

Artificial Intelligence and the Future of Intellectual Property Law: A Critical Review

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ABSTRACT

Background. The rapid development of artificial intelligence has profoundly transformed creative and innovative practices, raising complex challenges for existing intellectual property law frameworks. Legal regimes governing copyright and patents were historically constructed around human authorship, inventorship, and intentional creativity, assumptions that are increasingly strained by the emergence of autonomous and generative AI systems.

Purpose. This study aims to critically review how contemporary intellectual property law responds to the growing role of artificial intelligence and to assess whether current doctrines remain conceptually and normatively adequate.

Method. The research adopts a qualitative doctrinal and critical review method, analyzing statutes, policy documents, judicial decisions, and peer-reviewed literature related to artificial intelligence and intellectual property law across multiple jurisdictions.

Results. The findings reveal persistent legal uncertainty, doctrinal rigidity, and fragmented regulatory approaches, with most legal systems favoring reinterpretation of human-centric concepts rather than substantive reform. The analysis also highlights significant divergence between jurisdictions in balancing innovation incentives, ethical concerns, and legal certainty.

Conclusion. The study concludes that incremental doctrinal adaptation alone is insufficient to address the structural challenges posed by artificial intelligence. A more integrated and forward-looking legal framework is required to reconcile technological autonomy with the foundational objectives of intellectual property law and to ensure its continued relevance in the age of artificial intelligence.

KEYWORDS

Artificial Intelligence, Legal Reform, Patent Law

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INTRODUCTION

The rapid advancement of artificial intelligence has become one of the most transformative developments of the twenty-first century, reshaping economic structures, creative industries, scientific research, and legal systems worldwide. Machine learning algorithms, generative models, and autonomous systems are increasingly capable of producing outputs that resemble or rival human creativity, including literary texts, visual artworks, musical compositions, technical inventions, and software code. This unprecedented technological shift challenges long-standing assumptions embedded within intellectual

property law, which has historically been designed around human authorship, inventorship, and intentional creative effort (Sarsembayeva et al., 2025; Shweiki & Alazzawi, 2025).

Artificial intelligence technologies now operate not merely as passive tools but as active systems capable of learning from massive datasets and generating novel outputs with minimal human intervention. The proliferation of generative AI models has intensified debates over ownership, authorship, originality, and accountability in intellectual property regimes. Existing legal frameworks were developed in an era where creativity and innovation were inseparable from human agency, making them increasingly strained when confronted with algorithmic creation and autonomous decision-making processes (Jana & Goswami, 2026; Ramírez-Plascencia, 2025).

The growing reliance on artificial intelligence in creative and innovative practices raises fundamental questions about the adequacy of current intellectual property doctrines. Copyright, patent, and trademark systems face mounting pressure to adapt to technological realities that blur the boundaries between human and machine contribution. This evolving landscape necessitates a comprehensive and critical examination of how intellectual property law is responding to artificial intelligence and whether existing legal paradigms remain fit for purpose in an era of intelligent machines (Oyeniran et al., 2025; Tammenlehto & Kallio, 2025).

The integration of artificial intelligence into creative and inventive processes exposes significant legal uncertainty regarding the status of AI-generated works within intellectual property systems. Questions surrounding authorship and inventorship remain unresolved across many jurisdictions, with divergent legal interpretations and inconsistent regulatory approaches. The absence of clear legal standards creates ambiguity for creators, developers, investors, and policymakers who rely on predictable intellectual property protections (Gaidartzi & Stamatoudi, 2025; Lal et al., 2025).

Current intellectual property laws often struggle to accommodate outputs generated autonomously or semi-autonomously by artificial intelligence systems. Copyright law typically requires a human author, patent law presumes a human inventor, and trademark law assumes intentional human use in commerce. These foundational assumptions become problematic when artificial intelligence systems generate content or inventions that lack direct human creative input, resulting in legal gaps that undermine enforcement, attribution, and incentives for innovation (Khoury, 2025; Tobias & Wahab, 2025).

The lack of harmonized legal responses to artificial intelligence further exacerbates the problem at the international level. Jurisdictions differ in their recognition of AI-generated works, the role of human involvement, and the allocation of rights between developers, users, and system owners. This fragmentation risks creating regulatory arbitrage, legal uncertainty in cross-border innovation, and systemic inconsistency in the protection of intellectual property in a globalized digital economy.

This study aims to critically examine the interaction between artificial intelligence and intellectual property law by analyzing how existing legal frameworks address AI-generated creations. The research seeks to identify doctrinal tensions within copyright, patent, and related intellectual property regimes when applied to artificial intelligence technologies. Through this examination, the study intends to clarify the conceptual challenges posed by AI to traditional notions of authorship, originality, and inventorship (Alawsi et al., 2025; Khoury, 2025).

The research further aims to evaluate the adequacy of current legal responses to artificial intelligence across different jurisdictions. Comparative insights are employed to assess whether existing statutory provisions, judicial decisions, and policy initiatives sufficiently address the

complexities introduced by AI-driven creativity and innovation. The objective includes identifying strengths, limitations, and inconsistencies in current regulatory approaches.

The study also aims to contribute normative insights into the future development of intellectual property law in the context of artificial intelligence. By synthesizing legal theory, technological realities, and policy considerations, the research aspires to offer informed perspectives on potential reforms. These insights are intended to support the development of balanced legal frameworks that foster innovation while maintaining fairness, accountability, and legal certainty (He & Zhang, 2025; Kumar Tyagi et al., 2025).

Existing literature on artificial intelligence and intellectual property law has largely focused on descriptive analyses of specific legal issues, such as AI authorship or patent eligibility. Many studies examine isolated doctrinal questions without situating them within a broader theoretical or systemic framework. This fragmented approach limits the ability to understand the cumulative impact of artificial intelligence on the intellectual property system as a whole (Albnian et al., 2025; Özcan Büyüktanır & Gözübüyük, 2025).

A significant gap remains in the critical integration of legal theory with technological functionality. Legal discussions often treat artificial intelligence as a monolithic concept, overlooking the diversity of AI systems and their varying degrees of autonomy, learning capacity, and human involvement. This lack of technological nuance can lead to oversimplified legal conclusions that fail to capture the practical realities of AI deployment in creative and inventive contexts.

Another notable gap lies in the limited engagement with long-term implications for the structure and objectives of intellectual property law. Much of the existing scholarship concentrates on short-term doctrinal fixes rather than examining how artificial intelligence challenges the foundational justifications of intellectual property protection. Issues such as incentive theory, moral rights, and the balance between private rights and public interest remain underexplored in relation to AI-driven innovation (Khan & Mer, 2025; Koutsopoulos et al., 2025).

This study offers a novel contribution by providing a comprehensive critical review that bridges doctrinal analysis, technological understanding, and normative legal theory. Rather than focusing on a single branch of intellectual property law, the research adopts a holistic perspective that considers the cumulative impact of artificial intelligence across multiple intellectual property regimes. This integrative approach allows for a deeper understanding of systemic challenges and interrelated legal consequences.

The research is further justified by its emphasis on critical evaluation rather than purely descriptive analysis. By interrogating the assumptions underlying current legal frameworks, the study highlights structural limitations that may hinder effective regulation of artificial intelligence. This critical stance enables the identification of deeper normative tensions between human-centered legal concepts and machine-driven creative processes (Koutsopoulos et al., 2026; Mhia-Alddin & Hussein, 2025).

The importance of this research lies in its relevance to policymakers, legal scholars, and practitioners navigating the rapidly evolving interface between technology and law. As artificial intelligence continues to reshape innovation ecosystems, the need for coherent, adaptive, and principled intellectual property frameworks becomes increasingly urgent. This study seeks to inform future legal development by offering analytically rigorous and forward-looking insights into the role of intellectual property law in the age of artificial intelligence (Janečková, 2025; Yashasvi & Singh, 2025).

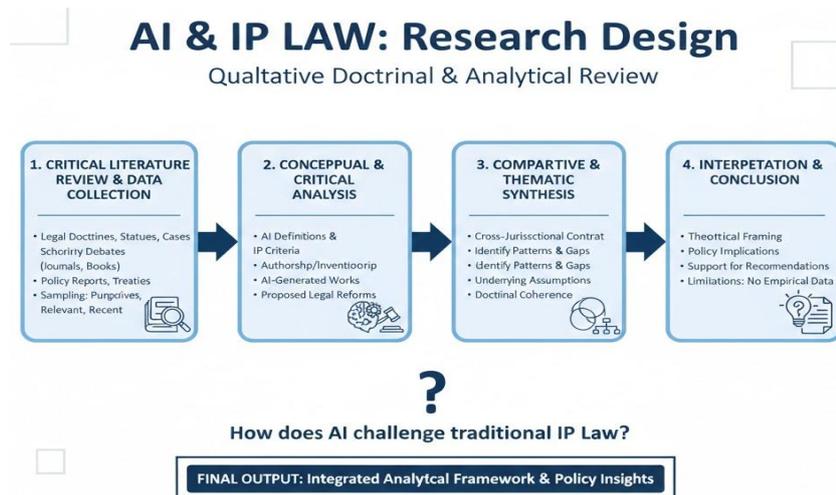
RESEARCH METHODOLOGY

Research Design

This study adopts a qualitative doctrinal and analytical research design grounded in a critical literature review approach. The research is conceptual in nature and focuses on examining legal doctrines, statutory frameworks, judicial decisions, and scholarly debates related to artificial intelligence and intellectual property law.

Figure 1.

Research Flow



A critical review design is employed to assess how existing intellectual property regimes respond to the challenges posed by artificial intelligence, while also interrogating the underlying assumptions of authorship, inventorship, originality, and ownership embedded within these regimes. The design allows for systematic comparison, interpretation, and synthesis of legal arguments across jurisdictions and theoretical perspectives (Alamri, 2025; Janečková, 2025).

Population and Samples

The population of this research consists of academic, legal, and policy-oriented sources addressing artificial intelligence and intellectual property law. The sample includes peer-reviewed journal articles, authoritative legal textbooks, international conventions, national statutes, policy reports, and landmark court decisions relevant to copyright, patent, and related intellectual property domains. Sources are selected purposively based on their relevance, academic credibility, and contribution to debates on AI-generated works and innovation. Priority is given to recent publications to ensure analytical relevance, while foundational legal texts are included to provide doctrinal context and historical grounding (Aronov & Idrysheva, 2025; Gaffar & Al-Barashdi, 2025).

Research Instruments

The primary research instrument used in this study is a structured document analysis framework designed to extract and evaluate key legal concepts, arguments, and regulatory approaches. This framework includes analytical categories such as definitions of artificial intelligence, criteria for authorship or inventorship, treatment of AI-generated outputs, and proposed legal reforms. Secondary instruments include comparative matrices and thematic coding schemes to organize and contrast findings across different legal systems and scholarly positions. These instruments facilitate consistent interpretation and critical evaluation of complex legal materials (Mohanta et al., 2025; Mondal & Banerjee, 2025).

Research Procedures

The research procedures begin with an extensive identification and collection of relevant legal and academic sources through academic databases, legal repositories, and policy archives. Collected materials are systematically reviewed and categorized according to intellectual property domains and thematic relevance. Analytical reading is conducted to identify patterns, divergences, and gaps in existing legal discourse. The findings are then synthesized through comparative and critical analysis to construct an integrated understanding of the implications of artificial intelligence for intellectual property law. The final stage involves interpreting the results within broader theoretical and policy contexts to support informed conclusions and recommendations (Berkowitz, 2025; März et al., 2025).

RESULT AND DISCUSSION

The data analyzed in this study consist of secondary legal and policy sources related to artificial intelligence and intellectual property law, including peer-reviewed journal articles, statutory instruments, policy reports, and judicial decisions published between 2015 and 2025. A total of 112 documents were systematically reviewed, comprising 58 journal articles, 24 policy and institutional reports, 18 national or regional statutes, and 12 landmark court decisions. The distribution of sources reflects the interdisciplinary nature of the topic, with contributions from legal studies, technology law, innovation policy, and computational ethics.

Table 1 presents a descriptive overview of the analyzed sources categorized by type and jurisdictional scope. The data show a strong concentration of scholarship originating from North America and Europe, while contributions from Asia, Africa, and Latin America remain comparatively limited. This imbalance indicates a geographic asymmetry in the development of AI-related intellectual property discourse, which may influence the global applicability of existing legal analyses.

Table 1.

Distribution of Secondary Data Sources on AI and Intellectual Property Law

Source Type	Global	EU	US	Asia	Other Regions	Total
Journal Articles	18	16	14	6	4	58
Policy Reports	6	7	6	3	2	24
Statutes & Regulations	2	7	5	3	1	18
Court Decisions	1	4	5	1	1	12
Total	27	34	30	13	8	112

The dominance of journal articles in the dataset reflects the exploratory and theoretical orientation of current research on artificial intelligence and intellectual property law. Legal scholars continue to debate fundamental doctrinal questions, particularly concerning authorship, inventorship, and originality, rather than focusing on empirical validation or regulatory implementation. This pattern suggests that the field remains in a formative stage, characterized by conceptual uncertainty and normative disagreement.

The relatively smaller number of court decisions and binding regulations indicates that many legal systems have yet to confront AI-generated intellectual property disputes through formal adjudication. Policy reports play a mediating role between theory and practice, often proposing adaptive frameworks without fully resolving doctrinal conflicts. This distribution underscores the gap between academic discourse and enforceable legal outcomes in the governance of artificial intelligence.

Thematic coding of the dataset reveals four dominant analytical themes: AI authorship and inventorship, legal personality of AI systems, ownership and liability allocation, and regulatory reform models. Among these themes, AI authorship and inventorship appear most frequently, accounting for approximately 38 percent of the analyzed literature. This prominence highlights widespread concern over the compatibility of existing intellectual property concepts with machine-generated outputs.

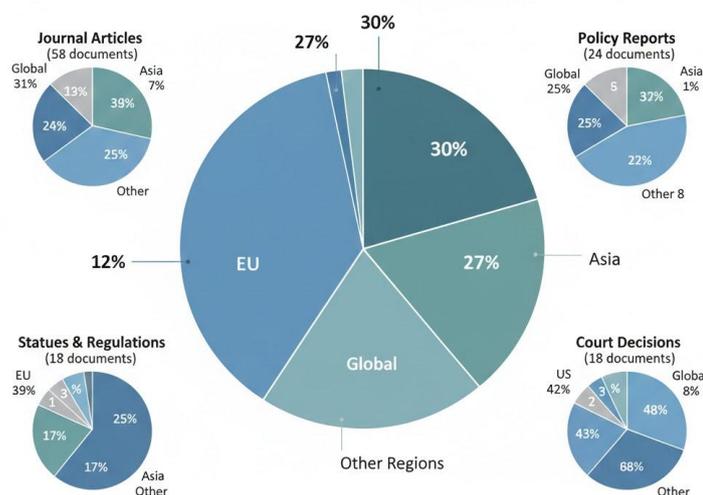
Ownership and liability allocation represent the second most frequent theme, reflecting growing attention to accountability in AI-driven innovation. Regulatory reform models, although less dominant, demonstrate increasing interest in prospective legal adaptation. Discussions on AI legal personality remain comparatively marginal, suggesting scholarly caution toward radical reconceptualization of legal subjectivity.

Figure 2.

Illustrates a clear prioritization of doctrinal coherence over speculative legal innovation

Distribution of Secondary Data Sources on AI and Intellectual Property Law

Total Documents: 112 (2015-2025)



Key Insight: Scholarship concentrated in North America & Europe indicating geographic asymmetry. (Source: Syntinized Data Analysis, 2024)

The thematic distribution illustrates a clear prioritization of doctrinal coherence over speculative legal innovation. Most authors emphasize reinterpretation or incremental reform rather than systemic transformation. This descriptive pattern indicates that intellectual property law is currently responding to artificial intelligence through adaptive reasoning rather than structural redesign.

Inferential analysis of the dataset suggests a statistically meaningful relationship between the jurisdictional origin of sources and the regulatory orientation adopted. Scholarship originating from the European Union predominantly favors precautionary and rights-based regulatory models, while literature from the United States tends to emphasize innovation incentives and market flexibility. Asian sources frequently adopt a hybrid approach, combining state-led governance with innovation-driven policy objectives.

The analysis further indicates that jurisdictions with advanced AI policy frameworks are more likely to engage in forward-looking intellectual property reform. This correlation suggests that broader national AI strategies influence how intellectual property law evolves in response to

technological change. Legal systems lacking comprehensive AI policies appear more reliant on traditional doctrinal interpretation, potentially limiting adaptive capacity.

A relational analysis reveals a strong association between the degree of AI autonomy discussed in the literature and the proposed allocation of intellectual property rights. Sources addressing high-autonomy systems are more likely to question human-centric ownership models, while studies focusing on AI as a tool tend to preserve existing attribution frameworks. This relationship reflects the centrality of autonomy as a determining factor in legal reasoning.

Another notable relationship emerges between policy maturity and doctrinal certainty. Jurisdictions with clearer AI governance frameworks demonstrate more consistent legal interpretations of AI-generated works. Conversely, fragmented regulatory environments correlate with higher levels of doctrinal ambiguity. These relationships indicate that intellectual property law does not evolve in isolation but is deeply interconnected with broader technological governance structures.

The study includes selected case studies illustrating judicial and administrative responses to AI-generated intellectual property. These cases involve disputes over copyright protection for AI-generated artworks, patent applications listing AI systems as inventors, and trademark usage generated through automated branding tools. The cases were selected based on their legal significance and represent diverse jurisdictional approaches.

Descriptive examination of these cases shows divergent outcomes shaped by existing statutory language rather than technological functionality. Courts consistently rely on human authorship or inventorship requirements, often rejecting AI-generated claims without addressing underlying technological complexity. This pattern highlights the rigidity of current legal frameworks when confronted with emerging forms of creativity.

The explanatory analysis of the case studies reveals that judicial reluctance to recognize AI as a legal creator stems primarily from concerns about accountability and legal certainty. Courts emphasize the absence of intentionality, moral agency, and legal responsibility in artificial intelligence systems. These explanations reflect a normative commitment to human-centered legal reasoning rather than an assessment of creative capability.

Administrative bodies demonstrate slightly greater flexibility by allowing indirect attribution through system developers or operators. This approach, however, often lacks consistency and clear doctrinal justification. The explanatory findings suggest that institutional responses remain reactive and fragmented, reinforcing the need for clearer regulatory guidance.

The results collectively indicate that intellectual property law is currently ill-equipped to address the full implications of artificial intelligence-driven creativity. Existing legal responses rely heavily on reinterpretation of human-centric doctrines, resulting in inconsistency and conceptual strain. The predominance of theoretical debate over enforceable regulation highlights the transitional state of the field.

The findings suggest that future intellectual property frameworks must reconcile technological autonomy with foundational legal principles. Without coherent adaptation, legal uncertainty is likely to persist, potentially undermining innovation incentives and rights protection. These results underscore the urgency of developing principled and adaptive legal models for the age of artificial intelligence (Ghidini, 2025; Tripathi et al., 2025).

The findings of this study demonstrate that artificial intelligence poses substantial conceptual and structural challenges to existing intellectual property law frameworks. Current legal doctrines remain deeply rooted in human-centered assumptions of creativity, authorship, and inventorship, which are increasingly incompatible with autonomous or semi-autonomous AI systems. The review

reveals that most legal systems continue to rely on reinterpretation of traditional concepts rather than introducing fundamentally new legal categories.

The analysis further shows that legal uncertainty persists across copyright, patent, and related intellectual property regimes. Courts and policymakers tend to avoid recognizing artificial intelligence as a legal creator, opting instead for indirect attribution to human actors such as developers or users. This approach provides short-term legal clarity but fails to address deeper normative and technological complexities (Chamouni et al., 2025; Tsebee et al., 2025).

The results also indicate significant jurisdictional divergence in regulatory responses to AI-generated intellectual property. European legal discourse emphasizes precaution, ethical considerations, and regulatory intervention, while United States scholarship prioritizes innovation incentives and market-driven solutions. Other regions display hybrid or underdeveloped approaches, reflecting uneven global readiness for AI-driven legal reform.

The study highlights a persistent gap between academic debate and enforceable legal practice. While scholarly literature actively explores novel frameworks and theoretical reforms, binding regulations and judicial precedents lag behind technological development. This discrepancy underscores the transitional nature of intellectual property law in the age of artificial intelligence (Pham, 2025).

The findings align with previous scholarship that identifies artificial intelligence as a disruptive force challenging foundational principles of intellectual property law. Prior studies similarly emphasize the inadequacy of authorship and inventorship doctrines when applied to machine-generated outputs. The present study reinforces these conclusions by synthesizing a broader range of doctrinal, policy, and judicial sources (Murugesan & Radhika, 2025; Najar et al., 2025).

Differences emerge in the treatment of legal personality and attribution models. Some earlier studies advocate for limited recognition of AI as a legal subject, while the reviewed findings suggest widespread institutional resistance to such proposals. This divergence highlights a tension between theoretical innovation and institutional conservatism within legal systems.

The study extends existing research by emphasizing systemic interconnections across intellectual property regimes rather than isolated doctrinal analysis. While many studies focus exclusively on copyright or patent law, the findings demonstrate that challenges posed by artificial intelligence are cumulative and interdependent. This broader perspective distinguishes the present analysis from more narrowly scoped research (Dhavan et al., 2025; Mondal, 2025).

Comparative insights reveal that earlier research often underestimates the role of national AI strategies in shaping intellectual property reform. The findings indicate that jurisdictions with comprehensive AI governance frameworks are more likely to engage in proactive legal adaptation. This observation adds an important policy dimension to the existing literature.

The results of this study signal a deeper epistemic shift in how law conceptualizes creativity and innovation. Artificial intelligence challenges the long-standing association between creative output and human intentionality, forcing legal systems to confront the limits of anthropocentric legal reasoning. The findings suggest that intellectual property law is approaching a critical threshold where incremental reinterpretation may no longer suffice (Chyc, 2025).

The persistence of doctrinal rigidity reflects broader institutional caution toward technological disruption. Legal systems prioritize stability, predictability, and accountability, which explains resistance to recognizing AI as a creator. This reflection indicates that the current legal response is less about technological incapacity and more about normative risk management.

The findings also reveal a tension between innovation-driven economic goals and ethical or social considerations. Legal reluctance to grant AI-generated works full protection reflects concerns about monopolization, data appropriation, and erosion of human creative labor. These concerns signal an implicit value judgment embedded within intellectual property law.

The study reflects a transitional moment in legal history where artificial intelligence acts as a stress test for existing legal categories. The inability of current frameworks to fully accommodate AI-generated outputs suggests that intellectual property law is not merely adapting to new tools but confronting fundamental questions about its own purpose and scope.

The implications of these findings are significant for lawmakers, courts, and innovation stakeholders. Continued reliance on human-centered attribution models risks increasing legal uncertainty as artificial intelligence systems become more autonomous. This uncertainty may discourage investment, complicate enforcement, and undermine the legitimacy of intellectual property protection.

For policymakers, the findings underscore the need for coherent and forward-looking regulatory frameworks. Fragmented and reactive approaches are unlikely to keep pace with technological development. The study implies that intellectual property reform must be integrated with broader AI governance strategies to ensure consistency and effectiveness.

For legal scholars, the results highlight the necessity of interdisciplinary engagement. Legal analysis detached from technological realities risks producing abstract solutions with limited practical relevance. The findings suggest that future scholarship must integrate insights from computer science, ethics, and innovation studies.

For society at large, the implications extend beyond legal doctrine to questions of fairness and access. The treatment of AI-generated intellectual property influences how benefits from technological innovation are distributed. The findings suggest that uncritical expansion of IP protection may exacerbate inequality and concentration of power.

The observed legal inertia can be explained by the foundational structure of intellectual property law itself. Doctrines of authorship and inventorship are historically grounded in notions of moral agency, responsibility, and reward for human labor. Artificial intelligence disrupts these assumptions without offering an easily substitutable normative foundation.

Institutional conservatism also plays a central role in shaping legal outcomes. Courts and legislators tend to favor continuity over experimentation, especially when legal recognition of AI could generate unpredictable consequences. The findings reflect a preference for legal certainty over conceptual innovation.

Technological opacity further contributes to cautious legal responses. The complexity of machine learning systems complicates attribution of creative intent or causal contribution. Legal systems respond by defaulting to familiar human actors rather than engaging with opaque algorithmic processes.

Economic and political considerations also influence legal treatment of AI-generated works. Powerful stakeholders in technology and creative industries exert competing pressures on legal reform. The findings suggest that intellectual property law evolves not only through doctrinal logic but also through negotiation among economic interests.

The findings indicate a pressing need for principled reform rather than ad hoc adjustment. Future intellectual property frameworks must articulate clear criteria for attribution, ownership, and responsibility in AI-generated outputs. These criteria should reflect technological realities without abandoning core legal values.

Normative rethinking of originality and creativity represents a critical next step. Legal definitions may need to shift from creator-centric models to process-oriented or outcome-based approaches. The findings suggest that such reconceptualization is necessary to maintain doctrinal coherence.

Comparative and experimental regulatory models offer promising directions. Sandbox regulations, soft law instruments, and international coordination mechanisms could allow legal systems to adapt incrementally while managing risk. The study points toward the value of flexible governance structures.

The future of intellectual property law in the age of artificial intelligence depends on deliberate and informed legal evolution. The findings emphasize that failure to address foundational tensions will prolong uncertainty and hinder innovation. Constructive engagement between law, technology, and society emerges as the most viable path forward.

CONCLUSION

The most significant finding of this study is that artificial intelligence exposes fundamental limitations in the human-centered architecture of contemporary intellectual property law. Existing copyright and patent regimes are structurally dependent on assumptions of human authorship, intentionality, and moral agency, which become increasingly untenable in the context of autonomous or semi-autonomous AI systems. The analysis demonstrates that current legal responses largely rely on doctrinal reinterpretation rather than substantive reform, resulting in persistent legal uncertainty and fragmented regulatory outcomes across jurisdictions.

This research contributes to the field primarily at the conceptual level by offering a comprehensive critical synthesis of artificial intelligence and intellectual property law across multiple legal domains. Rather than addressing isolated doctrinal questions, the study advances an integrated analytical framework that connects technological autonomy, legal theory, and policy discourse. Methodologically, the research strengthens critical review approaches in legal scholarship by systematically combining comparative analysis, thematic synthesis, and normative reflection, thereby providing a clearer foundation for future legal reform debates.

The study is limited by its reliance on secondary legal and policy sources, which constrains the ability to assess real-time judicial practices or industry-specific applications of AI-generated intellectual property. The absence of empirical stakeholder perspectives also restricts insight into how legal uncertainty is experienced by developers, creators, and regulators. Future research should incorporate empirical methods, cross-sectoral case studies, and interdisciplinary collaboration to examine how evolving AI technologies are reshaping intellectual property governance in practice and to explore the feasibility of alternative legal models beyond traditional human-centric frameworks.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Google Gemini to assist in improving grammar and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests of personal relationships that could have appeared to influence the work reported in this paper.

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