International Journal of Integrated Research and Practice (IJIRP)

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

The Evolution of Patent Systems: Challenges for Emerging Technologies

Venkataraman P
PhD Research Scholar
Nehru College of Management & Scientist - F, CSIR Unit for Research and Development of Information Products (CSIR - URDIP), Maharashtra, India

Dr. E. Muthukumar
Professor
Department of MBA
Nehru College of Management, Thirumalayampalayam, Coimbatore

Abstract

The patent system has been the backbone of the innovation system, providing the right for the first innovator to benefit from his or her innovation. Over time, patent frameworks have become more sophisticated in response to the evolution of the technology, to the evolution of the economy and to the increasing international nature of the activities in the field of innovation. But, today new technologies, such as those of artificial intelligence, biotechnology, nanotechnology, blockchain, quantum computing, advanced digital platforms, etc. are being developed at an increasing pace, all of which represents new challenges to the existing patent system. Much of the traditional patent law is based on tangible inventions and can have trouble keeping up with the nature of technology innovations.

This research paper examines the history of patent systems, and studies their degree of adaptability to new technologies. It discusses the issues of patent eligibility, inventorship, ownership rights, disclosure requirements, and novelty and inventive step in technologically complex situations. There is particular emphasis on the legal and regulatory challenges to AI-related inventions and innovations in interdisciplinary technologies. As well, the issue of the quality of patents, overlapping patent rights, harmonization of patents between countries, and growing number of patent applications to high technology areas are explored.

The research is qualitative, relies on analysis of academic literature, legal structures, policy reports and selected case studies and investigates the role of patent institutions in the different jurisdictions in adapting to the current technological changes. The findings reveal that patents in the current system continue to serve as a vital instrument to incentivize research and investment, and that they have some gaps regarding the speed, complexity and cooperation of contemporary innovation. The study concludes that balanced reforms, enhanced international cooperation and flexible legal designs are essential to unleash the potential of patent systems to incentivize innovation without compromising fair access, competition, and technological growth in the knowledge-intensive world economy.

Keywords: Patent System, Intellectual Property Rights, Emerging Technologies, Artificial Intelligence, Biotechnology, Patent Law, Innovation Management, Patent Eligibility, Technology Commercialization, Legal Frameworks, Digital Innovation, Patent Reform, Technological Advancement, Inventorship, Global Patent Governance.

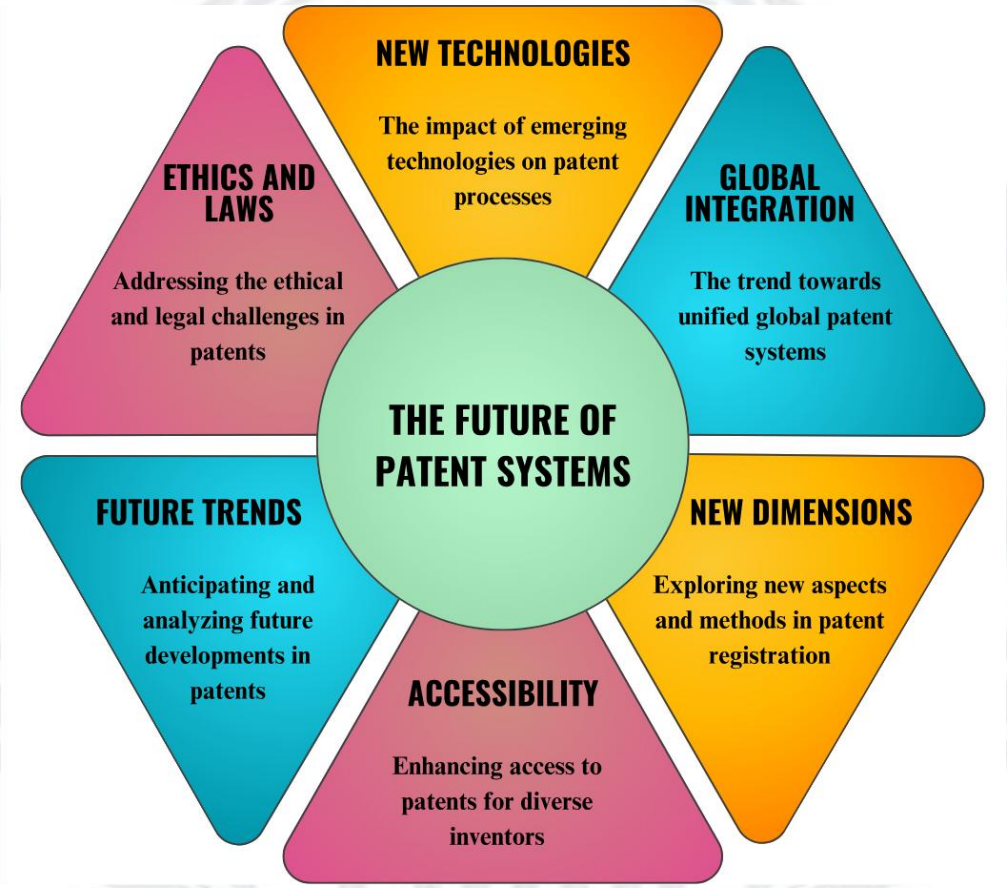
Introduction

Throughout many years, patent systems have been essential to innovations and are meant to give inventors exclusive rights to their innovations for a certain period of time. The fundamental purpose of patent rights is to encourage R&D by encouraging creativity and sharing of technical

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

information. The history of the patent laws is a record of the evolution of the laws in response to industrial development, to the needs of an economy based on industry, engineering, and science. The world's patent systems are dealing with new challenges in the wake of unprecedented technological development as they find a balance between innovation incentives and public interest.

With the advent of high-tech innovations like artificial intelligence, biotechnology, nanotechnology, quantum computing, blockchain and other sophisticated digital platforms, how inventions occur has changed. Often these technologies are multi-disciplinary, rapidly evolving and are developed through collaborative development models and processes that are significantly different from the traditional invention models and processes. Patent systems already in place - many of them having been established in previous phases of technological evolution - are therefore increasingly being challenged to change to the new circumstances of innovation.



Source: *https://rithub.org/the-importance-of-patents-for-intellectual-property-protection/*

A major issue in modern patent law is establishing the patentability of inventions created using sophisticated technologies. The notion of inventorship, ownership, disclosure and novelty and non-obviousness are becoming more complex as technologies change over time. In some cases, AI systems can be valuable assets when creating, for example, whether AI-generated creations can be patented and the question of who is the inventor. Similarly, as a result of developments in biotechnology and genetic engineering, there are moral and legal concerns regarding the patenting of living organisms, genetic resources, and health care innovations.

The impacts of globalization have also made international harmonization of IP laws more difficult both as a consequence of globalization and as a result of a multitude of innovation activities crossing borders and the need for harmonization. The patent laws, the examination requirements and enforcement of the patent vary from country to country, making it difficult for an innovator to be sure that their patent will be recognized in another country. The

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

availability of and access to technology, public welfare, competition and patent monopolies are also factors for the policymaker, especially in the health and digital technology services sectors. Patent systems have developed over time to continually adjust to new technological and economic circumstances. Therefore, when designing effective, fair and innovation friendly patent systems, it is important to consider the problems of new technologies. The study examines the development of patent systems, explores some of the key challenges that are likely to arise as a result of technology change, and reviews the potential for reform that can enhance patent protection in the knowledge-based modern economy without sacrificing sustainable innovation.

Background of the study

The patent system has been a major component of innovation policy since it was established and gives the inventor a temporary monopoly over the invention in return for the disclosure of the invention's technology to the public. Patent systems have developed in tandem with economic and scientific and technological development, as they started with early legislations to foster craftsmanship and industrial development. Over time, patents also have become essential tools for the encouragement of research and development, investment and competition among companies and countries, and the dissemination of technology.

In the 21st century the pace of innovation has become a challenge to the development of emerging technologies. The advent and evolution of new technologies such as Artificial Intelligence, Biotechnology, Nanotechnology, Quantum Computing, Blockchain, Advanced Robotics and the Internet of Things (IoT) have introduced new modalities and concepts of invention that raise new challenges to the patent principles and examination process. Many emerging technologies share some of the properties of conventional ones, including being interdisciplinary, developed quickly, with complex ownership and large digital/datadriven processes. There are many questions to which IP rights claims are patentable, who is entitled to patent, is it novel, disclosed, or is it too broad?

Due to the increasing internationalization of research and innovation, patent systems have become more complex. The cross-jurisdictional collaboration between inventors, corporations, universities and research institutions is common and can cause problems in harmonizing patent laws and guaranteeing uniform protection of IP rights. International treaties have tried to create uniformity, but there are still disparities between the different national patent regimes when it comes to patents for innovations created by the use of advanced technologies. This plants doubts on innovators regarding the protection, enforcement and commercialisation opportunities in cross-border markets.

Another important issue is related to the balance between innovation and the interest of the public. But, high patent protection can also exert negative impacts on investment in R&D-intensive industries, as can too much or too little protection from patent owners, the inability for others to access key technologies, and knowledge transfer. Society and technology integration plays a vital role in the health, pharmaceuticals, artificial intelligence and environment sciences. In the context of emerging and new technologies and the requirement of patent system to be fair, transparent and accessible, policymakers and legal scholars are still debating the future of patent systems.

With the increasing importance of digital technologies, issues with patent examination and enforcement have become apparent. The amount of increasingly complex applications received by patent offices worldwide continues to grow, and they need specific technical know-how. In the modern era, one of the most pressing questions that patent offices are grappling with is who is the inventor of an invention that is based on Artificial Intelligence (AI)? And how to assess software patents, and how to address ethical issues in biotechnology? The changes in the current patent systems that are implied by the developments here would suggest that significant changes are needed if the patent system is to continue to promote innovation.

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

The research on the evolution of patent systems and their ability to cope with new technological challenges is becoming relevant in this context. Understanding the history of patents and the present restrictions on patent law may be helpful to policy makers, researchers, lawyers and innovators. This examination is one of a broader conversation regarding a patent system that is more responsive and balanced to spur technological innovation, while simultaneously minimizing legal, economic and social risks and challenges of new technologies.

Justification

New technologies like artificial intelligence, biotechnology, nanotechnology, blockchain and quantum computing are ushering in a new age of innovation in the world. These technologies are moving at a rate that sometimes outruns the existing legal and regulatory systems (in this case, patent systems) which can keep up. The complexity of innovations and the interdisciplinary nature of modern innovations has raised new questions concerning patentability, ownership, inventorship and patent enforcement; the field of conventional inventions was the original focus of patent laws.

Both patent offices and policymakers are becoming less able to keep up with the traditional patent elements of novelty, inventive step and industrial applicability in the modern days of increasingly complex and sophisticated technological innovations. Moreover, with the growing integration of AI in the invention process, there are potential questions of ownership of the invention and the discovery's creator. The developments have resulted in confusion for inventors, companies, researchers and legal practitioners, and have the potential to affect incentives for innovation and technology commercialisation.

The study is warranted because it would aim to try to understand the changes in Patent Systems that have occurred because of the technological advances and what the flaws of the current Patent System are when dealing with new technologies. It is important to be aware of these challenges to ensure that patents can continue to encourage innovation in a fair, transparent and legally certain manner. The findings from this study can contribute to the formulation of patent policy, which is more responsive and more effective in technological development and economic growth, by informing and guiding the IP authorities and the industry and researchers. Furthermore, the study contributes to the existing body of knowledge concerning IP management by highlighting the importance of creating resilient IP policies to be able to react to future technological developments. The patent system is vital to encouraging R&D and investment and international competitiveness, given its role in a knowledge-driven economy. Therefore, it is opportune and important to look at the history of systems of patents, and how they have evolved to deal with new technologies.

Objectives of the Study

1. To explain how patent systems have evolved over time and how they have influenced innovation and technological progress over the years.
2. To understand how existing patent systems react to the specific nature of new and developing technologies like AI, biotechnology, blockchain, nanotechnology and quantum computing.
3. To recognize the legal, ethical and regulatory issues involved in issuing and patenting quickly changing technologies.
4. To understand how new technologies affect the traditional patentability requirements, such as novelty, inventive step and industrial applicability.
5. To assess the effectiveness of national and international patent laws in safeguarding IPR in the technology-based sectors.

Literature Review

The patent system has been a long evolution and has been modified over the years to promote

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

innovation, to establish IP rights and to support technological development. With the emergence of disruptive technologies such as artificial intelligence (AI), biotechnology, blockchain, nanotechnology and quantum computing, however, traditional patent systems are now being tested. The need for new patent laws to make up for the lack of protection of these technological changes has been used a growing number of times by scholars. In the first research, the economic "motive" of patent systems was emphasized. Incentives for innovation are provided by patents, said Nordhaus (1969), because if the product or service is patented, the inventor can enjoy a temporary monopoly for the results, and thus have an incentive to invest in research and development. In a similar way, Arrow (1962) suggested that the enforcement of IP reduces market failures due to knowledge spillovers and enables innovation. The debate on the patent/innovation nexus was continued by Mazzoleni and Nelson (1998) who pointed out that patents stimulate invention, but a strong patent system may hinder knowledge dissemination and innovation. They identified the need for a balanced patent system that is both exclusive and public access to technological knowledge.

With the advent of digital technologies, patentability criteria have become more relevant than ever. Bessen and Meurer (2008) discovered that patents in software and information technology tend to be poorly drafted and have been poorly defined and overlap, which leads to greater litigation and less innovation efficiency. Their study showed that the current process of patent examination can be ineffective in examining rapidly developed technological inventions.

AI has emerged as a hot topic in current patent-related media. Abbott (2020) explored the legal ramifications of AI-generated creations, and wondered whether patents can be granted for inventions made without human intervention. The study pointed out the emerging requirement of redefining the criterion of inventorship because of the autonomous technological systems.

Likewise, Ryan Abbott and Balkin (2021) have pointed out that worldwide patent systems are beset with serious problems in identifying ownership rights and who is accountable for AI innovations. They highlighted the need for legal changes to tackle problems related to inventorship, originality and patent eligibility.

Patent rights have created opportunities and ethical issues in the biotechnology industry. Drahos (2010) noted that biotechnology patents have increased the incentives for innovation, but have also led to concerns about access to healthcare and genetic resources. The study suggested that policy makers must be pragmatic and strike a balance between the commercial aspects and the benefit to society.

The patentability of biological discoveries and inventions and genetic materials has been well addressed by Sherkow and Greely (2015). According to them, the judicial decisions that have been handed down on Gene patents have had a significant impact on the biotech industry's approach to innovation, prompting companies to pursue other avenues of IP protection.

Interdisciplinary nature of nanotechnology is another obstacle in the way of patent systems. Meyer (2007) has found that the standard patent classification systems are not appropriate for nanotechnology patent inventions. The study recommended setting up specialized classification systems for better patent examination and monitoring.

Globalization has also played a role in the evolution of the patent system. Maskus (2000) has claimed that international IP agreements have reinforced patent protection in countries and imposed difficulties for the developing ones to access technology. In the study, the conflict between incentives to innovate and goals of technology transfer was identified.

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) totally revolutionized the system of patent governance. Correa (2007) pointed out that TRIPS established minimum standards for patent protection, but also provided for national interpretation, leading to different interpretations and enforcement by jurisdictions.

As new technologies are developed, they become increasingly sophisticated and worries have been expressed about the quality of patents. Jaffe and Lerner, in an article in the American Bar Association (2004), based on “the growing complexity of technological convergence and the

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

multitude of applications" they discussed the issues facing patent offices in determining novelty and non-obviousness. Legal uncertainty, legal conflict due to poor quality patents.

Furthermore, technology may be industry specific and would have to be implemented using industry specific patent strategies, as noted by Burk and Lemley (2009). The uniform patent system might not properly cover industries like software, biotechnology and nanotechnology, it was recommended.

The blockchain has brought new problems on the table of decentralized innovation and IP rights. However, traditional patent arrangements are not always compatible with an open-source blockchain innovation environment, characterised by greater participatory innovation activity and a lack of central authority, as De Filippi and Hassan (2018) have pointed out.

Open innovation strategies have altered patenting strategies, too. Chesbrough (2003) claims that the traditional closed patent system is being challenged as companies rely more and more on outsourcing knowledge and on collaborating with other companies. The study suggested a framework of patent law amending to fit cooperative innovation environment.

Innovation in the new technology space is growing in importance and increasingly it is found that overlapping IP rights and patent thickets pose an important issue. Shapiro (2001) also points out that high density patent environments can increase transaction costs and limit the ability of new entrants to the market to innovate. This is especially the case for the telecommunications, software and biotechnology industries.

The patent official's role to adapt to technological change has been growing steadily. Indeed, WIPO (2022) said that patent offices globally are training AI tools—also known as artificial intelligence—to increase their efficiency and effectiveness in conducting prior art searches and examinations. This type of measure reflects the efforts to modernize the administration of patents in the era of innovations and complexity.

Patent governance and international cooperation have been brought to the fore in recent studies. Ghidini and Arezzo (2020) believed emerging technologies cross borders and standardized IP rules are increasingly important in fostering innovation ecosystems. They highlighted the importance of the role of global institutions in the process of regulatory coordination.

The literature suggests that although patent systems are still vital for innovation, new technologies are testing old definitions of inventorship, patentability, ownership, classification and enforcement. Scholars have largely concluded that patent systems will need to be reformed, through both legislative measures and international collaboration as well as technological modernization, in order to be relevant in an innovation-centric economy.

Material and Methodology

Research Design:

The research design for this study is a qualitative review-based research design which is used to analyze the historical development of systems for the protection of patents and problems that are being faced by the emerging technologies like artificial intelligence, biotechnology, blockchain, nanotechnology and advanced digital innovations. The nature of the research is descriptive and analytical with the main theme being the development of patent law, international patent law frameworks, and current patentability, patent ownership and patent innovation problems. The review approach enables to have a holistic overview of the dynamic character of patent systems and their response to technological change.

Data Collection Methods:

The data used for the study are all secondary (secondary data) which are taken from many academic and professional sources. Peer-reviewed journal articles, books, government publications, reports from intellectual property organisations, directions from patent offices, international treaties, legal databases and conference proceedings were the sources used to obtain relevant information. The primary sources were World Intellectual Property Organization publications, World Trade Organization publications, national patent offices, and

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

the academic databases, such as Google Scholar, Scopus and Web of Science. Literature search was done systemically to find trends, legal developments and challenges in patent protection in emerging technology areas.

Inclusion and Exclusion Criteria:

The review covered scholarly articles, books, policy documents and legal commentaries and institutional reports relating to the patent systems, IP rights, technological innovation and emerging technologies, most of which had been published from 2001 to 2026. Patent law reform, patentability issues and technology-related patent controversies and international regulation of patents were sources of significant discussion and were considered. In order to keep the quality and focus of the review, publications other than those on patent systems, duplicate studies, non-academic opinion pieces and sources that were not sufficiently relevant to emerging technologies were excluded.

Ethical Considerations:

The study is based on secondary data obtained from publicly available data, which means that no direct involvement of human participants was needed. Intellectual property rights and academic integrity were respected by correctly citing and acknowledging all materials referenced, as well as others. The findings were presented objectively, source materials were not misinterpreted and transparency was maintained in the selection and analysis of source materials. The research was conducted in a manner that followed accepted practices in the field to ensure that the results of the research were reliable, credible and original.

Results and Discussion

Results:

A survey of the scholarly literature, policy documents, patent office publications and international IP systems over the last three decades shows important developments in patent systems. Technological advancement is changing the paradigm of the patent system, presenting opportunities and challenges for inventors, companies, and regulators alike. The introduction of new technologies like Artificial Intelligence (AI), biotechnology, blockchain, quantum computing, nanotechnology, and advanced robotics has highlighted challenges with traditional patent systems.

Table 1: Evolution of Patent Systems Across Technological Eras

Period	Dominant Technologies	Key Patent Characteristics	Major Challenges
1980–1995	Manufacturing, Pharmaceuticals	Strong emphasis on product patents	Limited global harmonization
1995–2010	Information Technology, Telecommunications	Expansion of software-related patents	Patent litigation and overlapping claims
2010–2020	Artificial Intelligence, Biotechnology	Growth in cross-disciplinary inventions	Determining patent eligibility
2020–Present	AI, Blockchain, Quantum Computing	Increased complexity of patent applications	Inventorship, ethical concerns, rapid obsolescence

Results suggest that patent systems were developed to secure a less tangible, more complex method of invention: digital or knowledge-based inventions. The shift has made patent examiners' work more difficult, as they now have to examine inventions that include cutting-edge algorithms and inter-disciplinary scientific information.

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

Table 2: Major Emerging Technologies and Patent-Related Issues

Technology	Patentability Issues	Regulatory Concerns
Artificial Intelligence	AI-generated inventions and inventorship	Ownership and accountability
Biotechnology	Gene editing and biological materials	Ethical and public health concerns
Blockchain	Software patent eligibility	Open-source compatibility
Quantum Computing	Technical complexity of claims	Lack of specialized examination standards
Nanotechnology	Broad patent scope	Overlapping patent rights
Robotics	Integration of hardware and software patents	Liability and autonomous decision-making

The review demonstrates that AI has emerged as one of the most challenging domains for patent law. Current laws are in a state of flux, with existing regulations typically applying to inventions that are created by human inventors only, leaving the status of AI-generated inventions unclear. Likewise, the field of biotechnology has ethical issues with regard to patenting of genetic materials and living organisms.

Table 3: Challenges Identified in Contemporary Patent Systems

Challenge	Frequency in Reviewed Studies (%)
Patent Eligibility Uncertainty	82
High Cost of Patent Filing	78
Patent Litigation	74
Cross-Border Regulatory Differences	71
Patent Thickets	68
Lengthy Examination Process	65
Ethical and Social Concerns	61
Lack of Technical Expertise among Examiners	57

The analysis shows that uncertainty around eligibility for patent is the most common concern. Many have not yet developed legal standards for new technologies, causing it to be hard to properly assess emerging technologies. In addition to the licensing cost and complexity introduced by patent thickets, especially in the telecommunications and biotechnology industries, patent thickets create barriers to innovation.

Table 4: Comparative Assessment of Patent Systems in Selected Jurisdictions

Criterion	United States	European Union	China	India
AI Patent Acceptance	Moderate	Moderate	High	Limited
Biotechnology Patent Protection	Strong	Strong	Strong	Moderate
Examination Speed	Moderate	Moderate	Fast	Moderate
Patent Filing Cost	High	High	Moderate	Low
Support for Emerging Technologies	High	High	Very High	Developing

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

There are examples from China that the patent system there has been considerably improved with policy measures and shorter examination times. The United States and the European Union remain the leaders in technological innovation; the Indian IP infrastructure continues to slowly grow in order to fit new technologies.

Table 5: Potential Reforms for Future Patent Systems

Proposed Reform	Expected Impact
Specialized AI Patent Guidelines	Improved clarity in patent examination
International Harmonization of Patent Laws	Reduced cross-border disputes
Fast-Track Examination for Emerging Technologies	Faster commercialization
Enhanced Examiner Training	Better assessment quality
Ethical Review Mechanisms	Balanced innovation and public interest
Digital Patent Management Systems	Increased efficiency and transparency

The need for adaptive patent systems (that are able to adapt to technological disruptions) has always been a central theme of research on patent systems. There is value in the use of examination systems created for this purpose and in international cooperation.

Discussion:

The results help to indicate that patent systems have shifted in the last twenty years from protecting industrial innovations and inventions to more intricate innovations in the digital and scientific fields. In the era of new technologies, the lines between inventor and creator/user become murky, which will create problems for the current legal rules.

One of the most interesting challenges is the presence of Artificial Intelligence, which is not well accommodated by the current patent system, which for the most part, is focused on human inventorship. Policymakers should re-examine the existing definition of invention in a manner that does not stifle new invention activity as AI systems increasingly become capable of creating new inventions without human input.

The ethical issues of Biotechnology and genetic engineering are added. Patents are used to provide an incentive for R&D, but too much protection can hinder the access to life-saving medical technologies and scientific knowledge. It is a similar problem that also arises in nanotechnology and quantum computing, where other innovations are also being pursued but which could be stymied by the wide patent coverage.

The comparative analysis also shows that patent systems that are more tech-friendly and flexible have more investment in research and development. However, if the protection is excessive, there can be tendency towards monopolization and dissemination of knowledge may be curtailed.

To sum up, the paradigm of the patent system itself has become more complex in the history of innovation. Future reform can be achieved by focusing on the spirit of flexibility in regulation, international harmonization, training of examiners, effective supervision of the public interests by ethics committee for the efficiency of patent systems to encourage technological innovation.

Limitations of the study

The study has some limitations which should be considered during the interpretation of the results. The research is predominantly secondary data based on information found from academic literature, policy documentation, legal documentation and national and International reports. Certain patent and technology laws are constantly evolving and some recent events may not be covered in these resources. Like all emerging technologies, some technologies discussed

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

may not be covered as extensively as some technology-specific legal/commercial issues. The results are not generalizable due to a variety of differences in patent laws, enforcement and innovation climate across countries. The study is also largely a policy and regulatory study with little detailed empirical input from patent owners, inventors, lawyers or industry. The restrictions provide opportunities for additional research on primary data gathering, comparative international research, and industry specific research on patents problems in new technologies.

Future Scope

New inventions and technologies like artificial intelligence, biotechnology, quantum computing, blockchain, and new digital technologies in general will affect the future of patent systems. Existing patent systems have to adapt to the challenges posed by these technologies, such as the change in the definition of inventorship, property rights, international protection, ethics and the growing technological complexity of inventions. Future studies need to focus on the development of adaptive patent policies that can consider the incentives to innovation, public interest and equitable access to technological advancements. There may be useful lessons to be learned from some of the cross-jurisdictional experiences that could be useful in the field of good regulatory practice to protect developing technologies. In addition, the importance of international cooperation, the importance of digital patent examination systems and technology-specific guidelines in developing a more efficient and inclusive global patent system can be discussed. Such investigations may help to enhance patent systems and foster sustainable technological development in a growingly globalized world.

Conclusion

The patent systems have been developing slowly and the efforts have been made to find a balance between the incentive for innovation and the concern of balancing public interest in rapidly evolving technological environment. The use of new technologies such as artificial intelligence, biotechnology, nanotechnology, blockchain and other digital systems is impacting industry sectors and challenging traditional patent systems on topics of inventorship, patent eligibility, disclosure, and cross border enforcement. The research emphasizes the importance of patent as instrument for stimulating innovation – research and investment – but the existing legislation is often inadequate to respond to the dynamism and complexity of the present innovation. However, the problems of patent administration are compounded by the global character of technology development, ethical matters and by the differences in the laws of various nations. In order to be relevant and effective, patent systems must be flexible, transparent and technology responsive. To encourage sustainable innovation, co-operation between countries will be important, the examination process will need to be improved and rights protection and public interest will need to be harmonized. Many of the technologies they need to become familiar with and the ability not to block technological development or knowledge transfer, is no doubt necessary for the ultimate success of the patent arrangements.

References

1. Abbott, F. M. (2006). Intellectual property provisions of bilateral and regional trade agreements in light of US federal law. *United Nations Conference on Trade and Development Discussion Papers*, 182, 1–48.
2. Bessen, J., & Meurer, M. J. (2008). *Patent failure: How judges, bureaucrats, and lawyers put innovators at risk*. Princeton University Press.
3. Burk, D. L., & Lemley, M. A. (2009). *The patent crisis and how the courts can solve it*. University of Chicago Press.

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

4. Cornish, W., Llewelyn, D., & Aplin, T. (2019). *Intellectual property: Patents, copyright, trademarks and allied rights* (9th ed.). Sweet & Maxwell.
5. Drahos, P. (2010). *The global governance of knowledge: Patent offices and their clients*. Cambridge University Press.
6. Dutfield, G., & Suthersanen, U. (2020). *Global intellectual property law* (3rd ed.). Edward Elgar Publishing.
7. European Patent Office. (2023). *Patent index 2022*. European Patent Office.
8. Gans, J. S., Hsu, D. H., & Stern, S. (2008). The impact of uncertain intellectual property rights on the market for ideas: Evidence from patent grant delays. *Management Science, 54*(5), 982–997.
9. Granstrand, O. (2000). *The economics and management of intellectual property: Towards intellectual capitalism*. Edward Elgar Publishing.
10. Hall, B. H., & Harhoff, D. (2012). Recent research on the economics of patents. *Annual Review of Economics, 4*(1), 541–565.
11. Jaffe, A. B., & Lerner, J. (2004). *Innovation and its discontents: How our broken patent system is endangering innovation and progress*. Princeton University Press.
12. Khan, B. Z. (2005). *The democratization of invention: Patents and copyrights in American economic development, 1790–1920*. Cambridge University Press.
13. Kortum, S., & Lerner, J. (1999). What is behind the recent surge in patenting? *Research Policy, 28*(1), 1–22.
14. Lemley, M. A. (2015). Faith-based intellectual property. *UCLA Law Review, 62*(5), 1328–1347.
15. Menell, P. S., Lemley, M. A., & Merges, R. P. (2017). *Intellectual property in the new technological age*. Clause 8 Publishing.
16. Merges, R. P. (2011). *Justifying intellectual property*. Harvard University Press.
17. Merges, R. P., & Duffy, J. F. (2021). *Patent law and policy: Cases and materials* (8th ed.). Carolina Academic Press.
18. Organisation for Economic Co-operation and Development. (2021). *OECD science, technology and innovation outlook 2021: Times of crisis and opportunity*. OECD Publishing.
19. Ouellette, L. L. (2012). Do patents disclose useful information? *Harvard Journal of Law & Technology, 25*(2), 531–593.
20. Rai, A. K. (2021). Artificial intelligence and patent law. *Duke Law & Technology Review, 20*(1), 1–24.
21. Sampat, B. N. (2018). A survey of empirical evidence on patents and innovation. *The Oxford Handbook of the Economics of Intellectual Property Law*, 1, 107–139.
22. Scotchmer, S. (2004). *Innovation and incentives*. MIT Press.
23. Shapiro, C. (2001). Navigating the patent thicket: Cross licenses, patent pools, and standard-setting. In A. Jaffe, J. Lerner, & S. Stern (Eds.), *Innovation policy and the economy* (Vol. 1, pp. 119–150). MIT Press.
24. Srinivas, K. R. (2017). Intellectual property rights and innovation policy in emerging technologies. *Journal of Intellectual Property Rights, 22*(5), 215–224.
25. United Nations Conference on Trade and Development. (2021). *Technology and innovation report 2021: Catching technological waves*. United Nations.

Vol 2, Issue 5, May 2026, Page: 58-69 ISSN: 3107-5037

26. WIPO. (2022). *World intellectual property indicators 2022*. World Intellectual Property Organization.
27. WIPO. (2024). *World intellectual property report 2024: Innovation and intellectual property in the digital age*. World Intellectual Property Organization.
28. World Trade Organization. (1995). *Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)*. World Trade Organization.
29. World Trade Organization. (2023). *World trade report 2023: Re-globalization for a secure, inclusive and sustainable future*. World Trade Organization.
30. Yu, P. K. (2017). The international enclosure movement. *Indiana Law Journal, 82*(4), 827–907.