The Impact of Emerging Technologies in Protection of Intellectual Property Rights in Pakistan: Legal and Regulatory Challenges

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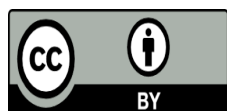
The Impact of Emerging Technologies in Protection of Intellectual Property Rights in Pakistan: Legal and Regulatory Challenges

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Abstract

Intellectual Property (IP) is an essential element of modern life which has a significant impact on many aspects of society. Numerous difficulties arise in various ways because of emerging technologies such as Artificial Intelligence (AI) and block chain. This research critically analyzes the effects of AI development the complication faced by IP law protection frameworks and also discusses the basic concept of block chain technology and its advantages in IP protection. This study specifically attempts to observe the consequences of works generated by AI in relation to IP law. This research has found that national legislation frequently fails to provide comprehensive regulations to adequately control IP rights, regardless of the dynamic nature of these difficulties. Laws governing IP in Pakistan need to change to meet these contemporary issues. They must take into account developing technologies for the protection of IP rights. This research also highlights the disproportionate impact the AI and block chain on IP rights and lack of adequate laws to mitigate its consequences. This research has adopted the doctrinal research methodology to comprehend the present situation of emerging technologies and their eligibility for IP protection, the analysis is based on previously published works and legal papers. By analyzing the existing legal framework, enforcement mechanisms, and institutional structures, this study uncovers the systemic challenges and loopholes in IP laws. This research provides that Pakistan does not have a specific action plan or specific legislation to address the issues caused by new technologies in the field of IP. In-depth analysis of these issues is done in this research, along with a look at how current legal frameworks adjust to new realities that AI presents. Finally, future-focused solutions that strike a balance between preserving IP rights and fostering innovation in a growing AI-driven world are suggested. This research puts forth recommendations for a comprehensive reform initiative with a particular focus on difficulties in IP law due to development of technology.

Keywords: Pakistan; Intellectual Property; Block Chain; Artificial Intelligence; Rights.

Introduction

Artificial Intelligence (AI) and Block chain have changed the landscape of Intellectual Property (IP) protection, many current IP laws were created before these technologies and

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may not address the complexities of AI and block chain requiring new legal and regulatory frameworks for effective IP protection. Emerging technologies in the digital age have completely changed how we produce, distribute, and safeguard IP. The legal and regulatory environment surrounding IP has grown more complicated and difficult to understand with the rise of big data, block chain, and artificial intelligence. The influence of these new technologies on IP protection are discussed in this research along with the resulting legal and regulatory issues. There are uncertainties about the possibility of abuse and violation of these technologies, even with their potential advantages in strengthening IP protection. Critical examination of these technologies' effects on IP protection as well as the legal and regulatory issues they raise is therefore important.

AI developers in particular need to make sure that they are following the law when it comes to obtaining the data necessary for their models' training. In order to do this, owners of IP that developers wish to use in their training data should be paid, either through licensing or a portion of the money made by AI tool. Customers should avoid generative AI tools that cannot verify that the training data is properly licensed from content creators or covered by open-source licenses that the AI companies comply with and instead ask providers whether their models were trained with any protected content. They should also review the terms of service and privacy policies. The foundation of innovation, which promotes creativity and economic prosperity, is IP protection. Laws pertaining to IP have historically been based on pre-digital age paradigms in Pakistan, as they are in many other countries. The emergence of disruptive technologies necessitates a reassessment of these frameworks to guarantee their continued resilience, adaptability, and ability to protect rights of creators, inventors, and innovators.

The purpose of this research is to examine the complex interplay between IP protection and new technologies in the particular context of Pakistan. Numerous industries, including healthcare, entertainment, manufacturing, and agriculture, are going through major changes as technology becomes more and more ingrained in daily life. Beyond the traditional purview of IP laws, these changes provide difficulties that need for a thorough grasp of how legal and regulatory frameworks might change to accommodate new complexities.

1. **Impact of Artificial Intelligence (AI) and Block Chain on Intellectual Property (IP)**

Technology and law coexist because once a new technology is developed, regulations ensure that it is protected as an Intellectual Property (IP) asset in situations when the law must change to maintain control over technology. Artificial Intelligence (AI) and block chain are two technologies that could lead all other technical fields in the future. Over the past ten years, these inventions have revolutionized every business, changing the way they operate. The importance of IP rights has increased as people's awareness of their creative rights has grown. In light of the emergence of new technologies AI's powers the efficiency and accuracy of IP procedures ranging from patent searches to infringement detection. Meanwhile, block chain's decentralized and unchangeable ledger offers a transparent and secure way to record IP transactions, establish background information, and verify ownership. IP covers works of art, literature, ideas, designs, names, symbols, and photographs used for commercial purposes. It is an intangible property that is legally protected from unlawful use, transport, or sale. IP holders have the legal right to control how their inventions are used, so they cannot be purchased, sold, or used by third parties without their permission.[1]

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[1] Mukhtar, S. Zainol. "ZA, Jusoh, S, Zahid, A. (2018) Review of Trademark and Its Enforcement Provisions under TRIPS." *Journal of Asian Research* 2, no. 2.

IP includes Patent which is a legal document that protect an innovation of the patent rights holder. To qualify, the invention must be new, useful, and not apparent. When an inventor submits details of their idea to a patents authority, they receive legal protection. Generally, before an innovation becomes public, a patent application must be filed since it must be original. Examples of patents are certain tools or advancement in machinery, software applications, medications, and new plant species. IP also includes Copyright which deals with various actions relevant to literary, dramatic, musical, or cinematographic works. Generally speaking, copyright refers to the exclusive right to decide or allow others to print or otherwise multiply copies of any literary, theatrical, musical, or artistic creations of copyright holder. It may be found in creative musical, theatrical, and literary works, movies and recordings with cinematography. IP includes literary works, scripts, lectures, musical compositions, photographs, cinematographs, and others, as their original owners the copyright holder can only use, distribute, or sell the content for a limited time (years vary depending on country). Examples are Films, writings, paintings, and musical creations. IP includes Trademark which is defined as a word, symbol, or phrase that distinguishes your company or product. Registering a trademark gives you the exclusive right to use the mark for as long as you keep using it and maintain its protection. In substitution for the trademark, copyright material cannot be utilized, however if such copyright in the creative work was also registered under Trademark Law then it can be used as an alternate. Examples of trademarks are goods and brand names, slogans, and logos. Trade Secrets are valuable pieces of confidential information, such as supplier or customer lists, algorithms, formulas, recipes, or procedures that gain their value from being kept secret. Unlike patents or trademarks, they aren't officially registered, but they can be protected through various legal measures like confidentiality agreements, nondisclosure agreements (NDAs), and employment contracts. Examples are formulas, procedures, vendor and supplier data, lists of consumers, algorithms, marketing plans, and price data.[2]

In England, the modern concept of IP began to develop during the 17th and 18th centuries. The term IP started being used in the 19th century, but it wasn't widely recognized by most legal systems around the world until the late 20th century. The first patent law was enacted in Venice in 1474. The United States passed a patent statute in 1790, and revolutionary France acknowledged inventor rights in 1791. Trademarks were first protected by passing-off lawsuits filed in English Courts, but in the middle of the 1800s, statutory trademark registration procedures started to emerge throughout Europe. Over the years Pakistan has passed and altered legislation pertaining to IP like laws and Ordinances related to copyright, patents, and trademarks and Pakistan has also signed the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) which is part of General Agreement on Tariff and Trades (GATT).[3]

John McCarthy created a term "Artificial Intelligence" in 1956. "Artificial Intelligence" may be defined as "the capability of machines to complete tasks that humans would say requires intelligence." It has the ability to solve problems. AI can perform tasks that usually need human intelligence or help, either by itself or with other technologies. Examples of AI in our daily lives and news include digital assistants, Global Positioning System (GPS), self-driving cars, and creative tools like Chat Generative Pre-Trained (GPT). AI increases human effort's

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[2] Mukhtar, Sohaib, and S. Jusoh. "Review of Trademark and Its Enforcement Procedures of Pakistan under TRIPS and Paris Convention." *Economics, Law and Policy* 1, no. 122 (2018): 10-22158.

[3] Mukhtar, Sohaib, Zainol Zinatul Ashiqin, and Jusoh Sufian. "Administrative Procedure of Trademark Enforcement in Pakistan: A Comparative Analysis with Malaysia and USA. Economics." *Law and Policy* 2 (2019): 113-128.

performance, speed and efficiency. Narrow AI is made to do specific tasks, like driving a car, doing online searches, or recognizing faces. This includes the majority of AI systems in use today, including those that are effective at complicated board games like Chess. General AI is a kind of AI that has extensive cognitive abilities similar to those of humans allowing it to work independently on novel and unfamiliar tasks. It applies its knowledge to solve any problem without any human intervention. Limited Memory is by examining the historical data that they have gathered, these AI systems are able to make better and more educated decisions. The majority of AI applications in use today, including self-driving cars and virtual assistants, fit under this category. Artificial Intelligence has a significant impact on the landscape of IP. AI has expanded its capabilities beyond gaming and research to include a wide range of fundamental tasks that were previously limited to human performance. AI is handling jobs that formerly needed to be completed by highly qualified experts. As AI is essentially a support technology that can simplify a wide range of education and problem-solving activities. One of the AI is that vehicles can drive autonomously without the need for human assistance thanks to their sophisticated sensors and AI systems. This has the potential to significantly increase road safety in addition to altering the way we travel. As a result, when AI is introduced into an innovation setting, it may affect the way innovation decisions are made, particularly with regard to the way novel concepts are created and validated resulting in an expansion of IP assets' variety and quantity.[4]

The copyright context has undergone major changes as a result of AI development, including art, music, literature, software, among others. As a result of AI, creativity has reached a new level, which has stimulated the creation of novelties and new technological solutions in different industries. Additionally, AI technologies have transformed IP protection and enforcement with new capabilities, empowering companies with additional techniques to protect and secure precious assets. More and more companies apply AI-based IP solutions, such as patent engine analysis, trademark monitoring, Algorithms analyze massive datasets, detect copyright violations, and support the enforcement process. AI has also provided companies with new opportunities to secure their IP assets, specifically due to the possibility of patenting AI algorithms, models, or datasets. These kinds of technologies are a great addition to human counselors, but they cannot yet completely replace them. Understanding how AI affects IP rights holders is still an ongoing process. But it's certain that as AI technology develops and becomes more extensively applied, companies who handle IP rights early on will be in a better position to benefit from AI-generated content while lowering its possible hazards. The application and execution of patent applications that the office of IP receives each year might be made easier by AI technologies. The intention is to shorten the duration and expense of previous-art searches and due diligence, which will enhance the caliber of the inspection process. AI helps innovators and creators to find out the previous ideas or work so that their work does not violate any IP right.[5]

Block chain is a reorganized way to record any kind of data in an unchangeable, continually secured ledger. This includes, but is not limited to, financial transactions and dispositions of assets. Block chain is a unique kind of database that is difficult to hack or change block chain technology has broad applications across a range of industries and legal domains, such as IP

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[4] Ng, Davy Tsz Kit, Min Lee, Roy Jun Yi Tan, Xiao Hu, J. Stephen Downie, and Samuel Kai Wah Chu. "A Review of AI Teaching and Learning from 2000 to 2020." *Education and Information Technologies* 28, no. 7 (2023): 8445-8501.

[5] Picht, Peter Georg, and Florent Thouvenin. "AI and IP: Theory to Policy and Back Again–Policy and Research Recommendations at the Intersection of Artificial Intelligence and Intellectual Property." *IIC-International Review of Intellectual Property and Competition Law* 54, no. 6 (2023): 916-940.

law. Block chain may have an effect on IP rights registration, administration, and enforcement. Block chain registries may be used to find and send synchronized, automated, coded information on any property in addition to being used for storage. It is also eaten and utilized extensively. Participants authorized may join the block chain and transact with other participants in the network, usually corporate users. Regulators are block chain users who possess specific authorization to monitor network transactions. Operators of block chain networks are people with specific power and authorization to design, develop, oversee, and maintain the block chain network. The administration, protection, enforcement, and commercialization of IP have never been more difficult or crucial in today's increasingly interconnected, globalized, and digital world. The distributed ledger technology that powers block chain has the ability to completely change how IP is handled, safeguarded, and made money.[6]

The decentralized, transparent, and impenetrable nature of block chain technology makes it ideal for documenting and confirming IP rights. Every file has a distinct fingerprint because block chain preserves an irreversible record of IP ownership variations and transfers through its decentralized database. IP audits and proof of usage in legal disputes can be greatly improved by this unchangeable record of occurrences throughout the lifespan of a registered IP right. Block chain technology's unchangeable record makes it a potent instrument for managing IP rights, including the processing of patent data. Additionally, block chain offers solid proof for unregistered IP rights by time-stamping original designs or works, which is essential for proving ownership and resolving disputes. The unchangeable record created by block chain technology is a strong tool for managing IP rights, including patent information. Block chain contributes to a decrease in piracy and counterfeiting by establishing distinct digital fingerprints for material that enable tracking and verification, creating a block chain-based IP market place that enables thorough IP registrations, trades, and transactions. As a result, the time and expenses involved in confirming ownership and transferring IP rights are decreased, which helps to expedite the procedures involved in IP protection, IP licensing, and IP registration administration.[7]

By enabling safe, transparent transactions on a single platform, block chain technology fosters confidence and transparency among IP stakeholders. It allow the transactions to be traced and made public, giving all parties involved consistent access to information. Block chain technology is an effective tool for managing IP rights because it fosters more trust and collaboration. The effect of AI on IP is profound and diverse as AI also helps to evaluate the value of IP by analyzing large amounts of data, and Information. Block chain is one such novel technology that can help preserve IP. According to the findings of the study, Block chain has enormous potential to suit the demands of today's IP offices worldwide. The more quickly IP offices integrate this technology into their day-to-day operations, the better the outcomes in terms of more rapid evaluation, dependable record keeping, smart licensing, and contract agreements.[8]

2. Challenges Posed by Emerging Technologies to Intellectual Property

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[6] Wang, Junyao, Shenling Wang, Junqi Guo, Yanchang Du, Shaochi Cheng, and Xiangyang Li. "A Summary of Research on Blockchain in the Field of Intellectual Property." *Procedia Computer Science* 147 (2019): 191-197.

[7] Song, Hongyu, Nafei Zhu, Ruixin Xue, Jingsha He, Kun Zhang, and Jianyu Wang. "Proof-of-Contribution Consensus Mechanism for Block Chain and Its Application in Intellectual Property Protection." *Information Processing & Management* 58, no. 3 (2021): 102507.

[8] Liang, Huan-Wei, Yuan-Chia Chu, and Tsung-Hsien Han. "Fortifying Health Care Intellectual Property Transactions with Block Chain." *Journal of Medical Internet Research* 25 (2023): e44578.

This research examines the particular challenges or difficulties that Intellectual Property (IP) system faces as a result of Artificial Intelligence (AI) advancements concentrating on copyrights, trademarks, patents, and trade secrets. The area of legislation around the connection of AI and IP rights is complex and constantly changing, with significant legal and philosophical issues arising. A I generated products and innovations are now subject to IP laws that are intended to safeguard human ingenuity and creativity. This calls into question the notion of ownership and the inventor ship in the era of AI, trademarks, patents, copyrights, and trade secrets. Regarding copyrights, the issue is whether AI-generated works, such as literary and artistic creations, may be safeguarded and, if so, by whom. Regarding patents, the discussion focuses on whether AI is capable of being considered an inventor and how AI-generated innovations fit into traditional definitions of originality and non-obviousness. As AI systems start to generate and utilize brand names and logos on their own, trademarks also confront new difficulties. The importance of AI in imaginative thinking and creative thinking has been recognized across the world. AI has a crucial role to play, particularly in patents, copyright, designs, and trade secrets, among other sorts of IP rights.[9]

AI has raised severe issues and challenges in the field of IP rights, notably in copyright law. AI-generated artworks, including works of art, music compositions, and literary writings, challenge the core concept of authorship. In the past, the person or programmer who produced the original work was awarded copyright. Nevertheless, given AI's growing complexity, we now confront the difficult topic of whose copyright should be applied to works created by intelligent computers that resemble humans. There is discussion on whether copyright should be awarded to the programmers who designed AI or to the technologies themselves when they are able to produce creative works without the need for human intervention. The major problem is who owns copyright for AI-generated works, the AI, the programmer, or the user who commissioned it. AI has the ability to provide significant work with minimal effort in a short period of time. AI-created works might be eligible for protection under copyright in all jurisdictions due to their originality. The code and parameters used by AI to compile and produce work may satisfy the requirement.[10]

One of the challenges posed by AI-generated works includes the ambiguity of ownership. AI-generated works raise questions about who may be deemed an author. Who provides data into the AI? The programmer, user, or the AI by itself? This topic challenges established ideas of creativity and originality. If AI cannot lawfully own copyright, identifying the proper owner becomes challenging. AI has advanced to the point where humans can use it to create images and music. The question of whether AI may be subject to copyright law is gaining attention. The present dispute is regarding the judgment order for object element and the subject element. Some experts argue that in Copyright Law, the object element must remain separate from the subject element. This means that whether or not a work is original should not be based on whether the author is a person or a computer. Considering AI as the creator of the AI generated work can cause various concerns. AI may not produce perfect results. AI may utilize biased and poisonous language, perhaps causing defamation or inciting violence based on caste, creed, or religion.[11]

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[9] Bader, Martin A., and Christian Stummeyer. "The Role of Innovation and IP in AI-based Business Models." *Digital Entrepreneurship: Interfaces Between Digital Technologies and Entrepreneurship* (2019): 23-56.

[10] Selvadurai, Niloufer, and Rita Matulionyte. "Reconsidering Creativity: Copyright Protection for Works Generated Using Artificial Intelligence." *Journal of Intellectual Property Law & Practice* 15, no. 7 (2020): 536-543.

[11] Gaffar, Hafiz, and Saleh Albarashdi. "Copyright Protection for AI-generated Works: Exploring Originality and Ownership in a Digital Landscape." *Asian Journal of International Law* 15, no. 1 (2025): 23-46.

Produce any other undesirable outcome. As AI is not recognized as a person, determining its legal and criminal accountability may be challenging. While such material may eventually be erased or AI software prohibited, it might be too late to prevent irreversible damage, so it further complicates the copyright enforcement due to lack of certainty about the creator or author. Another perplexing question will be over the title AI-generated works. AI does not die in the same way that humans do. Some claim that the term can be counted from publication for 50 or 60 years, depending on the country's legislation. Copyright protection for AI-generated works is questioned due to the fact that humans are mortal and suffer exhaustion throughout their job. Human authors generate finite works that are protected by copyright for their lifetime. The use of copyright can be justified as a way to reward their efforts while AI is immortal, fatigue-free, and can create unlimited masterpieces.[12]

In 2018 case law titled Naruto v. Slater the question of whether a selfie shot by Naruto the monkey may be covered by copyright was discussed. Although the owner of the camera who leased the gadgets to the monkey alleged copyright in the pictures, other parties contended that only works made by humans were eligible for copyright protection. The outcome of the case in which human hands did not create the product. In controlling IP in the digital and AI era, the Court determined that a monkey named Naruto was unable to copyright the photos taken by him since he was not human. The case of Naruto v. Slater highlights the difficulty of establishing ownership or copyright when the work was not created by a person. This is one example of how technological advancements and advances with regard to copyright have raised new questions requiring further legal clarification.[13]

It is critical that the legal system must has to create precise copyright laws and rules in the AI era to prevent future uncertainty and conflicts. This will guarantee the recognition and granting of copyright equitably, developing a system that is in line with these technical advancements without jeopardizing the rights of human creativity or the equity of copyright recognition. AI has advanced significantly in recent years, becoming an increasingly crucial component of many businesses, including those in the legal and patent fields. However, with the rapid advancement of AI technology new challenges to the patentability of innovations are generated by AI. One of the most significant barriers to a patent of AI-generated ideas is the problem of inventor ship. Traditional patent law requires that an innovation be ascribed to a human inventor. Machines lack the legal status to own patent rights. Furthermore, AI machines do not possess the capability to exercise patent rights independently. Granting inventor status to AI would fail to incentivize the machine since they lack emotions and desires. Instead, it emphasizes the need for human ownership. This raises the question of who should be identified as the inventor on an application for patents and who ought to be held accountable in the case of patent infringement. Machines do not have the legal standing to hold patent rights. Furthermore, AI robots lack the ability to use their patent rights autonomously. Giving AI inventor title would not encourage the computer since it lacks feelings and wants. Instead, it emphasizes the importance of personal ownership.[14]

Another obstacle is the question of uniqueness. To be eligible for patenting, an invention has to be both innovative and non-obvious. In the context of AI-generated inventions, it might be difficult to assess whether or not the invention is actually innovative and non-obvious

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[12] Salami, Emmanuel. "AI-generated Works and Copyright Law: Towards a Union of Strange Bedfellows." *Journal of Intellectual Property Law & Practice* 16, no. 2 (2021): 124-135.

[13] Hooker, Matthew P. "Naruto v. Slater: One Small Snap for a Monkey, One Giant Lawsuit for Animal-Kind." *Wake Forest L. Rev. Online* 10 (2020): 15.

[14] Burk, Dan L. "AI Patents and the Self-Assembling Machine." *Minnesota Law Review Headnotes.* 105 (2020): 301.

because the AI system could have been based on previous data and merely merged or recombined previous concepts in a different way. This raises the question of how much originality is necessary for AI-generated discoveries to be patented. Furthermore, the question of originality poses a hurdle to the patent of AI-derived ideas. Traditional patent law requires that an invention be the outcome of human creativity. However, in cases involving AI-generated breakthroughs, it can be challenging to identify whether the discovery is actually an outcome of human ingenuity, because the AI system, may have invented the idea totally on itself, with no human input or guidance. The fast development of AI systems has raised questions regarding liability in patent infringement cases. AI can create inventions that infringe on current patents. Determining accountability in such circumstances can be difficult, as the obligation may eventually lie on the AI's owner.[15]

In conclusion, the fast growth of AI technology raises new and difficult questions about the patent of AI-generated discoveries. As AI plays a growing role in the invention process, the legal and patent sectors must adapt to new difficulties and discover effective strategies to protect AI- generated ideas. Companies should remain current on advances in this field and engage with patent specialists to guarantee that their AI-generated discoveries are appropriately protected. AI undermines trademark rights by raising problems about responsibility, data privacy, and possible legal personality, all of which have an influence on legislation and decision-making processes. In circumstances when AI is employed to establish a trademark, the issue of ownership may emerge. Trademarks created by the AI include different sources which make it complex for determining the ownership. Furthermore, AI-generated material creates difficult problems about ownership and infringement of IP rights, as shown in legal case law like Getty Images, INC. v. Stability AI, INC.[16]

In the Case Law Getty Images INC. vs. Stability AI, Getty Images has filed a claim against Stability AI, the business that created the widely used picture creation algorithm named Stable Diffusion. The major complaint against Getty Images is on the unauthorized exploitation of their IP. They claim that Stability AI, when developing its picture generating model, integrated over 12 million photographs and related information without obtaining permission from Getty photographs or offering any remuneration. As a result, Getty Images believes that Stability AI has established itself as an immediate competitor in the field of creative images. Furthermore, they've noted that such AI-generated photographs frequently have modified versions of the Getty photographs watermark. This has had the negative impact of ruining Getty Images' reputation, which they see as a major concern. This case focuses on the infringement of Getty Images' trademark logo as a result of the unauthorized use of their watermark and highlights the rising issues given by AI with regard to trademark rights. The rise of AI poses various issues to trademark law, notably in the areas of online protection of brands and content production. Trademark law is dealing with challenges including the use of AI in website names conflicts, the spread of fake products on e-commerce platforms.[17]

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[15] Vertinsky, Liza. "Thinking Machines and Patent Law." In *Research Handbook on the Law of Artificial Intelligence*, pp. 489-510. Edward Elgar Publishing, 2018.

[16] Kim, Jieun, Buyong Jeong, Daejung Kim, Jieun Kim, Buyong Jeong, and Daejung Kim. "Is Trademark the First Sparring Partner of AI?" *Patent Analytics: Transforming IP Strategy into Intelligence* (2021): 175-186.

[17] Coulter, Matthew. "Aiming for Fairness: An Exploration into Getty Images v. Stability AI and Its Importance in the Landscape of Modern Copyright Law." *DePaul Journal of Art Technology & Intellectual Property Law.* 34 (2024): 124.

AI also presents several challenges to the protection of trade secrets. There are chances of leaking of trade secrets by the advanced analysis of data by AI which can cause loss to the owner of trade secrets. The disclosure of a trade secret might result in the information or data being public or no longer being protected. When a trade secret is revealed, it can have grave consequences for a company. The immediate outcome is loss of protection, which puts critical information at danger. AI systems can be vulnerable to cyber-attacks, potentially exposing trade secrets to unauthorized parties. Overall, the application of AI the trademark continues to evolve, it has become clear that any AI-generated trademarks must fulfill the same legal standards as established by humans in order to be capable of protection under IP law. The rapidly evolving AI landscape often causes difficulties in the legal frameworks, leaving trademarks and trade secrets protection uncertain. Legal issues are about the rules and regulations around us that protect things like creation, inventions, and ideas. With the rise of AI, new questions arise about who owns what. For example, when an AI system creates a piece of music or art, who can say that it belongs to it? These are the legal challenges posed by AI on IP rights protection because our laws are made for people, not for machines. For IP rights, rights such as confidentiality and integrity need to be taken into account. For example, AI often uses a lot of data to learn and make decisions, but there are very strict rules about how the data is used, especially when it is private information. There is lack of regulation rules that are set by the government and organizations to ensure everything is fair and safe in the context of AI. Therefore, regulations need to be made to ensure the responsible and ethical use of AI.[18]

There are several challenges posed by block chain in the management of IP. First of all authenticity problems arose by using block chain-based IP management because these techniques turn IP information into hashes or codes, which are then recorded in a distributed ledger as proof of existence. However, the 'garbage in, garbage out' problem, which occurs when wrong information is input, makes it impossible to ensure its legitimacy and it is difficult to guarantee its authenticity. This issue can be rectified by using a trusted third party (TTP) to verify the legitimacy of registered information. Until this issue is resolved, real activities will be confined to the public. This is comparable to an academic journal in that material is stored on a block chain, yet only approved editors are accountable for entry. However, relying on a third party goes against the idea of block chain in the management if IP which is directly managing the record without the involvement of any third party. If we suppose for the sake of argument that the authenticity problem has been overcome, but there is another challenge to verify the record of ownership history and its origin. Block chain cannot prevent or illegal replication outside the network. Physical assets, such as paintings, can be moved between owners without maintaining the ledger. If someone else gains access to the key, even for a temporary period. During that time, they might produce reproductions of the work of art without informing the rightful owner. Once IP addresses are transferred outside the network, the ledger entries no longer serve as a credible proof of ownership.[19]

The biggest barrier to widespread use of digital ledgers for managing IP rights is lack of awareness of its complicated procedures. So, only applications with simple and easy-to-use

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[18] Matulionyte, Rita, and Tatiana Aranovich. "Trade Secrets Versus the AI Explain ability Principle." In *Research Handbook on Intellectual Property and Artificial Intelligence*, pp. 405-422. Edward Elgar Publishing, 2022.

[19] Li, Nuo, Haiqiang Zhang, Rong Du, Shizhong Ai, Yang Zheng, and Cathal MacSwiney Brugha. "Blockchain Technology and Intellectual Property Protection: A Systematic Literature Review." *International Journal of Blockchains and Cryptocurrencies* 3, no. 2 (2022): 112-130.

are expected to be accepted and adopted in the near future. Furthermore, there are extremely unique technological obstacles that may prohibit the technique from being widely adopted. Using block chain technology for transactions, especially as a micropayment system, presents a considerable technological challenge because fast transaction processing is critical for managing IP rights. For example, if you're attempting to sell a digital artwork or license a piece of software, the transaction must happen swiftly but block chain transactions take longer to complete compared to traditional systems like VISA and PayPal. Block chain technology confronts various legal challenges as well. Identifying which nations' laws and regulations apply to a block chain application can be challenging due to its distributed nature. Therefore, Legal problems may hinder the development and acceptance of distributed ledger-based services.[20]

Due to the lack of regulations and standards by the government and organizations, IP is open to misuse and exploitation. Criminals can exploit this lack of control to violate IP rights, engage in illegal activities or misappropriate IP assets recorded on the block chain, causing financial harm and damage to IP. To solve these issues, legislators, legal experts, and others need to work together to create the right laws and standards to protect expert rights in the block chain ecosystem. The rise of AI and block chain presents difficult challenges for IP law. The IP system, which protects human intellectual achievements and encourages innovation, may face significant challenges with the rise of AI. Despite the immense potential of block chain technology, numerous obstacles prevent its application in a functional system. Practical problems still exist when adopting block chain for IP management. To understand the impact of AI and block chain on IP, its importance to analyze the issues they provide. Overall, AI and block chain technology add complexity to IP law, requiring legal adaption to control and IP in the digital era.[21]

3. **Role of Current Legal Framework in the Context of Rapid Technological Development to Protect Intellectual Property Rights in Pakistan**

Law and technology are compatible because when a new technology is developed, regulation ensures that it is protected as an Intellectual Property (IP) asset, and the law must be technologically flexible to provide further control. Artificial intelligence (AI) and block chain technologies are now influencing the IP landscape. For example, machine learning is increasingly often utilized in trademark and patent searches in IP databases. Machine learning applications in several IP sectors, such as patent tracking, copyright evaluation, and trademark comparisons, are becoming increasingly common. AI is increasingly being used to create objects of IP rights in the modern era. It is critical to evaluate the role of International Legal and National Law in controlling the use of AI and block chain with regard to IP. A nation cannot grow in modern world unless its IP rights are protected. Internationally, IP rights are protected by a variety of general and particular covenants. According to Article 15(1)(c) of 'The International Covenant on Economic, Social, and Cultural Rights (ICESCR)', signatory nations acknowledge the right to "benefit from the protection of the moral and material interests resulting from any scientific, literary, or artistic production of which he is the author." The Universal Declaration of Human Rights 1948 (UDHR), which served as the conceptual underpinning for many subsequent international legal treaties, also establishes a framework for IP. Article 27(2) of the UDHR states that "Everyone has the right to the

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[20] Bonnet, Severin, and Frank Teuteberg. "Impact of Blockchain and Distributed Ledger Technology for the Management of the Intellectual Property Life Cycle: A Multiple Case Study Analysis." *Computers in Industry* 144 (2023): 103789.

[21] Chaudhary, Gyandeep, and Aditi Nidhi. "Artificial Intelligence and Blockchain: A Breakthrough Collaboration in IP Law." *Journal of Intellectual Property Rights (JIPR)* 28, no. 5 (2023): 383-391.

protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author". The right to privacy is recognized under Article 12 of UDHR.[22]

In the context of new technologies such as AI and block chain, protecting personal data, processing and sharing sensitive data is important. Strong privacy protection encourages innovation. There are several treaties, agreements and organizations that play a vital role in the protection of IP rights. Moreover each nation has its own set of laws to preserve IP rights. There are currently no laws controlling the use of block chain technology in IP. However, several nations are beginning to investigate and adapt current legal frameworks to accommodate block chain's distinct capabilities for IP administration and protection. Organizations such as the World Intellectual Property Organization (WIPO) are looking at block chain's opportunities for IP. WIPO has held debates and working groups to investigate the potential of block chain in improving global IP systems.[23]

The most significant human rights organization in Europe, the Council of Europe, is creating a legally enforceable framework for the creation, development, and use of AI systems. The goal of the AI Convention, also known as "The Convention on Artificial Intelligence, Human Rights, Democracy, and the Rule of Law" aims to protect human rights from the harmful impacts of AI. The AI Convention could be the World's initial International Agreement on AI that has real legal power. The AI Convention is not the first piece of legislation governing AI. The U.S. Federal Government has released a draft AI Bill of Rights, while the European Commission is working on an EU AI Act.[24]

WIPO is one of the specialized agencies of United Nations (UN) dedicated to IP rights, providing services, rules, and cooperation worldwide. Established in 1967, WIPO aims to promote creativity and ensure global protection for IP. On December 13, 2019, WIPO requested member states and other international entities to contribute to the development of guidelines to govern the use of AI in the IP system. WIPO plays important role in protection of rights in the era of emerging technology by conducting research, organizing seminars, and conferences related to the impact of AI and block chain in IP rights to increase awareness about the necessity of IP protection. WIPO studies technological developments in AI and block chain to detect new IP concerns and trends. Patent Cooperation Treaty (PCT) of WIPO and Madrid System that is managed by WIPO is an International Treaty that streamlines the process of registering trademarks and administer applications related to patents and trademarks across many jurisdictions, especially those involving AI and block chain technologies and brands.[25]

The TRIPS Agreement, which came into effect on January 1, 1995, is now the most comprehensive multinational agreement on IP worldwide. Objectives of the TRIPS Agreement includes the promotion of effective and appropriate IP rights protection, as well as the implementation of policies and processes to enforce IP rights. These objectives should be read in combination with Article 7. Article 7 of TRIPS says that protecting IP rights should help with things like making new technology, sharing technology, helping both creators and users understand tech, and improving society and the economy. It also talks about making

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[22] Plomer, Aurora. "IP Rights and Human Rights." *Thomas Paine and the Idea of Human Rights* (2021): 54.

[23] Alketbi, Saeed, and Massudi Bin Mahmuddin. "Intellectual Property Blockchain." In *2024 6th International Conference on Blockchain Computing and Applications (BCCA)*, pp. 372-376. IEEE, 2024.

[24] Van Kolfschooten, Hannah, and Carmel Shachar. "The Council of Europe's AI Convention (2023–2024): Promises and pitfalls for health protection." *Health Policy* 138 (2023): 104935.

[25] Mukhtar, Sohaib, Zinatul Ashiqin Zainol, and Sufian Jusoh. "Provisional Measures of Trademark Enforcement in Pakistan: A Comparative Analysis with Malaysia and USA." *Economics* 4, no. 1 (2021).

sure there's a fair balance between rights and responsibilities. Article 40 of TRIPS states that some licensing practices or restrictions that hinder competition can have a negative effect on technology development. Members can identify these activities in legislation and implement mechanisms to restrict or control them. Members have to communicate with other members if they suspect an IP right owner is breaking the law or rules. Member nations are empowered to take steps to prohibit or restrict abusive and anti-competitive licensing practices, ensuring that technology exchanges continue to promote open competition and technological development. This provision emphasizes the need of resolving technology-related practices that may obstruct the free flow of ideas and inventions, hence fostering an environment in which technological advancement may develop in a way that benefits society as whole.[26]

The Berne Convention, ratified in 1886, addresses the protection of publications and the legal rights of their creators. It gives artists such as authors, musicians, poets, and painters the ability to govern how their works are utilized, by whom, and on what circumstances. Some of the provisions of Berne Convention indirectly states the exclusive rights of permission for protected works, such as the right to reproduce, modify, perform, and create translations. These rights also extend to digital content, software, and other advancements in technology. Its concepts and rules help to encourage a creative and advanced environment in the digital era by maintaining a balance between the interest of public and right holder for the purpose of IP rights protection. The United Kingdom (UK) was the first to enact legislation particularly addressing computer technology. They did this in 1988 with the Copyright, Designs, and Patents Law. This legislation established what computer-generated works are. It said that if a computer makes anything without the assistance of a human, the person who configures the computer and accepts the liability of the work is regarded the creator. This applies to literature, music, drama, and other arts. In 2013, the British Government began preparing for AI development. They enacted regulations stating that AI inventions are protected by copyright for 50 years after they are created.[27]

The Government's 2023 white paper, 'A pro-innovation approach to AI regulation', outlines cross-sectorial guidelines for regulators to adopt such as Safety, security, and robustness, transparency, explanation, fairness, accountability and governance etc. The European Union's Parliament adopted the World's first comprehensive set of regulatory ground rules for AI known as AI Act on 13 March 2024. The EU AI Act, like the EU's General Data Protection Regulation (GDPR) in 2018, has the potential to become a worldwide norm, defining how much AI has good rather than negative impact on your life, regardless of where you are.[28]

The 1973 version of the US Copyright Office Workbook stated that copyright law only protects works made by natural persons. In a 1978 report by the Panel for the Application of Copyright in New Technologies (CONTU), the Copyright Office stated its position on computer-generated content, stating that there was not a requirement to change the current copyright system and that computer programs existed solely as tools to aid in creation. AI technologies that were not involved in the act's creation are not considered as a "work". The US has declined to recognize AI products in a report. In 2014, the United States Copyright Office Guideline of Practice stated that items created by computers during the calculating

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26 Mukhtar, Sohaib, Zinatul Ashiqin Zainol, and Sufian Jusoh. "Border Measures of Trademark Enforcement in Pakistan: A Comparative Analysis with Malaysia and USA." *Economics* 5, no. 2 (2022).

27 Abbott, Ryan. "Artificial Intelligence, Big Data and Intellectual Property: Protecting Computer Generated Works in the United Kingdom." In *Research Handbook on Intellectual Property and Digital Technologies*, pp. 322-337. Edward Elgar Publishing, 2020.

28 Marchenko, Volodymyr, Alla Dombrovska, and Valerii Prodaivoda. "Comparative Analysis of Regulatory Acts of the EU Countries on the Protection of Intellectual Property in the Conditions of the Use of Artificial Intelligence." *Public Administration and Law Review* 3 (19) (2024): 44-66.

process should not be registered without the involvement and accountability of human authors. The United States presently lacks a legal framework for AI- generated material, and no relevant judicial practice case exists. In the United States, a 'Blueprint for an AI Bill of Rights' has been proposed. Currently, these non-binding recommendations attempt to address injustice, data privacy, and accountability.[29]

IP legislation supports economic development and expansion in Pakistan by promoting innovation and creativity. Pakistan, like any other country, understands the value of IP rights in promoting innovation, creativity, and economic success. The country's legal framework for safeguarding IP rights is well-established, including Trade Marks Ordinance 2001, Patents Ordinance 2000, Copyrights Ordinance 1962, and Intellectual Property Organization of Pakistan Act 2012. These laws safeguard a variety of rights related to IP, such as trademarks, copyrights, and patents. Intellectual Property Organization of Pakistan Act 2012, governs Pakistan's IP law and protects patents, trademarks, and copyrights. Legislation creates the Intellectual Property Organization of Pakistan (IPO-Pakistan), which is in charge of registering and enforcing IP rights. Pakistan has laws for controlling patents, trademarks, and copyrights, but none exist for the emerging technologies such as AI and block chain.[30]

However, for a comprehensive examination, there are certain loopholes that must be filled such as Pakistan's unclear laws governing the protection of AI-generated material, it is unclear whether AI-generated material falls within the category of "literary, artistic, musical, or cinematographic works," as defined under Copyright Ordinance 1962. There is a lack of authoritative interpretations and case laws, leaving creators and users in the dark. The issue that requires more research is how to interpret or change present copyright rules to expressly target work made by AI. Disregarding social and ethical aspects, the research gap fails to address ethical concerns such as ownership, creativity, and potential biases in AI-generated content. The Pakistani environment has yet to address the societal consequences of widespread AI content creation, such as employment displacement or cultural impacts. Challenges in addressing IP rights to effectively protect IP rights related to emerging technology in Pakistan, major challenges include a lack of effective enforcement mechanisms, coordination and cooperation between government and law enforcement agencies, public awareness and education, and limited resources and capacity building for law enforcement and the judiciary. Pakistan has adopted and revised IP legislation to ensure that its legal system complies with international requirements stated in the TRIPS Agreement. Despite these efforts, Pakistan's infrastructure continues to face issues from the development of technologies. Pakistan has a low level of IP protection, and many artists and innovators have difficulties in defending their rights. A major obstacle is the public's and artists' lack of understanding and grasp of IP rights. The country's weak legal system and insufficient resources for enforcing IP rights also provide substantial challenges.[31]

IP rights are frequently violated, with numerous examples of infringement, piracy, and unauthorized use of private technology. One possible explanation is that existing statutory gaps have been exacerbated by a lack of regulatory monitoring, law enforcement, and lenient

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[29] Boyden, Bruce E. "Generative AI and IP under US Law." *Marquette Law School Legal Studies Paper* 24-09 (2024).

[30] Anwar, Ayesha, and Rasidah Mohd-Rashid. "Moderating Effect of Investor Demand: Privatized IPOs and Flipping Activity in the Pakistan IPO Market." *Pacific Accounting Review* 33, no. 3 (2021): 347-360.

[31] Zaman, Sohaib Uz, Hafiz Abdul Basit Bin Nadeem, and Syed Hasnain Alam. "Challenges and Opportunities of Intellectual Property Rights Protection in Pakistan." *Journal of Business and Management Research* 4, no. 2 (2025): 27-53.

punishments. Furthermore, current fines and punishments are insufficient to deter illegal action. In compared to the vast pirate sector, the fines levied on the offenders are rather low. For example, a person charged with such an infraction may face a maximum term of three years in jail and a fine of five thousand rupees. In contrast, the execution of legislation is incompetent, and the litigation process is costly and time consuming. This research also advises that Government of Pakistan collaborate with foreign organizations to combat piracy. Intellectual Property Organization of Pakistan (IPO-Pakistan) plays an important role in the implementation and enforcement of IP laws in Pakistan. According to Section 13(xvii) of the IPO Pakistan Act 2012, IPO-Pakistan is responsible for proposing and introducing enactments and modifications to safeguard IP laws in Pakistan. However, it appears that IPO-Pakistan fails to meet its legal responsibilities as not much efforts are not made by IPO-Pakistan in protection of IP rights with regard to AI and Block chain. According to Section 13 (xviii) of the Intellectual Property Organization of Pakistan Act 2012, it is IPO Pakistan's obligation to safeguard and implement IP rights. IPO-Pakistan is also responsible to gather data and information on cases of IP rights implementation. In this context, no comprehensive data on IP rights infringements such as counterfeiting and piracy is available. On IPO-Pakistan website imprecise date is supplied, making it impossible to identify and evaluate the true condition of counterfeiting and piracy offenses.[32]

Each nation has its own set of laws to preserve IP rights, but the basic principle remains the same, no one should claim ownership of something they did not create for the protection of IP rights in this era of emerging technologies. A strong IP system needs traceable, immutable, and accountable records of IP rights. Legal and regulatory challenges of emerging technologies have led to a growing need to improve IP laws. Moreover, it is clear that the importance of IP is continuously overlooked in Pakistan and there is lack of legislation in Pakistan to address issues related to AI and block chain. As the realm of AI generated material expands, Pakistan's legal system faces both potential and difficulties. As technology advances, authorities may consider amending current laws or introducing new legislation to meet developing concerns and possibilities in the digital realm.

Conclusion and Recommendations

The impact of AI on IP is extensive and broad, since it aids in determining the value of IP through the analysis of enormous volumes of data and information. Block chain is one example of new technology that might assist protect IP. According to the study's results, block chain has immense potential to meet the needs of today's global IP offices. The sooner IP offices incorporate this technology into their day-to-day operations, the better the results in terms of faster evaluation, trustworthy record keeping, smart authorization, and contract agreements. The emergence of AI and block chain poses serious challenges to IP law. The IP system, which secures human intellectual achievements and promotes innovation, may confront serious problems as artificial intelligence advances. Despite the enormous promise of block chain technology, various barriers prohibit its implementation in a working system. Practical issues persist when using block chain for IP management. To comprehend the influence of AI and block chain on IP, it is necessary to examine the difficulties they raise. Overall, AI and block chain technologies complicate IP law, necessitating legal adaptations to regulate and protect IP in the age of technology.

The legal and regulatory problems of developing technology have resulted in an increased need to update IP laws. Furthermore, it is obvious that the value of IP is consistently

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[32] Soomro, Abdul Salam, Muhammad Zakir Shah, Muhammad Hassan Sajjad, and Sadia Fatima. "An Evaluation of Legal Gaps Regarding the Artificial Intelligence and Copyright Infringement in the Context of Pakistan." *Indus Journal of Social Sciences* 2, no. 2 (2024): 592-601.

disregarded in Pakistan, and there is a lack of laws in place to handle AI and block chain challenges. As the field of AI generated content grows, Pakistan's legal system faces both opportunities and challenges. As technology progresses, authorities may consider changing existing laws or enacting new legislation to address emerging challenges and opportunities in the world of technology.

It is recommended that Legislators should design IP laws that can adapt and respond to the fast rate of technology progress. This includes incorporating provisions related to AI-generated works, and block chain technology in the legal framework for the protection of IP in this age of technology. For example, legislators can draft a separate act titled as "The Intellectual Property (AI and Block Chain) Act" which aims to modernize Pakistan's IP laws to address the unique challenges and opportunities presented by AI and block chain technology. Main provisions of the proposed Act includes recognizing AI-generated works as eligible for copyright protection, with authorship attributed to AI system's owner at the time of creation. It also establishes clear jurisdictional guidelines and dispute resolution mechanisms for cross-border block chain transactions.

Develop clear guidelines and legal frameworks regarding the ownership and protection of AI-generated works. This includes determining whether AI can be recognized as an author or inventor and how IP rights are allocated for AI-assisted creations. There must be Modernize patent and trademark examination procedures to account for the complexities introduced by emerging technologies. This may involve training examiners in new technological domains and integrating AI tools to assist in the examination process. Further efforts should be made to develop worldwide standards and harmonize IP legislation in order to create a uniform framework that encourages global innovation. The increasing link between technology and IP right emphasizes the significance of global collaboration and standardization. As developing technologies cross geographical boundaries, a coordinated worldwide strategy becomes necessary. The findings emphasize the importance of education and knowledge in negotiating the complexities of technology and IP.

It is therefore recommended to conduct educational programs for innovators, artists, policy makers and legal professionals about the benefits and complexities of using the regulatory body IPO-Pakistan must propose enactments and modifications to establish a strong legal basis for using AI and block chain in IP management and enforcement by creating a dedicated advisory committee comprising AI experts, legal professionals, and industry representatives to provide insights and recommendations on managing AI-related IP issues.

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