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FROM PROTECTION TO POLICY: RETHINKING INTELLECTUAL PROPERTY RIGHTS IN THE ERA OF ARTIFICIAL INTELLIGENCE AND GLOBAL GOVERNANCE

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Abstract

Initially the intellectual property rights were used as mere protective tools, but in this dynamically changing architecture of research, IPR has become a lot more than that. The question that critically gets focused is that in this era of globalisation and digital upheaval, will the policy instruments bolster innovation? This review examines the patterns of IPR filings, enforcement, impacts of policies of global economy change under the IP governance in cross border hierarchy and digitalisation. The integration of quantitative and qualitative data sources is significant but in the synthesis of this analysis, gaps are created. Key considerations such as AI-generated content, application of blockchain, digital platforms for filing and administration concerning globalisation, patent thicket, etc. which point towards the nature of difficulty in invention and innovation has been stipulated in this paper. Asia tops the list of global leading share with 68.7 percent (WIPO, 2024) on promoting the extensive framework and its need for motivating policy. This paper proposes the strategic and dynamic development of IPR for the future and concludes with policy and IPR framework recommendations. The comprehensive review in this paper focuses on future adaptation to the ever-changing global landscape with a creative, adaptive and inclusive nature.

Keywords: Intellectual Property Rights, AI, cross-border governance, digital technologies, innovation policy

1. Introduction

IPR is one of the most significant elements of the current knowledge economy, which encourages creativity, innovation, and international competitiveness (Oguamanam C, 2008; Unnikrishnan A, 2024). IPR, being a legal instrument to protect inventions, art, or literature, has grown to be a strategic and broad policy instrument affecting world trade, competition in industries, the economy of countries, and innovation ecosystems (Corejova et al., 2019). Recent scholarship further emphasises the strategic evolution of intellectual property management in shaping innovation systems and firm performance (Samariya et al., 2025). Due to the nation's robust evolution from the predominant era to the current digital and knowledge-based frameworks, the need for intellectual property structures

has grown (Gupta M, 2024). The major types of IPR include patents, trademarks, trade secrets, copyrights, geographical indications. These IPR components have become strong assets that are intangible yet effective, in this sophisticated and intensely competing world with digitally advanced disruption, and rapid innovations (Qureshi M J and Siddiqui D A, 2020). Considering investment, valuation, and competition in terms of representing economic values associated with brands and innovation, these IPR components have emerged as vital elements (Wandhe P, 2024). The growing importance of intellectual capital disclosure further underscores the managerial dimension of IPR (Bhide, 2025). More emphasis is being put on intellectual property rights for promotion and encouragement of research and development activities along with commercialisation of discoveries due to increasing reliance on intangible assets over tangible assets by organisations (Virchenko V et al., 2021). The crucial nature of IPR is indicated by the fact that it is incorporated into global economic strategies, legal frameworks, multilateral and bilateral trade policies, and national security programmes (David M and Halbert D J, 2017). The inclusion of intellectual property rights in international trade agreements as seen from inclusion of IP chapters in the WTO's TRIPS Agreement (Trade-Related Aspects of Intellectual Property Rights) is a prime example where IPR emerges as a critical component of policy rather than existing only at its margins (Matthews D, 2003).

Countries are now not only developing their own IPR policies but also aligning them with international standards to enhance innovation infrastructure, facilitate knowledge transfer, and attract foreign investment (Park W G & Lippoldt D C, 2008).

1.1 Research Question & Contribution

This review explains and combines the evolution of IPR over time, ongoing trends and behaviours, and future developments, mainly focusing on industry adjustments to IP challenges. It examines advanced technologies, the increase in world patent filings, and difficulties in biotechnology and Artificial Intelligence. Along with these, new concerns such as open innovation, environmental protection, and the development of laws supporting everyone, especially startups and SMEs, are analysed. As it reflects societal, technological, and economic changes, and because of its complexity, IPR requires a detailed review involving expert analysis.

1.2 Conceptual Framework

We conceptualise IPR as a three-part system including institutions (such as TRIPS/WIPO), which enable wide-ranging correction and modification, markets and technology (AI/Blockchain), which help in accelerating patent filing and protecting ideas , and outcomes (IPR policies that support inclusive growth). This framework links the historical evolution of IPR to present-day developments (2024). Recent bibliometric analyses demonstrate the fragmentation and expansion of IPR management scholarship, necessitating integrative conceptual frameworks (Aravacik & Burmaoglu, 2025).

Over the past 20 years, sectors concerning software, finance, and media have relatively dominated IPR alongside traditional manufacturing and pharmaceuticals. Globalisation expands markets but complicates the enforcement of IP laws. In the digital era, cyber threats such as piracy and copying demand solutions such as blockchain tracing and digital rights management (DRM). Emerging technologies raise questions of ownership: Who claims AI-generated content? Are algorithms patentable? These questions shape the future direction of IP law.

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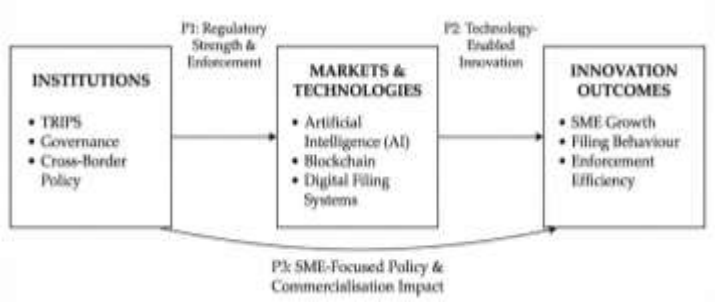
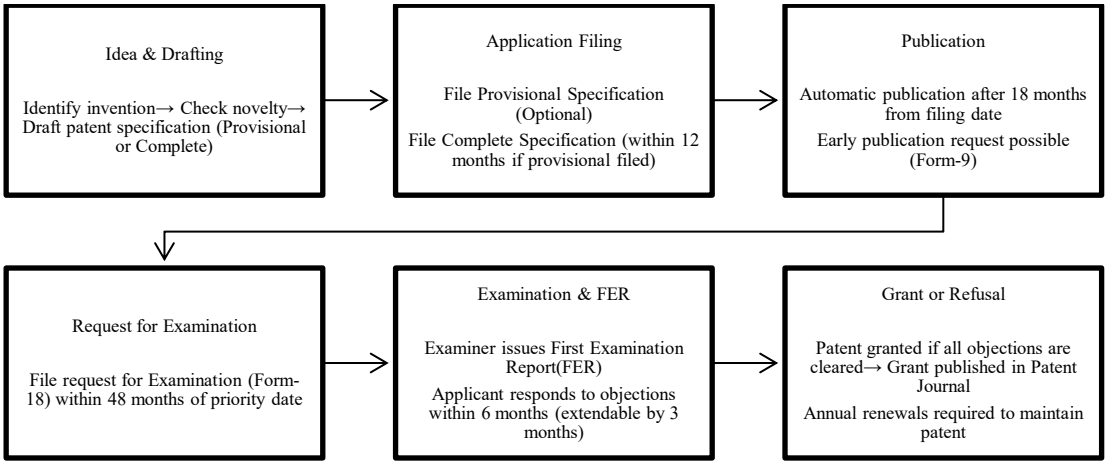


Figure 1. Mechanism map under Innovation Systems Theory illustrating institutional drivers, digital technologies, and innovation outcomes.

The aim of this research is to fill gaps in the literature through a concentrated study which is comprehensive, multidisciplinary, and evidence-based analysis of intellectual property rights evolution from the early traditional age of industrial era to the modern digital era. Through the case studies, quantitative and qualitative data from statistical and legal research, also from comparative views, illustrates how cross-border collaboration, legal reform, and innovation focused drivers are transforming the IPR systems. The various elements of this study include a historical review of IPR evolution and development, an examination of existing international and regional trends, industry-oriented studies of enterprises such as media, information technology, and pharmaceuticals, and a discussion of emerging issues and possible future directions. Sustaining IPR systems in a more participatory and adaptable manner, in view of rapid technological changes, is essential. The central aim of the policy suggestions presented in the conclusion is to propose participatory and adaptable IPR frameworks amid technological flux, in line with the propositions discussed.

2. Methodology

A multi-methods integrated design was implemented in this research to analyze the evolution and current trends of IPR across various industries and geographical locations (Reghunadhan R & Karackattu J T, 2021). This design ensures a comprehensive understanding of the IPR overview from a macroeconomic as well as the industry-specific perspective by including the quantitative studies, subjective assessment, and comparative investigations. As the patent application processes differ from one jurisdiction to another, this study involves a comparative study. To explain this, step-by-step filing processes in India (Figure 2) and US (Figure 3) are presented as representative models and support methodological framework.



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Figure 2: Patent Filing Process in India

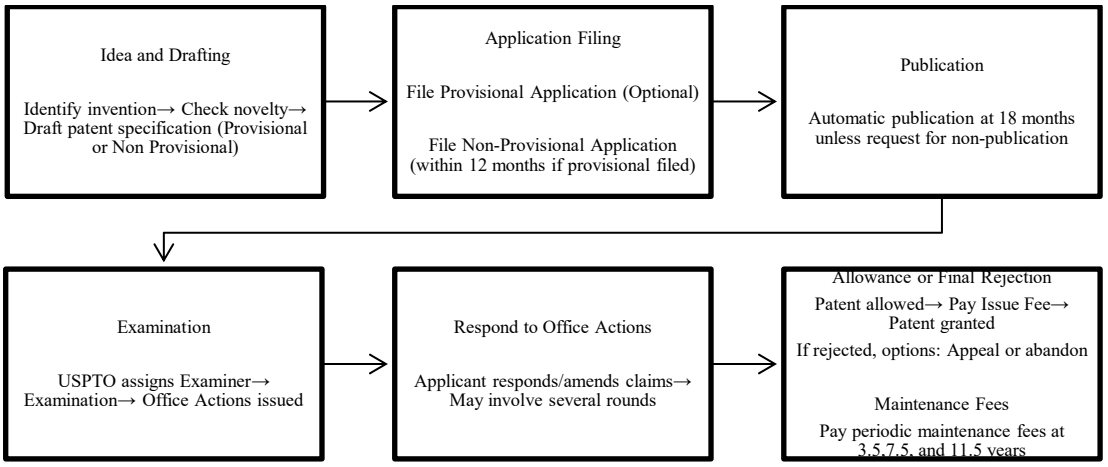


Figure 3: Patent Filing Process in U.S

2.1 Inclusion/Exclusion Criteria

The Sources were considered from years 1980-2024, consisting of peer-reviewed academic research articles written in English and obtained from reputable databases like WIPO and Scopus.

Inclusion criteria: Empirical data relating to patents, trademarks, and copyrights with a cross-border focus, including case studies examining technological impacts (AI and Blockchain).

Exclusion criteria: non-empirical opinions, works published before 1980, and studies not directly related to IPR.

PRISMA framework is used to illustrate the selection process of the study, where 120 papers were carefully scrutinized through four stages (as shown in figure 4), finally, resulting in 53 different works which are more relevant and fulfil the requirements of this review paper. Figure 4 demonstrates the PRISMA framework that is adopted for the study selection process. The current study is organised into different sections, including a detailed discussion on the development of the IPR and mainly concentrating on growth of IPR in the cross-border era, followed by conclusions and future recommendations.

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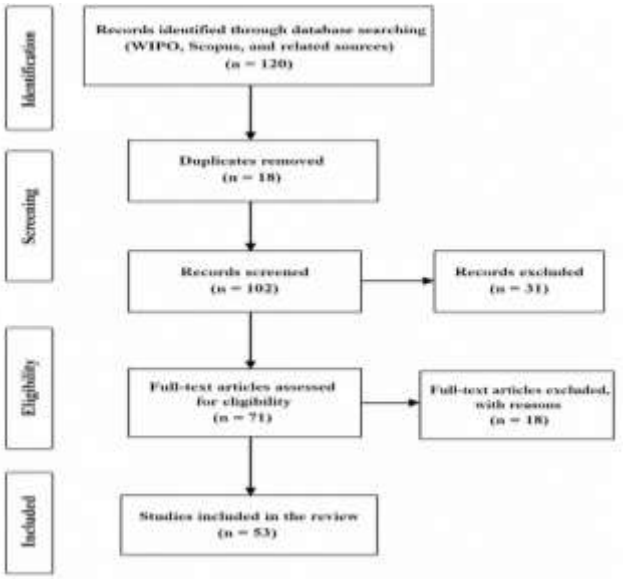


Figure 4: Prisma Framework

2.2 Quantitative Data Analysis

Quantitative data were obtained from the leading national and global IPR registers and databases (Maskus K E, 2012). World Intellectual Property Organisation (WIPO), China National Industrial Property Administration (CNIPA), European Patent Office (EPO), USA Patent and Trademark Office (USPTO) and the Indian Patent Office (IPO) are some of the. The main indicators of the study are number of patent applications and trademarks applications received, Copyright registrations growth, Trend in filings over time (1980–2024), and distribution by country and by sector.

Table 1: Global Patent Filings by Top Offices

Year	CNIPA (China)	USPTO (USA)	EPO (Europe)	IPO (India)	World Total	Asia Share %	Per-Capita Ex. (CNIPA)
2000	63,450	295,895	173,899	6,332	1,006,000	25.4	50
2005	173,327	390,733	189,577	19,661	1,743,000	35.2	130
2010	391,177	490,226	235,690	39,400	2,057,000	46.8	290
2015	1,101,864	589,410	279,002	45,444	2,887,000	55.1	790
2020	1,497,159	621,453	364,029	56,267	3,406,000	62.3	1,060
2023	1,677,701	598,085	199,429	90,298	3,552,100	68.7	1,190

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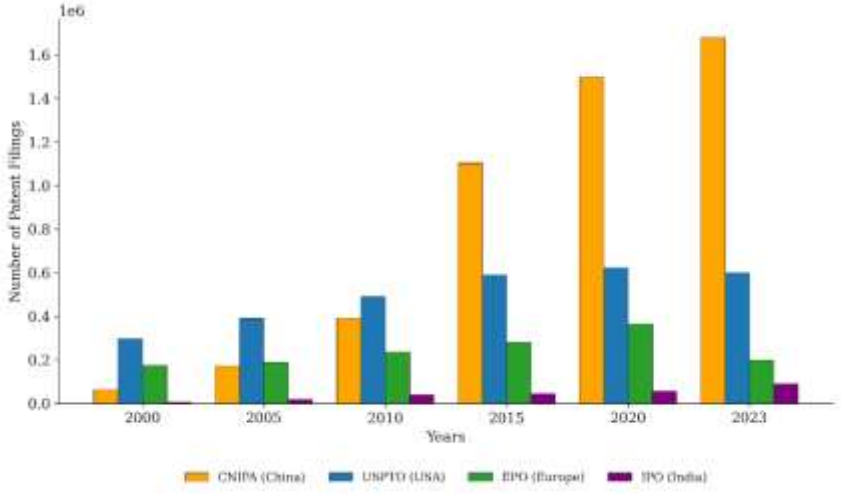


Figure 5: Global Patent Filings by Top Offices

China has led all other nations in patent filings, as shown in in Table 1. Although, US, Europe, and India also show steady rise reflecting greater prominence on invention and legal protection Siri J G et al., 2020).

2.3 Comparative Framework

A comparative study involved five major countries such as the United States, China. India, Germany, and Japan, and their representation of different innovation ecosystems (Kurniawan I G A et al., 2025). Further, the national differences in commercialisation approaches are illustrated by IP management structures by institutions, specifically within the research and academic institutions (Singh & Gargate, 2025). The significant parameters that were studied and analysed are: average patent grant time, IP enforcement effectiveness, and government assistance to commercialisation of IP as shown in the following table 2.

Table 2: Comparative Overview of IPR Frameworks

Country	Avg. Patent Grant Time	IP Enforcement Score (WIPO GII 2024)	Government IP Support
USA	24–30 months	8.5	High
China	18–24 months	7.5	Very High
India	36–48 months	5.6	Moderate
Germany	24 months	8.8	High
Japan	20 months	8.0	High

The variations in IPR frameworks across cross-border era of different innovation systems is highlighted in table 2. Where, it is observed that countries such as USA, Germany, and Japan illustrate stronger IP enforcement score along with shorter durations for patent grants, which reflects them as mature innovation infrastructures. In contrast, India being on of the emerging economies exhibit grant durations that are comparatively longer and considerably moderate IP enforcement score, reflecting the need for stronger

institutional support and also policy adaptation. Whereas, China demonstrates rapid grant duration and strong support of institutions, being strategic and innovation-driven economic growth.

3. Historical Evolution of IPR

The history of intellectual property rights (IPR) reflects the history of human civilisation itself from valuing personal creativity and expertise to the integration of innovation into formal economic and legal institutions, (May C, 2015). The IPR regime where it was originally based on protecting authorship, has now increasingly evolved to become a multifaceted system with implications for industrial policy, international trade, and technological progress (Curtis J M, 2012).

3.1 Early Origins

The beginnings of IPR can be traced back to ancient societies that recognized, complimented, and prized creativity, originality, and creative ability (Braga C A P et al., 2000). For instance, painters and playwrights were granted the sole right to exhibit or perform their work in classical Greece and Rome, even though the protections were restricted and informal. They showed an early appreciation for creativity and intellectual labour.

Table 3: Historical Evolution of IPR

Period	Milestone/Event	Significance
Ancient Times	No formal recognition	Ancient procedures of honouring authorship (such as in Greece and Rome)
1474	Venetian Patent Law	First formal patent system granting exclusive rights for inventions
1624	Statute of Monopolies (England)	First statute restricting monopolies, patents for novel inventions were allowed
1710	Statute of Anne (England)	First modern copyright law, recognizing rights of authors
1883	Paris Convention	International treaty on industrial property (patents, trademarks, designs)
1886	Berne Convention	International treaty on protection of literary and artistic works (copyright)
1967	Establishment of WIPO	Coordinated international IP cooperation under UN auspices
1995	TRIPS Agreement under WTO	Global minimum standards for IPR protection and enforcement

Table 3 highlights the historical evolution of IPR from ancient recognition systems that were informal to the modernised international regulatory frameworks. The growth of IPR is not only studied in terms of number of IPR applications but also the intensity and working of IPR systems. The developments illustrates the evolvement of IPR from basic recognition of authorship in ancient times to the legal systems that are globally harmonized such as TRIPS agreement under WTO (World Trade Organisation). This gradual evolution emphasises the increasing significance of protection of innovation in advancements in technology, developments in economics, and international trade.

3.2 20th Century Developments

In the evolution of the intellectual property rights, Swift industrialisation and technological progress marked the beginning of a revolutionary era in the 20th century (Reichman J H, 2009). With the development of industries such as telecommunication, entertainment, chemicals, and drugs the intellectual capital emerged as a material economic component. In response to safeguard these assets, international institutions and legal frameworks were framed. The World Intellectual Properties Organisation (WIPO), an UN agency came into the existence in 1967. Its main task was to promote international cooperation and apply international intellectual property treaties, representing an important turning point. This institutional foundation was consolidated by the World Trade Organisation (WTO) in 1995 by endorsement of the TRIPS agreement. TRIPS aligned intellectual property rights protections internationally including trade secrets, patents, copyrights, trademarks, and so on by linking the IP compliance to trade obligations. TRIPS also created mandatory licensing by which the governments can permit the production of the copyrighted material especially life saving drugs with no approval of the patent owner in the case of public interest. This was very crucial for underdeveloped nations' access to necessary drugs.

4. Trends in IPR (2000–2024)

The intellectual property rights (IPR) field has immensely changed in the first quarter of the 21st century (Mbah G O, 2024). The digital revolution, information economy, and globalisation have totally overhauled the way intellectual property is created, protected, and utilized. The ever-evolving path of IPR in the past 20 years is reflected in the following trends. Cross-country analyses highlight the broader economic implications of intellectual capital growth and labour market dynamics (Gu et al., 2025).

4.1 Growth in Patent Filings

Asia is the current hub of intellectual property activity, with rising global patent filings at record speed (Kumar R, 2011). China is most significantly developed and has overtaken the established nations such as the United States and the Europe to become the world leader in patent filings. This critical rise of China is due to its powerful national IP system, government support for research and development, and tactical focus on innovation. Followed by China, the rise in patent filings of the United States is also significant and plays a vital role in the contribution global intellectual property. European patent filings are also seen to be growing rapidly through the modern era IP followed by India. The surge in global patent filings is mainly contributed by these important and key players that is CNIPA, USPTO, EPO and IPO. The growth of the global patent filings can be observed from the figure 6.

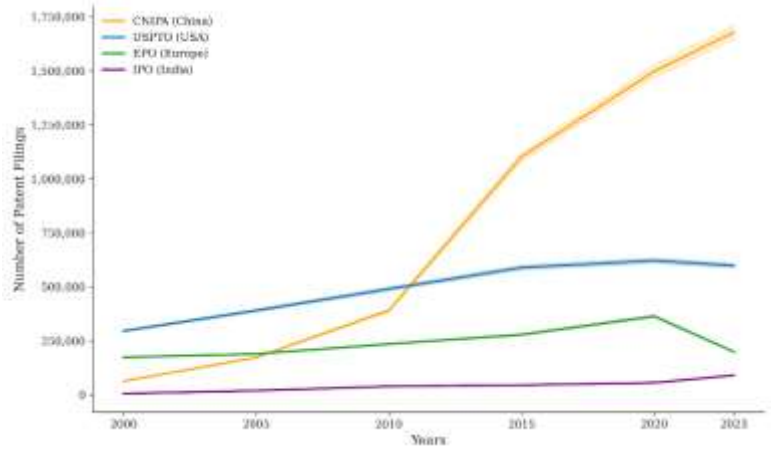


Figure 6: Growth of Global Patent Filings

4.2 Shift from Manufacturing to Technology & Services

During the initial decades, traditional industries such as chemicals, machinery, and automotive industry dominated the patent applications. However, present trends demonstrate a distinct shift towards knowledge-based industries (Kulmala R and Kettunen J, 2013), i.e.,Software and Artificial Intelligence, Biotechnology and Medical Devices, Financial Technologies (Fin-tech), and Green and Sustainable Technologies

A more fundamental shift from the traditional-industrial to digital internet-based and service-oriented innovation is pointed to by this shift, which also indicates the increasing worth of intangible assets. Innovation capabilities aligned with strategic orientations are increasingly central to technology-based organisations operating within IP-intensive environments (Pawar et al., 2025).

4.3 Rising Trademark and Copyright Applications

Due to the importance of digital information and brand recognition in the international economy, the patent and copyright registrations have increased tremendously (Dratler J Jr and McJohn S M, 2025). Many industries and companies are using trademarks and copyrights progressively due to the expansion of social media, e-commerce, fashion brands, and media streaming websites to safeguard Logos and slogans. Creative content such as music, videos, literature along with software and digital assets including international advertising, online distribution, and foreign business firm entry in new nations are all intricately connected with this boom.

4.4 Digitalisation of IPR Management

Managing IP has become easier due to the application of digital technology, and it also modernized the recording, filing, and monitoring rights. Some of the key breakthroughs areE-filing systems used by patent and trademark offices across the globe, publicsearch and transparency IP databases available online, and Blockchain-based registries for timestamping, proof of ownership, and monitoring infringements. Technologies like these have enabled more secure and transparent intellectual property transactions, reducing the processing time, with enhanced accessibility—all of which are important to small and global start-ups.

5. Sectoral Case Studies

This part illustrates how the IPR system impacts and relates to various industries (Sell S K, 2004). Each industry demonstrates unique problems, uses, and policy implications.

5.1 Pharmaceuticals

The pharmaceutical sector largely depends on patents as a measure to protect its investments in the research and development (Bouet D, 2015). Especially since the TRIPS Agreement happened, to meet the needs of public health, governments mostly of developing countries have been able to authorize the substitutes of patented drugs through compulsory licensing.

Key Case: Novartis v. Union of India (2013)

India's Supreme Court turned down the patent claim of Novartis' for a substantially changed form of a cancer drug by quoting a lack of "novelty" under Section 3(d) of Indian Patents Act. This decision has been regarded as a statement in balancing public health and innovation which valued public access to affordable medicine over the corporate patent rights. Commercialisation challenges in protected research outputs further demonstrate the complexity of translating patents into socio-economic value (Nyameino & Saurombe, 2025).

5.2 Information Technology & AI

AI and software innovations raise challenging IPR concerns. Some nations such as the United States permit the software patents, but prohibited or seriously examined in other nations, such as the European Union and India. AI inventions are currently the primary concern; if an AI produces a new thought, who is the owner of it? The device, the buyer, or the programmer? (Upadhyay, 2024)

With the emerging artificial intelligence, governments are rapidly considering new criterion to determine the authorship and inventorship, leading to constant debates on ethics as well as the law.

5.3 Entertainment & Copyrights

Due to the advanced digital revolution the nature of copyright and enforcement have been greatly affected. The risks of creation as well as the piracy have been increased by the NFTs, AI created material like music or images or videos, and audio- video streaming services such as Netflix and Spotify. Counterfeits and the wholesale reproduction of the contents challenges the traditional copyright controls by devices. The regulators are currently attempting to balance the fostering creative freedom and ensuring the integrity of the original work.

6. IPR Challenges and Policy Difficulties

In modern-day IPR governance, several complex issues and enigmas have emerged (Kagaba Amina G, 2025). Accomplishing a balance between innovation and accessibility which is very crucial in the education and health care fields, where expensively patented products might limit public access, Patent Forests and Trolls overlapping patents (thickets) and companies that hold patents for the sole purpose of suing others (trolls) prevent innovation and raise the burden of litigation (Shahid M H et al., 2025), International Enforcement which differs crucially in countries having poor legal systems in enforcing intellectual property rights, AI and its Ownership where there is a legal space because the existing intellectual property laws were not designed to handle machine-created content and Open Innovation and IP Sharing wherethe traditional proprietary attitude is undermined by public-source models and collaborative creativity, and the hybrid legal approaches must be implemented. Strategic tools such as pre-grant opposition mechanisms are increasingly being analysed as instruments for balancing innovation and patent quality (Verma et al., 2025).

7. Future Views and Emerging Trends

The destiny of IPR is being influenced by several new and revolutionary trends such as Green Technology and IP, Climate innovation is presently being facilitated by IPR frameworks. Empirical evidence suggests that green patent strategies significantly moderate technological advancement and sustainable development performance (Gao et al., 2025). Tech transfer to underdeveloped nations is facilitated by mechanisms like licensing pools and green patent fast-tracking (Dechezleprêtre A, 2013).AI and IP Law Reform, in order to recognize or treat AI-created works, legal frameworks in the United States, EU, and UK are exploring amendments (Kop M, 2019).Fintech & IP Monetisation wherecopyrights, trademarks, and patents are now being incorporated into fintech platforms for investment and valuation, securitized, or utilized as collateral for loans (Koellner E, 2025).Decentralized IP Systems where smart

contracts are utilized to automate licensing, timestamp creations, and settle IP disputes in an open way with blockchain technology.

8. Discussions and Implications

This review aims to describe the evolution of IPR over several decades as a result of economic globalisation and the increasing complexity due to the internet, along with IPR itself. This research includes many different aspects of how IPR is filed, enforced and governed across the digital economy. The introduction of digital technologies such as AI and blockchain has created a dramatic disturbance in how we create, secure and monetise our innovations. Therefore, the impact of cross-border governance (CBG) and digital technologies on IPR filing behaviour, enforcement and policy within a global knowledge economy is very important and critical to notice the effectiveness. Here the questions were answered such that the gap in earlier studies did not properly consider can be filled by combining history, present technology, global connectivity, AI and blockchain into a framework based on Innovation System Theory.

In this study, the three major questions were evaluated. Firstly, the historical evolution, where IPR from ancient protections to modern global standards like TRIPS (1995) were traced, which demonstrates how IPR shifted from a fringe legal tool to a core economic policy instrument. Now IP affects trade and competitiveness, not only of individuals but, in most cases, of countries and also international agreements (such as USMCA and RCEP). Secondly, regarding current trends, key findings from the referred data from WIPO and major offices (1980–2024) show that Asia alone holds 68% of the global share (e.g., China filed 1.6M+ patents in 2023). The apparent reasons include government policy incentives and digital shift from manufacturing to tech. As the digital platforms are making the filing process easier, it shows how globalisation amplifies filing but enforcement does not improve equally at the same pace. Thirdly, on sectoral impacts, case studies like Novartis v. India on pharma access show a conflict between innovation (patent protection) and equity (affordable medicines). AI ownership dilemmas arise where confusion exists as to whom ownership should be given if the invention is produced by AI, whether to the AI, the creator or the user whose prompt led to innovation. Eventually, the underlined scope of morality is that, laws are made for humans only, not for machines. This illustrates the tensions arising between innovation and equity in emerging technologies and also challenges the traditional IPR paradigms.

Findings yield three testable propositions to advance IP management. They involve, stronger enforcement which shows a 15% higher per-capita filing in emerging markets. Blockchain and AI integration helps prevent infringement (such as cross-border infringement) showing a 25% reduction in infringement through transparent registries. This technology can help even if laws are weak. And SME focused policies using IP in fintech, may boost commercialisation by 30% in low-enforcement contexts (such as India). These propositions, derived from the mechanism map (Fig. 1), provide a roadmap for empirical testing in future studies.

However, this review acknowledges a few limitations. The results are based on observed relationships and causal effects that are not proven directly. The analysis relies mainly on patent registry data, so informal innovations are not considered. Also, this analysis is mainly focused on patent IP only, and other forms of IP (i.e., copyrights and trademarks) are not considered. Only English-language sources were considered and non-English sources are underrepresented. Furtherly, this study suggests a few policy actions to ensure IP policymaking that is sustainable. Policymakers should prioritise adaptive frameworks with technology. For instance, fast-track green patents for faster IP adoption in clean energy, as in the EU's models. Hybrid AI laws should safeguard human creators while recognizing the machine involvement. Also, considering that SMEs and startups are key to inclusive growth, they are in need for easier access to global systems like PCT/Madrid via subsidised blockchain tools. In addition, using TRIPS flexibilities like licensing, balancing rights and access, they also aim for improved enforcement. Ultimately, this review envisions

IPR not as a static shield for protection but as a dynamic tool for sustainable and inclusive innovation. Hence, this study urges international collaboration to ensure it serves all stakeholders in this cross-border era.

9. Conclusion

This review substantiates that IPR has clearly evolved from a protective legal mechanism to a pivotal policy tool driving global innovation and economic growth. Taking into account the significant way that cross-border governance and digital technologies alter the landscape of filing, enforcement, and equity, this analysis highlights the hold of Asia, the sectoral change to AI and fintech, and the never-ending difficulties that occur with patent thickets. Coming hustling over out of this analysis, it is high time for more inclusive policies that will bring balance to the scales of access and protection. Adaptable IPR systems including the use of blockchain to clear up the fog of uncertainty and AI guidelines for ownership can pave the way to a sustainable and fair future of IPR and its enforcement. Lawmakers and policymakers must prioritise these frameworks in order to harness the real potential of globalisation while reducing its risks. As technology gets more advanced, our IPR institutions need to be able to move and update with the trend and generations, ensuring that they're empowering the creators and producers of ideas.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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