International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# Legal Frameworks and Patentability Standards for Blockchain Innovations in the USA, European Union, China, and India

**Mandip Kaur**

Department of Law, Mahatma Jyotiba Phule Rohilkhand University, Bareilly (U.P.) India.

**Abstract**

This paper conducts a comparative analysis of the legal frameworks and patentability standards for blockchain innovations across the USA, European Union, China, and India. It examines how regulatory regimes and intellectual property policies shape the development, protection, and global competitiveness of blockchain technologies, including distributed ledgers, smart contracts, DeFi, tokenization, and related applications.

In the United States, a market-driven and enforcement-oriented approach prevails, with blockchain activities regulated primarily through SEC and CFTC oversight on a case-by-case basis. Patentability follows the Alice-Mayo framework under 35 U.S.C. § 101, requiring blockchain inventions to demonstrate a practical technical improvement beyond abstract ideas or generic computer implementation. Recent USPTO guidance and leadership signals have aimed to support emerging technologies like crypto and blockchain while maintaining rigorous eligibility standards.

The European Union emphasizes consumer protection and market integrity through the fully implemented Markets in Crypto-Assets (MiCA) regulation, which provides a harmonized framework for crypto-asset service providers (CASPs), stablecoins, and related activities. Patentability at the European Patent Office demands a clear "technical character" for computer-implemented inventions, prioritizing legal certainty, data privacy, and risk mitigation over unchecked innovation.

China pursues a state-centric strategy, prohibiting public cryptocurrencies while aggressively advancing centralized blockchain infrastructure via the Blockchain-based Service Network (BSN) and the digital yuan (e-CNY). The China National Intellectual Property Administration (CNIPA) has historically supported high volumes of blockchain patents aligned with national digital sovereignty goals, though updated 2026 Patent Examination Guidelines introduce stricter standards for AI-related and algorithm-driven inventions, emphasizing inventive step, ethical compliance, and sufficient disclosure.

India navigates a transitional regulatory environment, with virtual digital assets (VDAs) subject to Prevention of Money Laundering Act (PMLA) obligations, a 30% tax regime, and ongoing CBDC (digital rupee) pilots. Under the Patents Act, 1970, Section 3(k) excludes "computer programs per se," "mathematical methods," and "algorithms," allowing blockchain patents only when they demonstrate a novel technical effect or solve a technical problem, as clarified in the 2025 Guidelines for Computer-Related Inventions (CRI).

## 1. INTRODUCTION

The twenty-first century has witnessed a technological transformation across all domains of economic and

social life, with blockchain technology emerging as one of the most disruptive innovations. Initially developed as the underlying infrastructure for Bitcoin in 2008, blockchain has evolved into a general-purpose technology (GPT), enabling decentralized, tamper-proof data storage and real-time verification across distributed networks.[1] Its applications now span sectors such as finance, healthcare, logistics, intellectual property (IP), energy, and government services.[2]

As innovation in blockchain architecture—ranging from consensus mechanisms to smart contracts and interoperability protocols—continues to intensify, firms and developers increasingly seek to protect their inventions through patents. In theory, patent law serves to incentivize innovation by granting inventors exclusive rights over novel, non-obvious, and industrially applicable inventions for a limited period.[3] However, the intersection of blockchain technology and patent law presents deep structural and doctrinal challenges.

One of the most contentious issues is whether blockchain-based innovations, particularly those involving software algorithms or decentralized computing models, qualify as patentable subject matter under traditional legal frameworks. Patent systems in most jurisdictions were not designed to accommodate non-physical, process-oriented inventions such as those found in blockchain ecosystems. As a result, ambiguity persists over how these inventions should be classified and evaluated.[4]

Moreover, a comparative review of global jurisdictions reveals sharp divergences in how national patent offices interpret and apply patentability criteria to blockchain technologies. For instance, the United States Patent and Trademark Office (USPTO) applies a stringent two-step test established under *Alice Corp. v. CLS Bank* to determine whether software-based inventions are merely abstract ideas.[5] In contrast, the European Patent Office (EPO) focuses on the presence of a "technical contribution" to decide patentability, while China's National Intellectual Property Administration (CNIPA) has embraced a more flexible, pro-innovation stance that has led to a rapid increase in granted blockchain patents.[6] Meanwhile, India's patent regime continues to exclude computer programs per se under Section 3(k) of the Patents Act, although guidelines on Computer-Related Inventions (CRIs) have been periodically updated to allow for limited exceptions.[7]

This global divergence raises critical concerns for inventors and innovators who operate in cross-border digital environments. The decentralized nature of blockchain itself compounds enforcement difficulties, as smart contracts and distributed applications may function simultaneously across multiple jurisdictions. In this context, patent holders face significant barriers in enforcing rights, while the lack of harmonized guidelines contributes to legal uncertainty and forum shopping.[8]

In addition, the open-source ethos of the blockchain community often clashes with the exclusivity inherent in patent systems. Some argue that aggressive patenting of blockchain protocols may hinder

[1] Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008), https://bitcoin.org/bitcoin.pdf
[2] Yannis Kalfoglou et al., *The Use of Blockchain in Healthcare: A Review of Challenges and Opportunities*, 13 J. Healthc. Eng'g 1, 2 (2022).
[3] World Intellectual Prop. Org. [WIPO], *Understanding Patents: A Basic Guide*, https://www.wipo.int/patents/en/.
[4] Paul R. Michel & John T. Battaglia, *Fixing Software Patent Law*, 17 Yale J.L. & Tech. 195, 197 (2015).
[5] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208, 217–18 (2014).
[6] CC Kuo & JZ Shyu, *A Cross-National Comparative Policy Analysis of Blockchain Technology Between the USA and China*, 13 Sustainability 6893, 6899 (2021), https://www.mdpi.com/2071-1050/13/12/6893.
[7] Patents Act, No. 39 of 1970, § 3(k) (India); Office of the Controller Gen. of Patents, Designs & Trademarks (India), *Guidelines for Examination of Computer-Related Inventions* (2017).
[8] I Staley & E Amankwa, *Bridging Blockchain and Digital Asset Gaps: A Comparative Policy Analysis of Regulatory Practices*, IET Blockchain (2025), https://ietresearch.onlinelibrary.wiley.com/doi/abs/10.1049/blc2.70019.

interoperability, restrict collaboration, and entrench monopolies, contrary to the decentralized principles that underpin blockchain itself.[9] Others, however, view patents as necessary to safeguard the massive investments made in the research and development of novel blockchain-based solutions, especially in enterprise, fintech, and supply chain systems.[10]

Given these tensions, it becomes imperative to critically examine the evolving legal landscape surrounding the patentability of blockchain innovations. A comparative legal analysis can reveal not only doctrinal inconsistencies but also deeper normative questions about the role of IP law in digital and decentralized innovation ecosystems.

## 2. LEGAL FRAMEWORK AND PATENTABILITY STANDARDS IN KEY JURISDICTIONS

### 2.1 United States

The United States has played a central role in shaping global patent jurisprudence, particularly in the domain of software and emerging technologies. As blockchain innovations increasingly intersect with financial systems, cybersecurity, digital identity, and decentralized applications, U.S. patent law has become a critical reference point for determining the scope of protection available to blockchain-based inventions. The American framework is primarily statutory, governed by Title 35 of the United States Code, but heavily shaped by Supreme Court jurisprudence interpreting subject matter eligibility under § 101. This section examines the doctrinal structure of U.S. patent law, the impact of the *Alice/Mayo* framework on software and blockchain patents, administrative examination practices, key precedents, recent filing trends, and persistent legal uncertainties.

#### 2.1.1 Overview of U.S. Patent Law (35 U.S.C.)

The statutory foundation of U.S. patent law is found in Title 35 of the United States Code. Section 101 establishes the categories of patentable subject matter, permitting patents for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[11] This language appears expansive, reflecting Congress's intention to provide broad protection for technological innovation. However, judicial interpretation has imposed important limitations.

Beyond subject matter eligibility, U.S. patent law imposes additional substantive requirements:

- Novelty (§ 102): An invention must be new and not previously disclosed in prior art.[12]
- Non-obviousness (§ 103): The invention must not have been obvious to a person having ordinary skill in the art at the time of invention.[13]
- Specification and Enablement (§ 112): The patent application must describe the invention in sufficient detail to enable others skilled in the art to make and use it.[14]

These statutory provisions collectively form the backbone of patentability analysis. For blockchain-related inventions, while novelty and non-obviousness remain essential, the most contentious requirement is subject matter eligibility under § 101. Over the past decade, the Supreme Court has clarified—and significantly narrowed—the scope of patent-eligible subject matter, particularly in the context of software and business method patents.

[9] Primavera De Filippi & Aaron Wright, *Blockchain and the Law: The Rule of Code* 121–24 (Harvard Univ. Press 2018).
[10] NM Denter, *Blockchain Breeding Grounds: Asia's Advance Over the USA and Europe*, 63 World Pat. Info. 102089, 102093 (2021).
[11] 35 U.S.C. § 101.
[12] 35 U.S.C. § 102.
[13] 35 U.S.C. § 103.
[14] 35 U.S.C. § 112.

### 2.1.2 Alice/Mayo Framework and Software Patentability

The modern eligibility doctrine in the United States is defined by two landmark Supreme Court decisions: *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*[15] and *Alice Corp. v. CLS Bank International*.[16] Together, these cases established a two-step framework for evaluating patent eligibility under § 101.

Under this framework:

**Step One:** Determine whether the claims are directed to a patent-ineligible concept, such as a law of nature, natural phenomenon, or abstract idea.

**Step Two:** If so, determine whether the claim elements, individually or as an ordered combination, contain an "inventive concept" sufficient to transform the ineligible concept into a patent-eligible application.

In *Alice*, the Court invalidated patents directed to a computerized scheme for mitigating settlement risk in financial transactions, holding that implementing an abstract idea on a generic computer does not satisfy § 101.[17] The decision significantly impacted software patents, particularly those involving financial or business methods.

Blockchain inventions frequently fall within the domain scrutinized by *Alice*. Many blockchain patents relate to transaction verification, distributed record-keeping, and financial exchanges—areas susceptible to classification as abstract ideas. Courts applying *Alice* have often characterized data processing, information exchange, and economic arrangements as abstract unless accompanied by demonstrable technological improvements.[18]

Subsequent Federal Circuit decisions have clarified that claims directed to improvements in computer functionality may survive eligibility challenges. In *Enfish, LLC v. Microsoft Corp.*, the court upheld claims directed to a self-referential database structure, emphasizing that improvements to computer technology itself are patent-eligible.[19] Conversely, in *Electric Power Group, LLC v. Alstom S.A.*, claims involving data collection and analysis were deemed abstract.[20] These cases illustrate the fine distinction between abstract informational processes and patentable technological improvements—a distinction highly relevant to blockchain systems.

### 2.1.3 USPTO Examination Guidelines for Blockchain

In response to judicial developments, the United States Patent and Trademark Office (USPTO) has issued examination guidance to assist examiners in applying § 101. The USPTO's 2019 Revised Patent Subject Matter Eligibility Guidance provides a structured approach, instructing examiners to determine whether claims recite a judicial exception and, if so, whether they integrate the exception into a practical application.[21]

While the USPTO has not issued blockchain-specific statutory rules, it has recognized blockchain as a subset of computer-implemented technologies. Examiners are instructed to evaluate whether claims reciting distributed ledger functionality improve computer performance, enhance data security, or provide technical solutions to network-level problems. Claims merely describing financial transactions using blockchain are often rejected as abstract.

---

[15] *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012).
[16] *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 573 U.S. 208 (2014).
[17] Id. at 221–24.
[18] *Electric Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350 (Fed. Cir. 2016).
[19] *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016).
[20] *Electric Power Grp.*, 830 F.3d at 1353–56.
[21] U.S. Patent & Trademark Office, *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50 (Jan. 7, 2019).

The USPTO has also emphasized the importance of claim drafting. Applicants are encouraged to articulate technical improvements in consensus mechanisms, cryptographic validation processes, or system architecture rather than framing claims in purely transactional or economic terms. As such, patent eligibility often turns not only on the substance of the invention but also on its presentation within the claims.

**2.1.4 Relevant Case Law and Precedents**

Although few Supreme Court cases address blockchain directly, broader software patent jurisprudence significantly shapes blockchain eligibility.

In *Bilski v. Kappos*, the Supreme Court rejected a patent on a method of hedging risk, reinforcing the exclusion of abstract business methods.[22] This decision signaled judicial skepticism toward financial process patents, a category into which many blockchain innovations may fall.

In *DDR Holdings, LLC v. Hotels.com*, however, the Federal Circuit upheld claims addressing a problem specific to internet-based commerce, suggesting that technological solutions to technological problems may qualify.[23] This reasoning has been invoked by blockchain applicants arguing that distributed ledger systems address network-level trust and verification issues not present in traditional systems.

More recently, Federal Circuit jurisprudence has shown increasing scrutiny of software patents lacking specific technical improvements. The unpredictability of eligibility determinations remains a defining feature of U.S. patent law.

**2.1.5 Recent Trends in Blockchain Patent Grants**

Despite eligibility challenges, blockchain patent filings in the United States have increased substantially over the past decade. According to data from the USPTO and WIPO, U.S.-based entities remain among the leading global filers of blockchain-related patents, alongside China.[24] Major corporate actors include IBM, Bank of America, Mastercard, and Walmart.

Blockchain patents in the United States often focus on:

- Distributed ledger security enhancements
- Supply chain tracking systems
- Identity verification frameworks
- Payment processing architectures
- Cross-border transaction systems

Notably, many granted patents emphasize technical improvements in system architecture rather than abstract transactional models. Applicants increasingly tailor claims to highlight network efficiency, cryptographic security, or computational optimization to overcome § 101 rejections.

The number of blockchain patents granted annually in the U.S. has fluctuated following *Alice*, with an initial decline in software-related grants followed by gradual stabilization as applicants adapted to eligibility standards.

**2.1.6 Challenges and Uncertainties**

Despite administrative guidance and evolving case law, significant uncertainty remains in the U.S. patentability landscape for blockchain innovations.

First, the abstract idea doctrine remains inherently subjective. Courts differ in how broadly they define abstract concepts. A claim characterized as improving distributed computing in one case may be framed

[22] *Bilski v. Kappos*, 561 U.S. 593 (2010).
[23] *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245 (Fed. Cir. 2014).
[24] World Intell. Prop. Org. (WIPO), *Technology Trends 2019: Blockchain*.

as mere data processing in another. This unpredictability affects investment decisions and increases litigation risk.

Second, the boundary between business methods and technological improvements remains blurred. Blockchain often combines economic incentive models with technical infrastructure. Distinguishing between economic logic and technical contribution can be analytically challenging.

Third, enforcement challenges arise in decentralized systems. Patent infringement typically requires identifiable acts within U.S. territory. Blockchain networks, however, distribute operations across global nodes, complicating infringement analysis.

Finally, legislative reform efforts have emerged in response to criticism of § 101 jurisprudence. Scholars and policymakers have proposed clarifying amendments to restore predictability in eligibility standards.[25] While no comprehensive reform has yet been enacted, debates continue regarding the appropriate scope of patent protection for digital technologies.

The United States patent framework, grounded in 35 U.S.C. and shaped by Supreme Court jurisprudence, provides both opportunity and uncertainty for blockchain innovation. While statutory language remains broad, judicial interpretation—particularly under the *Alice/Mayo* framework—has imposed significant constraints on software-related patents. Blockchain inventions that demonstrate concrete technological improvements in distributed systems may qualify for protection, but those framed as abstract transactional methods face rejection.

As blockchain continues to evolve, the adaptability and clarity of U.S. patent doctrine will play a pivotal role in determining the country's competitive position in decentralized technologies. The tension between incentivizing innovation and preventing overbroad monopolization remains central to ongoing legal and policy debates.

### 2.2 European Union

The European Union presents a distinctive patent framework shaped not only by supranational legal instruments but also by the institutional role of the European Patent Office (EPO) and the interpretative authority of the Boards of Appeal. Unlike the United States, where patent law is unified under federal statute and judicial precedent, the European patent system operates through the European Patent Convention (EPC)—an international treaty separate from the EU legal order—while enforcement remains largely national. This structural complexity has profound implications for the patentability of blockchain innovations, particularly in relation to computer-implemented inventions and the technical contribution doctrine.

#### 2.2.1 EPO and EPC Structure

The European Patent Convention (EPC), signed in 1973 and revised in 2000, establishes a centralized procedure for the grant of European patents.[26] The EPC created the European Patent Organisation, composed of two bodies: the European Patent Office (EPO), which examines and grants patents, and the Administrative Council, which supervises its activities.

Although the EPO is not formally an institution of the European Union, its patent grants produce a "bundle" of national patents enforceable in designated member states. Thus, patent validity is determined centrally by the EPO, but enforcement and infringement proceedings occur before national courts unless covered by the recently established Unified Patent Court (UPC).

[25] Mark A. Lemley, *The Myth of the Sole Inventor*, 110 Mich. L. Rev. 709 (2012).
[26] Convention on the Grant of European Patents (European Patent Convention) Oct. 5, 1973, 1065 U.N.T.S. 199.

The EPC outlines substantive patentability criteria, including:

- Patentable subject matter (Article 52);
- Novelty (Article 54);
- Inventive step (Article 56);
- Industrial applicability (Article 57).[27]

The EPO applies these standards through detailed examination guidelines and jurisprudence developed by the Boards of Appeal. For emerging technologies such as blockchain, eligibility under Article 52 remains the most contested doctrinal issue.

**2.2.2 Article 52 EPC and the Technical Contribution Requirement**

Article 52(1) EPC provides that European patents shall be granted for inventions in all fields of technology, provided they are new, involve an inventive step, and are susceptible of industrial application.[28] However, Article 52(2) excludes certain subject matter from patentability, including:

- Discoveries and scientific theories;
- Mathematical methods;
- Schemes, rules, and methods for performing mental acts or doing business;
- Programs for computers;
- Presentations of information.[29]

Importantly, Article 52(3) clarifies that these exclusions apply only to the extent that a European patent application relates to such subject matter "as such."[30] This phrase has been the subject of extensive interpretation and serves as the doctrinal gateway for computer-implemented inventions.

The EPO developed the "technical character" or "technical contribution" doctrine to interpret Article 52. Under this approach, an invention involving excluded subject matter may still be patentable if it provides a technical solution to a technical problem. The leading jurisprudence on this issue stems from decisions of the Boards of Appeal, which have consistently held that the presence of technical means confers technical character on a claim.[31]

In practice, the EPO employs the problem-solution approach when assessing inventive step. Non-technical features (such as economic or business aspects) may be included in the formulation of the technical problem but cannot contribute to inventive step unless they interact with technical elements to produce a further technical effect.[32]

For blockchain inventions, this framework requires applicants to demonstrate that the claimed distributed ledger system or consensus mechanism produces a measurable technical improvement—such as enhanced data integrity, improved cryptographic security, or optimized network performance—rather than merely implementing a business method in a decentralized format.

**2.2.3 EPO Guidelines on Blockchain and AI**

The EPO's Guidelines for Examination provide detailed instruction on the assessment of computer-implemented inventions, including artificial intelligence and distributed ledger technologies.[33] Although

[27] Id. arts. 52–57.
[28] Id. art. 52(1).
[29] Id. art. 52(2).
[30] Id. art. 52(3).
[31] Case T 258/03, Auction Method/Hitachi, 2004 O.J. E.P.O. 575.
[32] Case T 641/00, Two Identities/COMVIK, 2003 O.J. E.P.O. 352.
[33] European Patent Office, *Guidelines for Examination in the European Patent Office* (2023).

blockchain is not treated as a separate statutory category, it is evaluated under the broader framework applicable to software-related inventions.

The Guidelines clarify that claims involving algorithms or data structures are not automatically excluded if they produce a further technical effect beyond normal computer operation. For example, improvements in internal functioning of a computer system, such as faster processing or reduced memory consumption, may qualify as technical contributions.

In recent years, the EPO has also issued updates addressing AI and machine learning, emphasizing that mathematical methods used in training models must demonstrate technical application to be patentable.[34] This reasoning applies analogously to blockchain systems, where consensus protocols or cryptographic techniques must be tied to technical implementation rather than abstract economic models.

The EPO's approach is often viewed as more structured and predictable than the U.S. abstract idea doctrine. By focusing on technical effect rather than abstraction, the EPO provides clearer guidance to applicants drafting blockchain claims. Nonetheless, determining what constitutes a sufficient "technical" contribution remains inherently interpretative.

**2.2.4 Decisions of the EPO Boards of Appeal**

The jurisprudence of the Boards of Appeal has shaped the contours of software patentability in Europe. One of the foundational cases is T 641/00 (COMVIK), which established that non-technical features may not contribute to inventive step unless they interact with technical elements to produce a technical effect.[35] This principle remains central to evaluating blockchain claims involving business logic or financial mechanisms.

Another influential decision is T 258/03 (Hitachi), which clarified that a method involving technical means (e.g., a computer) possesses technical character, even if it relates to business purposes.[36] However, the mere presence of technical means does not guarantee inventive step.

More recently, the Boards of Appeal have considered cases involving cryptographic and distributed systems, reinforcing the requirement that claims must demonstrate concrete technical improvement rather than abstract informational processing. While few published decisions specifically reference blockchain by name, distributed ledger technologies fall squarely within the doctrinal framework developed for computer-implemented inventions.

The Boards' jurisprudence reflects a careful balance: preserving flexibility for genuine technological innovation while preventing monopolization of economic schemes disguised as technical systems.

**2.2.5 Comparison with National Patent Offices (e.g., Germany, France)**

Although the EPO grants European patents centrally, national patent offices and courts retain authority over enforcement and revocation (unless under the UPC system). Germany and France, as leading jurisdictions, provide instructive comparisons.

In Germany, patentability standards align closely with EPC doctrine. German courts emphasize technical character and have adopted similar interpretations to the EPO regarding computer-implemented inventions.[37] However, German infringement courts are known for their procedural efficiency and bifurcated system separating validity and infringement, which may affect enforcement dynamics for blockchain patents.

[34] Id. Part G-II, § 3.3.1.
[35] Case T 641/00, supra note 134.
[36] Case T 258/03, supra note 133.
[37] Bundesgerichtshof [BGH] [Federal Court of Justice], May 22, 2012, X ZR 59/11 (Ger.).

France similarly adheres to EPC principles, though French courts may adopt nuanced interpretations of technical effect depending on case-specific facts.[38] While substantive eligibility standards are largely harmonized through the EPC, national judicial interpretation introduces practical variability in enforcement.

The introduction of the Unified Patent Court (UPC) aims to reduce fragmentation by providing centralized litigation for European patents with unitary effect. However, the UPC's jurisprudence on blockchain-related patents remains in early development stages.

**2.2.6 Legal Ambiguities and Fragmentation**

Despite the relative coherence of EPC doctrine, several ambiguities persist. First, the definition of "technical" remains inherently flexible. While the EPO emphasizes measurable technical effects, borderline cases—such as blockchain-based financial platforms—often require subjective evaluation.

Second, fragmentation arises from the interplay between supranational grant procedures and national enforcement. A blockchain patent granted by the EPO may face divergent interpretations in national courts. Until UPC jurisprudence stabilizes, inconsistencies may persist.

Third, emerging technologies evolve faster than doctrinal clarification. Blockchain innovations combining cryptography, AI, and token-based governance challenge existing analytical categories. The absence of blockchain-specific legislative guidance leaves interpretation largely to examiner discretion and evolving case law.

Finally, policy debates continue regarding the appropriate scope of protection for foundational digital infrastructures. While the EPO's structured approach mitigates unpredictability compared to U.S. law, concerns remain about overbroad claims that could hinder interoperability within decentralized ecosystems.

The European Union, through the EPC and the EPO, provides a comparatively structured framework for evaluating blockchain patentability. The technical contribution doctrine, reinforced by Board of Appeal jurisprudence, offers clearer analytical criteria than the U.S. abstract idea doctrine. However, ambiguities surrounding the definition of technical effect and the interplay between supranational and national enforcement introduce complexity.

As blockchain continues to mature, the European patent system's ability to balance innovation incentives with preservation of the public domain will significantly influence the global trajectory of decentralized technologies.

**2.3 China**

China has emerged as a global leader in blockchain patent filings over the past decade. Its rapid ascent in distributed ledger innovation is closely intertwined with state-driven industrial policy, administrative guidance from the China National Intellectual Property Administration (CNIPA), and strategic positioning within the global digital economy. Unlike the United States and European Union, where judicial interpretation plays a dominant role in shaping patentability standards for software-based technologies, China's patent system is characterized by strong administrative direction and policy alignment with national development objectives. This section examines China's patent law framework, CNIPA's approach to computer-related inventions (CRIs) and blockchain, patterns of patent proliferation influenced by

[38] Code de la propriété intellectuelle [C. prop. intell.] art. L611-10 (Fr.).

government incentives, enforcement challenges, and criticisms concerning patent quality and transparency.

### 2.3.1 Patent Law and Guidelines on CRIs

The governing statute for patent protection in China is the Patent Law of the People's Republic of China, originally enacted in 1984 and most recently amended in 2020.[39] Article 2 defines an invention as a "new technical solution relating to a product, a process or improvement thereof."[40] Unlike the European Patent Convention's explicit exclusion of computer programs "as such," China's Patent Law does not categorically exclude software. However, the Implementing Regulations and Examination Guidelines clarify that rules and methods for mental activities are not patentable.[41]

To address ambiguity in software-related inventions, CNIPA has issued detailed provisions in the Patent Examination Guidelines, particularly Part II, Chapter 9, which governs computer-implemented inventions.[42] The Guidelines recognize that inventions involving algorithms or business rules may be patentable if they combine technical features and produce a technical effect. Specifically, an invention that integrates algorithmic features with technical means—such as hardware components or network systems—may qualify as a "technical solution" under Article 2.

This doctrinal formulation parallels, but is not identical to, the European "technical effect" approach. Chinese examiners assess whether the claim as a whole solves a technical problem using technical means and achieves a technical effect. Notably, pure business methods or economic models remain excluded unless embedded within technical implementation.

In 2017 and 2020 revisions to the Examination Guidelines, CNIPA clarified eligibility standards for emerging technologies including artificial intelligence, big data, and blockchain.[43] These revisions signaled administrative openness to protecting digital innovations, provided that claims emphasize system architecture, hardware interaction, or data processing improvements rather than abstract transactional logic.

### 2.3.2 CNIPA's Approach to Software and Blockchain

China's administrative approach to blockchain patentability is comparatively permissive. Following President Xi Jinping's 2019 public endorsement of blockchain as a "core technology breakthrough,"[44] CNIPA witnessed a surge in blockchain-related filings. The Examination Guidelines emphasize that distributed ledger systems, consensus mechanisms, and cryptographic methods may qualify as patentable subject matter if they demonstrate technical characteristics.

Unlike the U.S. *Alice* framework, which begins with identifying abstract ideas, CNIPA's examination focuses on whether the invention constitutes a technical solution. For blockchain claims, this often involves demonstrating improvements in data storage security, transaction validation efficiency, or system scalability. Claims that merely describe financial transactions implemented on blockchain without technical improvement are typically rejected.

---

[39] Patent Law of the People's Republic of China (promulgated by the Standing Comm. Nat'l People's Cong., Mar. 12, 1984, amended Oct. 17, 2020) [hereinafter China Patent Law].
[40] Id. art. 2.
[41] Id.; Regulations on the Implementation of the Patent Law of the People's Republic of China (2010)
[42] China Nat'l Intell. Prop. Admin. (CNIPA), *Patent Examination Guidelines*, pt. II, ch. 9 (2020).
[43] Id.
[44] Xi Jinping, Speech at the 18th Collective Study Session of the Political Bureau of the CPC Central Committee (Oct. 24, 2019).

Chinese practice has also recognized hybrid inventions combining blockchain with hardware systems—such as IoT devices or industrial supply chains—as technical solutions. This integrated systems perspective reflects China's emphasis on practical industrial application rather than conceptual abstraction. However, CNIPA retains discretion in determining whether algorithmic features are sufficiently technical. While blockchain patents are frequently granted, applicants must draft claims emphasizing technical architecture rather than economic governance models.

**2.3.3 Patent Proliferation in Blockchain – Government Incentives**

China accounts for a significant proportion of global blockchain patent filings. Reports from the World Intellectual Property Organization (WIPO) indicate that Chinese entities have filed more blockchain-related patent applications than any other country.[45] This proliferation is closely linked to government incentive structures.

For many years, local governments in China offered subsidies and tax benefits for patent filings, encouraging enterprises to accumulate intellectual property portfolios.[46] Blockchain, identified as a strategic emerging technology in national development plans, benefited substantially from these incentives. State-backed enterprises, technology giants such as Alibaba and Tencent, and research institutions aggressively filed blockchain-related patents to align with industrial policy objectives.

The Chinese government's inclusion of blockchain within the New Infrastructure Initiative and digital currency development further amplified filing activity. The People's Bank of China's Digital Currency Electronic Payment (DCEP) project, for example, spurred research and patent filings related to cryptographic security and distributed ledger systems.

While these incentives accelerated innovation metrics, critics argue that quantity-driven patent strategies may not always reflect substantive technological advancement. The alignment of patent policy with state planning distinguishes China from more market-driven patent ecosystems.

**2.3.4 Jurisprudence and Enforcement Challenges**

Although CNIPA grants patents centrally, enforcement occurs through specialized Intellectual Property Courts established in Beijing, Shanghai, and Guangzhou, as well as IP tribunals nationwide. China has significantly strengthened its IP enforcement regime over the past decade, including increased statutory damages and streamlined procedures.[47]

However, blockchain patents present unique enforcement challenges. As in other jurisdictions, distributed networks operate across borders, complicating territorial infringement analysis. Chinese courts have limited published jurisprudence specifically addressing blockchain patents, though cases involving software and network technologies provide analogical guidance.

One challenge lies in technical complexity. Judges must evaluate cryptographic mechanisms and distributed consensus protocols, requiring expert testimony. Moreover, proving infringement in decentralized systems may involve tracing node operations and server locations, which may not always be within Chinese jurisdiction.

Despite these challenges, China has demonstrated increasing willingness to enforce IP rights, including granting injunctions and substantial damages in technology cases. The establishment of the Supreme People's Court IP Tribunal has further centralized appellate review, contributing to greater consistency.

[45] World Intell. Prop. Org. (WIPO), *Technology Trends 2019: Blockchain*.
[46] Dan Prud'homme, *Dulling the Cutting Edge: How Patent-Related Policies and Practices Hamper Innovation in China*, 45 World Dev. 160 (2017).
[47] China Patent Law, supra note 141, art. 71.

### 2.3.5 Criticisms of Patent Quality and Transparency

While China's blockchain patent numbers are impressive, scholars and international observers have raised concerns about patent quality. The earlier subsidy-driven filing environment allegedly encouraged low-threshold applications, resulting in patents of limited inventive depth.[48] In response, the Chinese government has announced reforms aimed at discouraging "abnormal patent applications" and emphasizing quality over quantity.

Transparency also remains a debated issue. Although CNIPA publishes patent data, language barriers and limited English translations reduce accessibility for foreign researchers. Moreover, administrative discretion in eligibility determinations may lack the detailed reasoning commonly found in U.S. or EPO Board decisions.

Critics further argue that rapid grant rates may increase the risk of overlapping claims or fragmented patent landscapes, potentially creating enforcement uncertainty. Nevertheless, China's reforms since 2020 indicate an effort to align patent quality with global standards.

China's approach to blockchain patentability reflects a strategic convergence of administrative flexibility, industrial policy alignment, and expanding enforcement capacity. The Patent Law and Examination Guidelines provide a doctrinal framework emphasizing technical solutions rather than abstract exclusions. CNIPA's permissive stance has facilitated rapid growth in blockchain patent filings, supported by government incentives and digital economy initiatives.

However, challenges remain regarding patent quality, transparency, and cross-border enforcement. As China continues to refine its IP regime, its evolving standards will significantly influence global competition in blockchain innovation.

## 2.4 India

India presents one of the most cautious and contested patentability regimes for software-based and emerging digital technologies among major jurisdictions. While India is an important participant in the global digital economy and has expressed strong interest in blockchain adoption across sectors such as finance, supply chains, and governance, its patent law framework remains structurally restrictive toward computer-implemented inventions. The primary doctrinal constraint arises from Section 3(k) of the Patents Act, 1970, which excludes "a mathematical or business method or a computer programme per se or algorithms" from patentability.[49] This statutory language, coupled with evolving administrative guidelines and judicial interpretation, has shaped India's approach to blockchain-related inventions.

This section examines the legislative framework under the Patents Act, the Indian Patent Office's (IPO) interpretative position on computer-related inventions (CRIs), administrative and quasi-judicial decisions concerning blockchain applications, India's broader policy stance toward emerging technologies, and recent reform initiatives aimed at clarifying eligibility standards.

### 2.4.1 The Patents Act, 1970 – Section 3(k) and CRIs

The Patents Act, 1970 governs patent protection in India. Unlike the United States and the European Union, where software patentability has evolved primarily through judicial doctrine, India codified explicit exclusions within the statute itself. Section 3 of the Act enumerates subject matter that is not

[48] Prud'homme, supra note 148.
[49] Patents Act, No. 39 of 1970, § 3(k) (India).

considered an invention within the meaning of Section 2(1)(j). Section 3(k) provides that "a mathematical or business method or a computer programme per se or algorithms" is not patentable.[50]

The phrase "per se" has been central to interpretative debates. Legislative history suggests that Parliament intended to prevent patent monopolies over pure software or abstract computational logic, while potentially allowing protection where a computer program forms part of a larger technical system.[51] However, ambiguity regarding the scope of "per se" has generated inconsistent examination outcomes.

To provide clarity, the Controller General of Patents, Designs and Trade Marks issued the Guidelines for Examination of Computer-Related Inventions (CRI Guidelines) in 2013, revised in 2016 and again in 2017.[52] The 2017 Guidelines emphasize that claims must demonstrate a "technical effect" or "technical advancement" beyond a mere algorithm or business method. Examples of acceptable technical effects include improved speed, reduced memory usage, enhanced security, or more efficient hardware utilization.

Notably, the 2016 Guidelines initially adopted a more permissive interpretation, allowing claims that involved software in combination with hardware. However, after criticism that this approach diluted Section 3(k), the 2017 revision reinstated a stricter interpretation, requiring demonstration of a specific technical contribution.[53] This oscillation reflects the ongoing tension within India's patent policy between innovation encouragement and statutory exclusion.

For blockchain inventions, the Section 3(k) barrier is particularly significant. Many blockchain applications involve distributed ledger software, cryptographic algorithms, and transactional logic—elements potentially classified as computer programs or business methods. Thus, patentability hinges on whether the claimed invention demonstrates a concrete technical solution beyond computational abstraction.

**2.4.2 Indian Patent Office's Position on Software Inventions**

The Indian Patent Office has historically maintained a restrictive stance toward software patents. Examination reports frequently invoke Section 3(k) objections for claims relating to algorithms, data processing, or financial systems implemented on computers. Examiners require applicants to establish that the invention produces a demonstrable technical effect and is not merely a computer-implemented business scheme.

The IPO's interpretative approach aligns, in part, with the European "technical contribution" doctrine but is arguably stricter in practice. While the European Patent Convention excludes computer programs "as such," it allows patents where a further technical effect is shown. In India, even when hardware components are included in claims, examiners may reject applications if the substance of the invention is deemed algorithmic.

Judicial decisions have provided limited but important clarification. In Ferid Allani v. Union of India, the Delhi High Court held that inventions demonstrating technical effect or technical contribution are patentable even if based on computer programs.[54] The Court emphasized that Section 3(k) must not be interpreted in a manner that stifles genuine technological innovation. This decision marked a significant development, signaling judicial willingness to interpret Section 3(k) more flexibly in light of technological advancement.

---

[50] Id.
[51] Joint Parliamentary Committee Report on the Patents (Second Amendment) Bill, 1999.
[52] Office of the Controller Gen. of Patents, Designs & Trade Marks (India), *Guidelines for Examination of Computer-Related Inventions* (2017).
[53] Id.
[54] *Ferid Allani v. Union of India*, W.P.(C) 7/2014 (Delhi High Court 2019).

Subsequently, Indian courts have underscored that patent applications should be evaluated holistically rather than dissected into technical and non-technical components. Nonetheless, IPO examination practice remains cautious, and applicants must draft claims carefully to emphasize hardware integration or system-level improvements.

**2.4.3 Analysis of IPO Decisions on Blockchain Applications**

Published IPO decisions specifically referencing "blockchain" remain relatively limited, reflecting the emerging nature of the technology within India's patent landscape. However, examination reports and publicly available orders reveal consistent patterns in handling blockchain-related applications.

First, IPO examiners frequently raise Section 3(k) objections where claims involve transaction validation methods, distributed record-keeping, or cryptocurrency exchanges. Applications that describe blockchain merely as a tool for executing financial transactions are typically rejected as business methods implemented via computer programs.

Second, applicants who frame blockchain inventions as technical improvements in network architecture, cryptographic verification, or data integrity mechanisms have higher prospects of overcoming objections. For instance, claims emphasizing enhanced cybersecurity through distributed ledger synchronization or novel data storage architectures are more likely to satisfy the "technical effect" requirement under the CRI Guidelines.

Third, the IPO often scrutinizes inventive step under Section 2(1)(ja), requiring demonstration of a technical advancement over prior art. Because blockchain systems often build upon open-source protocols such as Ethereum or Hyperledger, establishing novelty and non-obviousness may present additional challenges.

Although Indian jurisprudence on blockchain patents remains nascent, the general trajectory suggests incremental judicial openness combined with administrative conservatism. The absence of extensive appellate decisions specific to blockchain contributes to ongoing uncertainty.

**2.4.4 Policy Stance on Emerging Technologies**

India's policy stance toward emerging technologies reflects a dual orientation: strong promotion of digital innovation on one hand, and cautious intellectual property expansion on the other. Initiatives such as Digital India, fintech regulatory sandboxes, and blockchain pilot projects in land registries and supply chain systems demonstrate governmental support for distributed ledger adoption.

At the same time, India's IP policy historically prioritized public access and technological diffusion. The National Intellectual Property Rights Policy (2016) emphasized balancing innovation incentives with public interest considerations.[55] Unlike China's state-driven patent accumulation strategy, India has not offered aggressive filing subsidies for blockchain patents.

Policy discourse increasingly recognizes the importance of aligning patent law with global standards to attract foreign investment. However, concerns persist regarding over-patenting in digital domains and the potential impact on startups and open-source ecosystems.

Thus, India's blockchain patent regime exists within a broader policy framework emphasizing cautious expansion of IP rights, judicial oversight, and statutory fidelity.

**2.4.5 Recent Trends and Reform Initiatives**

Recent years have witnessed efforts to modernize India's patent system. The Patent (Amendment) Rules, 2021 introduced procedural efficiencies, including expedited examination for startups and reduced time-

[55] Ministry of Commerce & Industry, *National Intellectual Property Rights Policy* (2016).

lines. These reforms may indirectly benefit blockchain innovators.

Judicial developments, particularly the Delhi High Court's pro-innovation interpretations, signal evolving attitudes toward computer-implemented inventions. Legal commentators have suggested clarifying amendments to Section 3(k) to reduce ambiguity and align India more closely with global best practices.

Blockchain patent filings in India remain modest compared to China or the United States. However, domestic fintech firms and multinational corporations have begun exploring Indian filings to secure regional protection. As blockchain adoption expands in sectors such as banking and supply chain management, patent activity is likely to increase.

Nonetheless, challenges remain: interpretative uncertainty under Section 3(k), limited precedential case law, and conservative examination practices. Reform initiatives may gradually harmonize Indian standards with international norms, but statutory amendment would be required for definitive change.

India's approach to blockchain patentability is shaped fundamentally by Section 3(k) of the Patents Act, 1970 and the CRI Guidelines. While judicial decisions such as *Ferid Allani* have opened space for recognizing technical effect, administrative practice remains cautious. Blockchain inventions framed as business methods implemented through distributed software face significant obstacles, whereas those demonstrating concrete technical improvements may qualify.

India's policy stance reflects a balancing act between fostering innovation and preserving statutory exclusions. As blockchain technologies mature and economic reliance on digital infrastructure deepens, India's patent framework may face increasing pressure to clarify eligibility standards. The trajectory suggests gradual adaptation rather than sweeping reform, with judicial interpretation playing a pivotal role.