



Research article

JNL: <https://ijlcw.emnuvens.com.br/revista>

DOI: <https://doi.org/10.54934/ijlcw.v5i1.186>

INTELLECTUAL PROPERTY GOVERNANCE IN THE AGE OF ARTIFICIAL INTELLIGENCE: REGULATORY FRAGMENTATION AND THE TRANSFORMATION OF DIGITAL AUTHORITY

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Article Information:

Received

May 18, 2025

Reviewed & Revised

May 25, 2025

Accepted

May 25, 2025

Published

July 30, 2026

ABSTRACT | 摘要 | RESUMEN

Regulatory fragmentation surrounding artificial Intelligence (AI) and intellectual property governance reflects deeper transformations in the organization of digital authority rather than mere doctrinal inconsistency. Existing scholarship frequently approaches AI-related copyright and patent disputes through narrow legal formalism, offering limited explanation of how algorithmic creativity reconfigures governance relations between states, multinational technology corporations, and transnational digital infrastructures. Using a comparative socio-legal and interpretive governance framework, this article analyzes legislation, judicial decisions, and regulatory instruments across the United States, the European Union, China, and selected Global South jurisdictions. The findings demonstrate that fragmented regulatory responses emerge from competing governance rationalities concerning technological sovereignty, innovation control, platform governance, and digital economic power. The article reconceptualizes intellectual property law as a contested governance arena through which authority over algorithmic production and digital innovation is increasingly negotiated within transnational technological ecosystems.

Keywords:

Artificial Intelligence,
intellectual property
governance,
regulatory
fragmentation,
algorithmic creativity,
digital governance

FOR CITATION:

Jaman, U. B., Armansyah, & Marah, T. S. (2026). Intellectual Property Governance in the Age of Artificial Intelligence: Regulatory Fragmentation and the Transformation of Digital Authority. *International Journal of Law in Changing World*, 5 (1), 145-169. DOI: <https://doi.org/10.54934/ijlcw.v5i1.186>

1. INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming systems of cultural production, scientific innovation, and digital commerce in ways that increasingly destabilize foundational assumptions underpinning contemporary intellectual property (IP) law. [11] [20] Existing copyright and patent frameworks remain predominantly structured around anthropocentric conceptions of authorship, inventorship, ownership, and originality despite the emergence of algorithmic systems capable of generating autonomous or semi-autonomous outputs across creative, industrial, and knowledge-intensive sectors. [2] [37] As generative AI technologies become embedded within transnational innovation ecosystems, regulators confront increasingly complex questions concerning AI-generated works, machine-assisted invention, copyrighted training datasets, and platform-mediated governance infrastructures. [22] [23] The resulting disputes reveal growing tensions between territorially bounded legal regimes and digitally networked systems of production that transcend conventional jurisdictional boundaries.

These tensions are particularly visible in contemporary litigation concerning AI authorship and inventorship. Judicial disputes involving copyright claims over AI-generated outputs and patent controversies surrounding the DABUS system expose substantial divergence in how legal institutions conceptualize algorithmic creativity. In copyright law, *Thaler v. Perlmutter* reaffirmed the United States commitment to human authorship requirements by rejecting copyright protection for autonomously generated AI works lacking meaningful human creative contribution. [3] [14] [38] Comparable fragmentation has emerged in patent law through DABUS-related litigation, where different jurisdictions adopted divergent institutional responses to AI inventorship claims. While the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), and the United Kingdom Supreme Court rejected AI inventorship based upon statutory and doctrinal commitments to human inventors, South Africa recognized DABUS within its patent registration framework, while Australia experienced significant judicial contestation before appellate reversal. [1] These divergent institutional outcomes suggest that regulatory fragmentation cannot be explained solely as temporary doctrinal uncertainty. Rather, they indicate deeper tensions concerning authority allocation, innovation governance, and institutional adaptation under conditions of technological transformation.

Contemporary scholarship examining AI and intellectual property has expanded considerably in response to these developments, particularly concerning copyright attribution, patent inventorship, data ownership, and digital platform regulation. [10] [33] Nevertheless, much of this literature remains divided

between doctrinal formalism and technologically deterministic approaches that conceptualize AI primarily as a technical legal problem requiring incremental regulatory adjustment. Legal scholarship frequently concentrates on whether algorithmically generated outputs satisfy existing thresholds of human authorship or inventorship, often privileging doctrinal continuity over broader institutional transformation. [24] [43] Pamela Samuelson's scholarship on digital copyright governance demonstrates that technological transformation repeatedly destabilizes inherited copyright assumptions and requires institutional adaptation beyond narrow doctrinal recalibration. [34] Similarly, Jane Ginsburg and Budiardjo work on authorship doctrine highlights the centrality of human creative contribution within copyright systems while simultaneously exposing tensions introduced by technologically mediated production processes. [13] More recent scholarship further suggests that AI-generated creativity may require greater doctrinal flexibility than conventional copyright frameworks presently allow. Gooding argues that emerging forms of human–AI collaborative production challenge binary distinctions between fully human and fully machine-generated works, proposing more permissive recognition of partial AI authorship within copyright doctrine. [14] This perspective highlights growing tension between inherited anthropocentric copyright principles and increasingly hybrid forms of algorithmically mediated creativity. Within patent scholarship, Annette Kur's scholarship on intellectual property protection frameworks further demonstrates how technological transformation increasingly challenges conventional legal categories governing ownership allocation and innovation protection, creating pressure for institutional adaptation within intellectual property systems. [25] Collectively, these contributions indicate that AI governance raises institutional questions extending beyond formal legal classification.

Parallel developments within governance scholarship provide additional explanatory insight. Julie Cohen's work on informational capitalism demonstrates how digital infrastructures redistribute economic and informational power through platform-mediated systems of governance, while Shoshana Zuboff's theory of surveillance capitalism explains how technological infrastructures increasingly shape authority relations within contemporary digital economies. [7] [46] Related scholarship by Mireille Hildebrandt, Laura DeNardis, and Nicolas Suzor further demonstrates that regulatory authority increasingly operates through hybrid governance arrangements in which private technological infrastructures exercise quasi-regulatory functions traditionally associated with state institutions. [9] [18] [36] These governance debates remain insufficiently integrated into contemporary intellectual property scholarship, which frequently treats regulatory fragmentation as a temporary consequence of technological novelty rather than as a structural characteristic of evolving digital governance regimes.

The omission is analytically significant because AI-related intellectual property disputes increasingly intersect with broader dynamics of platform capitalism, technological sovereignty, cross-border data extraction, geopolitical competition, and asymmetrical control over digital infrastructures. [32] [42] Under these conditions, intellectual property law functions not merely as a neutral mechanism for protecting innovation but increasingly as a governance technology through which states, multinational technology corporations, and international institutions negotiate authority within emerging digital economies. [19] [26] Existing scholarship frequently underestimates this political-economic dimension by privileging doctrinal coherence over institutional analysis and by insufficiently examining how regulatory divergence reproduces asymmetrical governance relationships between technologically dominant jurisdictions and structurally dependent regulatory environments.

The comparative dimension of these dynamics is particularly important. Major regulatory actors including the United States, the European Union, and China increasingly shape global AI governance standards through distinct institutional strategies. The United States continues to privilege innovation flexibility and market-oriented regulatory adaptation. The European Union increasingly emphasizes accountability, rights protection, and integrated digital constitutionalism through instruments such as the AI Act and broader digital governance frameworks. China adopts a sovereignty-centered regulatory approach integrating technological governance with industrial policy and strategic modernization objectives. Anu Bradford's theory of the "Brussels Effect" provides an especially important explanatory framework for understanding how regulatory power diffuses transnationally, demonstrating how large regulatory jurisdictions can externalize domestic governance preferences beyond territorial boundaries through market influence and institutional capacity. Global South jurisdictions, by contrast, frequently operate under conditions of regulatory diffusion and infrastructural dependency, shaping participation within AI governance architectures in institutionally asymmetrical ways. [17] [41]

Existing scholarship therefore provides only limited explanatory capacity for understanding why fragmentation persists despite growing recognition of the need for regulatory coordination. Much existing work treats fragmentation primarily as regulatory delay, legislative incompleteness, or technological novelty. Such explanations insufficiently account for how competing governance rationalities embedded within different political-economic systems produce durable forms of institutional divergence.

This article addresses these limitations by developing a socio-legal governance framework that conceptualizes regulatory fragmentation in AI-related intellectual property governance as an adaptive institutional response to competing governance rationalities within evolving digital political economy. Drawing upon regulatory governance theory and socio-legal institutionalism, the article argues that

fragmentation cannot be understood solely as doctrinal inconsistency because it reflects broader transformations in authority distribution between states, private technological infrastructures, international regulatory institutions, and transnational platform ecosystems. [5] [28] This perspective enables a more institutionally grounded understanding of how algorithmic creativity destabilizes traditional legal categories while simultaneously generating jurisdictional competition, governance experimentation, and hybrid regulatory arrangements.

The article therefore examines how artificial Intelligence reconfigures intellectual property governance under conditions of transnational regulatory fragmentation and institutional asymmetry. It addresses two central research questions. First, how do contemporary intellectual property regimes respond to legal and institutional challenges generated by algorithmic creativity and AI-assisted innovation across jurisdictions? Second, how does regulatory fragmentation reshape digital innovation governance by redistributing authority among states, international institutions, and private technological actors? Methodologically, the study adopts a comparative socio-legal approach integrating doctrinal legal analysis with governance-oriented institutional interpretation to examine interactions between legal regulation, technological transformation, and evolving structures of digital authority.

The article advances existing scholarship in three principal respects. First, it reconceptualizes AI-related intellectual property disputes as governance conflicts embedded within broader transformations of digital political economy rather than isolated doctrinal inconsistencies. Second, it bridges fragmented scholarship across intellectual property law, platform governance, and regulatory institutionalism by demonstrating how algorithmic production intensifies tensions between territorially bounded legal systems and transnational technological infrastructures. Third, it develops a governance-centered interpretation of regulatory fragmentation that explains institutional divergence not as regulatory failure but as an adaptive manifestation of competing political-economic strategies shaping contemporary digital governance architectures. In doing so, the article contributes to broader debates concerning technological regulation, digital constitutionalism, governance pluralism, and the future distribution of legal authority within increasingly transnational digital economies.

2. MATERIALS AND METHODS

This study employs a comparative socio-legal and interpretive governance research design to examine how contemporary intellectual property (IP) regimes respond to regulatory challenges generated by artificial Intelligence (AI)-driven innovation and algorithmic creativity. The methodological framework integrates socio-legal institutionalism with regulatory governance theory, conceptualizing law

not merely as a doctrinal system of formal rules but as a dynamic governance mechanism through which states, regulatory institutions, and private technological actors negotiate authority, innovation control, market organization, and digital sovereignty under conditions of technological disruption. [5] [7] [28] The analytical objective extends beyond identifying doctrinal inconsistencies within intellectual property law toward explaining how regulatory fragmentation emerges through competing governance rationalities embedded within contemporary digital political economy and transnational technological infrastructures. Accordingly, the study combines comparative doctrinal legal analysis with institutional interpretation to investigate the interaction between legal regulation, algorithmic production, and evolving configurations of digital authority.

The study adopts an interpretivist socio-legal orientation that treats legal norms, regulatory instruments, and governance arrangements as institutionally embedded processes shaped by political, technological, and economic contestation. [5] [7] This perspective permits analysis beyond formal statutory interpretation by examining how intellectual property governance increasingly intersects with platform infrastructures, industrial policy strategies, technological sovereignty objectives, and divergent institutional approaches to AI regulation. [9] [18] [36] The comparative design employs purposive jurisdictional selection based upon four analytical criteria: (i) global regulatory influence in AI governance; (ii) institutional distinctiveness in approaches toward intellectual property regulation and technological governance; (iii) demonstrated engagement with AI-related copyright, patent, or platform governance disputes; and (iv) comparative relevance for evaluating governance fragmentation across advanced and developing regulatory environments.

Applying these criteria, the study examines the United States, the European Union, China, and selected Global South jurisdictions comprising Indonesia and African Union governance frameworks. The United States was selected because it represents a market-oriented innovation governance model characterized by judicial adaptation, private-sector technological leadership, and strong anthropocentric intellectual property doctrine. The European Union was selected because it reflects a rights-based regulatory constitutionalist model emphasizing accountability, transparency, and integrated digital governance. China was included because it represents a sovereignty-centered techno-industrial governance model integrating AI regulation with state modernization and industrial policy objectives. Indonesia was selected as a Global South case because of its expanding digital economy, emerging AI governance initiatives, and institutional reliance upon externally developed technological infrastructures within ASEAN digital governance environments. African Union governance initiatives were incorporated to examine continental approaches toward digital sovereignty, ethical AI governance, and institutional

adaptation under conditions of infrastructural dependency and asymmetrical technological capacity. Collectively, these jurisdictions capture variation across major governance rationalities shaping contemporary AI-related intellectual property regulation.

The evidentiary corpus consists of primary legal and institutional materials produced between 2018 and 2026, reflecting the accelerated development of generative AI technologies and corresponding governance responses concerning authorship, inventorship, copyright liability, platform accountability, algorithmic regulation, and digital sovereignty. Primary materials were selected based upon institutional significance, comparative relevance, and demonstrated influence over emerging governance approaches toward AI-related intellectual property regulation.

The analysis incorporates four categories of primary materials. First, judicial decisions addressing AI-generated intellectual property disputes were examined, including *Thaler v. Perlmutter* in the United States and DABUS-related patent litigation across multiple jurisdictions, including the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), the United Kingdom Supreme Court, Australian patent litigation, and South African patent registration developments. Second, legislative and regulatory instruments were analyzed, including the European Union Artificial Intelligence Act, the Digital Services Act, the Copyright in the Digital Single Market Directive, and China's Interim Measures for the Management of Generative Artificial Intelligence Services. Third, regulatory guidance documents and institutional governance materials were examined, including United States Copyright Office guidance concerning AI-generated works, World Intellectual Property Organization (WIPO) governance documents, African Union AI governance frameworks, and Indonesian and ASEAN digital governance initiatives. Fourth, parliamentary consultations, administrative policy statements, and institutional governance reports were incorporated to contextualize evolving regulatory trajectories. Secondary scholarship was utilized selectively to situate doctrinal developments within broader debates concerning socio-legal institutionalism, platform governance, regulatory capitalism, and digital political economy.

Materials were collected through systematic review of publicly accessible legal databases, judicial repositories, governmental regulatory publications, institutional documentation, and international governance databases. Comparative analysis proceeded through a structured qualitative coding framework designed to operationalize recurring governance dimensions identified within AI-related intellectual property regulation.

Coding procedures employed eight operational indicators. Human authorship requirements measured whether legal protection remained contingent upon identifiable human creative contribution.

Inventorship attribution examined whether AI systems could qualify as legally recognized inventors under patent frameworks. Data governance assessed regulatory treatment of training datasets, data extraction practices, and informational accountability obligations. Platform-centered governance evaluated the extent to which regulatory authority operated through platform obligations, intermediary governance mechanisms, or private technological infrastructures. Innovation orientation measured whether regulatory systems prioritized technological flexibility and innovation incentives. Sovereignty orientation assessed institutional emphasis on technological autonomy, strategic industrial coordination, and digital sovereignty objectives. Governance architecture examined whether regulatory arrangements reflected judicial adaptation, centralized administrative coordination, supranational oversight, or hybrid governance configurations. Finally, accountability mechanisms evaluated institutional requirements concerning transparency obligations, regulatory supervision, rights-holder protection, and public oversight.

Each legal and institutional source was coded according to these indicators and subsequently compared across jurisdictions to identify patterns of convergence, divergence, and institutional adaptation. Comparative interpretation focused specifically on how different governance systems constructed legal authority, balanced innovation incentives against regulatory accountability, distributed governance power between public institutions and private technological actors, and responded to challenges generated by algorithmic creativity. Cross-jurisdictional comparison further enabled identification of competing governance rationalities shaping regulatory fragmentation across transnational digital governance architectures.

Methodological robustness was strengthened through triangulation across judicial decisions, legislative instruments, institutional governance materials, and academic scholarship, facilitating cross-validation of interpretive findings and comparative consistency across institutional settings. Nevertheless, several limitations remain. Regulatory developments concerning generative AI continue to evolve rapidly, creating temporal constraints upon long-term governance assessment. In addition, regulatory documentation remains uneven across developing governance environments, particularly within emerging Global South institutional contexts. Finally, because the study prioritizes comparative institutional interpretation rather than quantitative behavioral measurement, its conclusions remain explanatory rather than predictive. These limitations are consistent with the study's objective of examining the institutional dynamics through which regulatory fragmentation reshapes intellectual property governance within evolving transnational digital ecosystems.

3. RESULTS AND DISCUSSION

3.1 Regulatory Fragmentation and Divergent Legal Conceptions of Algorithmic Creativity

Comparative evidence indicates that generative artificial Intelligence destabilizes foundational assumptions upon which contemporary intellectual property regimes remain structurally dependent. Existing copyright and patent systems continue to rely predominantly upon anthropocentric legal principles that associate ownership attribution, authorship, originality, and inventorship with identifiable human agency. [30] The emergence of increasingly autonomous algorithmic systems capable of generating text, images, software, scientific outputs, and technical solutions complicates these assumptions by challenging whether artificial Intelligence should be treated merely as an assistive technological instrument or as a productive actor requiring new legal categorization. [15] Regulatory fragmentation has consequently emerged not simply because legal systems face technological novelty, but because jurisdictions adopt fundamentally different institutional responses concerning innovation governance, accountability allocation, technological sovereignty, and regulatory authority.

The United States continues to preserve a strongly anthropocentric orientation toward intellectual property governance grounded in maintaining human creative contribution as the defining threshold for legal protection. [31] This institutional position is particularly visible within copyright doctrine. United States Copyright Office guidance has consistently maintained that copyright protection requires meaningful human authorship and excludes works generated entirely through autonomous artificial intelligence processes. Judicial reasoning in *Thaler v. Perlmutter* further reinforced this principle by affirming that copyright protection under existing statutory frameworks remains contingent upon human creative contribution rather than machine-generated production. [3]

The reasoning in *Thaler* is especially significant because it illustrates how legal doctrine operates as a governance mechanism for defining institutional boundaries surrounding technological innovation. Stephen Thaler sought copyright registration for an image generated autonomously by an AI system known as the Creativity Machine. The United States Copyright Office denied registration, concluding that copyright law requires human authorship. [14] [38] Subsequent judicial review upheld this determination, emphasizing that the Copyright Act and longstanding jurisprudential traditions conceptualize authorship as a fundamentally human legal category [38] The court did not merely reject machine authorship as a doctrinal technicality. Rather, its reasoning reflected broader governance concerns involving accountability allocation, ownership attribution, and institutional predictability within increasingly automated innovation ecosystems. Human authorship requirements therefore operate not solely as

doctrinal continuity mechanisms but as governance tools preserving established distributions of legal authority within digital production systems. [13] [14]

Comparable tensions emerge within patent governance through litigation involving the Device for the Autonomous Bootstrapping of Unified Sentience (DABUS), developed by Stephen Thaler. DABUS has become a defining transnational test case concerning whether artificial intelligence systems may qualify as inventors under existing patent frameworks. [1] Jurisdictional responses reveal substantial divergence regarding how legal institutions conceptualize inventorship under conditions of algorithmic innovation.

United States patent authorities rejected DABUS inventorship claims on the basis that inventorship under the Patent Act requires natural person status. Federal judicial review subsequently reinforced this interpretation by emphasizing statutory language linking inventorship to human agency and legal accountability structures. [1] [29] Similar reasoning emerged within the European Patent Office (EPO), which rejected DABUS patent applications because the European Patent Convention presupposes inventorship as a human legal category capable of possessing rights and obligations. The United Kingdom Supreme Court adopted a comparable approach, concluding that existing statutory frameworks require identifiable human inventors and that policy considerations regarding AI innovation could not override legislative design.

Australia briefly departed from this emerging doctrinal convergence when initial judicial reasoning suggested that artificial intelligence systems might potentially qualify as inventors under evolving technological conditions. However, appellate review ultimately reversed this position and restored anthropocentric inventorship interpretation. South Africa presents the most significant institutional divergence. Unlike the United States, Europe, and the United Kingdom, South African authorities accepted a DABUS patent application through a registration-oriented administrative framework lacking substantive inventorship examination. Although South Africa's outcome does not necessarily indicate doctrinal endorsement of AI inventorship, it demonstrates how institutional design influences regulatory responses to technological disruption. [1] [29]

These divergent outcomes complicate scholarship treating regulatory fragmentation primarily as temporary legislative delay or transitional technological uncertainty. The comparative evidence instead suggests that fragmentation reflects competing governance rationalities embedded within distinct political-economic and institutional models of technological regulation. The United States prioritizes market-oriented innovation governance while preserving doctrinal continuity through anthropocentric

conceptions of authorship and inventorship. European institutional responses prioritize legal accountability, regulatory coordination, and rights-based governance principles. China adopts a comparatively different governance model integrating technological regulation more directly within industrial policy coordination and techno-sovereignty objectives. [40] [45] Regulatory divergence therefore emerges not because jurisdictions misunderstand common governance challenges, but because institutional actors operationalize competing governance rationalities concerning innovation incentives, technological sovereignty, and regulatory authority allocation.

From a socio-legal governance perspective, algorithmic creativity exposes tensions between territorially bounded legal frameworks and increasingly transnational technological infrastructures. Intellectual property disputes concerning AI authorship and inventorship therefore operate not merely as doctrinal controversies but as institutional arenas through which states negotiate broader questions concerning technological sovereignty, innovation governance, accountability structures, and authority distribution within contemporary digital political economy. Regulatory fragmentation should consequently be understood not as regulatory failure alone but as an adaptive institutional condition emerging from competing governance rationalities shaping contemporary AI governance architectures. [5] [28] [35] To facilitate systematic cross-jurisdictional comparison, Table 1 synthesizes the principal regulatory approaches identified across the jurisdictions examined.

Table 1. Comparative Regulatory Approaches to AI-Related Intellectual Property Governance Across Jurisdictions

Governance Dimension	United States	European Union	China	Indonesia / African Union
Human Authorship Standard	Human authorship required under <i>Thaler v. Perlmutter</i> and US Copyright Office guidance	Human-centered copyright framework; AI governance integrated through AI Act and DSM Directive	No formal recognition of AI authorship; governance embedded within state AI regulation	Emerging frameworks; governance discussions emphasize ethical AI and human accountability
AI Inventorship Treatment	DABUS rejected by USPTO and federal courts	DABUS rejected by EPO	No formal AI inventorship recognition; innovation governed through industrial coordination mechanisms	Limited formal doctrine; regulatory development remains emerging
Data Governance Approach	Fair use doctrine and litigation-centered governance	GDPR + AI Act + Digital Services Act + DSM Directive	Interim Measures for Management of Generative AI Services	Regulatory adaptation and externally influenced governance development
Governance Coordination Model	Judicial interpretation + administrative guidance	Integrated supranational governance architecture	Centralized administrative governance	Hybrid and institutionally developing systems
Primary Regulatory Instruments	Copyright Office Guidance; Patent Act; <i>Thaler</i> ; DABUS litigation	AI Act; GDPR; DSA; DSM Directive	Interim Measures for Generative AI Services	ASEAN digital governance initiatives; African Union AI frameworks

Source: Author synthesis derived from comparative analysis of judicial decisions, legislative instruments, and governance frameworks examined in Sections 3.1–3.3.

3.2 Algorithmic Creativity and the Redistribution of Regulatory Authority

Comparative evidence indicates that algorithmic creativity transforms not only the interpretation of intellectual property doctrine but also the institutional distribution of regulatory authority within contemporary digital governance systems. Artificial Intelligence increasingly operates through platform-mediated infrastructures controlled by multinational technology corporations that possess substantial influence over data access, computational resources, licensing architectures, and digital production ecosystems. [7] [9] [28] Intellectual property governance consequently extends beyond formal legal institutions into hybrid regulatory environments in which private technological actors increasingly exercise governance functions historically associated with state authority. The governance implications of artificial Intelligence therefore cannot be understood exclusively through doctrinal questions concerning authorship or inventorship because algorithmic production simultaneously restructures institutional authority within transnational digital political economy.

Julie Cohen's work on informational capitalism provides an important explanatory foundation for understanding this transformation. Cohen argues that digital infrastructures increasingly organize authority relations by concentrating informational and economic power within platform ecosystems rather than traditional public institutions. [7] Similarly, Laura DeNardis demonstrates that governance authority increasingly operates through infrastructural control mechanisms embedded within technological systems themselves rather than solely through formal regulatory intervention. [9] Nicolas Suzor further illustrates how private platforms increasingly perform quasi-regulatory functions by establishing behavioral norms, access conditions, and governance standards independent of direct state supervision. [36] Within AI governance, these dynamics become especially significant because intellectual property regulation increasingly depends upon access to computational infrastructure, training data, platform distribution systems, and proprietary technological ecosystems controlled by a relatively small number of multinational corporations.

This redistribution of authority becomes particularly visible in disputes concerning training datasets, data extraction practices, and ownership claims over AI-generated outputs. Litigation involving OpenAI, Stability AI, Getty Images, and major publishing industries illustrates escalating institutional conflict concerning the extraction and use of copyrighted materials for training generative AI systems. [8] [11] [39] These disputes extend beyond conventional copyright enforcement questions because they

concern who possesses institutional authority to govern informational resources underpinning AI development itself.

Competing regulatory responses reveal broader struggles over innovation governance and regulatory power allocation. In the United States, fair use doctrine continues to function as a mechanism preserving technological flexibility and private innovation incentives even where copyright protections remain contested. [3] [8] The institutional orientation favors market adaptability and private technological experimentation while relying substantially upon litigation and judicial interpretation to resolve emerging conflicts. By contrast, the European regulatory model increasingly integrates copyright governance within broader accountability infrastructures through interaction among the Copyright in the Digital Single Market Directive, the General Data Protection Regulation (GDPR), and emerging AI governance mechanisms emphasizing transparency obligations and rights-holder protections. [12] [27] This institutional architecture reflects what Anu Bradford conceptualizes as transnational regulatory influence through market power and regulatory capacity. Bradford's theory of the Brussels Effect helps explain how large regulatory jurisdictions externalize governance preferences beyond territorial boundaries by establishing compliance expectations that multinational actors adopt globally. [6] European AI governance therefore shapes not merely domestic regulatory practice but broader transnational governance standards.

China follows a different institutional trajectory by embedding AI governance more directly within state-centered technological management strategies emphasizing industrial coordination, data governance, and technological sovereignty objectives [41] [44] Regulatory instruments governing generative artificial Intelligence integrate innovation promotion with centralized oversight mechanisms, reflecting governance priorities focused upon strategic technological competitiveness and state coordination capacity. The resulting divergence across governance systems demonstrates that regulatory fragmentation reflects competing institutional strategies concerning authority allocation rather than temporary failures of legal adaptation.

Private technological actors increasingly occupy governance positions traditionally associated with public institutions. Major AI developers exercise substantial influence over access to computational infrastructure, platform participation, training resources, licensing conditions, and content governance mechanisms through contractual arrangements, application programming interface restrictions, and proprietary technological systems. [16] [18] Governance consequently operates increasingly through hybrid public-private institutional arrangements rather than exclusively through formal legal systems.

Regulatory authority becomes distributed across states, multinational corporations, platform ecosystems, and transnational technological infrastructures simultaneously.

These developments expose substantial geopolitical asymmetries within contemporary AI governance architectures. Technology corporations headquartered primarily in the United States and China maintain disproportionate influence over AI development ecosystems because they control computational resources, platform infrastructures, investment capital, and large-scale technological capabilities. [32] [42] By contrast, many Global South jurisdictions remain institutionally constrained by technological dependency and externally generated regulatory standards. [17] Indonesia illustrates this challenge through continued reliance upon externally developed digital infrastructures despite expanding national digital governance ambitions. African Union digital governance initiatives increasingly emphasize ethical AI governance and technological sovereignty but remain constrained by infrastructural asymmetries and limited standard-setting capacity within global technology markets. [17] [21] Participation in AI governance therefore depends not only upon formal regulatory authority but increasingly upon access to computational infrastructure, technological ecosystems, and institutional capacity to influence governance standards.

From a socio-legal governance perspective, intellectual property regulation increasingly functions within hybrid governance environments rather than isolated doctrinal systems concerned solely with ownership protection. Algorithmic creativity restructures institutional authority by redistributing governance power across uneven technological and regulatory terrains shaped by platform concentration, geopolitical competition, infrastructural dependency, and transnational digital infrastructures. Fragmentation persists not because legal systems fail to adapt technically to innovation but because emerging governance architectures reorganize authority itself. AI-related intellectual property disputes consequently operate as broader institutional struggles concerning who possesses the capacity to govern digital production systems within contemporary transnational technological ecosystems.

3.3 Adaptive Governance, Institutional Experimentation, and the Future Trajectory of Digital Innovation Governance

The findings indicate that regulatory fragmentation in AI-related intellectual property governance generates not only legal uncertainty but also institutional experimentation through which emerging governance models are negotiated, contested, and recalibrated under conditions of technological acceleration.[5] [28] Fragmentation therefore cannot be interpreted exclusively as regulatory deficiency or governance failure. Rather, fragmented regulatory responses increasingly function as adaptive

institutional mechanisms through which states, international organizations, private technological actors, and regulatory institutions respond to evolving technological conditions characterized by transnational interdependence and rapid innovation cycles. [4] [26] [35] From a socio-legal governance perspective, institutional divergence reflects ongoing processes of governance adaptation within a digital political economy increasingly shaped by hybrid regulatory authority and technological complexity.

The comparative findings demonstrate that conventional intellectual property frameworks alone are increasingly insufficient for governing AI-driven innovation ecosystems. Regulatory responses to algorithmic production now operate across interconnected institutional domains involving copyright governance, data governance, competition oversight, platform accountability, cybersecurity regulation, algorithmic supervision, and digital constitutional protections. Governance adaptation consequently involves institutional layering rather than simple doctrinal modification. Emerging regulatory architectures increasingly combine previously separate governance domains into integrated systems designed to address technological risks extending beyond conventional intellectual property concerns.

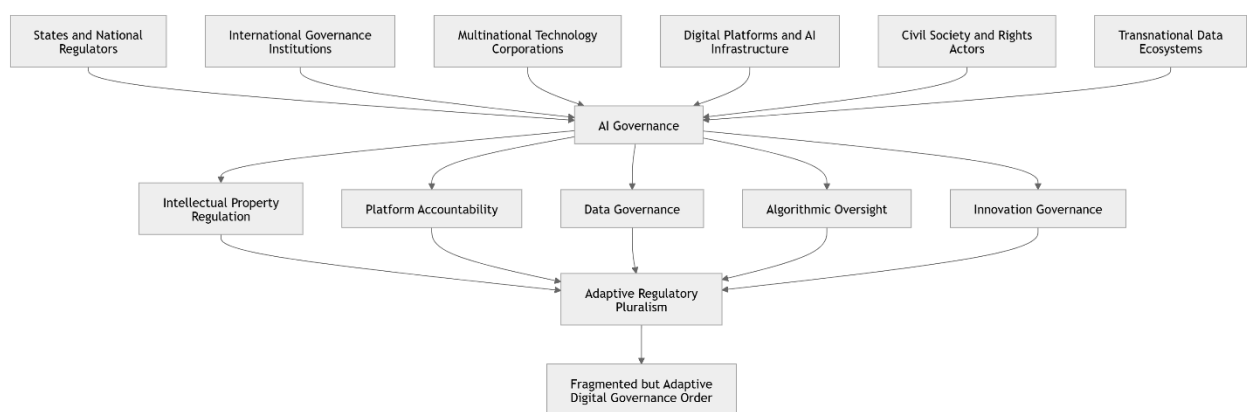
This institutional evolution reflects broader transformations in regulatory governance theory. Black's conception of regulatory pluralism emphasizes that governance authority increasingly operates across multiple institutional actors rather than exclusively through centralized state command structures. [5] Similarly, Levi-Faur's regulatory governance framework demonstrates that contemporary governance increasingly depends upon dispersed institutional coordination involving public regulators, private actors, and transnational governance mechanisms. [28] The findings extend these theoretical perspectives by demonstrating that artificial intelligence governance increasingly depends upon adaptive institutional capacity rather than doctrinal stability alone. Legal authority within AI governance environments is becoming progressively distributed across overlapping governance arrangements involving states, international institutions, multinational technology corporations, and infrastructure-based regulatory systems.

Institutional experimentation also reflects growing recognition that governance adaptation must reconcile competing objectives that frequently operate in tension with one another. Governments increasingly seek to preserve technological competitiveness, attract investment, stimulate innovation ecosystems, and secure strategic technological capacity while simultaneously responding to concerns involving copyright protection, market concentration, data extraction practices, informational asymmetries, and algorithmic accountability. These competing objectives generate governance environments characterized less by institutional convergence than by layered and overlapping regulatory architectures operating simultaneously across multiple governance domains.

This tension is particularly visible in the interaction between digital sovereignty objectives and transnational technological interdependence. States increasingly pursue sovereign regulatory capacity concerning artificial Intelligence while remaining deeply embedded within globally interconnected technological infrastructures controlled by multinational actors. Governance adaptation therefore occurs under conditions where institutional autonomy and technological dependency coexist simultaneously. The result is not governance harmonization but adaptive regulatory pluralism characterized by multiple coexisting institutional approaches toward managing technological transformation.

The findings further suggest that fragmentation persists not because regulatory institutions have failed to coordinate effectively, but because contemporary AI governance operates across competing political-economic environments characterized by divergent institutional priorities, sovereignty concerns, market structures, and technological capacities. Fragmentation therefore reflects structural features of emerging digital governance systems rather than temporary regulatory incompleteness. Attempts to eliminate fragmentation entirely may consequently prove institutionally unrealistic because governance diversity increasingly reflects enduring differences in political-economic organization rather than merely incomplete regulatory development. Figure 1 conceptualizes the adaptive governance ecosystem emerging around AI-driven intellectual property regulation, illustrating how contemporary governance authority is increasingly dispersed across hybrid institutional and transnational digital infrastructures.

Figure 1. Hybrid Governance Ecosystem in AI-Driven Digital Innovation Regulation



Source: Developed by the author from the adaptive governance analysis and socio-legal institutional framework discussed in Section 3.3.

These dynamics are particularly significant within Global South governance environments, where institutional adaptation frequently occurs under conditions of technological dependency and asymmetrical infrastructural access. Many developing regulatory systems increasingly participate within transnational

AI governance ecosystems while possessing comparatively limited influence over infrastructure ownership, computational capacity, investment concentration, and regulatory standard-setting processes. [17] Governance adaptation under these conditions involves navigating tensions between technological development objectives and structural dependence upon externally developed technological systems. The result is often adaptive regulatory incorporation rather than direct governance leadership.

The analysis consequently challenges assumptions that legal harmonization necessarily represents the optimal institutional solution to AI governance fragmentation. Governance effectiveness increasingly depends less upon doctrinal uniformity than institutional flexibility capable of responding to rapidly evolving technological conditions without reinforcing asymmetries in innovation capacity, infrastructural access, and regulatory authority. Regulatory resilience within AI governance environments therefore depends increasingly upon adaptive institutional design rather than complete legal convergence.

From a socio-legal governance perspective, intellectual property governance is evolving toward pluralized regulatory ecosystems in which authority is increasingly dispersed across hybrid governance arrangements linking states, international institutions, private technological actors, and transnational infrastructures simultaneously. AI-related intellectual property disputes consequently operate as broader institutional arenas through which struggles concerning technological authority, innovation governance, economic competitiveness, and digital sovereignty are continuously negotiated. The future trajectory of AI governance may therefore depend less upon achieving regulatory uniformity than upon constructing adaptive institutional frameworks capable of governing technological transformation under conditions of enduring regulatory pluralism. Comparative findings further reveal that AI-driven innovation reshapes intellectual property governance through identifiable institutional transformations extending beyond doctrinal adaptation alone. Table 2 summarizes the principal governance shifts identified through analysis of legislative developments, judicial reasoning, and regulatory interventions across jurisdictions. The table links observed governance transformations to specific primary materials examined in the study and illustrates how institutional responses contribute to broader patterns of regulatory fragmentation and adaptive governance.

Table 2. Governance Transformations and Institutional Evidence in AI-Related Intellectual Property Regulation

Governance Transformation	Evidence Identified	Primary Material	Institutional Consequence
Human authorship contestation	<i>Thaler v. Perlmutter</i> rejects autonomous AI copyright authorship	US judicial decision + Copyright Office guidance	Preservation of anthropocentric copyright doctrine
AI inventorship fragmentation	Divergent DABUS outcomes across USPTO, EPO, UK Supreme Court, Australia, South Africa	Judicial and patent authority decisions	Regulatory fragmentation across patent governance
Expansion of platform governance	OpenAI, Stability AI, Getty Images disputes	Litigation and platform governance mechanisms	Greater private-sector regulatory influence
Data governance expansion	AI Act + GDPR + DSM Directive interaction	EU legislative instruments	Multi-layered accountability obligations
Sovereignty-oriented AI governance	China Interim Measures	Chinese regulatory framework	Centralized AI governance coordination
Global South governance dependency	Indonesian AI governance initiatives + African Union frameworks	Regional governance materials	Uneven institutional participation

Source: Author synthesis from primary materials analyzed in the comparative study.

4. CONCLUSION

The expansion of artificial intelligence within systems of cultural production, technological innovation, and digital commerce has exposed fundamental limitations in contemporary intellectual property governance. This article has argued that the central challenge generated by AI-driven innovation extends beyond doctrinal uncertainty concerning authorship, inventorship, and ownership. Rather, the emergence of algorithmic creativity reflects a broader transformation in the institutional organization of regulatory authority across increasingly transnational and platform-mediated digital economies. Comparative analysis across the United States, the European Union, China, and selected Global South contexts demonstrates that contemporary regulatory fragmentation is not simply a temporary consequence of technological disruption, but a structural manifestation of competing governance rationalities concerning innovation control, technological sovereignty, market regulation, and digital economic power.

By integrating socio-legal institutionalism with regulatory governance theory, the article reconceptualizes fragmentation as an adaptive institutional condition emerging from tensions between territorially bounded legal systems and globally networked technological infrastructures. This governance-centered interpretation advances existing scholarship by demonstrating that AI-related intellectual property disputes cannot be adequately understood through doctrinal analysis alone because legal regulation increasingly operates within hybrid governance environments shaped simultaneously by

states, multinational technology corporations, and transnational regulatory architectures. The findings therefore challenge state-centric and technocratic interpretations of AI governance that treat fragmentation primarily as legislative delay or regulatory insufficiency rather than as an institutional response to restructuring forms of digital authority.

The broader implications of the analysis extend beyond intellectual property law itself. The findings indicate that contemporary AI governance increasingly concerns the redistribution of regulatory authority across overlapping public and private institutional domains in which technological infrastructures, platform economies, and sovereignty-oriented governance strategies interact in complex and often conflicting ways. Under these conditions, legal frameworks organized exclusively around territorial sovereignty and doctrinal coherence may prove increasingly inadequate for governing transnational systems of algorithmic production and digital innovation. The article consequently contributes to wider debates concerning digital constitutionalism, platform governance, regulatory capitalism, and the transformation of legal authority within contemporary digital political economy.

At the same time, the study remains subject to several limitations. The analysis focuses primarily on formal regulatory developments and institutional responses within major governance jurisdictions and therefore cannot fully capture operational variations across less institutionalized regulatory environments. In addition, the rapidly evolving nature of generative AI technologies limits the long-term predictability of emerging governance trajectories. Future research should therefore examine how Global South jurisdictions negotiate technological dependency within evolving AI governance architectures and further investigate how platform concentration and data extraction reshape the political economy of digital innovation across asymmetrical regulatory environments. AI-related intellectual property conflicts ultimately reveal that contemporary digital governance is increasingly defined not by the stability of legal doctrine, but by the contested redistribution of regulatory authority across transnational technological infrastructures.

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ABOUT THIS ARTICLE

Conflict of Interest: The authors declare no conflicting interests

Data Availability Statement: The data supporting the findings of this study are available from the author upon reasonable request. Corresponding author contact: ujang.badru@nusaputra.ac.id

AI-use Disclosure: LLM tools were used during manuscript preparation for language refinement, structural editing, and clarity enhancement. AI tools were not used in the original legal analysis, substantive arguments, or conclusions. All conceptual development, source verification, comparative analysis, and scholarly judgments were conducted by the authors, who assume full responsibility for the accuracy and integrity of the manuscript.

CrediT Authorship Contribution Statement:

Ujang Badru Jaman: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review & Editing.

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LA GOBERNANZA DE LA PROPIEDAD INTELECTUAL EN LA ERA DE LA INTELIGENCIA ARTIFICIAL: FRAGMENTACIÓN REGULATORIA Y TRANSFORMACIÓN DE LA AUTORIDAD DIGITAL

RESUMEN

La fragmentación regulatoria en torno a la inteligencia artificial (IA) y la gobernanza de la propiedad intelectual refleja transformaciones más profundas en la organización de la autoridad digital, más que una mera inconsistencia doctrinal. La literatura académica existente suele abordar las disputas sobre derechos de autor y patentes relacionadas con la IA desde un formalismo jurídico estrecho, ofreciendo una explicación limitada de cómo la creatividad algorítmica reconfigura las relaciones de gobernanza entre Estados, corporaciones tecnológicas multinacionales e infraestructuras digitales transnacionales. Mediante un marco comparativo sociojurídico y de gobernanza interpretativa, este artículo analiza la legislación, las decisiones judiciales y los instrumentos regulatorios de Estados Unidos, la Unión Europea, China y determinadas jurisdicciones del Sur Global. Los resultados demuestran que las respuestas regulatorias fragmentadas surgen de racionalidades de gobernanza en pugna relativas a la soberanía tecnológica, el control de la innovación, la gobernanza de plataformas y el poder económico digital. El artículo reconceptualiza el derecho de propiedad intelectual como un ámbito de gobernanza en disputa, a través del cual la autoridad sobre la producción algorítmica y la innovación digital se negocia cada vez más en el seno de ecosistemas tecnológicos transnacionales.

Palabras clave: Inteligencia artificial, gobernanza de la propiedad intelectual, fragmentación regulatoria, creatividad algorítmica, gobernanza digital

人工智能时代的知识产权治理：监管碎片化与数字权力的重构

摘要

围绕人工智能（AI）与知识产权治理的监管碎片化现象，反映了数字权力组织形式的深层变革，而不仅仅是法律教义上的不一致。既有研究往往局限于狭隘的法律形式主义视角来探讨与AI相关的版权及专利纠纷，难以充分阐释算法创造力如何重塑国家、跨国科技公司与跨国数字基础设施之间的治理关系。本文采用比较社会法律与解释性治理的分析框架，考察了美国、欧盟、中国及部分“全球南方”国家和地区的立法、司法判决与监管举措。研究发现，监管响应的碎片化源于各方在技术主权、创新控制、平台治理及数字经济权力等议题上相互竞争的治理逻辑。本文将知识产权法重新界定为一个充满博弈的治理场域；在这一场域中，针对算法生产与数字创新的权力，正日益在跨国技术生态系统中通过各种互动与协商得以重构。

关键词：人工智能，知识产权治理，监管碎片化，算法创造力，数字治理