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ARTIFICIAL INTELLIGENCE AND PATENT INNOVATION: A DOCTRINAL ANALYSIS OF PATENTABILITY STANDARDS IN THE DIGITAL ERA

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ABSTRACT:

One of the most disruptive technologies of the modern era, artificial intelligence (AI), has an extensive influence on innovation in various sectors of economy, including healthcare, manufacturing, finance, education, and information technology. Since AI is becoming increasingly effective in developing innovative solutions, complex questions about how to protect AI-derived or AI-assisted innovations within the existing patent laws emerge. The issue becomes difficult when innovations are developed in such a way that a considerable amount of involvement from an AI system is required, while existing regimes, for instance, the Indian Patents Act, 1970, are predominantly based on the concept of human inventors.

The patentability criteria applicable to inventions involving AI in the digital era will be looked into through this doctrinal research. The extent to which the three basic patentability criteria, such as novelty, invention, and industry applicability, cater to inventions through AI will be analyzed. By considering the international conventions such as the Patent Cooperation Treaty (PCT), TRIPS Agreement, and WIPO projects, the research goes further into the legal framework relating to patents in India. In order to detect any global trend, a short comparison of the methods adopted by countries including the United States, European Union, and the United Kingdom will also be undertaken.

Among the problems concerning the inventorship of AI, the ownership of inventions created by AI, the patent eligibility of computer-related innovations, and the absence of legislative rules in the field of AI inventions are noted in the study. The authors argue that even though at this point the patent regime continues to encourage technological advancements, some particular modifications are required for dealing with the reality of AI-assisted invention. The study concludes that for fostering innovation, ensuring legal certainty, and protecting the public interest in the rapidly growing digital economy, it is essential to have an appropriate legal framework based on patent examination rules.

Keywords: Artificial Intelligence (AI), Patent Innovation, Patentability Standards, AI-Generated Inventions, Intellectual Property Rights (IPR), Digital Era.

CHAPTER I

INTRODUCTION

Artificial Intelligence (AI) has become one of the most significant technological advancements of the twenty-first century, transforming the way individuals, businesses, and governments operate. AI refers to computer systems that are capable of performing tasks that traditionally require human intelligence, such as learning, reasoning, problem-solving, decision-making, and pattern recognition. With the rapid growth of digital technologies, AI has become an essential driver of innovation in sectors including healthcare, pharmaceuticals, manufacturing, finance, education, transportation, and communication. AI-powered systems are increasingly contributing to the development of new products, processes, and technological solutions, thereby accelerating research and economic growth.

Innovation is the foundation of technological progress, and patent law plays a vital role in encouraging innovation by granting inventors exclusive rights over their inventions for a limited period. Patent protection provides incentives for research and development, promotes investment, and facilitates the disclosure of new technologies to society. However, the emergence of AI-generated and AI-assisted inventions has raised important legal questions regarding the application of traditional patent law. Existing patent systems were developed on the assumption that inventions are created by human inventors, whereas AI systems are now capable of making substantial contributions to the inventive process.

The increasing role of AI in innovation challenges established concepts such as inventorship, ownership, novelty, and inventive step. Consequently, policymakers and legal scholars are debating whether existing patent laws are sufficient to address AI-driven inventions or whether reforms are necessary. This study examines the relationship between Artificial Intelligence and patent innovation by analysing the patentability standards applicable in the digital era and assessing whether the current legal framework effectively supports technological advancement while maintaining legal certainty and public interest.

1.2 Background of the Study

The rapid advancement of Artificial Intelligence has transformed the global innovation landscape. Modern AI systems can analyse large volumes of data, identify patterns, generate

creative solutions, and assist researchers in developing new inventions with greater speed and accuracy. These capabilities have increased the use of AI in scientific research, pharmaceutical development, software engineering, autonomous vehicles, robotics, and other technology-driven industries. As AI continues to evolve, its role has shifted from being merely a supporting tool to becoming an active contributor to the innovation process.

The patent system is intended to encourage innovation by protecting inventions that satisfy the legal requirements of novelty, inventive step, and industrial applicability. However, existing patent laws, including the Indian Patents Act, 1970, were enacted at a time when inventions were assumed to be the result of human creativity. Consequently, they do not expressly address inventions generated or significantly assisted by AI. This has created legal uncertainty regarding the recognition of inventorship, ownership of AI-generated inventions, and the patentability of software-based innovations. Several jurisdictions have also faced these challenges, particularly in cases involving AI-generated inventions, highlighting the need for greater legal clarity.

In the digital era, where AI is becoming an integral part of research and development, it is essential to examine whether current patentability standards remain suitable for protecting technological innovation. This study seeks to analyse the existing legal framework governing AI-related inventions, identify the challenges arising from AI-assisted innovation, and evaluate the need for legal reforms. Such an analysis is important for ensuring that patent law continues to promote innovation while maintaining fairness, legal certainty, and the broader public interest.

CHAPTER II

ARTIFICIAL INTELLIGENCE, PATENT INNOVATION AND PATENTABILITY STANDARDS

2.1 Meaning and Concept of Artificial Intelligence

Artificial Intelligence (AI) refers to the branch of computer science that focuses on creating systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, problem-solving, decision-making, language processing, and pattern recognition.¹ AI enables machines to analyse large volumes of data, identify relationships, make predictions, and continuously improve their performance through experience. Unlike traditional computer programs that operate according to fixed instructions, AI systems can

¹ Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* 1–5 (3d ed. 2010).

adapt to new information and generate outputs with minimal human intervention.²

AI encompasses several technologies, including machine learning, deep learning, natural language processing, computer vision, robotics, and expert systems. These technologies have transformed numerous sectors, including healthcare, finance, agriculture, transportation, education, and manufacturing. AI-powered applications such as virtual assistants, autonomous vehicles, fraud detection systems, and medical diagnostic tools demonstrate the practical significance of AI in modern society.³

From a legal perspective, AI presents new challenges for intellectual property law, particularly patent law. AI systems are increasingly used to assist researchers and inventors in developing innovative products and processes. In some instances, AI contributes significantly to the inventive process by identifying novel solutions or generating technical improvements. This development raises important legal questions regarding inventorship, ownership, and the patentability of AI-assisted or AI-generated inventions. Since existing patent laws were primarily designed with human inventors in mind, the growing role of AI has prompted policymakers and scholars to reconsider whether current legal frameworks adequately protect AI-driven innovation. Consequently, understanding the concept and capabilities of AI is essential for analysing its impact on patent law in the digital era.

2.2 Evolution of Artificial Intelligence

The evolution of Artificial Intelligence (AI) has been marked by significant technological and scientific advancements over the past several decades. The concept of AI was formally introduced in 1956 during the Dartmouth Summer Research Project on Artificial Intelligence, where John McCarthy coined the term "Artificial Intelligence" and envisioned the development of machines capable of performing tasks associated with human intelligence.⁴ This conference laid the foundation for AI research and inspired further developments in computer science and cognitive sciences.

During the 1960s and 1970s, AI research focused on rule-based systems and symbolic reasoning, leading to the development of expert systems that could mimic human decision-making in specialised fields such as medicine and engineering.⁵ Although these systems

² Margaret A. Boden, *Artificial Intelligence: A Very Short Introduction* 1–18 (Oxford Univ. Press 2018).

³ World Intellectual Property Organization (WIPO), *WIPO Technology Trends 2019: Artificial Intelligence* 13–25 (2019), <https://www.wipo.int/publications/en/details.jsp?id=4386>.

⁴ John McCarthy et al., *A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence* (1955), reprinted in *AI Magazine* (2006).

⁵ Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* 16–28 (3d ed. Pearson 2010).

demonstrated the potential of AI, their capabilities were limited by computing power and the availability of data. The 1980s and 1990s witnessed the emergence of machine learning techniques, enabling computers to learn from data rather than relying solely on pre-programmed rules.⁶

The rapid growth of computing power, cloud technology, and big data in the twenty-first century accelerated AI development. Deep learning, natural language processing, computer vision, and generative AI have significantly enhanced the ability of machines to perform complex tasks such as language translation, medical diagnosis, autonomous driving, and content generation.⁷ Today, AI plays a vital role in research and innovation by assisting scientists, engineers, and inventors in developing new products and technologies. This evolution has also created legal challenges, particularly in patent law, as AI systems increasingly contribute to the inventive process. Consequently, there is a growing need to examine whether existing patent laws are capable of addressing innovations developed with substantial AI assistance.

2.3 Meaning of Patent and Patent Innovation

A patent is a statutory intellectual property right granted by the government to an inventor for a new invention that satisfies the legal requirements of novelty, inventive step, and industrial applicability.⁸ The patent holder is granted the exclusive right to prevent others from making, using, selling, offering for sale, or importing the patented invention without permission for a specified period, generally twenty years from the date of filing.⁹ The primary objective of the patent system is to encourage innovation by rewarding inventors for their creative efforts while promoting public disclosure of technological knowledge.

Patent innovation refers to the process of developing new or improved products, processes, or technologies that qualify for patent protection under the applicable legal framework.¹⁰ In today's digital economy, innovation is increasingly driven by advanced technologies such as Artificial Intelligence (AI), machine learning, robotics, biotechnology, and data analytics. AI has transformed the innovation process by assisting inventors in analysing large datasets, identifying technical solutions, designing new products, and

⁶ Margaret A. Boden, *Artificial Intelligence: A Very Short Introduction* 29–52 (Oxford Univ. Press 2018).

⁷ World Intellectual Property Organization (WIPO), *WIPO Technology Trends 2019: Artificial Intelligence* 19–40 (2019).

⁸ The Patents Act, No. 39 of 1970, § 2(1)(j) & § 2(1)(ja) (India).

⁹ The Patents Act, No. 39 of 1970, § 48 & § 53 (India).

¹⁰ World Intellectual Property Organization (WIPO), *Understanding Patents, Industrial Designs and Geographical Indications* 5–12 (WIPO Publ'n 2020).

improving industrial processes. As a result, AI-assisted inventions are becoming more common across sectors including healthcare, pharmaceuticals, manufacturing, transportation, and information technology.¹¹

The increasing use of AI in research and development has raised important legal issues concerning patent innovation. Traditional patent law assumes that inventions are conceived by human inventors, whereas AI systems are now capable of making substantial contributions to the inventive process. This development has generated debates regarding inventorship, ownership, and the patentability of AI-generated inventions. Therefore, understanding the concept of patent innovation is essential for evaluating whether existing patent laws are capable of protecting technological advancements in the digital era while continuing to promote innovation and economic development.

CHAPTER III

LEGAL FRAMEWORK GOVERNING AI PATENTS

3.1 Patent Protection under the Patents Act, 1970

The **Patents Act, 1970** is the principal legislation governing patent protection in India. It establishes the legal framework for granting patents to inventors whose inventions satisfy the statutory requirements of novelty, inventive step, and industrial applicability.¹² The Act seeks to encourage innovation by providing inventors with exclusive rights over their inventions for a period of twenty years from the filing date, while simultaneously ensuring that technological knowledge enters the public domain after the expiry of the patent term.¹³

The Act defines an invention as a new product or process involving an inventive step and capable of industrial application.¹⁴ However, not every invention qualifies for patent protection. Sections 3 and 4 of the Act specify categories of non-patentable inventions, including mathematical methods, business methods, computer programs per se, and algorithms.¹⁵ These exclusions have significant implications for Artificial Intelligence (AI)-based inventions because many AI technologies rely on software algorithms and computational methods.

¹¹ World Intellectual Property Organization (WIPO), *WIPO Technology Trends 2019: Artificial Intelligence* 45–70 (2019).

¹² The Patents Act, No. 39 of 1970, §§ 2(1)(j), 2(1)(ja), & 2(1)(ac) (India).

¹³ The Patents Act, No. 39 of 1970, §§ 48 & 53 (India).

¹⁴ The Patents Act, No. 39 of 1970, § 2(1)(j) (India).

¹⁵ The Patents Act, No. 39 of 1970, §§ 3 & 4 (India).

In addition to the Act, the **Guidelines for Examination of Computer Related Inventions (CRI Guidelines), 2017** assist patent examiners in determining the patentability of computer-related inventions. The guidelines clarify that although a computer program per se is excluded from patentability, an invention demonstrating a technical effect or technical contribution may qualify for patent protection.¹⁶ Consequently, AI-assisted inventions that produce a technical advancement or industrial application may be considered patentable if they satisfy the statutory requirements.

Therefore, the Patents Act, 1970 provides the foundation for protecting technological innovation in India. However, the increasing use of AI has highlighted the need for greater clarity regarding the patentability of AI-assisted inventions and the interpretation of existing legal provisions.

3.2 Patentability of AI-Based Inventions in India

The patentability of Artificial Intelligence (AI)-based inventions in India is determined by the provisions of the **Patents Act, 1970** and the examination guidelines issued by the Indian Patent Office. AI inventions are not expressly recognised as a separate category under Indian patent law. Instead, they are examined using the traditional patentability requirements of novelty, inventive step, and industrial applicability.¹⁷

One of the principal challenges in patenting AI-related inventions arises from **Section 3(k)** of the Patents Act, which excludes "a mathematical or business method or a computer programme per se or algorithms" from patentability.¹⁸ Since many AI technologies are based on algorithms, software, and machine learning models, they may initially appear to fall within this exclusion. However, the CRI Guidelines, 2017 clarify that an invention is not automatically excluded merely because it involves software. If the invention demonstrates a technical effect, technical advancement, or technical contribution beyond the software itself, it may qualify for patent protection.¹⁹

Another challenge concerns inventorship. Indian patent law presently recognises only natural persons as inventors, and there is no statutory provision permitting an AI system to be named as an inventor. Consequently, AI is treated as a tool that assists human inventors rather

¹⁶ Office of the Controller General of Patents, Designs & Trade Marks, **Guidelines for Examination of Computer Related Inventions (CRI)** 5–17 (2017).

¹⁷ The Patents Act, No. 39 of 1970, §§ 2(1)(j), 2(1)(ja), & 2(1)(ac) (India).

¹⁸ The Patents Act, No. 39 of 1970, § 3(k) (India).

¹⁹ Office of the Controller General of Patents, Designs & Trade Marks, **Guidelines for Examination of Computer Related Inventions (CRI)** 9–20 (2017).

than an independent legal inventor.²⁰ As AI technologies become increasingly autonomous, questions regarding ownership, inventorship, and disclosure are expected to become more significant.

Therefore, while the existing legal framework provides limited protection for AI-assisted inventions, greater legislative clarity and updated examination standards are necessary to encourage innovation and ensure consistency in the patenting of AI-related technologies in India.

3.3 International Legal Framework

The international legal framework governing patents establishes minimum standards for the protection of inventions and promotes cooperation among member states. Although there is no international treaty specifically regulating Artificial Intelligence (AI) patents, several international instruments play a significant role in determining the patentability of AI-related inventions.

The **Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)**, administered by the World Trade Organization (WTO), establishes minimum standards for patent protection among member countries. Article 27 of the TRIPS Agreement requires patents to be available for inventions in all fields of technology, provided they are new, involve an inventive step, and are capable of industrial application.²¹ These standards are equally relevant to AI-assisted inventions.

The **Patent Cooperation Treaty (PCT)**, administered by the World Intellectual Property Organization (WIPO), simplifies the process of seeking patent protection in multiple countries through a single international patent application.²² Although the PCT does not grant an international patent, it reduces procedural complexity and facilitates the global protection of technological innovations, including AI-based inventions.

The **World Intellectual Property Organization (WIPO)** plays a crucial role in developing international intellectual property policies and promoting discussions on AI and intellectual property rights. WIPO has published reports and organised international conversations addressing issues such as AI inventorship, patentability, ownership, and future

²⁰ World Intellectual Property Organization (WIPO), **WIPO Technology Trends 2019: Artificial Intelligence** 95–110 (2019).

²¹ Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299

²² Patent Cooperation Treaty arts. 3–4, June 19, 1970, 1160 U.N.T.S. 231.

legal reforms.²³ These initiatives assist member states in understanding the legal implications of AI-driven innovation and encourage harmonisation of patent practices.

Together, TRIPS, the PCT, and WIPO provide an important international framework for patent protection. However, continued international cooperation is necessary to address the unique legal challenges posed by AI-generated and AI-assisted inventions.

CHAPTER IV

CHALLENGES AND FUTURE PROSPECTS OF AI PATENT INNOVATION

Artificial Intelligence (AI) has significantly transformed the innovation ecosystem by enabling the creation of new products, processes, and technologies. However, its increasing role in the inventive process has created several legal and practical challenges for the patent system.²⁴ One of the primary issues is inventorship, as existing patent laws, including the Patents Act, 1970, recognise only natural persons as inventors. Consequently, AI systems cannot currently be named as inventors, even when they make substantial contributions to an invention.²⁵

Another challenge concerns the patentability of AI-based inventions, particularly those involving software algorithms and machine learning models. Section 3(k) of the Patents Act excludes computer programmes *per se* and algorithms from patent protection, creating uncertainty regarding the patent eligibility of AI-related innovations.²⁶ Additionally, determining whether an AI-assisted invention satisfies the requirements of novelty and inventive step becomes increasingly complex when AI systems independently analyse data and generate technical solutions.²⁷

Despite these challenges, the future of AI patent innovation remains promising. Governments and international organisations are actively exploring reforms to modernise patent laws and accommodate AI-assisted inventions. The World Intellectual Property Organization (WIPO) has initiated discussions on AI and intellectual property, while several jurisdictions are reviewing their patent examination practices to address emerging

²³ World Intellectual Property Organization, WIPO Technology Trends 2019: Artificial Intelligence 1–18 (2019); World Intellectual Property Organization, Revised Issues Paper on Intellectual Property Policy and Artificial Intelligence (2020).

²⁴ World Intellectual Property Organization, WIPO Technology Trends 2019: Artificial Intelligence 45–70 (2019).

²⁵ The Patents Act, No. 39 of 1970, §§ 2(1)(y), 6, & 28 (India).

²⁶ The Patents Act, No. 39 of 1970, § 3(k) (India).

²⁷ N.S. Gopalakrishnan & T.G. Agitha, *Principles of Intellectual Property* 145–52 (2d ed., Eastern Book Co. 2014).

technological developments.²⁸ India can strengthen its patent system by issuing AI-specific examination guidelines, clarifying inventorship rules, and encouraging innovation through a balanced legal framework. Such reforms would provide greater legal certainty, promote research and development, attract investment, and ensure that the patent system remains effective in the rapidly evolving digital economy.

CHAPTER V

FINDINGS AND CONCLUSION

The study finds that Artificial Intelligence (AI) has become a significant driver of technological innovation, influencing diverse sectors such as healthcare, manufacturing, finance, and information technology. AI-assisted inventions are increasingly contributing to research and development by improving efficiency, accuracy, and the generation of novel solutions. However, the existing patent framework, particularly the Patents Act, 1970, was drafted with the assumption that inventions are created by human inventors. As a result, it does not specifically address the legal status of AI-generated inventions or the issue of AI inventorship.

The research further reveals that while AI-based inventions may qualify for patent protection if they satisfy the requirements of novelty, inventive step, and industrial applicability, uncertainty remains due to the exclusion of computer programmes *per se* and algorithms under Section 3(k) of the Patents Act. The study also observes that international frameworks such as the TRIPS Agreement, the Patent Cooperation Treaty (PCT), and the initiatives of the World Intellectual Property Organization (WIPO) provide general standards for patent protection but do not offer comprehensive rules for AI-generated inventions.

The study concludes that the current patent regime is capable of protecting many AI-assisted innovations but requires legislative and policy reforms to address emerging technological developments. India should consider issuing AI-specific patent examination guidelines, clarifying the legal position on inventorship, and promoting greater harmonisation with international practices. A balanced legal framework that protects innovation while safeguarding public interest will encourage research, technological advancement, and economic growth. Such reforms will ensure that the patent system remains effective and responsive to the evolving challenges of the digital era.

²⁸ World Intellectual Property Organization, Revised Issues Paper on Intellectual Property Policy and Artificial Intelligence 8–21 (2020).