate patterns and primarily owing to increased concentrations of greenhouse gases that result from the actions of humans. Major sources include combustion of fossil fuels, industrial processes, agriculture, urbanization and transportation; however it includes several other human activities and factors. Scientific research indicates that greenhouse gases retain heat in the Earth's atmosphere, thus global warming occurs. Consequently, effects such as rise in the global sea levels, global glacier retreat, widespread extreme weather events, shortages of water and food, habitat degradation and biodiversity loss and so on arise and extend to economic, political, social and environmental areas of life and livelihood.

Green Technology

Green technology refers to the use of engineering and science in order to produce innovative products or services that reduce or eliminate the impact of humans on the environment[494].

Green technologies primarily aim at minimising pollution and natural resource degradation whilst ensuring economic growth. Examples include renewable energy sources such as solar and wind energy systems, electricity and hydrogen fueled transport vehicles and systems, energy-efficient manufacturing systems, clean industrial technologies and so on, waste treatment and recycling systems, pollution abatement technologies, water purification technologies etc. Unlike ordinary technologies, green technologies often include environmental benefits as an intrinsic part of the design or operation thereof.

Sustainability and Sustainable Development

[493] W. R. Cornish, David Llewelyn and Tanya Aplin, *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights* (9th edn, Sweet & Maxwell 2019).https://tind.wipo.int/record/27464?ln=en

[494] World Intellectual Property Organization, *Global Innovation Index 2023* (WIPO 2023).https://www.wipo.int/publications/en/details.jsp?id=4680&plang=EN

Sustainability can be said to have gained much attention after 1987 Brundtland Commission, which provided definition as "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[495].

Sustainability is comprised of the following components:

- Environmental sustainability
- Protection of natural resources and ecological systems.
- Economic sustainability
- Long-term profitable growth and prosperity.
- Social sustainability
- Promoting equity and welfare.

Technological innovation is viewed as an essential prerequisite for moving towards sustainability but is not enough on its own, it is required to be combined with other means of supporting its effective and equitable dissemination and diffusion.

Relationship Between Patent Law and Sustainability

Patent law is by its very nature designed to foster exclusion, rather than the inclusion and accessibility which is a key aspect of the concept of sustainability. Nevertheless, patent law and sustainability are not intrinsically at odds. For example, patent law incentivises investment in green technology that promotes sustainability, encourages the development of renewable technologies, fosters rapid innovation that aids the sustainability quest, and creates market demand for environmentally friendly products. On the other hand excessive patent exclusivity has the potential to limit its widespread dissemination and thus hinder sustainability at greater level as cost may increase due to the exclusive rights given to inventors and developing countries may also be restricted due to the high cost of obtaining technology for development purposes. Hence, Intellectual property regulation needs to consider sustainability issues for a balance.

[495] United Nations, *Transforming Our World: The 2030 Agenda for Sustainable Development* (2015).https://digitallibrary.un.org/record/3923923

The Emerging Concept of Green Patents

Green patents can be said to relate to those inventions which are of benefit to the environment. The introduction of Green Patent Fast Track examinations for green inventions has been adopted by certain patent offices around the world so as to enable the inventors of green technology, get rapid market access. The primary objectives are speedy availability of technology and increase in environmentally sound innovations and reducing the time for market entry. Green patents represent a developing understanding of the interaction between environmental and IPR goals.

Importance of the Topic in the Contemporary Legal Studies

It is significant and increasingly important to discuss patent law and climate change in contemporary legal studies due to the severity and urgency of the global climate crisis. The capacity for legal institutions to promote or hinder technological diffusion is central to addressing the issue effectively. Hence the legal system can be seen to play a pivotal role in sustainable development and the fight against climate change, especially given that the future governance structure is to heavily rely on the utilization and propagation of the environmentally-conscious technological innovation.

ANALYTICAL DISCUSSION

Patent Protection and Climate Governance

The patent environment debate has emerged as one of the most contentious issues in contemporary intellectual property law[496]. Though environmental regulation has generally been geared toward industries and emissions, recent global climate governance turns innovators'rights in intellectual property into an integral part of climate control.

Green technologies demand a highly involved investment for research and trials, infrastructure and capital. Patent systems thus function as a means of promoting innovation as they let an

[496] Daniel Gervais, *The TRIPS Agreement: Drafting History and Analysis* (5th edn, London: Sweet & Maxwell 2021).https://www.sweetandmaxwell.co.uk/en-gb/products/the-trips-agreement-drafting-history-and-analysis-5th-edition-proview-ebook-42871416

inventor a period of time having the monopoly over commercially relevant innovative invention[497].

Theories of Environmental Sustainability

Innovative technologies associated with the climate are not simply commercial products because they have implications for peoples' well-being, global environmental commitments and future preservation of the planet, legal systems are faced with the dilemma of reconciling individual legal interests in these new methods with broader political concerns.

A. Innovation Incentive Theory

The principal rationale behind patent protection is the incentive theory. The theory assumes inventors put time, money and skill into developing a new technology. If the technology is not protected, other firms could copy it right away, destroying incentives to invest.

Green innovations are, to a very great extent, patent dependent as they face relatively longer, costlier, and riskier development and demonstration phases. In order to invest heavily for years on end into the long and difficult process of developing and testing of new technologies, firms require robust protection through the patents system to have returns on the considerable cost and effort that go in developing and producing environmentally sound technologies in the absence of certainty of their functioning or acceptability in the market.

There exists multiple complexities in industrial implementation. For instance, many renewable energy technologies take several years of research and development before they are commercially feasible. Patent protection stands up for investors by providing market exclusivity and expanding chances for economic return[498]. Hence, from this view, diminution of patent regimes could result in a decline in private involvement in environmental innovation.

B. Access and Technology Diffusion Theory

[497] The Patent Act ,1970,No. 39 of 1970, India

[498] W. R. Cornish, David Llewelyn and Tanya Aplin, *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights* (9th edn, Sweet & Maxwell 2019).https://tind.wipo.int/record/27464?ln=en

Another rival argument suggests that climate change benefits from fast and large technology diffusion[499]. It might limit the diffusion of technology and restrict access because: it becomes too expensive to utilize technology. A limited set of partners would control the production processes. Unequal access across companies and countries. Patent-based exclusivity could become more imposing if licensors are charging expensive licensing, thus restricting the utilization, access, limited partners will have the control to process, not equitable access, etc. It would restrict the international transfer of technology to the whole world thus having slower dissemination.
The diffusion of environmentally advanced technologies is normally limited in developing countries mainly because of their high costs and their difficulty to access them being protected by the intellectual property. Advocates of access-based models contend that climate technologies should be managed as global public goods.

It would give much easier access to technology through reduced licence costs, promote co-operation and data-sharing between countries, facilitate knowledge sharing and results from R&D, and allow governments to pool public funds to foster innovation. Policy takeaway This model of cheap licences and open, collaborative intellectual property would help overcome prohibitive cost barriers for users and encourage the use and sharing of innovative technologies among nations. If this is supported by public funds and partnerships, countries could share research outcomes, promote jointly produced technologies and increase and distribute technology access much more broadly and equitably.

So the issue is not whether there should be patents; it is a question of how exclusivity will be organized.

C. Technology Transfer and Climate Justice

Technology transfer is the transnational movement of technical knowledge, equipment, expertise and innovation[500]. Technology transfer has consistently been identified by international climate policy debates as a key means to achieve sustainable development.

[499] John H. Barton, "Intellectual Property and Access to Clean Energy Technologies" (2010) 2 *Climate Law Review* 15.https://ili.ac.in/pgl.pdf
[500] United Nations Framework Convention on Climate Change, 1771 UNTS 107 (adopted 9 May 1992, entered into force 21 March 1994).https://unfccc.int/resource/docs/convkp/conveng.pdf

Reducing greenhouse gases The transfer of technologies decreases global emissions through increased adoption of cleaner and more efficient alternatives. It provides support for countries in developing and least developed countries, improving their capacity and fostering their technological independence. Technological transfer provides additional job opportunities by promoting more competitive, sustainable industries and also helps address issues of environmental equality.

The advantages are not significant and may easily be trumped by many major problems such as high cost of licensing a patent, the constraints of the institutions, financial constraints as well as divergent regulations.

Climate justice principles have been developing to include the argument that nations with higher past emissions should be helping developing countries through other mechanisms of technological cooperation.

D. Patent Pools and Collaborative Innovation

Patent Pool: A patent pool is when a group of patent holders cross-license patent rights to each other and create a common licensing platform[501].

One reason green patent systems stand out is how they cut down expenses when deals happen. Access becomes simpler because more people can reach the tools they need. Legal fights drop since rules are clearer and cooperation increases. Progress moves quicker when knowledge flows without delays. Sharing eco-friendly tech by choice grows common within these spaces.

Co-creative innovations de-emphasize ownership and competition, with collaborative and sustainability values driving innovation systems. The open-innovation approach involves a cooperative model for sharing information about university findings, companies' industry cross-fertilization, and the provision of policy and financial support by national governments, which ultimately accelerates the circulation and utilization of technologies while contributing to environmental sustainability.

[501] John H. Barton, "Intellectual Property and Access to Clean Energy Technologies" (2010) 2 *Climate Law Review* 15.https://ili.ac.in/pgl.pdf

Open innovation can bring a significant implication to this notion as it is vital for tackling the emergencies for climate change when environment and climate matters require co-operations.

Some environmental researchers suggest that patent regimes in the future might one day more and more adopt the combination of an exclusive regime with some type of regime of openness.

E. Public Interest and Intellectual Property

There is a growing recognition of public interest factors in the contemporary legal system. The shift from rivalry and ownership towards collaborative innovation abandons a regime of competition and possession in favour of cooperation and long term sustainability. Within the framework of the open innovation, universities offer all access to their research work; industries have opportunities to work collaboratively across their borders. They have access to facilities and favorable conditions, which are made available by the Government. It therefore accelerates technology diffusion, innovation and makes the innovation as environmentally friendly practice by encouraging mutual benefits and not unilateral ones.

In response to such challenges, it appears that states are taking forward-looking approaches, formulating policies to promote sound management of intellectual assets.

All these measures include accelerated green examination, research exemptions, public findings, and licensing reforms.

GLOBAL PERSPECTIVE

Climate change is a global problem necessitating collaborative international action. Various jurisdictions have implemented approaches that address how patent protection intersects with environmental efforts.

A. United States

The United States is currently under one of the most innovative intellectual property systems in the world. American climate innovation policy combines: Strong patent protection, Private

investments, and Technological entrepreneurship. Much support is provided to environmental technologies in renewables, electric transport and industrial sustainable production.

The U.S. has also launched various accelerated examination systems, such as mechanisms led for environment protection.This model promotes rapid technological development but has also generated concerns regarding affordability and unequal access.[502]

Advantages of the American approach include: High private participation, Strong commercial incentives, Enjoys a fast pace of new technology.

Challenges include: Unequal accessibility, Cost barriers, Market concentration.

B. European Union

In the European Union's approach towards sustainability it seems more integrated.The European Union integrates sustainability objectives with intellectual property policy through environmental regulation and innovation incentives.[503] European climate strategy combines: Environmental regulation, Innovation incentives, Industrial transformation. European environmental policies stress the importance of balancing competitiveness and climate goals.

Important features include: Green Industrial Policy, Suggest an environmentally friendly investment, Research Collaboration,Facilitates international collaboration in innovation.

C. India

India follows a mixed approach combining innovation promotion with public interest considerations.[504]India presents a particularly important example because of its dual objectives: Promoting innovation, Safeguarding the public interest.

India's intellectual property may be trying to simultaneously foster advances in technology and maintain affordability and accessibility.

Climate priorities in India include:

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[502] United Nations Environment Programme, *About the United Nations Environment Programme* (2026).
[503] United Nations General Assembly, Resolution 70/1, *Transforming Our World: The 2030 Agenda for Sustainable Development* (25 September 2015).https://press.un.org/en/2015/ga11688.doc.htm
[504] The Patent Act ,1970,No. 39 of 1970, India
https://www.indiacode.nic.in/handle/123456789/1392?sam_handle=123456789/1362

- Renewable energy expansion;
- Sustainable infrastructure;
- Green industrial transition.

Indian policy is heading towards the realisation that environmental innovation must be affordable.

Major areas of green technological development include:

- Solar energy;
- Agricultural sustainability;
- Electric mobility;

Other key factors that have proven to be incredibly useful for the efficiency of the fish pond are water conservation. India also highlights international cooperation and mechanisms of transfer of technology.

D. China

China has become a new global leader. Its approach combines: Government investment, Patent expansion, Industrial policy. The strategy of China is based on dimension and production ability.
Major areas include: Solar manufacturing, Electric mobility, Energy infrastructure.
As the case of China shows, state support can trigger the acceleration of technological transition.China's approach demonstrates the role of coordinated public policy in accelerating sustainable technological growth.[505] Nonetheless, doubts continue to linger about competition and technological governance.

DEVELOPING COUNTRIES AND CLIMATE INEQUALITY

Significant climate impacts arise from countries that have historically contributed considerably less to historical emissions.

[505] United Nations Environment Programme, *About the United Nations Environment Programme* (2026).

Common barriers include:

- Financial limitations;
- Patent dependence;
- Limited infrastructure;
- Limitations of study.

The notion of access to sustainable innovation is gaining importance in international environmental governance.
Developing countries often advocate: Flexible intellectual property approaches, Technology-sharing arrangements, Support from the international community.

INTERNATIONAL COOPERATION & FUTURE GOVERNANCE

The reality of global climate governance is that there is an increasing recognition that climbing action cannot be left solely to individual nations.
Effective future systems may require:

- International licensing mechanisms;
- Cross-border innovation partnerships;
- Sustainable intellectual property frameworks;
- Collaboration of private and public interests.

They continue to morph outside the classic framework of sole ownership. International climate discussions increasingly support flexible mechanisms for improving technological accessibility and reducing environmental inequality.[506] Instead of polarizing patent law and climate policy, we should look for reform directions that resolve the conflict.In order to innovate, incentive is vital.

[506] Paris Agreement under the United Nations Framework Convention on Climate Change, 2187 UNTS 79 (adopted 12 December 2015, entered into force 4 November 2016).https://www.un.org/en/climatechange/paris-agreement

Moving forward, regulatory regimes should be designed to promote both policies simultaneously. That is, a future legal framework should find ways to benefit green inventions and still provide for their broad diffusion. This balance will dictate whether intellectual property will, in fact, become a preeminent facilitator or blockage to the mitigation of climate change.

CHALLENGES

Although patent systems play a substantial role in promoting innovation, a number of problems still affect the relationship between intellectual property rights and climate sustainability. Such problems reflect the tension between the proprietary nature of knowledge and technology on the one hand, and the global demand for environmental solutions on the other.[507]

1. Costly green technology development

A large amount of capital is required to develop beneficial green technology. Research and development requires:

- Experimentation with materials and processes;
- Establishing research infrastructure;
- Testing and certification procedures;
- Adapting production processes;
- Bringing the invention to market.

Many green technologies require many years to generate profit. Small firms, universities, and researchers may face difficulties in raising enough funds, and although the patent itself encourages innovation, initial research and development is still a costly endeavor, which is problematic in some developing countries that do not have as many funds or technological resources.This challenge becomes more significant in developing economies where research capacity and financial support remain limited.[508]

[507] Keith E. Maskus, *Private Rights and Public Problems: The Global Economics of Intellectual Property in the 21st Century*(Peterson Institute 2012).https://www.piie.com/events/private-rights-and-public-problems-global-economics-intellectual-property-21st-century

[508] United Nations Environment Programme, *Global Environment Outlook* (UNEP 2022).https://www.unep.org/geo/

2. Unequal access to climate technology

One of the most commonly cited problems of patent rights is access, as many advanced green technologies are patented by companies located in developed countries, leading to expensive licensing fees, high costs of importing technology and dependence of developing countries on technologies imported from abroad. Climate change is a global issue, which affects the welfare of all countries, and denial of equal access to the relevant technologies may further marginalize poor countries and pose severe problems regarding environmental justice and equitable development.[509]

3. Patent accumulation and market power

Another problem arising from patents is that patent rights for green technology are accumulated in the hands of only a few large transnational corporations, limiting market competition and increasing the barriers for entry. Furthermore, a large part of a patent holder's business may lie in the collection of patents rather than actual invention and application of technology, slowing down dissemination of and innovation in green technology.

4. Barriers to technology transfer

Technology transfer is one of the central objectives in international climate governance.[510] However, it faces several problems, including legal and ethical issues arising from patent regimes, as well as practical and economic impediments in actual transfer of technology, where technical expertise and economic resources are lacking in many recipient countries, and the national interests of technology-producing and receiving countries often conflict, thus restricting the flow of technology across borders.

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[509] United Nations General Assembly, Resolution 70/1, *Transforming Our World: The 2030 Agenda for Sustainable Development* (25 September 2015).https://press.un.org/en/2015/ga11688.doc.htm

[510] United Nations Framework Convention on Climate Change, 1771 UNTS 107 (adopted 9 May 1992, entered into force 21 March 1994).https://unfccc.int/resource/docs/convkp/conveng.pdf

5. Insufficient research and development capabilities in developing countries

A major problem in many developing countries is the shortage of research and development infrastructure[511]. Problems include poor laboratory equipment, limited funding, shortage of qualified personnel, and poor cooperation between industries and academia. Without a robust local research capacity, many developing countries become wholly dependent on imported technologies for a sustainable future.

6. Complex regulatory regimes

Many green technologies can be affected by a range of complementary legal and regulatory systems beyond the scope of patent law, including environmental law, competition law, trade law, and energy regulations. These overlapping frameworks increase the costs associated with research, development, and commercialisation of green technology.

SUGGESTIONS AND POLICY RECOMMENDATIONS

To address the problems and find optimal legal framework that supports both innovation and access, several proposals and recommendations need to be adopted.

1. Expand Green Patent Fast-Track programs; these could accelerate examination of green invention applications, reduce administrative delays, stimulate green innovation and facilitate quick market introduction.
2. Promote patent pools: a better means of knowledge sharing by establishing joint licensing agreements among firms involved in a certain technology area, or other international organizations could effectively promote cooperation and reduce technology barriers.
3. Enhance mechanisms for technology transfer: with financial assistance and expertise provided to the recipient countries by the patent holding nations and international organizations to ensure they can implement these new technologies, climate technology transfer could be facilitated more effectively.

[511] United Nations Environment Programme, *About the United Nations Environment Programme* (2026).

4. Encourage public-private partnerships: governments should consider developing frameworks that foster collaboration between research institutions and industries, creating innovation networks, which will enhance sharing of research findings and commercialization.
5. Increased public funding: government support for research and development in green technology fields could substitute the dependence on private funding and encourage innovation for the public interest.
6. Strengthen international cooperation: agreements on technology transfer and research collaboration, such as under the auspices of a multilateral treaty could play a central role in reducing disparities in green technology access and fostering environmental protection across the globe.
7. Integrate sustainability into intellectual property policies: sustainability issues must be embedded within IP regimes and a balance struck between incentivising the creation of green technology and ensuring that its potential benefits reach those who need them.
8. Capacity building in developing countries: it is crucial to develop endogenous research and development capabilities in poorer countries so that technology transfer may be supplemented by local invention.

FUTURE OF PATENT LAW IN THE ERA OF CLIMATE CHANGE

The relationship between patent law and climate change is increasingly moving toward stronger integration, as governments are trying to find innovative ways to address climate change. Several trends may shape this future relationship: increased prioritization of green innovation, emphasis on cooperative research models, a shift in regulations toward sustainability, and an increasing role of global climate governance in shaping technology transfer. Future patent systems will perhaps transition into tools of sustainable development and environmental protection rather than just mechanisms to ensure a market monopoly.

CONCLUSION

The most pressing challenges facing humankind in the 21st century is climate change and its associated problems that require immediate attention. Addressing climate change necessitates not only robust environmental regulation but also continuous innovation that aims to provide cleaner sources of energy and improve resource management. Patent law is a crucial tool that can stimulate investment in research and development for green technologies, which include but are not limited to, new renewable energy technologies, carbon capture, storage and transportation systems, energy-efficient industrial processes, and sustainable modes of transportation. However, intellectual property protection through patents also brings challenges related to technology transfer, especially among developed and developing countries that have different socio-economic capabilities. The application of intellectual property regimes must therefore strike an appropriate balance between encouraging innovation, providing adequate reward for inventors, and ensuring affordable and widespread access to beneficial green technology to the developing world. Diverse approaches among regions like the United States, the EU, China and India clearly demonstrate efforts to achieve effective integration of IP and climate objectives. Future patent regimes will likely serve as key enablers of a sustainable future if innovative legal frameworks, technology transfer mechanisms, and collaborative strategies are implemented globally to create an IP system conducive to the sustainable development of the global environment.Future legal frameworks should continue integrating sustainability objectives into intellectual property governance so that technological advancement contributes effectively to climate resilience and global environmental justice.[512]

[512] Intergovernmental Panel on Climate Change, *Climate Change 2023: AR6 Synthesis Report* (2023).https://www.ipcc.ch/assessment-report/ar6/

CHAPTER 14: TRADITIONAL KNOWLEDGE, BIOPIRACY, AND THE LIMITS OF PATENT PROTECTION

BY NANDITHA GUJARATHI

INTRODUCTION

As technology continues to evolve rapidly and international trade increases throughout the world, protecting intellectual property has become extremely important. Historically, traditional intellectual property regimes, including patent law, have provided individuals with the ability to create new and innovative products by incentivizing them to do so[513]. A major area of concern, however, is how Traditional Knowledge will be recognized and protected. This chapter presents an overview of how traditional knowledge, along with the global threat associated with biopiracy[514] and the limits of traditional patent systems, create significant challenges for indigenous and local peoples as custodians of large amounts of traditional knowledge. The Traditional Knowledge issues discussed in this chapter will illustrate how biopiracy occurs when non-indigenous and local communities have their collective heritage exploited by others without their consent or equitable benefits. This chapter will provide a detailed analysis of Traditional Knowledge, biopiracy issues, and the challenges that the parties face in protecting Traditional Knowledge,, including legal issues, ethical issues, and socio-economic issues. The goal of this chapter is to demonstrate how Traditional Knowledge/ biopiracy will impact the creation of a more equitable and inclusive intellectual property system for the 21st century.

CONCEPTUAL UNDERSTANDING/ BACKGROUND

[513] N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property 327 (Eastern Book Company, 2nd edn., 2014)
[514] Madhavi Sunder, "The Invention of Traditional Knowledge," 70 Law and Contemporary Problems 97 (2007).

Traditional Knowledge can be described as the collective knowledge, wisdom, and practices that indigenous and local peoples have created, developed, recorded, maintained, and transmitted through generations.[515] Traditional Knowledge encompasses much more than what is described above. It often contains elements from nature, society, culture, and spirituality, and has been passed down orally through the generations. The contents of Traditional Knowledge are often intertwined with, or related to, the identity of an indigenous or local person. In addition, Traditional Knowledge is associated with the materials and practices that indigenous and local peoples have developed for managing their resources and ecosystems sustainably. Traditional Knowledge is generally shared among multiple generations and is frequently passed on orally, making its documentation and protection difficult to accomplish using existing methods or systems.

Essentially, biopiracy is the unauthorized use of traditional knowledge. Biopiracy has occurred when someone uses, creates a business model or shares benefits from traditional knowledge without the consent of the knowledge holder(s). Biopiracy is a form of intellectual/cultural appropriation that adversely affects the rights and livelihoods of indigenous peoples. When biopiracy occurs, this may involve patenting a traditional medicinal plant or agricultural production techniques or using genetic material. The patent would show that a person has invented the use of this material; however, what the patent is really showing is that the person has either discovered a use for traditional knowledge or made modifications to traditional knowledge.

The patent system is designed to provide exclusive rights to inventors so they may benefit from the invention. The patent system is designed for new inventions that are not obvious and can be manufactured. The patent system cannot adequately and / or completely adjust to the characteristics of the traditional knowledge:

With respect to the “newness” of the traditional knowledge: Traditional Knowledge is hundreds, if not thousands, of years old within the community (under its definition, Traditional Knowledge cannot be “new”).

[515] World Intellectual Property Organization, *Traditional Knowledge and Intellectual Property: Background Brief* (WIPO, Geneva, 2020).

With regard to the "inventive step" of Traditional Knowledge: Traditional practices, even though they may be successful, may be considered to be obvious to someone skilled in the art because traditional knowledge represents historical development. Therefore, the traditional knowledge would not qualify for a patent.

The two fundamental distinctions between the treatment of knowledge protected by patent rights and traditional knowledge under existing law are:

1) Individual vs. Collective Rights – Patents are granted to an individual inventor or to a legal entity, whereas traditional knowledge is typically owned collectively by the community.

2) Disclosure Requirements – Under patent law, an inventor must disclose the details of his or her invention. Disclosure can be problematic for communities who wish to keep their sacred or culturally sensitive traditional knowledge private.

India has adopted a comprehensive legal framework for protecting traditional knowledge from biopiracy; the key components of that framework are as follows:

1. Patents Act, 1970 (amended) – Section 3(p) prohibits the patenting of inventions that are derived from traditional knowledge or that merely aggregate known traditional properties[516]. The act requires that any patent application disclose the source and geographic origin of biological materials from which the invention is derived. This fosters compliance with the act's benefit-sharing provisions. The act permits third parties to challenge an applicant's patent application on the basis of novelty and/or prior art to protect the rights of communities.
2. Biological Diversity Act, 2002 – The purpose of the Biological Diversity Act is to implement the Convention on Biological Diversity (CBD)[517]. The act seeks to conserve biological diversity and achieve equitable sharing of the benefits derived from genetic resources. To achieve this, the act establishes: (i) the National Biodiversity Authority (NBA), (ii) state biodiversity boards, and (iii) local biodiversity committees. Any person wishing to use biological resources must first obtain approval from the National Biodiversity Authority, which requires that the use of those resources benefit local communities and involve their participation in sharing those benefits.

[516] The Patents Act, 1970, s. 3(p)
[517] The Biological Diversity Act, 2002

3. Protection of Plant Varieties and Farmers' Rights Act protects new plant varieties (e.g., potatoes, tomatoes) while recognizing farmers' rights[518]. This act establishes protections for farmers' traditional/indigenous seed varieties, provides a mechanism to register, and encourages the benefit of commercialization from all varieties registered by farmers.

The protection of traditional and indigenous knowledge regarding biodiversity involves various international agreements:

- Convention on Biological Diversity (1992)[519] recognizes the right of each nation to sovereignty of its natural resources (including seeds) and the right to develop protection and compensation for traditional and indigenous knowledge associated with biodiversity.

- Nagoya Protocol (2010)[520] requires nations to implement legislative measures to ensure that prior and informed consent is obtained prior to accessing and utilizing genetic resources, including those associated with traditional and indigenous knowledge.

- TRIPS Agreement permits member countries to exclude biological processes from being patented and allows for flexibility for developing countries to implement laws protecting specific plant varieties within national law.[521]

- WIPO Intergovernmental Committee has been negotiating for over a decade to produce an international framework for protecting genetic resources and traditional and indigenous knowledge.

ANALYSIS/ DISCUSSION

Due to the fundamental differences between traditional knowledge and conventional patent laws, the protection of traditional knowledge from biopiracy is difficult. Traditional knowledge is traditionally passed down orally through successive generations and traditionally does not meet the patent criteria for novelty and inventive steps. This presents a gap that biopirates have

[518] Protection of Plant Varieties and Farmers' Rights Act, 2001
[519] Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79.
[520] Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, Oct. 29, 2010, 2011 U.N.T.S. 1
[521] Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 401.

exploited through patenting traditional knowledge that already exists within the communities of traditional knowledge, such as the medicinal use of plants.

To combat biopiracy, one of the major strategies is "defensive" protection of traditional knowledge. This involves establishing existing traditional knowledge as prior art so that if an invention has prior art in the public domain of the community of traditional knowledge, the patent application can be rejected.

India's Traditional Knowledge Digital Library is an important resource in the effort to protect traditional knowledge from biopiracy. The Traditional Knowledge Digital Library is a comprehensive database of Indian traditional knowledge, primarily related to medicine, in several languages; therefore, by providing patent examiners with evidence of the existence of traditional knowledge, it protects against the erroneous patenting of existing traditional knowledge. The success of the Traditional Knowledge Digital Library in protecting traditional knowledge from biopiracy is evidenced by the frequent revocation of patent applications[522] that attempt to extend their claims over India's traditional practices of medicine, demonstrating a proactive approach to the preservation of traditional knowledge.

Challenges and Opportunities of Positive Protection Methods for Traditional Knowledge: Issues with Positive Protection Systems Include:

1. Complexity of Determining Ownership due to Collective Nature of Traditional Knowledge Making It Difficult to Attribute Rights to Individual or Legal Entities.

2. Scope of Protection (Debating If Protection Applies to Practices, Products or Knowledge Underlying Traditional Knowledge) remains Debated and Uncertainty Exists.

3. Enforcement Issues Generally, Disproportionate Access to Enforcement Resources Provided Marginalized Communities Challenged by Resource-Rich Industries at a National or International Level (Corporations) Will Face Challenges in Enforcing Rights Under Traditional Knowledge. Alternative Systems, Such as Sui Generis Legal Frameworks Like the Biological Diversity Act of India, Have Made Progress Towards Providing Positive Protection for

[522] Shubha Ghosh, "Traditional Knowledge, Patents and the New Economy," 7 Journal of World Intellectual Property 211 (2004)

Traditional Knowledge by Providing Recognition of Collective Community Rights and Establishing Benefit-Sharing Arrangements to Rights Holders.

There are ethical and economic ramifications associated with biopiracy; therefore, in addition to the legal implications there are cultural and ethical implications associated with biopiracy that can be economically damaging to the community from which the resource was obtained (in terms of loss of revenue). Therefore, the exploitation of resources from these communities (due to biopiracy) impedes their progress and creates a cycle of poverty. Communities that have been negatively impacted by biopiracy will hence have less incentive to maintain their traditional knowledge as a way to conserve biodiversity and promote sustainable living.

Additional Strong Arguments:

1. Furthermore, the inability to demonstrate from an international perspective that Traditional Knowledge exists in the public domain (i.e., as "prior art") has made it extremely difficult to protect Traditional Knowledge due to inadequate documentation or oral traditions. The Traditional Knowledge Digital Library has provided a means to provide searchability for such information whilst preventing inappropriate patenting of such information.

2. Moreover, the patenting of traditional knowledge does not necessarily adequately reflect the cultural aspects of innovativeness within traditional knowledge (in terms of being passed down over generational time) in an inventive step type of assessment. Consequently, there needs to be a change in paradigms for patent systems so that such diversity can continue to be recognized as valid and authentic modes of invention.

3. Ultimately, biopiracy as an act of biopiracy undermines the ability of traditional knowledge holders to participate fully in the ongoing international economic and ecological initiatives for the promotion of biodiversity conservation where the traditional knowledge holders are universally the custodians of biodiversity. Thus, protecting traditional knowledge is essential to ensure that sustainable development is achieved as it relates to the management of resources and the preservation of important traditional practices.

CONTEMPORARY DEVELOPMENTS/ GLOBAL PERSPECTIVE

The situation with regard to traditional knowledge and biopiracy at the global level is changing as there is now an increased awareness and changes in legislation.

1. **India's Leadership**: India's role as a leader in the area of traditional knowledge protection is evidenced by the following initiatives: the establishment of the Traditional Knowledge Digital Library[523] and amendments to the Patents Act of 1970 together with the Biological Diversity Act, all demonstrate a national policy approach to traditional knowledge protection. In addition to having a national policy, India is advocating through various forums including WIPO (World Intellectual Property Organization) for the establishment of a legally binding international framework for the protection of traditional knowledge. Many of the legislative discussions associated with the Biological Diversity Bill and the Patents (Amendment) Bill illustrate a commitment by India to the protection of biodiversity and traditional knowledge.
2. **EU and US Perspectives:** In both the EU (European Union) and the US (United States), there are no specific provisions regarding traditional knowledge protection in their respective patent systems. Both jurisdictions concentrate on conventional patent criteria. However, there is growing recognition of the need for disclosure on the origin of genetic resources and traditional knowledge associated with those genetic resources in order to support benefit-sharing and to curb biopiracy; this recognition has not resulted in significant changes to the structures of patent laws within those jurisdictions.
3. **Digitalization and AI:** The use of digital technology and artificial intelligence can provide challenges and opportunities in relation to traditional knowledge around the world. For example, the traditional knowledge digital library has allowed for better documentation and dissemination of traditional knowledge, but has also led to greater risks of biopiracy, as well as issues in managing digital rights. With the help of artificial intelligence, databases containing traditional knowledge can be searched and analysed more readily, prompting the need for clearer ethical guidelines and access controls.

[523] N.S. Gopalakrishnan, "Protecting Traditional Knowledge: The Indian Experience," 3 Intellectual Property Quarterly 240 (2005)

4. **Recent Trends:** There has been an increasing recognition of the rights of indigenous peoples to their traditional knowledge around the world, and this has been supported by the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[524]. There has been an increase in momentum for specific systems for traditional knowledge that are separate from the existing intellectual property laws and systems, which is evident in the negotiations happening in the World Intellectual Property Organization's Intergovernmental Committee (WIPO's IGC).[525]

CASE LAW ANALYSIS

While there are limits to "landmark cases" arising from the patent opposition process in biopiracy, there are several notable examples which have had a significant impact on the legislative framework in both India and globally. These cases have shaped law and policy as they have arisen from administrative disputes, and they have stimulated the development of protective law and policy.

1. *The CSIR vs. U. S*[526]*. Patent No. 5,401,504* (The Turmeric Case): In 1995 the United States patent office issued a patent for the use of turmeric powder in the treatment of wounds.

Issue: The Council of Scientific and Industrial Research (CSIR) of India petitions the United States Patent and Trademark Office (USPTO) for a review of the patent on the basis that the patent does not satisfy the statutory requirements for patentability, because the use of turmeric in treating wounds is based on traditional Indian knowledge, which has been around for hundreds of years.

[524] United Nations Declaration on the Rights of Indigenous Peoples, G.A. Res. 61/295, U.N. Doc. A/RES/61/295 (Sept. 13, 2007).
[525] World Intellectual Property Organization, Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC), WIPO available at: https://www.wipo.int/en/web/igc/ (last visited June 23, 2026).
[526] Indian Council of Scientific and Industrial Research v. University of Mississippi Medical Centre, 1995 USA

Judgment: In 1997, the USPTO conducted a re-examination of the patent and rendered the patent invalid after examining prior art that included ancient Sanskrit texts, as well as other publications on the medicinal properties of turmeric.

Impact: The Turmeric Case marked a watershed moment for India, as it demonstrated the vulnerability of traditional knowledge to biopiracy and highlighted the need for improved documentation of traditional knowledge. The case ultimately contributed to the establishment of the Traditional Knowledge Digital Library to help prevent future instances of biopiracy.

2. The neem case (*W.R. Grace & Co./USDA v. European Patent* [527]*No. 0436257 B1*) was about a patent from 1994 issued by the European Patent Office (EPO) for fungicidal compositions made from neem tree (Azadirachta indica) seed.

Issue: The application of traditional knowledge that has been used by farmers in India for thousands of years was the issue. Farmers from India and Non-Governmental Organizations (NGOs) claimed the invention lacked newness.

Judgment: The EPO revoked the patent in 2000 because the fungicidal effects of the neem tree have been known in India for a long time and therefore there was no invention.

Impact: The impact of this decision was that the case demonstrated India's need to create records of its traditional knowledge as prior art and continues to catalyse the work to establish a Traditional Knowledge Digital Library to prevent the misuse of this intellectual property. The result of the neem tree case is similar to that of the turmeric case; it makes it clear that stronger national laws are required to protect traditional biological resources and knowledge.

3. The lawsuit "*RiceTec Inc. vs. US* [528]*Patent No. 5,663,484*" involves a patent granted to RiceTec Inc., on 11/4/97, for a new type of rice that is very similar to the traditional Indian Basmati rice variety, and was therefore considered a threat to India's agriculture and the export market for Basmati rice.

Issue: The Indian Government and various agricultural groups opposed this patent claiming it was an act of biopiracy, that the original Indian agricultural land and heritage were at risk, and

[527] W.R. Grace & Co./USDA v. European Patent No. 0436257 B1
[528] Agricultural and Processed Food Exports Development Authority v. Rice Tec Inc., 1997 USA

that RiceTec's claims of developing a "new" type of rice were false, since Basmati rice is approximately five thousand years old and already exists in India.

Judgment: Despite no change to the original patent, RiceTec was eventually forced to limit its claims to only three out of the original twenty claims located in the patent. In addition, RiceTec was also forced to give up its right to use the word "Basmati" on its product due to significant public pressure and re-examination requests that the United States Patent and Trademark Office (USPTO) received regarding the patent.

Impact: The case illustrates the challenge of protecting traditional agricultural knowledge and geographic indicators using patent law, demonstrating that patent law must be reformed and that larger comprehensive solutions are necessary including legislation that provides specific protection for geographic indicators and traditional agricultural knowledge such as India's Protection of Plant Varieties and Farmers' Rights Act.

The event led to a modification of India's Patents Act (1970) in that there now exists a provision that eliminates the patentability of traditional knowledge and to set up the Traditional Knowledge Digital Library[529] which led to the creation of laws to control access to biological resources such as the Biological Diversity Act (2002)[530] and the Protection of Plant Varieties and Farmers' Rights Act (2001).[531] These laws have positioned India at the forefront of fighting against biopiracy and serve as a good example of how biopiracy incidents have spurred new and significant legal development.

CHALLENGES

There are still many challenges to protecting traditional knowledge and preventing biopiracy. Continued reform is necessary, along with innovative approaches to solve these problems.

Existing Gaps and Society Challenges:

- Defining and Documenting Traditional Knowledge: Traditional Knowledge is largely an oral tradition and suffers from having no written indication. This makes it very difficult to

[529] The Patents Act, 1970, No. 39 of 1970.
[530] The Biological Diversity Act, 2002, No. 18 of 2003.
[531] The Protection of Plant Varieties and Farmers' Rights Act, 2001, No. 53 of 2001

document Traditional Knowledge. Documenting traditional knowledge without providing opportunities for further exploitation must also take into account the protocols associated with access to traditional knowledge and benefit-sharing agreements.

- Transboundary Enforcement: Many biopiracy actors operate in multiple jurisdictions. Enforcing national traditional knowledge laws against international biopirates in countries with less stringent laws or different legal philosophies can make enforcement difficult.
- Lack of Awareness and Capacity: Many indigenous and local communities are not aware of their rights under national or international laws, as well as the legal and financial tools required to effectively respond to biopiracy.
- Harmonization of Laws: With a lack of international consensus on a legally-binding traditional knowledge instrument, many national laws are ineffective, and biopiracy can occur by using different regulatory systems.
- Funding and Resources: There is often not enough funding/resources available to adequately document traditional knowledge, support legal claims, and establish long-term measures of protection for traditional knowledge through mechanisms like the Traditional Knowledge Digital Library.
- Inter-Ministerial Collaboration: To truly protect Traditional Knowledge, there must be full collaboration between the different government departments (e.g., AYUSH, Environment, Commercial, External Affairs). This has not been easy to do in the past.

RECOMMENDATIONS/ SUGGESTIONS

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1. Improved Sui Generis Systems: Nations must create or enhance their existing Sui generis legislation specifically addressing Traditional Knowledge. The nature of traditional knowledge must be recognized as collective, transmitted through many generations, and culturally important. The following elements should be part of an effective law providing protection of traditional knowledge: community-based ownership; prior informed consent; and mandatory benefit-sharing.

2. Mandatory Disclosure of Origin: Global consensus is needed to place an obligation upon applicants to disclose the country of origin of any biological material or associated traditional knowledge or genetic resources in all patent applications. Requiring such disclosures will enhance transparency, make conducting patent searches easier, and allow for enforcement for benefit-sharing obligations.

3. Binding International Legal Instrument: The worldwide community must speed up negotiations to create a legally binding international instrument to protect Traditional Knowledge, especially through WIPO. A legally binding instrument will develop consistency across nations and regions, eliminate uncertainty in regard to different jurisdictions, and create a mechanism for effective enforcement across borders.

4. Establishment and Development of Traditional Knowledge Digital Library- like National Databases: Countries that possess traditional knowledge should receive encouragement and support to establish their own Traditional Knowledge Digital Library- like databases at the national level to eventually link them together to create a global network of prior art for traditional knowledge. International collaboration on this matter would greatly enhance worldwide defensive protection.

5. Training and Legal Assistance: There must be an investment by governments and the international community into training programs for both indigenous and local communities on their rights and the provision of legal and technical assistance with both documenting their knowledge and fighting against biopiracy.

6. Creation of Fair and Equitable Benefit-Sharing Mechanisms: Clear, transparent and enforceable benefit-sharing mechanisms must be developed that provide for both monetary and non-monetary benefits, supported by strong contractual arrangements and comprehensive monitoring mechanisms.

7. Establishment of Ethical Guidelines for Research: Academic and research institutions must develop and implement ethical guidelines that govern research being conducted on traditional knowledge and genetic resources to protect the rights of traditional knowledge and genetic resource-holding communities by verifying the community's prior informed consent to conducting research and complying with the protocol requirements established by the

community and providing benefit-sharing to the traditional knowledge/and or genetic resource-holding community on an equitable basis.

8. Creation of Broad-Based Public Awareness Campaigns: Broad-based public awareness campaigns are necessary to provide education on traditional knowledge and the ethical implications of biopiracy to consumers, industry and policy makers in order to foster a culture of respect and responsible innovation.

CONCLUSION

Traditional knowledge, biopiracy, and patent protection are issues that are of great concern to all those working in intellectual property law. Traditional knowledge is knowledge derived from centuries of collective experience. It has also been subject to appropriating actions by patent systems thus causing damage to the economy and cultural heritage of Indigenous communities. As a result of the above concerns, legislative amendments in addition to establishing the Traditional Knowledge Digital Library have been put into place in India for the purpose of providing defensive and positive mechanisms for protecting traditional knowledge. However, issues such as defining ownership, border enforcement, harmonization of international laws, etc still need to be addressed. There is a need for more cooperation at the global level and further national reform so that an intellectual property framework can be created which will continue to foster innovation and will also respect and value traditional knowledge.[532] In order for the future to be successful we need to focus on inclusivity, social justice and ecological sustainability while protecting the wisdom of the past for the future.

[532] Carlos M. Correa, *Protection and Promotion of Traditional Medicine: Implications for Public Health in Developing Countries* (South Centre, Geneva, 2002).

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