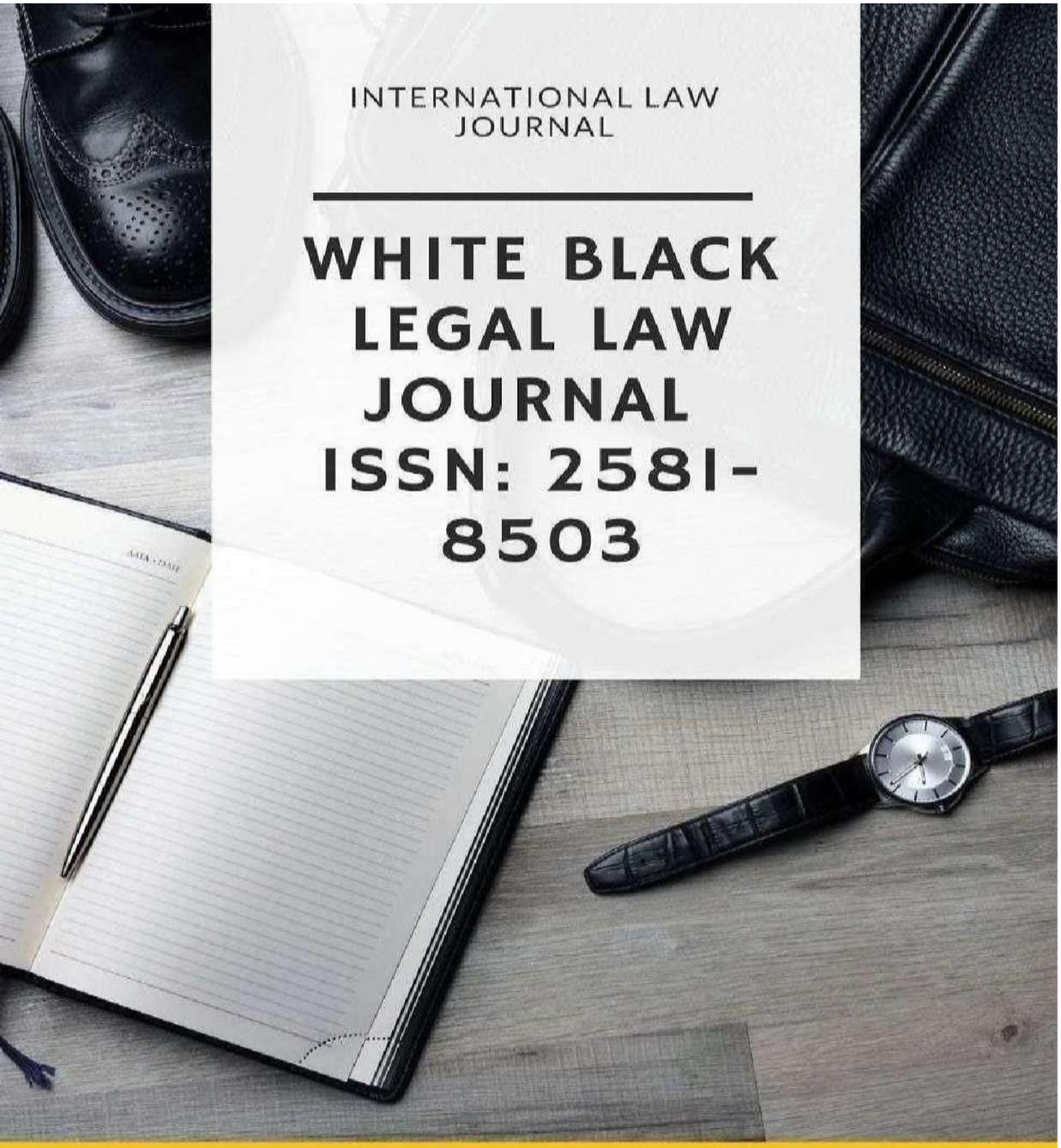

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``THE IMPACT OF ARTIFICIAL INTELLIGENCE IN INTELLECTUAL PROPERTY RIGHTS. ``

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ABSTRACT

This research paper examines and outlines the growing tensions in India between copyright enforcement and continuous avoidance of IPR laws with respect to artificial intelligence.

KEY FINDINGS -

1. **Traditonal IPR laws are no longer enough to sustain the growing demands of IPR and other intellectual rights.**
2. **The ideas of 'author' and 'inventor' is changing**

Since AI can can create things on its own, it becomes unclear who shoukd be called the author or inventor, which creates confusion about ownership.

3. **Different countries are handling things differently**

There is no uniform approach—countries interpret and apply IPR laws in different ways, which leads to confusion and uncertainity.

4, IPR is becoming more flexible over time

Even with all the confusion, intellectual property has become a very important business asset, especially in AI.

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CHAPTER 1 INTRODUCTION

1.1. Background and Context: IPR in the Age of Disruption

Intellectual Property Rights (IPR) have historically functioned as a central mechanism for fostering innovation, creativity, and economic development. The classical justification for IPR is deeply rooted in utilitarian philosophy, which emphasizes the maximization of overall social welfare. According to this approach, granting exclusive rights to creators and inventors serves as an incentive for the production of knowledge, inventions, and artistic works that benefit society at large.[1] The underlying premise is that without such legal protection, individuals and firms would lack sufficient motivation to invest time, resources, and intellectual effort into creating new products or ideas, as others could freely copy and exploit their work without compensation.

The utilitarian framework further supports the notion of a temporary monopoly. By granting exclusive rights for a limited period, the law seeks to strike a balance between private reward and public benefit.[2] During the term of protection, the rights holder can control the use and commercialization of the invention or work, thereby recouping their investment. After the expiration of this period, the work enters the public domain, allowing unrestricted access and use by society. This dual objective encouraging innovation while ultimately promoting dissemination has been a defining feature of IPR systems across jurisdictions.

The historical development of IPR reflects its enduring importance. The origins of modern intellectual property law can be traced back to early English statutes, notably the Statute of Monopolies 1624 and the Statute of Anne 1710.[3] The former laid the foundation for patent law by restricting the Crown's power to grant monopolies and establishing the principle that patents should be awarded only for genuine inventions. The latter, often regarded as the first copyright

[1] William M. Landes & Richard A. Posner, *The Economic Structure of Intellectual Property Law* (Harvard University Press, 2003).

[2] Jeremy Bentham, *A Manual of Political Economy* (1795).

[3] Statute of Monopolies 1624 (UK); Statute of Anne 1710 (UK).

statute, recognized the rights of authors over their literary works. Over time, these national frameworks evolved into a complex international system, culminating in agreements such as the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which harmonizes IPR standards across member states and integrates them into the global trade regime.

Despite its evolution, IPR law has traditionally been built upon certain foundational assumptions. Patent law, for instance, has long presumed that an inventor is a natural person a human being who conceives an invention and is named in the patent application.[4] This assumption reflects the historical context in which inventions were the product of individual ingenuity and manual experimentation. Similarly, copyright law is premised on the existence of an author who exercises original, creative expression.[5] The requirement of originality implies a degree of human creativity, judgment, and intellectual effort, which distinguishes protected works from mere facts or mechanical reproductions.

These assumptions collectively form what may be described as the "traditional paradigm" of IPR. This paradigm is characterized by its human-centric orientation, wherein rights are granted to individuals or entities based on human creativity and labor. It is also grounded in the protection of tangible or clearly defined subject matter, such as machines, chemical compositions, literary works, and artistic expressions. The legal framework was thus designed to address the needs of an industrial economy, where innovation was largely incremental and attributable to identifiable human actors.

However, the rapid advancement of technology in the modern era has significantly challenged these foundational assumptions. Two domains in particular Artificial Intelligence (AI) and biotechnology have introduced complexities that strain the traditional IPR framework. AI systems, especially those based on machine learning and deep learning, are now capable of generating outputs that resemble human creativity and invention. These systems can compose music, write articles, create visual art, and even design new products or chemical compounds.[6]

[4] Patent Act, 1970 (India); see also TRIPS Agreement, Article 27.

[5] Copyright Act, 1957 (India), Section 13.

[6] Ryan Abbott, "I Think, Therefore I Invent: Creative Computers and the Future of Patent Law," (2016) 57 B.C. L. Rev. 1079.

Unlike traditional tools, AI operates with a degree of autonomy, often producing results that are not directly attributable to a specific human author or inventor.

Generative AI models, such as GPT-4, DALL·E, and DeepMind's AlphaFold, exemplify this shift.[7] These systems can produce sophisticated outputs that, if created by humans, would likely qualify for copyright or patent protection. For example, AI-generated artworks may exhibit originality and aesthetic value, while AI-designed molecules may meet the criteria of novelty and inventive step required for patentability. This raises fundamental legal questions: Can an AI system be recognized as an author or inventor? If not, who should be granted ownership of the resulting work or invention the programmer, the user, or the entity that owns the AI system?

Current legal frameworks generally do not recognize AI as a legal person capable of holding rights. As a result, courts and policymakers have grappled with the challenge of attributing authorship and inventorship in cases involving AI-generated outputs. Some jurisdictions have adopted a conservative approach, requiring human involvement as a for protection. Others have begun to explore more flexible interpretations, acknowledging the role of AI while still grounding rights in human agency. The lack of uniformity across jurisdictions has led to legal uncertainty, which may hinder innovation and investment in AI technologies.

Biotechnology presents a different but equally complex set of challenges. Advances in this field have enabled scientists to manipulate genetic material, create genetically modified organisms, and develop novel medical therapies. The question of whether living organisms can be patented was addressed in the landmark case of Diamond v. Chakrabarty (1980), in which the United States Supreme Court held that a genetically modified bacterium was patentable subject matter.[8] The Court's statement that "anything under the sun that is made by man" is eligible for patent protection marked a significant expansion of the scope of patent law.

Subsequent developments in biotechnology have further tested the boundaries of patentability. Technologies such as CRISPR-Cas9 allow for precise editing of genetic sequences, raising

[7] WIPO, *WIPO Technology Trends: Artificial Intelligence* (2019).

[8] *Diamond v. Chakrabarty*, 447 U.S. 303 (1980).

ethical and legal questions about the ownership of life forms and genetic information.[9] The mapping of the human genome has also prompted debates about whether naturally occurring DNA sequences can be patented. These issues came to a head in the Myriad Genetics case, where the United States Supreme Court ruled that isolated DNA sequences that occur naturally are not patentable, although complementary DNA (cDNA), which is synthetically created, may be eligible for protection.[10]

The Myriad decision reflects a broader effort to recalibrate the boundaries of patent law in light of technological advancements. It underscores the tension between encouraging innovation and preventing the monopolization of fundamental scientific knowledge. Granting patents on basic building blocks of life could impede research and limit access to essential medical technologies, while denying protection altogether could reduce incentives for investment in biotechnology.

The relevance of IPR in the contemporary era is therefore subject to ongoing debate. On one hand, IPR remain critically important for promoting innovation, attracting investment, and facilitating international trade. They are integral to the business models of technology companies and play a key role in shaping national innovation policies. On the other hand, the traditional doctrinal tools of IPR law appear increasingly inadequate to address the complexities introduced by AI and biotechnology.

One of the key challenges is the risk of overprotection. Granting excessively broad rights could stifle follow-on innovation by restricting access to essential technologies and information. This is particularly concerning in fields such as AI and biotechnology, where progress often depends on cumulative research and collaboration. Conversely, insufficient protection could undermine incentives for innovation, particularly in industries that require substantial investment in research and development.

In response to these challenges, the IPR system is undergoing a process of transformation. This dissertation adopts a doctrinal approach to examine how the legal framework is adapting to the pressures of technological change. By analyzing developments in both AI and biotechnology, the

[9] Jennifer Doudna & Samuel Sternberg, *A Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution* (2017).

[10] *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).

study highlights the ways in which the IPR regime is evolving to accommodate new forms of innovation.

A central argument of this study is that the IPR system is transitioning from a static, rule-based framework to a more dynamic and adaptive regime. This shift is characterized by increased reliance on judicial interpretation, as courts play a crucial role in applying existing laws to novel situations. It is also marked by a growing recognition of the need to balance competing policy objectives, including innovation, competition, public health, and ethical considerations.

However, this transformation is not uniform across jurisdictions or technological domains. Different countries have adopted varying approaches to issues such as AI-generated works and biotechnological inventions, leading to a fragmentation of legal doctrine. This lack of harmonization poses challenges for global innovation, as businesses must navigate a complex and often inconsistent legal landscape.

Moreover, the intersection of IPR with broader policy concerns has become increasingly pronounced. Issues such as data privacy, algorithmic bias, access to medicines, and environmental sustainability are now integral to discussions about intellectual property. This reflects a shift from a purely economic perspective to a more holistic understanding of the role of IPR in society.

In conclusion, the traditional paradigm of intellectual property law, with its emphasis on human creativity and tangible subject matter, is being fundamentally reshaped by the rise of AI and biotechnology. While the core principles of IPR remain relevant, their application in the modern context requires careful reconsideration and adaptation. The challenge for policymakers and legal scholars is to develop a framework that continues to incentivize innovation while ensuring that the benefits of technological progress are shared broadly across society.

1.2. Statement of the Research Problem

The contemporary IPR system faces a fundamental tension. On the one hand, it is called upon to incentivise and protect innovation in cutting-edge technologies that promise immense social and economic benefits. On the other hand, its core doctrines such as the requirement of a human inventor in patent law and human author in copyright law were designed long before AI could autonomously generate inventions or works. Similarly, the patentability of life forms has been contested since *Chakrabarty*, yet the advent of CRISPR gene-editing and synthetic biology has intensified ethical and doctrinal debates.

Despite a growing body of scholarship, the legal response remains fragmented. Some jurisdictions, like the United States, have adopted a pragmatic, case-by-case approach, while others, like the European Union, have sought to embed ethical constraints into IPR frameworks.[13] International treaties, particularly the TRIPS Agreement, provide broad principles but leave ample room for national interpretation. The result is legal uncertainty for innovators and a risk that IPR may hinder rather than foster progress.

The research problem, therefore, is the absence of a coherent, doctrinally grounded understanding of how IPR's relevance is being reshaped by technological advances. This study addresses that gap by systematically analysing the impacts in two paradigmatic technological domains and synthesising findings to propose doctrinal reforms.

1.3. Research Questions

To guide the inquiry, the dissertation formulates the following research questions:

1. What are the foundational principles of the IPR regime, and how do they reflect a human-centric and tangible-oriented paradigm?
2. How does the emergence of autonomous AI challenge the doctrines of authorship, inventorship, and infringement in copyright and patent law?
3. How does modern biotechnology challenge the patentability criteria and ethical boundaries of IPR, particularly in relation to life forms, genetic material, and traditional knowledge?
4. What are the doctrinal responses to these challenges across key jurisdictions (USA, EU, and Asia-Pacific), and what patterns of convergence or divergence emerge?
5. What role do international treaties and institutions play in harmonising or fragmenting IPR in the face of technological disruption?
6. What doctrinal and policy reforms can reconcile the IPR regime with the realities of AI and biotechnology while preserving its underlying objectives?

1.4. Scope and Limitations

The study is **doctrinal** in nature, focusing on black-letter law, judicial decisions, legislative instruments, and treaty provisions. It does not include empirical research such as surveys or

interviews with practitioners, though it draws extensively on secondary empirical studies. The geographical scope is primarily the United States, the European Union (with emphasis on EPO practice), and selected Asia-Pacific jurisdictions (Australia, Japan, India) to provide comparative depth. The temporal scope spans from the emergence of modern IPR statutes to recent decisions in 2024.

The bifurcation into AI and biotechnology is deliberate but not exhaustive. Other emerging technologies, such as blockchain, quantum computing, or nanotechnology, are referenced only insofar as they intersect with the two core domains. Moreover, the study does not comprehensively address competition law aspects, such as antitrust implications of patent pools, except where they directly impact IPR relevance.

1.5. Significance of the Study

This dissertation contributes to legal scholarship in several ways. First, it offers a systematic doctrinal analysis of the two most challenging technological domains for IPR, providing a clear map of the legal landscape. Second, it synthesises comparative insights from multiple jurisdictions, revealing how different legal traditions and policy priorities shape outcomes. Third, it advances a coherent set of reform proposals grounded in doctrinal analysis rather than mere policy preference. Fourth, by framing the inquiry as a paradigm shift from static rules to adaptive governance, it provides a theoretical lens that can be applied to future technological challenges.

1.6. Definition of Key Terms

1.6.1. Intellectual Property Rights (IPR): The legal rights that result from intellectual activity in industrial, scientific, literary, and artistic fields. For this study, the focus is on copyright, patents, and trade secrets, as they are most implicated by AI and biotechnology.

1.6.2. Modern Era: The period from the early 2000s to the present, characterised by the widespread commercialisation and integration of AI and biotechnological innovations.

1.6.3. Technological Advances: Refers to Artificial Intelligence (including machine learning and generative AI) and Biotechnology (including genetic engineering, CRISPR, and synthetic biology).

1.6.4. Doctrinal Study: A legal research methodology that systematically analyses statutes, case law, and legal principles to understand, critique, and develop legal doctrine.

1.6.5. Bifurcation: The analytical separation of the study into two parallel but interconnected streams AI and biotechnology to allow in-depth examination of each before synthesising findings.

1.7. Methodology

The research adopts a **doctrinal methodology**, also known as black-letter law research.[14] This approach is appropriate because the study seeks to understand how the IPR regime as a body of formal rules is responding to technological change. Doctrinal analysis allows for the identification of legal inconsistencies, gaps, and emerging trends. It relies on primary sources (statutes, case law, treaties) and secondary sources (commentaries, scholarly articles) to interpret and critique the law.[15]

The study is **analytical** rather than purely descriptive. It does not merely summarise existing law but critically evaluates its coherence, effectiveness, and adaptability. It also employs **comparative** elements to contrast responses across jurisdictions, revealing how different legal cultures shape outcomes.[16] The bifurcated structure is maintained to ensure analytical depth.

Primary sources include: the US Patent and Copyright Acts, UK Patents Act 1977 and Copyright, Designs and Patents Act 1988, European Patent Convention, EU Directives on biotechnological inventions and trade secrets, Indian Patents Act 1970, Australian Patents Act 1990, and the TRIPS Agreement. Case law from the US Supreme Court, CAFC, UK Supreme Court, CJEU, EPO Boards of Appeal, High Court of Australia, and Federal Court of Australia is analysed.

Secondary sources include leading textbooks (e.g., Cornish, Llewelyn & Aplin; Bently & Sherman), peer-reviewed journals (*EIPR*, *IPQ*, *JIPLP*, *Harvard JLT*, *Berkeley Tech LJ*), and policy papers from WIPO, OECD, and national IP offices.

Data analysis proceeds in stages: detailed reading of primary sources to identify key doctrines; thematic analysis of case law to extract reasoning patterns; comparative synthesis to identify convergences and divergences.

1.8. Thesis Structure (Chapterisation)

The dissertation comprises seven chapters.

Chapter 1 introduces the background, research problem, questions, scope, significance, definitions, and methodology.

Chapter 2 lays the theoretical and historical foundations of IPR, establishing the pre-disruption paradigm.

Chapter 3 examines the impact of AI on IPR, focusing on copyright authorship, patent inventorship, and trade secret protection.

Chapter 4 analyses biotechnology's impact, covering patentability of life forms, ethical exclusions, and traditional knowledge.

Chapter 5 provides a comparative analysis of jurisdictional responses in the US, EU, and Asia-Pacific.

Chapter 6 explores the role of international law and the emerging paradigm of IPR as a strategic asset.

Chapter 7 concludes with findings, recommendations, contributions, and avenues for future research

CHAPTER 2

THE THEORETICAL AND HISTORICAL FOUNDATIONS OF IPR

2.1 Introduction

Intellectual Property Rights (IPR) serve as a crucial legal framework that incentivizes innovation, creativity, and cultural development. Rooted in complex philosophical reasoning and shaped by a long historical trajectory, IPR has evolved to accommodate the rapid pace of technological change. In particular, recent breakthroughs in artificial intelligence (AI) and biotechnology have posed significant challenges to traditional notions of authorship, ownership, and access, compelling a re-examination of the underlying principles that justify and structure these rights.

To fully grasp the implications of these developments, it is essential to understand the philosophical foundations that have historically supported IPR, how the legal regimes have evolved over time, and how new technologies are reshaping the landscape. This discussion explores four principal philosophical theories underpinning IPR utilitarianism, natural rights, personality, and social planning and traces the evolution of the legal framework from early origins to contemporary global agreements such as TRIPS. It also considers the pressing questions raised by AI and biotechnology, emphasizing the importance of a nuanced understanding of both philosophy and history in navigating current legal challenges.

The utilitarian perspective is among the most influential in justifying IPR. It posits that granting exclusive rights to creators and inventors leads to greater overall societal welfare. The core idea is that by providing inventors with temporary monopolies, society incentivizes innovation and creative effort, which ultimately results in increased economic productivity, technological progress, and cultural enrichment.

From this viewpoint, IPR acts as a reward mechanism encouraging individuals to invest time, effort, and resources into developing new ideas, knowing they will reap the benefits of their labor. The restriction of access for a limited period ensures that, after the expiration of rights,

knowledge and innovations become part of the public domain, fostering further progress. The utilitarian justification thus balances private gains with broader social benefits, aiming to maximize overall happiness and prosperity.

However, critics argue that excessive protection can hinder access to knowledge, create monopolistic practices, and stifle subsequent innovation. Therefore, the utilitarian approach emphasizes a careful calibration of the scope and duration of rights to optimize societal welfare.

The natural rights theory derives from moral philosophy, asserting that creators possess inherent rights over their intellectual outputs by virtue of their moral agency. This perspective aligns with broader ideas of individual autonomy and property rights, emphasizing that individuals have a moral claim to control and benefit from their creations, much like physical property.

According to this view, intellectual creations are extensions of a person's personality and labor; thus, denying creators control over their works is unjust. This theory underscores the moral obligation to recognize and protect the individual's moral and economic interests, framing IPR as a natural extension of personal rights.

In practice, this perspective supports strong protections for inventors and authors, emphasizing the importance of moral rights, such as attribution and integrity, which persist beyond economic considerations. Critics note, however, that natural rights alone do not specify the appropriate scope or duration of protections, necessitating additional frameworks for regulation.

The personality theory emphasizes that intellectual creations are expressions of an individual's personality, identity, and selfhood. Protecting such works is akin to safeguarding an extension of oneself, fostering personal dignity and autonomy.

This perspective posits that individuals have a fundamental interest in controlling how their creations are used and represented, reinforcing moral rights associated with attribution and integrity. It underscores the importance of recognizing the personal connection between creators and their works, promoting respect for individual agency.

However, the personality theory raises questions about the extent to which personal rights should be protected, especially when the work intersects with societal interests or commercial

considerations. It also highlights the importance of balancing individual expression with broader social benefits.

The social planning approach views IPR as a tool for achieving societal goals through deliberate planning and regulation. It considers intellectual property rights as instruments to shape innovation, cultural development, and economic growth in ways that align with collective interests. Under this framework, rights are granted not solely based on moral or utilitarian grounds but as part of a comprehensive strategy to promote social welfare, technological advancement, and cultural preservation. It emphasizes the role of governments and international bodies in designing policies that foster balanced and equitable development.

This theory supports flexible and adaptive legal regimes that respond to changing societal needs, such as emerging technologies. It also underscores the importance of international cooperation to establish coherent standards that facilitate global trade and innovation.

The origins of IPR can be traced back to medieval and early modern legal systems, where regulations sought to control the dissemination of knowledge and artistic works. The earliest formal protections emerged in Europe, notably through the Statute of Anne (1710) in England, which is often regarded as the first modern copyright law. This statute established the concept of authorial rights, recognizing authors' moral and economic interests and setting a limited duration for protections.

Intellectual property rights initially focused on copyright and patents, primarily aimed at incentivizing the dissemination of literature, art, and technological innovations. These rights were predominantly national in scope, reflecting the sovereignty of individual states.

The 19th century witnessed significant expansion and formalization of IPR, driven by industrialization, technological progress, and increased international trade. Countries began to establish more comprehensive legal frameworks, often inspired by British and French models, to protect inventors, authors, and artists.

International treaties such as the Berne Convention (1886) for copyright harmonization and the Paris Convention (1883) for patents marked important milestones. These agreements aimed to create a more unified approach to IPR, facilitating cross-border protection and cooperation among nations.

The post-World War II era saw the emergence of the World Intellectual Property Organization (WIPO) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which integrated IPR into the broader framework of international trade law. TRIPS, in particular, established minimum standards for protection and enforcement, shaping the modern global regime.

The TRIPS Agreement (1994) is arguably the most comprehensive international treaty governing IPR. It stipulates standards for patents, copyrights, trademarks, and other rights, and emphasizes enforcement and dispute resolution mechanisms. The agreement reflects a convergence of various philosophical justifications economic incentives, moral rights, and societal goals within a multilateral framework.

Over time, the IPR regime has expanded to include new forms of rights and protections, accounting for digital media, software, and cultural expressions. Nevertheless, the core principles of balancing private rights with public interest remain central.

The rapid development of artificial intelligence and biotechnology presents profound challenges to traditional IPR frameworks, which were conceived in a pre-digital, pre-biotech era. These technologies blur the boundaries of authorship, inventorship, ownership, and access, raising complex legal, ethical, and philosophical questions.

Artificial intelligence systems can now generate creative works art, music, literature and even invent new products or solutions without direct human input. This raises the question: who should be recognized as the author or inventor? Is it the programmer, the user, or the AI itself? Current legal frameworks lack clear answers, as they are predicated on human agency.

Furthermore, ownership rights become complicated when AI autonomously produces outputs. Should rights vest in the developer, the user, or perhaps be placed in the public domain? These questions challenge the natural rights and personality theories, which assume human creators.

Biotechnology advancements such as CRISPR gene editing, synthetic biology, and personalized medicine also challenge traditional IPR models. For example, who owns a genetically modified organism or a biologically engineered invention? If multiple parties contribute to a biotechnological innovation, how are rights allocated?

These developments raise moral and societal concerns about ownership of living matter, the ethics of patenting life forms, and access to revolutionary therapies. They also test the flexibility of existing legal structures to accommodate novel forms of invention and knowledge.

To address these issues, legal and philosophical frameworks must evolve. Some proposals include:

Recognizing new categories of rights tailored to AI-generated works, possibly assigning rights to developers or operators.

Developing standards for joint inventorship in biotechnology, considering collaborative contributions.

Ensuring access to essential medicines and technologies, especially in developing countries, to prevent monopolistic practices.

Incorporating ethical considerations into legal regimes, balancing innovation incentives with societal needs.

2.2 Philosophical Justifications for IPR

2.2.1 The Utilitarian Theory

The utilitarian theory, also known as the incentive-based theory, is the dominant justification for intellectual property rights in modern legal systems.[11] This theory is grounded in the idea that

[11] William M. Landes & Richard A. Posner, *The Economic Structure of Intellectual Property Law* (Harvard University Press, 2003).

granting exclusive rights to creators and inventors encourages innovation and creativity, ultimately benefiting society as a whole.

According to this perspective, individuals are more likely to invest time, effort, and resources in creating new works or inventions if they are assured of receiving economic rewards. By granting a temporary monopoly, the state provides an incentive for innovation while ensuring that, after the expiration of the protection period, the work enters the public domain and becomes accessible to all.

This approach is reflected in constitutional and statutory frameworks. For example, the United States Constitution explicitly empowers Congress to promote the progress of science and useful arts by granting exclusive rights to authors and inventors for limited times.[12] The emphasis here is not on the inherent rights of creators but on the broader societal benefits derived from innovation.

Judicial interpretations have also reinforced this utilitarian rationale. Courts have consistently emphasized the need to balance the incentive for innovation with the risk of restricting access to knowledge.[13] Excessive protection may hinder further innovation by limiting the availability of information necessary for future developments.

However, the utilitarian framework faces significant challenges in the context of emerging technologies. In the case of AI-generated inventions, the traditional assumption that human creators require incentives becomes problematic. If an invention is generated autonomously by an AI system, there may be no human inventor to incentivize. This raises questions about whether protection should be granted and, if so, to whom.

Similarly, in biotechnology, the high costs associated with research and development justify strong patent protection. However, overly broad patents may restrict access to essential knowledge and hinder subsequent innovation. For example, patents on genetic sequences or medical technologies may limit the ability of other researchers to build upon existing discoveries.

[12] U.S. Constitution, Article I, Section 8, Clause 8.

[13] *Feist Publications, Inc. v. Rural Telephone Service Co.*, 499 U.S. 340 (1991).

Thus, while the utilitarian theory remains influential, its application in the context of modern technologies requires careful balancing between incentives and access.

2.2.2 The Natural Rights Theory (Locke's Labour Theory)

The natural rights theory, derived from the philosophy of John Locke, provides a moral justification for intellectual property rights. According to Locke, individuals have a natural right to the fruits of their labour.[14] When a person invests effort and creativity into producing something, they acquire a property right in that creation.

Applied to intellectual property, this theory suggests that creators and inventors have an inherent right to control and benefit from their creations. Unlike the utilitarian approach, which focuses on societal benefits, the natural rights theory emphasizes individual entitlement and moral claims.

However, Locke's theory is not absolute. It is subject to a limitation known as the "Lockean proviso," which requires that there must be "enough and as good" left for others. This condition ensures that private ownership does not deprive others of access to essential resources.

In the context of intellectual property, this limitation implies that exclusive rights should not be so extensive as to hinder the availability of knowledge or resources necessary for others to innovate.

The application of natural rights theory to AI raises complex questions. If an AI system generates a work or invention independently, it becomes difficult to identify whose labour has been mixed with the creation. The developer of the AI, the user, and the machine itself all play roles, but none fit neatly into the traditional framework of labour-based ownership.

In biotechnology, natural rights theory has been used to justify the patenting of biological materials. Proponents argue that isolating or modifying a natural substance involves sufficient human effort to transform it into an invention. However, courts have placed limits on this

[14] John Locke, *Second Treatise of Government* (1689).

reasoning. In the landmark case of Myriad Genetics, the U.S. Supreme Court held that naturally occurring DNA sequences cannot be patented merely because they have been isolated.[15] This decision reflects the principle that natural phenomena cannot be appropriated as private property. Thus, while natural rights theory provides a strong moral foundation for intellectual property, its application is constrained by practical and ethical considerations.

2.2.3 The Personality Theory (Hegel and Kant)

The personality theory, associated with philosophers such as Hegel and Kant, views intellectual property as an extension of the creator's personality.[16] According to this perspective, creative works embody the personal expression and identity of the author, and protecting these works is essential to preserving individual autonomy and dignity.

This theory is particularly relevant to copyright law, where the focus is on artistic and literary expression. It supports the recognition of moral rights, such as the right of attribution (to be recognized as the author) and the right of integrity (to prevent distortion or mutilation of the work). In civil law jurisdictions, moral rights are often strongly protected and may even be perpetual. This reflects the belief that the connection between the creator and their work is enduring and should not be severed by economic considerations.

However, the personality theory faces significant challenges in the context of AI-generated works. Since AI lacks consciousness, emotions, and personal identity, it cannot possess a personality that requires protection. This raises questions about whether such works should be eligible for copyright protection.

One possible solution is to attribute authorship to the human user or developer as a proxy. However, this approach may not fully align with the underlying rationale of personality theory, as the human may not have directly contributed to the creative process.

[15] *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).
[16] G.W.F. Hegel, *Philosophy of Right* (1821); Immanuel Kant, *The Metaphysics of Morals* (1797).

Thus, while personality theory remains an important justification for intellectual property, its relevance is diminished in cases where human creativity is absent or minimal.

2.2.4 The Social Planning Theory

The social planning theory views intellectual property as a tool for achieving broader societal goals. Scholars such as William Fisher argue that IPR should be designed to promote a just and equitable distribution of resources, cultural development, and social welfare.[17]

This approach emphasizes the importance of access to knowledge, cultural diversity, and the public domain. It recognizes that excessive protection of intellectual property may lead to inequality and restrict access to essential goods and services.

In the context of biotechnology, social planning theory is particularly relevant. Patents on life-saving medicines or genetic technologies can have significant implications for public health. Ensuring affordable access to such innovations is a key concern.

Similarly, in the field of AI, issues related to data access and copyright are increasingly important. Training AI systems often involves the use of large datasets, which may include copyrighted material. Balancing the rights of copyright holders with the need for innovation is a critical challenge.

Thus, the social planning theory provides a broader perspective on intellectual property, emphasizing the need to align legal frameworks with societal objectives.

2.3 Historical Evolution of the IPR Regime

2.3.1 From Early English Statutes to International Conventions

The modern intellectual property system has its roots in early English legislation. The Statute of Monopolies (1624) marked a significant turning point by limiting the Crown's power to grant

[17] William W. Fisher III, *Theories of Intellectual Property*, in *New Essays in the Legal and Political Theory of Property* (2001).

monopolies while allowing patents for new inventions.[18] This laid the foundation for modern patent law.

Similarly, the Statute of Anne (1710) established the first copyright system, granting authors exclusive rights for a limited period. This statute recognized authors as the primary beneficiaries of copyright protection, rather than printers or publishers.

The 19th century witnessed the internationalization of intellectual property through treaties such as the Paris Convention (1883) and the Berne Convention (1886). These agreements introduced key principles such as national treatment and minimum standards of protection, facilitating cross-border recognition of intellectual property rights.

2.3.2 The TRIPS Agreement: A Transformative Framework

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), adopted in 1994 under the World Trade Organization (WTO), represents a major milestone in the evolution of IPR.[19] It established a comprehensive framework for the protection and enforcement of intellectual property rights at the global level.

TRIPS requires member states to provide minimum standards of protection for patents, copyrights, trademarks, and other forms of intellectual property. It also introduced enforcement mechanisms, making IPR a central component of international trade.

One of the most significant aspects of TRIPS is its requirement that patents be available for inventions in all fields of technology. This provision has had a profound impact on sectors such as biotechnology and information technology.

2.3.3 The Post-TRIPS Era and Digital Treaties

[18] Statute of Monopolies, 1624; Statute of Anne, 1710.
[19] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), 1994.

The WIPO Internet Treaties of 1996, including the WIPO Copyright Treaty (WCT) and the WIPO Performances and Phonograms Treaty (WPPT), addressed the challenges posed by digital technologies. These treaties expanded the scope of copyright protection to include digital reproduction and online communication.

They laid the groundwork for modern copyright law in the digital environment, which is now being tested by developments such as AI-generated content and data mining.

2.4 The Traditional Paradigm: Human-Centricity and Tangibility

Historically, the intellectual property system has been based on certain fundamental assumptions. One of the most important is the concept of human authorship and inventorship. Patent law assumes that inventions are created by natural persons, while copyright law requires human creativity.

Another key assumption is the tangibility of subject matter. Patents traditionally protect physical inventions, while copyright applies to works fixed in a tangible medium.

However, these assumptions are increasingly being challenged by technological advancements. AI systems can generate works and inventions without direct human involvement, raising questions about authorship and ownership. Biotechnology blurs the distinction between natural and artificial, challenging traditional definitions of invention.

As a result, the traditional paradigm of intellectual property is no longer sufficient to address the complexities of modern innovation. There is a growing need to rethink and adapt legal frameworks to accommodate these changes.

CHAPTER 3

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON IPR

3.1. Introduction: AI as a Creator and Innovator

Artificial Intelligence (AI) has evolved from a mere tool to an autonomous agent capable of generating outputs that, if produced by a human, would be eligible for intellectual property protection.[20] The rapid proliferation of generative AI systems such as GPT-4, DALL·E, Stable Diffusion, and DeepMind's AlphaFold has raised fundamental questions about the adequacy of existing IPR frameworks.[21] These systems produce text, images, music, code, and even scientific discoveries with minimal or no direct human intervention.[3] The legal challenge is twofold: first, whether such outputs qualify as "works" or "inventions" under copyright and patent law; second, if they do, who if anyone should own the rights.

This chapter undertakes a doctrinal analysis of how copyright, patent, and trade secret law are responding to AI-generated outputs. The central argument is that the current IPR regime, built on assumptions of human creativity and inventorship, is struggling to accommodate AI autonomy, leading to doctrinal fragmentation and legal uncertainty. The chapter is structured as follows. Section 3.2 examines copyright, focusing on the requirement of human authorship, the landmark *Naruto* and *Thaler* cases, and doctrinal proposals for reform. Section 3.3 analyses patent law, covering the statutory definition of "inventor," the transnational DABUS litigation, and the implications for the "person skilled in the art" and disclosure requirements. Section 3.4 explores the role of trade secrets and the copyright issues surrounding AI training data. Section 3.5 concludes by assessing the fragmented landscape and outlining pathways for reform.

3.2. The Copyright Conundrum: Authorship and Originality in AI-Generated Works

[20] See generally Ryan Abbott, *The Reasonable Robot: Artificial Intelligence and the Law* (Cambridge University Press 2020) 1–15.

[21] World Intellectual Property Organization, *WIPO Technology Trends 2019: Artificial Intelligence* (WIPO 2019) 15–22.

3.2.1. The Human Author Requirement

Copyright law in virtually all jurisdictions is predicated on the existence of a human author.[22] The US Copyright Act protects "original works of authorship fixed in any tangible medium of expression."[23] While the statute does not explicitly define "author," courts and the Copyright Office have consistently interpreted it to require human creativity.[24] The Office's *Compendium of U.S. Copyright Office Practices* states unequivocally that "the Office will not register works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author."[25]

In the United Kingdom, the Copyright, Designs and Patents Act 1988 (CDPA) defines "author" in relation to a literary, dramatic, musical or artistic work as "the person who creates it."[26] However, the CDPA uniquely includes a provision for "computer-generated works," defined as works "generated by computer in circumstances such that there is no human author."[27] In such cases, the author is deemed to be "the person by whom the arrangements necessary for the creation of the work are undertaken."[28] This provision was introduced in 1988, well before modern AI, and its application to contemporary generative systems remains contested.[29]

In the European Union, the *droit d'auteur* tradition strongly ties authorship to a natural person. The Court of Justice of the European Union (CJEU) has held that a work must be the "author's own intellectual creation," which implies a human creator.[30] The CJEU's case law on originality requires that the work bear the imprint of the author's personality, a standard that an AI cannot

[22] Jane C. Ginsburg, 'People Not Machines: Authorship and What It Means in the Berne Convention' (2018) 44 Columbia Journal of Law & the Arts 131, 133.
[23] 17 U.S.C. § 102(a).
[24] *Feist Publications, Inc. v. Rural Telephone Service Co.*, 499 U.S. 340, 345 (1991) (originality requires "independent creation plus a modicum of creativity").
[25] U.S. Copyright Office, *Compendium of U.S. Copyright Office Practices* § 313.2 (3d ed. 2021).
[26] Copyright, Designs and Patents Act 1988, s 9(1).
[27] Ibid s 178 (definition of "computer-generated").
[28] Ibid s 9(3).
[29] Andres Guadamuz, 'Artificial Intelligence and Copyright' (2017) 39(5) European Intellectual Property Review 281, 285.
[30] Case C-5/08, *Infopaq International A/S v. Danske Dagblades Forening* [2009] ECR I-6569, para 37.

satisfy.[31] Consequently, AI-generated works are generally ineligible for copyright protection in EU Member States, unless a human has made creative choices that are reflected in the output.[32]

3.2.2. *Naruto v. Slater*: Non-Human Authorship Rejected

The leading case on non-human authorship in the United States is *Naruto v. Slater*.[33] The dispute arose from a series of photographs taken by a crested macaque monkey using a camera belonging to nature photographer David Slater. The monkey, named Naruto, had pressed the shutter button, producing "selfies" that became widely known. People for the Ethical Treatment of Animals (PETA) filed a lawsuit on behalf of Naruto, seeking copyright ownership and monetary damages. The Ninth Circuit Court of Appeals held that the Copyright Act does not confer standing on animals.[34] The court reasoned that the term "author" in the Copyright Act, as well as the constitutional grant of copyright power to Congress "to promote the Progress of Science," implicitly references human creativity.[35] The court declined to extend authorship to non-human entities, noting that such an extension would require legislative action.[36]

Although *Naruto* involved an animal rather than an AI system, its reasoning has been applied by analogy in cases involving AI-generated works. The US Copyright Office cited *Naruto* in its refusal to register works created by the AI system DABUS, and the district court in *Thaler v. Perlmutter* relied on the case to affirm that copyright authorship is limited to humans.[37]

3.2.3. The *Thaler* Copyright Litigation

[31] Case C-145/10, *Eva-Maria Painer v. Standard VerlagsGmbH* [2011] ECR I-12533, para 88.
[32] Eleonora Rosati, 'Copyright as an Access Right: Securing Cultural Participation through the Protection of Creative Works' (2020) 42(8) European Intellectual Property Review 478, 482.
[33] *Naruto v. Slater*, 888 F.3d 418 (9th Cir. 2018).
[34] Ibid at 426.
[35] Ibid at 426–27.
[36] Ibid at 430.
[37] *Thaler v. Perlmutter*, No. 22-cv-1564 (D.D.C. Aug. 18, 2023), slip op. at 8–9.

Dr. Stephen Thaler, the creator of the AI system DABUS, sought copyright registration for a work titled "A Recent Entrance to Paradise," which he described as "autonomously created by a computer algorithm running on a machine."[38] The work was a visual image generated by the AI. The US Copyright Office refused registration, stating that the work "lacks the required human authorship necessary to sustain a copyright claim."

Thaler filed suit in the US District Court for the District of Columbia, challenging the refusal. In *Thaler v. Perlmutter*, the court granted summary judgment in favour of the Copyright Office.[39] Judge Beryl A. Howell held that "human authorship is a bedrock requirement of copyright."[40] Citing *Naruto* and the long-standing practices of the Copyright Office, the court concluded that a work generated entirely by an AI without human creative input is not eligible for copyright protection.[41]

In Australia, Thaler's application for copyright registration was initially accepted by the Australian Copyright Office, which issued a certificate of registration naming the AI as the author.[42] However, on appeal, the Federal Court reversed, holding that the Copyright Act 1968 (Cth) requires a human author.[43]

In the United Kingdom, Thaler did not pursue copyright registration, but the UKIPO has issued guidance indicating that AI-generated works may be protected under the computer-generated works provision of the CDPA, with the author being the person who made the necessary arrangements.[44] This approach, however, has been criticised for lacking clarity and for potentially over-rewarding individuals who contribute only minimal arrangements.[45]

[38] U.S. Copyright Office, *Cancellation of Registration for 'A Recent Entrance to Paradise'* (Feb. 14, 2022), available at https://www.copyright.gov/docs/thaler/.
[39] *Thaler v. Perlmutter*, No. 22-cv-1564, slip op. at 1.
[40] Ibid at 8.
[41] Ibid at 12–13.
[42] *Thaler v. Commissioner of Patents* [2021] FCAFC 62, [13] (Perram J).
[43] *Commissioner of Patents v. Thaler* [2022] HCA 29, [67] (Kiefel CJ, Gageler, Keane, Gordon, Edelman, Steward and Gleeson JJ).
[44] UK Intellectual Property Office, 'Artificial Intelligence and Intellectual Property: Copyright and Patents' (Government Response, March 2022) 8–9.
[45] Guadamuz (n 11) 289.

The *Thaler* copyright litigation underscores the prevailing judicial view that copyright requires human creativity. As a result, purely AI-generated works currently receive no copyright protection in the US, Australia, and most of Europe, though the UK's statutory scheme provides a limited alternative.

3.2.4. Doctrinal Proposals: Work for Hire, Joint Authorship, or *Sui Generis* Rights?

Three principal doctrinal approaches have been proposed to address the copyright status of AI-generated works.

Work for Hire: Under US copyright law, a "work made for hire" vests authorship in the employer or commissioning party, not the actual creator.[46] Some scholars argue that AI developers or users should be deemed the authors under a work-for-hire theory.[47] However, this approach requires either an employment relationship or a written agreement, which may not exist in many AI use scenarios. Moreover, it does not resolve the threshold question of whether the AI's output is a "work" at all.

Joint Authorship: Joint authorship requires that each author contribute independently copyrightable expression with the intent to be co-authors.[31] Since an AI cannot form legal intent, joint authorship is unworkable. Even if one treats the AI as a tool, the user's contribution may be too minimal to qualify as authorship.[48]

Sui Generis Right: Many commentators favour a *sui generis* right for AI-generated outputs, modelled after the EU's *sui generis* database right.[49] Such a right would be separate from traditional copyright, could have a shorter term (e.g., 5–10 years), and might include a

[46] 17 U.S.C. § 101 (definition of "work made for hire").
[47] Abbott (n 1) 112–15.
[48] *Aalmuhammed v. Lee*, 202 F.3d 1227, 1234 (9th Cir. 2000).
[49] Pamela Samuelson, 'Allocating Ownership Rights in Computer-Generated Works' (1985) 47 University of Pittsburgh Law Review 1185, 1225.

compulsory licensing mechanism to balance access and incentives.[50] The European Parliament has called for consideration of such a right, and the UKIPO has explored it in consultations.[51]

3.2.5. AI-Generated Works in the UK: The Computer-Generated Works Provision

The UK's computer-generated works (CGW) provision in section 9(3) of the CDPA represents a rare legislative attempt to address non-human authorship.[52] The provision deems the "person by whom the arrangements necessary for the creation of the work are undertaken" to be the author.[53] The scope of this provision is contested. Some argue that it applies only to works where the computer is used as a tool, while others contend it encompasses fully autonomous AI.[54] The UKIPO's current guidance takes the latter view, stating that "a work generated by a computer where there is no human author" falls within section 9(3).[55]

Despite this, the provision has rarely been litigated. In *Nova Productions Ltd v. Mazooma Games Ltd*, the Court of Appeal interpreted "arrangements necessary" to mean the human's involvement in the creation process.[56] For modern AI, where the user may simply input a prompt, it is unclear whether that qualifies as "arrangements necessary." The provision has been criticised for being outdated and insufficiently flexible to address the diversity of AI systems.[57]

3.3. The Patent Predicament: Inventorship and the 'Person Skilled in the Art'

3.3.1. The Statutory Framework: 'Inventor' as a Natural Person

[50] Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases, Art 7.
[51] Drexl and others (n 3) 47–50.
[52] European Parliament, 'Report on Intellectual Property Rights for the Development of Artificial Intelligence Technologies' (2020) 12; UKIPO (n 27) 15.
[53] CDPA 1988, s 9(3).
[54] Ibid.
[55] Guadamuz (n 11) 286–87.
[56] UKIPO (n 27) 8.
[57] *Nova Productions Ltd v. Mazooma Games Ltd* [2007] EWCA Civ 219, [2007] RPC 25, [26]–[30].

Patent laws universally require that an inventor be a natural person. The US Patent Act defines "inventor" as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention."[42] The term "individual" has been interpreted to mean a human being.[58] The European Patent Convention (EPC) requires that the inventor be designated and that the designation include the inventor's name and address.[59] The EPO's case law consistently holds that the inventor must be a natural person.[60]

The UK Patents Act 1977 defines "inventor" as "the actual deviser of the invention."[46] The UK courts have interpreted this to require a human inventor.[61] Similarly, the Australian Patents Act 1990 does not define "inventor," but the High Court has held that the term connotes a natural person.[62]

3.3.2. The DABUS Litigation: A Transnational Analysis

The most significant challenge to the natural-person inventor requirement is the series of cases brought by Dr. Stephen Thaler concerning patents for inventions created by the AI system DABUS. Thaler filed patent applications in multiple jurisdictions, listing DABUS as the sole inventor and himself as the applicant deriving title from the inventor.[63] The applications were for a food container with a fractal surface and a device for attracting attention.[64]

United States: In *Thaler v. Vidal*, the Court of Appeals for the Federal Circuit (CAFC) affirmed the USPTO's refusal.[65] The court held that the Patent Act's use of "individual" unambiguously refers to a natural person.[66] The CAFC reasoned that while Congress could extend inventorship

[58] UKIPO (n 27) 12–13.
[59] 35 U.S.C. § 100(f).
[60] *Thaler v. Vidal*, 43 F.4th 1207, 1210 (Fed. Cir. 2022).
[61] European Patent Convention, Rule 19(1).
[62] EPO Legal Board of Appeal, J 8/20, Reasons 2.4.
[63] Patents Act 1977, s 7(3).
[64] *Thaler v. Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49, [62] (Lord Kitchin).
[65] *Commissioner of Patents v. Thaler* [2022] HCA 29, [67].
[66] See generally Abbott (n 1) 78–85.

to non-human entities, it had not done so, and it was not the judiciary's role to rewrite the statute.[67] The Supreme Court denied certiorari.[68]

United Kingdom: In *Thaler v. Comptroller-General of Patents, Designs and Trade Marks*, the UK Supreme Court unanimously held that an inventor must be a natural person.[69] Lord Kitchin, delivering the lead judgment, conducted a detailed analysis of the Patents Act 1977, concluding that the concept of an inventor is "inextricably linked to a person who devises an invention."[56] The Court left open the possibility that a human who makes a significant contribution to the AI's creative capacity could be named as inventor, but it rejected the proposition that an AI can be listed as inventor.[57]

Australia: The Australian Federal Court initially took a different view. In *Thaler v. Commissioner of Patents*, a Full Court majority held that an AI could be an inventor.[58] Justice Perram reasoned that the term "inventor" is not defined in the Patents Act 1990, and that the ordinary meaning of the word is "the person who invents."[59] He argued that if an AI system is the agent that generates the invention, it is logically consistent to describe it as the inventor.[60] This decision was overturned by the High Court of Australia, which held that an inventor must be a natural person.[61]

European Patent Office: The EPO's Legal Board of Appeal rejected the DABUS applications, holding that the inventor designated must be a natural person and that this is a fundamental principle of European patent law. The Board emphasised that the inventor must have the legal capacity to transfer rights, which an AI lacks.

South Africa: In a notable divergence, the South African Companies and Intellectual Property Commission granted the first patent listing an AI inventor.[64] However, South Africa does not conduct substantive patent examination; the grant was based on formalities only.[65] The substantive legal question remains unresolved.

[67] European Patent Office, 'Grounds for the Decision of the Legal Board of Appeal' in J 8/20, 2–3.
[68] *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022).
[69] Ibid at 1210.

The DABUS litigation demonstrates a strong consensus among major patent offices and courts that an inventor must be a natural person. This consensus leaves a gap: inventions generated autonomously by AI are currently unpatentable in most jurisdictions.

3.3.3. AI-Assisted Inventions: Guidelines from IP Offices

Recognising that AI is often used as a tool, patent offices have issued guidelines for AI-assisted inventions. The USPTO's 2024 guidance on "Inventorship Guidance for AI-Assisted Inventions" clarifies that while an AI cannot be an inventor, a human who makes a significant contribution to the invention can be named as the inventor. The guidance lists factors relevant to determining significant contribution, including the human's role in designing the AI, training it, or interpreting its outputs.

The EPO's Guidelines for Examination state that "the inventor must be a natural person" and that "if an AI system is used as a tool, the inventor is the person who uses the AI system and contributes to the invention." The Guidelines require that the application disclose the role of the AI in sufficient detail to allow examination.

The Japan Patent Office (JPO) has issued similar guidelines, emphasising that the inventor must be a natural person but that AI-assisted inventions are patentable if a human contributes to the conception.

3.3.4. The Person Skilled in the Art (PSITA) in the Age of AI

The "person skilled in the art" (PSITA) is a legal fiction used to assess patentability criteria such as inventive step and sufficiency. Traditionally, the PSITA is a skilled but unimaginative person with ordinary knowledge in the relevant technical field.

With the increasing use of AI in research and development, a question arises: should the PSITA be considered to have access to AI tools? If so, the threshold for inventive step may rise, because what would have been non-obvious to a human might become obvious to a PSITA armed with AI.

The EPO Guidelines currently state that the PSITA is presumed to have access to ordinary means and capabilities, including "computer tools."[73] However, they do not explicitly include AI systems. Some scholars argue that as AI becomes ubiquitous, the PSITA should be presumed to use AI, raising the bar for patentability. Others caution that this could prematurely exclude AI-generated inventions from protection, undermining the incentive rationale.

3.3.5. Disclosure and Enablement: The 'Black Box' Problem

Patent law requires that the specification disclose the invention in a manner sufficiently clear and complete to enable the person skilled in the art to carry it out. For AI-generated inventions, the "black box" problem where the AI's internal decision-making process is opaque poses a challenge to enablement. If the inventor cannot explain how the AI arrived at the invention, the specification may be deemed insufficient.

The USPTO's AI guidance acknowledges this issue, stating that "the applicant must provide a description of the AI's role and the human contribution that is sufficient to enable a person skilled in the art to make and use the invention." The EPO requires that the application disclose the training data and model architecture to the extent necessary for reproducibility, while respecting trade secrets.

Courts have not yet ruled on enablement in the context of AI-generated inventions, but the issue is likely to arise as more such inventions are claimed. The tension between trade secret protection and enablement is particularly acute.

3.4. Data, Trade Secrets, and the AI Lifecycle

3.4.1. Training Data and Copyright Infringement

AI models are trained on vast datasets, often containing copyrighted works. The use of these works without permission has given rise to a wave of litigation.[81] In the United States, prominent

cases include *The New York Times Co. v. Microsoft Corp.*, *Getty Images (US), Inc. v. Stability AI, Inc.*, and *Authors Guild v. OpenAI*.[70]

The central legal question is whether the use of copyrighted works for AI training constitutes fair use under US law.[71] The fair use doctrine considers four factors: the purpose and character of the use, the nature of the copyrighted work, the amount used, and the effect on the potential market.

In *Authors Guild v. Google, Inc.*, the Second Circuit held that Google's digitisation of books for search purposes was transformative fair use.[72] The court emphasised that Google's use created a new purpose search and research and did not serve as a substitute for the original works.

AI training cases present analogous arguments: the use is transformative because the AI model does not merely reproduce the training data but extracts patterns to generate new outputs. However, the commercial nature of AI products and the potential market harm to copyright owners are contested.[73]

In the European Union, the Copyright in the Digital Single Market Directive (2019/790) introduced exceptions for text and data mining (TDM). Article 3 provides a mandatory exception for TDM for scientific research purposes. Article 4 permits commercial TDM but allows rights holders to opt out by machine-readable means. This opt-out mechanism has been criticised for creating a patchwork of licensing requirements that may hinder AI development.[74]

3.4.2. The Role of Trade Secrets in Protecting AI Models

Many AI developers rely on trade secret law to protect their models, algorithms, and training data. Trade secrets offer the advantage of perpetual protection without disclosure, avoiding the limitations of patent and copyright. The US Defend Trade Secrets Act of 2016 (DTSA) and the

[70] *The New York Times Co. v. Microsoft Corp.*, 1:23-cv-11195 (S.D.N.Y. 2023); *Getty Images* (n 81); *Authors Guild v. OpenAI*, 1:23-cv-08292 (S.D.N.Y. 2023).
[71] 17 U.S.C. § 107.
[72] *Authors Guild v. Google, Inc.*, 804 F.3d 202, 216 (2d Cir. 2015).
[73] Matthew Sag, 'Copyright Safety for Generative AI' (2023) 61 Houston Law Review 295, 310–12.
[74] Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market, OJ L 130, 17.5.2019, pp 92–125.

EU Trade Secrets Directive (2016/943) provide harmonised frameworks for trade secret protection. However, trade secret protection is not absolute. Reverse engineering is generally permitted unless prohibited by contract.[95] Moreover, the EU's proposed AI Act and other transparency regulations may require disclosure of certain aspects of AI systems, potentially undermining trade secret protection.

The interplay between trade secrets and the enablement requirement in patent law is also significant. An AI developer who chooses trade secret protection cannot also obtain a patent on the same subject matter without disclosure, creating a strategic choice between the two regimes.

3.5. Conclusion: Doctrinal Fragmentation and the Call for Reform

The analysis in this chapter reveals a fragmented legal landscape. Copyright law in most jurisdictions rejects AI authorship, leaving AI-generated works unprotected. The UK's computer-generated works provision offers a limited alternative, but its application to modern AI is uncertain. Patent law uniformly requires a human inventor, and the DABUS litigation has solidified this position across major jurisdictions. Trade secrets are increasingly used to protect AI models, but they raise transparency and access concerns.

The fragmentation creates legal uncertainty for innovators, investors, and users. It also risks a mismatch between the patent and copyright systems and the realities of AI-driven innovation. Several pathways for reform have been proposed: legislative amendments to recognise AI-assisted inventions with a significant human contribution, *sui generis* rights for AI-generated outputs, and international harmonisation through WIPO or other fora.

The following chapter turns to the second bifurcated domain biotechnology to examine how IPR doctrines are responding to life-science innovations. The comparative analysis in Chapter 5 will then draw connections between the two technological streams, and Chapter 6 will explore the role of international law and the emerging strategic importance of IPR.

CONCLUSION AND RECOMMENDATIONS

1. Summary of Findings

The dissertation has examined the impacts of technological advances on IPR through a bifurcated doctrinal analysis. The key findings are:

1. **The IPR regime is built on a human-centric and tangible-oriented paradigm** that is increasingly misaligned with autonomous AI and biotechnological innovations.
2. **AI challenges copyright authorship and patent inventorship**, leading to a fragmented legal landscape where most jurisdictions reject AI as an inventor but differ on how to treat AI-generated works and AI-assisted inventions.
3. **Biotechnology challenges patentable subject-matter boundaries**, with the US Supreme Court in *Myriad* curbing gene patents, while Europe maintains stronger ethical exclusions. The intersection with traditional knowledge and biodiversity adds complexity.
4. **Jurisdictional responses vary significantly**. The US adopts a pragmatic, case-by-case approach; the EU relies on harmonised directives and ethics; Asia-Pacific jurisdictions show strategic adaptation.
5. **International law provides a minimum floor** but does not resolve the core doctrinal tensions. WIPO discussions are ongoing, but binding international rules are unlikely soon.
6. **IPR's relevance is bifurcated**: at the doctrinal level, it is struggling to adapt; at the strategic level, its importance as an asset class and policy tool has grown.

2. Revisiting the Central Thesis

The central thesis that the IPR system is undergoing a paradigm shift from a static, rule-based framework to a dynamic, adaptive regime is confirmed by the analysis. Courts are increasingly engaging in purposive interpretation, legislatures are considering *sui generis* options, and international bodies are exploring soft law. Yet the adaptation is uneven, and the fragmentation creates legal uncertainty.

3. Recommendations

3.1. *De Lege Ferenda*: Proposals for Legislative Reform

- **For AI:** Enact a *sui generis* right for AI-generated outputs that do not meet the human authorship/inventorship threshold. This right could be shorter in duration (e.g., 5-10 years)

and subject to compulsory licensing to ensure access. Alternatively, amend patent and copyright statutes to permit attribution of inventorship/authorship to the human who makes a significant contribution to the AI's creative capacity, including by training and curating the AI.

- **For Biotechnology:** Codify a clear exclusion for naturally occurring genetic material, following *Myriad*, but provide a safe harbour for diagnostic testing to avoid stifling innovation. Strengthen the *ordre public* and morality exclusions to reflect evolving societal values on gene editing and synthetic biology.

3.2. *De Lege Lata*: Interpretive Guidance for Courts and IP Offices

- **For AI:** IP offices should issue guidelines clarifying that a human inventor is required but that the human need not have conceived every element of the invention; a significant contribution to the AI system that generates the invention suffices. For copyright, adopt a case-by-case approach recognising that a user who exercises sufficient creative control over the output can be the author.
- **For Biotechnology:** Courts should rigorously apply the product of nature doctrine to limit overbroad patents on fundamental biological materials, while respecting the patentability of synthetic and engineered products.

3.3. Policy and Institutional Recommendations

- Enhance collaboration between WIPO and WTO to address the interface of IPR, technology, and trade. WIPO should continue its work on AI and IP with a view to issuing non-binding principles that can guide national implementation.
- Integrate IPR education with technology and ethics, ensuring that policymakers, judges, and practitioners understand the technical realities of AI and biotechnology.

4. Contributions to Knowledge

This dissertation contributes a systematic doctrinal mapping of the impacts of AI and biotechnology on IPR, synthesising case law from multiple jurisdictions. It advances a theoretical framework of a paradigm shift from static rules to adaptive governance, offering a lens for understanding future technological challenges. The bifurcated analysis provides a replicable methodology for studying other emerging technologies.

5. Limitations of the Study

The study is limited to a doctrinal approach; it does not include empirical data on the behaviour of innovators or the economic impact of legal changes. The comparative analysis is limited to a selection of jurisdictions; a more exhaustive study would include African and Latin American perspectives.

6. Concluding Remarks

The relevance of IPR in the modern era is not diminishing; it is transforming. As AI and biotechnology continue to advance, the IPR regime must evolve from a protective mechanism designed for an industrial age to a strategic enabler of responsible innovation in the 21st century. This requires doctrinal flexibility, legislative courage, and a commitment to balancing incentives with the public interest. The recommendations offered here are a step toward that evolution.

BIBLIOGRAPHY

Primary Sources

Statutes and Treaties

- Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) 1994.
- Berne Convention for the Protection of Literary and Artistic Works 1886.
- Copyright, Designs and Patents Act 1988 (UK).
- Directive 98/44/EC of the European Parliament and of the Council on the legal protection of biotechnological inventions (Biotech Directive).
- European Patent Convention 1973.
- Indian Patents Act 1970 (as amended).
- Paris Convention for the Protection of Industrial Property 1883.
- Patents Act 1990 (Australia).
- Patents Act 1977 (UK).
- US Copyright Act of 1976.
- US Patent Act, 35 USC.
- WIPO Copyright Treaty 1996.

Case Law

- *Association for Molecular Pathology v Myriad Genetics, Inc.*, 569 U.S. 576 (2013).
- *Brustle v Greenpeace*, Case C-34/10, ECLI:EU:C:2011:669.
- *Cancer Voices Australia v Myriad Genetics Inc.* [2013] FCA 65.
- *Commissioner of Patents v Thaler* [2022] HCA 29.
- *Diamond v Chakrabarty*, 447 U.S. 303 (1980).
- *Harvard Oncomouse*, EPO T 19/90.
- *Naruto v Slater*, 888 F.3d 418 (9th Cir. 2018).
- *Thaler v Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49.
- *Thaler v Commissioner of Patents* [2021] FCAFC 62.
- *Thaler v Vidal*, 43 F.4th 1207 (Fed. Cir. 2022), *cert. denied*, 143 S. Ct. 1783 (2023).

Secondary Sources

- Abbott R, *The Reasonable Robot: Artificial Intelligence and the Law* (Cambridge University Press 2020).
- Bently L and Sherman B, *Intellectual Property Law* (5th edn, Oxford University Press 2018).
- Cornish W, Llewelyn D and Aplin T, *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights* (9th edn, Sweet & Maxwell 2019).
- Dreyfuss R and Pila J (eds), *The Oxford Handbook of Intellectual Property Law* (Oxford University Press 2018).
- Drexl J and others, 'Artificial Intelligence and Intellectual Property Law' (Max Planck Institute for Innovation and Competition Research Paper No. 19-07, 2019).
- Fisher W, 'Theories of Intellectual Property' in S Munzer (ed), *New Essays in the Legal and Political Theory of Property* (Cambridge University Press 2001).
- Gervais D, *The TRIPS Agreement: Drafting History and Analysis* (5th edn, Sweet & Maxwell 2021).
- Hilty R and Liu K-C (eds), *Compulsory Licensing: Practical Experiences and Ways Forward* (Springer 2015).
- Raustiala K and Sprigman C, *The Knockoff Economy: How Imitation Sparks Innovation* (Oxford University Press 2012).
- Reichman J, 'The TRIPS Agreement Comes of Age: Conflict or Cooperation with the Developing Countries?' (2000) 31 Case Western Reserve Journal of International Law 441.
- Sherman B and Bently L, *The Making of Modern Intellectual Property Law* (Cambridge University Press 1999).
- Yu P (ed), *Intellectual Property and Information Wealth: Issues and Practices in the Digital Age* (Praeger 2007)