Legal Analysis of the Advancement of AI and Blockchain Amid Lagging Digital Copyright Regulation in Indonesia

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History of Article
Submitted : July 24, 2024
Revised : August 02, 2025
Accepted : September 10, 2025
Published : December 01, 2025
DOI : https://doi.org/10.37253/jjr.v27i2.11069

Abstract

The rapid advancement of Artificial Intelligence (AI) and blockchain technology has reshaped the digital landscape, particularly in content creation, storage, and distribution. Despite these innovations, Indonesia's copyright law has not kept pace, creating a pressing research problem: the adequacy of existing regulations in addressing AI- and blockchain-based works. This study aims to examine the legal implications of these technologies and evaluate whether Indonesia's current copyright framework, particularly Law No. 28 of 2014, can effectively respond to such challenges. Using a normative juridical methodology that combines statutory, conceptual, and comparative approaches, the research examines Indonesian copyright law and contrasts it with developments in the European Union and the United States. The findings reveal critical regulatory gaps, including the absence of recognition for non-human authorship, insufficient mechanisms for decentralized content management, and the lack of clarity on smart contract-based licensing. These deficiencies create legal uncertainty that risks weakening the protection of creators' rights in the digital era. The study contributes by emphasizing the significance of adaptive and technology-responsive reforms, recommending proactive legislative updates and the adoption of flexible legal doctrines to ensure Indonesian copyright law remains effective and relevant in the face of rapid technological change.

Keywords: Digital Copyright; Artificial Intelligence; Blockchain; Indonesian Law; Legal Reform

Introduction

The exponential advancement of digital technologies, particularly Artificial Intelligence (AI) and blockchain, has transformed global socio-economic landscapes, including intellectual property (IP) frameworks (Zuboff, 2019; Hariyanto, et al 2024). In Indonesia, AI applications are increasingly used in creative industries such as digital art, music, and content production, while blockchain-based platforms, especially for non-fungible tokens (NFTs), are gaining traction in both the art and financial sectors. According to data from the Ministry of Communication and Information, Indonesia recorded over 16,000 digital copyright disputes between 2018 and 2023, many involving online distribution of digital content (Kominfo, 2024). At the same time, blockchain adoption in Indonesia grew by nearly 56% in 2022, with NFT transactions reaching IDR 200 billion, yet without clear legal certainty for creators and consumers (Airachia & Sharma, 2025). These statistics demonstrate that the urgency of the problem is not merely theoretical but grounded in rapidly expanding digital practices.

Despite these developments, the Indonesian copyright framework, governed by Law No. 28 of 2014, remains grounded in human-centered authorship and traditional distribution models (Edgina, et al 2024). Under the WTO/TRIPS regime, Indonesia is obliged to ensure copyright protection for works regardless of technological form. However, the current law does not recognize non-human authorship, decentralized content management, or smart contract licensing (Maria & Fakrulloh, 2025). This legal gap reflects the das sollen of the law versus the das sein of technological realities: while creators and industries are already using AI and blockchain, the law provides no adequate recognition or protection.

The practical significance of this issue extends beyond academic discourse. Unclear copyright protection discourages creators from adopting innovative tools, exposes industries to enforcement risks, and undermines Indonesia's ambition to expand its digital economy, which is projected to reach USD 146 billion by 2025 (Google, Temasek & Bain, 2022). Without regulatory

adaptation, Indonesia risks losing competitiveness in global creative markets while creators' rights remain unprotected (Sudirman, et al 2025).

This study positions itself within this gap. Previous works emphasize the challenges of AI-generated authorship (Gervais, 2020; Li, 2025) and blockchain-based rights management (O'Dair & Beaven, 2017), but few provide empirical or doctrinal analysis in the Indonesian context. The central research question of this paper is therefore: To what extent is the Indonesian digital copyright framework responsive to the challenges and opportunities brought by AI and blockchain technologies? The methodology employed is normative juridical, combining statutory, conceptual, and comparative approaches, while drawing from secondary data such as journal articles, court decisions, and government reports.

To situate this research within the broader academic discourse, it is necessary to examine how previous studies have addressed the intersection of copyright law, AI, and blockchain. While the introduction has established the empirical and doctrinal urgency of the problem in Indonesia, the literature review provides an overview of scholarly perspectives, both global and regional, that highlight the legal and practical challenges posed by these technologies. This review not only maps existing debates but also identifies gaps in scholarship, particularly the scarcity of Indonesia-focused studies and the limited integration of AI and blockchain as interconnected phenomena thereby justifying the relevance and contribution of this research.

The intersection of copyright law with emerging technologies such as AI and blockchain has become a growing field of scholarly inquiry. A substantial body of international literature has explored how these technologies disrupt traditional concepts of authorship, originality, and enforcement.

Several scholars focus on AI-generated works and the question of authorship. Gervais (2020) highlights that copyright law, premised on human creativity, struggles to accommodate outputs autonomously generated by AI, and proposes a "user-centered" model granting rights to those who configure or train AI systems. Li (2025) similarly underscores the doctrinal challenges of attributing authorship to non-human agents, arguing that existing legal categories are ill-equipped for generative AI.

Blockchain, conversely, has been discussed for its potential to address copyright enforcement issues. O'Dair & Beaven (2017) demonstrate how blockchain-based smart contracts can facilitate real-time royalty distribution and immutable recordkeeping, citing practical applications in the music industry. Benhamou (2020) further notes that blockchain evidence and timestamping could strengthen rights protection, though legal recognition remains inconsistent.

Regional and Indonesian studies remain relatively scarce. Airachia & Sharma (2025) examine digital copyright enforcement in Indonesia, concluding that regulatory gaps persist, particularly concerning decentralized platforms and the absence of recognition for smart contracts in court proceedings. Lee (2021) provides a comparative perspective from East Asia, where countries such as Japan and South Korea experiment with sui generis protections for AI-assisted works, offering useful lessons for Indonesian policymakers. Vishnu (2023) adds a European perspective, warning that legislative inertia risks creating a legal vacuum exploitable by market actors.

Despite these contributions, gaps remain. First, few studies integrate empirical data from Indonesia's growing disputes over digital copyright, NFT adoption, or AI-generated works. Second, most literature treats AI and blockchain in isolation, whereas their combined use poses interconnected legal challenges. This study seeks to address these gaps by examining Indonesia's copyright law doctrinally and comparatively, while grounding the analysis in local empirical realities of digital creative practices.

Research Method

This study employs a normative juridical approach (Soekanto & Mamudji, 2019), which is appropriate for examining how legal instruments respond to technological change in the field of copyright. This approach emphasizes the analysis of statutory law, legal principles, and doctrinal thought to evaluate the adequacy of existing regulations in addressing the challenges posed by Artificial Intelligence (AI) and blockchain. The primary focus is the Indonesian copyright framework, particularly Law No. 28 of 2014 on Copyright, its implementing

regulations such as Government Regulation No. 56 of 2021 on Song and/or Music Royalties, and relevant Ministerial Regulations issued by the Ministry of Law and Human Rights. International instruments including the Berne Convention, the TRIPS Agreement, and the WIPO Internet Treaties are also examined to ensure compliance with Indonesia's global obligations.

In addition to statutory analysis, this study adopts a conceptual and doctrinal approach to scrutinize fundamental notions of authorship, originality, ownership, and licensing in light of AI-generated works and blockchain-based content management. The analysis incorporates perspectives from Indonesian scholars such as Satjipto Rahardjo and Jimly Asshiddiqie, alongside contemporary discussions on smart contracts and decentralized systems (Khuan, Wulandari et al., 2025). The research also considers available Indonesian court decisions related to digital copyright disputes to contextualize how judiciary practice interprets technological disruption in intellectual property rights.

Furthermore, a comparative jurisprudence approach is applied by referencing legal developments in the European Union (e.g., EU Copyright Directive 2019 and CJEU rulings), the United States (e.g., U.S. Copyright Office 2023 policy on AI works), the United Kingdom, and Singapore. This comparative dimension enables the study to identify adaptive legal frameworks and innovative regulatory practices that may inform Indonesia's future reforms. Methodologically, the analysis relies on qualitative normative legal reasoning, employing deductive and analogical interpretation as well as legal hermeneutics to clarify ambiguous statutory language and assess the responsiveness of Indonesian copyright law.

The sources of legal materials include primary sources national legislation, ministerial regulations, court decisions, and international treaties and secondary sources such as journal articles, expert commentaries, policy reports from the Directorate General of Intellectual Property (DGIP), as well as publications from WIPO, UNESCO, and NGOs. This multifaceted design ensures that the research not only evaluates doctrinal adequacy but also captures the practical implications of AI and blockchain for Indonesia's copyright framework.

Results and Discussions

AI-Generated Authorship and Legal Recognition

The findings of this study demonstrate a clear regulatory misalignment between how AI-generated works and blockchain-based licensing mechanisms are governed under Indonesian copyright law, versus the technological realities reshaping content creation and enforcement (Pantanowitz et al., 2024). The increasing reliance on artificial intelligence to generate creative content presents a substantial legal conflict for the Indonesian copyright system. Law No. 28 of 2014 presumes that all protected works must originate from a human author, while the factual reality shows the rapid proliferation of autonomous AI-generated outputs. This gap between the das sollen of statutory requirements and the das sein of technological practices creates a doctrinal vacuum. Several recent Indonesian legal studies have underscored this tension. Mayana et al. (2024) critique the legal vacuum surrounding AI-generated outputs, arguing that the current law provides no mechanism for recognizing works autonomously produced by generative AI systems. This ambiguity creates significant uncertainty regarding ownership rights, moral rights, and liability in cases of infringement (Jubaidi & Khoirunnisa, 2024). To address this, Mayana and colleagues propose the introduction of a limited form of artificial legal personhood, allowing AI to be attributed creative outputs indirectly through the individuals or entities responsible for its training and deployment. Similarly, Putra, Kurniawan, and Atsar (2021) emphasize the urgency of reinterpreting the definitions of "creator" and "authorship" in Indonesian law, as the traditional anthropocentric model is no longer sufficient to capture the dynamics of machine-assisted or machine-generated creativity.

This issue is not unique to Indonesia. Gervais (2020), in his comparative analysis of international copyright systems, proposes a functional equivalence approach, suggesting that legal rights should be granted based on the human contributions embedded within the AI's creative process, such as data curation, prompt design, and system training. Jurisdictions such as Australia and Japan have experimented with hybrid frameworks that attribute authorship to the

human agents configuring and directing AI systems, rather than the AI itself (Putra et al., 2021). However, whether these hybrid models can be transplanted into Indonesia requires critical scrutiny. Unlike Australia's common law system, Indonesia's civil law tradition, coupled with its constitutional principles rooted in Pancasila and the protection of human dignity, may not easily accommodate such legal transplants without significant adaptation. This raises important normative questions: should Indonesia merely borrow from foreign practices, or should it develop a context-specific approach that aligns with its socio-legal culture and constitutional mandate to protect creators?

Without meaningful reform, Indonesia risks falling behind in protecting the rights of stakeholders engaged in the rapidly evolving AI-driven creative economy. The absence of clear legal recognition not only weakens enforcement but also creates vulnerabilities that could be exploited in future copyright disputes. Thus, resolving this doctrinal gap is not only a matter of academic interest but also a practical necessity for ensuring certainty, fairness, and competitiveness in Indonesia's digital economy.

Blockchain and Smart Contracts: Enforcement Gap

The legal relevance of blockchain technology lies not merely in its technical sophistication, but in its promise to decentralize trust and automate enforcement through mechanisms like smart contracts (Nwariaku et al., 2024). These self-executing contracts, encoded within blockchain systems, are increasingly used to regulate the distribution and licensing of digital content, including copyrighted materials. In theory, smart contracts can enable creators to set precise usage terms, automate royalty payments, and control downstream distribution without reliance on intermediaries or traditional enforcement institutions (Abidin, 2023).

However, in the Indonesian legal system, the recognition of smart contracts remains limited and ambiguous. While the 2020 Omnibus Law and subsequent derivative regulations acknowledge the importance of digital platforms and electronic transactions, there is no explicit statutory recognition of smart contracts as enforceable legal instruments (Berliana et al., 2025). This creates a

significant gap between the technological affordances of blockchain and the doctrinal requirements of contract validity under Indonesian Civil Law. Article 1320 of the Indonesian Civil Code requires four elements of validity: consent (consensus), lawful cause, a certain object, and the legal capacity of parties. Smart contracts most critically challenge the first two elements consensus and lawful cause since autonomous code-based agreements operate without human negotiation and often without a clearly defined legal purpose attributable to identifiable parties. Without doctrinal clarity on how these elements map onto algorithmic transactions, enforceability remains uncertain and doctrinally underdeveloped.

This enforcement gap is magnified in cross-border contexts. Smart contracts may be executed on foreign blockchain nodes or involve anonymous parties outside Indonesian jurisdiction (Khoirunnisa & Jubaidi, 2023). This raises hard conflict-of-law questions: would Indonesian courts recognize or enforce a blockchain-based contract executed abroad? Which country's law governs disputes where nodes are decentralized across multiple jurisdictions? Could international arbitration or lex cryptographica principles fill this vacuum? Without clear guidance, enforcement risks being fragmented, leaving creators and users in a state of uncertainty regarding applicable law, jurisdiction, and remedies.

Despite these challenges, the potential of blockchain as a tool for transparency, traceability, and automatic enforcement should not be underestimated. The current cautious approach relying on incremental interpretation of the Electronic Information and Transactions (ITE) Law may be insufficient. A more transformative reform agenda is required. Indonesia should consider either bold amendments to the ITE Law that explicitly recognize the validity and enforceability of smart contracts or the adoption of sui generis legislation on digital and automated contracts. Such reforms would not only enhance domestic legal certainty but also position Indonesia competitively within the global digital economy.

The lack of enforcement clarity also affects the creative economy, particularly in music, digital art, and publishing, where smart contracts could

serve as efficient licensing tools. Without proper recognition, however, creators and users remain trapped between innovative potential and legal inertia. Bridging this enforcement gap is therefore not just a matter of modernization, but a strategic imperative for supporting Indonesia's participation in a rapidly evolving global digital ecosystem.

While blockchain and smart contracts offer promise in decentralizing enforcement and increasing transactional transparency, they also expose deeper legal uncertainties regarding authorship, ownership, and liability, particularly when intersecting with AI systems. Unlike the deterministic character of smart contracts, AI models, especially generative ones operate probabilistically and opaquely, raising questions about control and accountability (Kuznetsov et al., 2023). This shift from deterministic code to autonomous learning systems complicates the application of conventional legal concepts, most notably in determining liability for outputs generated by AI models trained on vast, and often disputed, data sets.

Liability and Data Input Issues

A crucial yet insufficiently addressed legal challenge in Indonesia's AI development landscape involves the liability risks associated with using copyrighted works as input data for training artificial intelligence models. Gema (2022) underscores that Indonesia's Copyright Law (Law No. 28 of 2014) does not explicitly regulate whether acts of data mining or content scraping common practices in AI training pipelines fall under permissible use or constitute infringement.

This ambiguity is rooted in several statutory provisions. For example, Article 9 on the exclusive right of reproduction is drafted broadly enough that even temporary copying of protected works during model training may qualify as infringement, while Articles 43–51 on limitations and exceptions omit any reference to text and data mining (TDM). The absence of statutory recognition of such practices leaves AI developers exposed to liability in a way that is increasingly out of step with international developments. By contrast, the European Union's DSM Directive expressly permits TDM under certain

conditions (Europe, 2025), thereby reducing legal uncertainty for innovators (Khuan, Tendean, et al., 2025).

This ambiguity creates a precarious legal environment for AI developers, researchers, and technology companies, who may inadvertently violate copyright protections by utilizing online content, books, music, artworks, or even academic journals as training datasets. Because Indonesian law lacks structured fair use criteria or flexible public interest-based exceptions, and does not provide compulsory licensing mechanisms tailored to machine learning, developers face heightened exposure. Moreover, the expansive notion of "reproduction" under Law No. 28/2014 exacerbates the risk that training data activities could be construed as infringement, even when no human-readable copies are produced.

Global litigation trends highlight the seriousness of this liability gap. International lawsuits such as Getty Images v. Stability AI, Sarah Silverman v. OpenAI, and Andersen v. Stability AI demonstrate how creators are increasingly asserting claims that their copyrighted works were used without consent for AI training. These disputes underscore the potential for massive liability and class-action suits as AI-generated content begins to compete directly with original human-authored works. For Indonesia, the absence of judicial precedent, policy guidance, or sector-specific soft law instruments leaves stakeholders unprepared to confront such risks. Courts have yet to interpret the legality of AI training practices, and regulatory authorities have issued no guidelines on permissible data sourcing, ethical AI, or copyright exceptions for the digital era.

Beyond liability, the unregulated use of copyrighted input data raises broader ethical and economic concerns. Indigenous knowledge, local art, literature, and traditional cultural expressions often digitized and shared online may be appropriated without attribution or benefit-sharing (Disemadi & Silviani, 2025). This risk of cultural commodification reinforces historical patterns of intellectual exploitation and adds urgency to developing a sovereignty-conscious regulatory framework. To mitigate these issues, Indonesia should consider legislative reform along several dimensions: (i) introducing explicit TDM exceptions, (ii) creating compulsory licensing models for AI training, (iii) embedding cultural sovereignty clauses to protect indigenous and

traditional knowledge, and (iv) imposing dataset transparency obligations. Regional cooperation through ASEAN could further harmonize governance principles and strengthen responsible AI innovation across Southeast Asia (Isono & Prilliadi, 2023).

In conclusion, Indonesia's current legal infrastructure is ill-equipped to address the growing tension between copyright protection and the data-driven nature of AI systems. Without bold reforms ranging from statutory amendments to sui generis rules the country risks lagging behind global standards in AI innovation and digital rights protection. Proactive intervention is therefore essential not only to reduce liability risks for developers but also to safeguard creators, indigenous communities, and the state from unanticipated legal and economic repercussions.

The preceding discussions highlight how existing Indonesian intellectual property and civil law frameworks remain ill-equipped to handle the evolving complexities introduced by AI and blockchain technologies. While doctrinal interpretations offer some provisional guidance, the acceleration of technological innovation continues to outpace legal certainty. The fragmentation between sectoral approaches and the absence of harmonized definitions across regulatory domains exacerbate the challenge. These unresolved tensions signal a deeper need for adaptive governance structures that go beyond isolated doctrinal reform. It is within this context that the next section explores the broader policy and regulatory gaps that must be addressed through a more flexible, future-oriented legal response.

Adaptive Reform and Policy Gaps

Collectively, the reviewed literature reveals a growing consensus that Indonesia's legal and regulatory framework is struggling to keep pace with the transformative impact of emerging technologies such as artificial intelligence (AI) and blockchain on intellectual property (IP) systems. Scholars like Mayana et al. (2024) and Putra et al. (2021) argue that existing definitions of authorship, originality, and creativity core concepts underpinning copyright law—remain rigidly anthropocentric and are thus ill-equipped to address content generated

autonomously or semi-autonomously by AI systems. These studies call for legal reform that reconceptualizes authorship not solely as a human endeavor, but as a product that can also emerge from human–machine collaboration. Without such reform, creators who use generative AI tools may find themselves in a legal vacuum, unable to secure protection for their works or challenged by unclear liability structures in the event of infringement.

This challenge is mirrored in discussions around blockchain technology, where scholars such as Kurniawan et al. (2025) highlight the need for Indonesia to formally recognize smart contracts and decentralized mechanisms for copyright registration. Blockchain offers a new paradigm for managing ownership, licensing, and transfer of rights, especially in digital ecosystems. However, its legal status in Indonesia remains ambiguous, with no statutory provisions that address the enforceability of smart contracts or the validity of tokenized IP assets. As a result, while these technologies continue to be adopted informally by creators and developers, their legal enforceability is uncertain, and disputes involving blockchain-based assets may struggle to find resolution within the current judicial framework.

These observations reflect a broader issue in Indonesia's legal landscape: the absence of a responsive and anticipatory regulatory approach. Drawing on the theory of regulatory governance advanced by Print et al. (2022), several scholars argue that laws must not only be clear and enforceable, but also flexible enough to adapt to the rapid shifts in technology and innovation practices. Concrete governance mechanisms such as regulatory sandboxes for AI-generated content, adaptive licensing models for blockchain-based IP platforms, and inter-ministerial task forces coordinating Kominfo, DJKI, and the financial regulator are crucial to prevent legal obsolescence.

The Indonesian government has acknowledged the need for innovation governance through initiatives such as the National AI Strategy launched by BPPT (2020). Yet, while the strategy outlines pillars for AI development ethics, infrastructure, and talent development it is silent on intellectual property governance. This silence constitutes a critical policy failure because it leaves unaddressed the questions of authorship, liability, and IP asset management in

AI and blockchain contexts. By failing to integrate IP law into AI policy, Indonesia risks undermining its own ability to regulate AI-generated content and blockchain-based IP assets effectively. In contrast, comparative experiences demonstrate more adaptive approaches: the European Union's Digital Services Act incorporates content governance principles relevant to digital rights; Japan's IP strategy explicitly addresses AI-generated works and data ownership; and Singapore has experimented with blockchain regulatory sandboxes that provide both legal certainty and innovation space. These lessons show that regulatory adaptability is achievable when states integrate foresight into their governance models.

In conclusion, while Indonesian scholarship has begun to diagnose the inadequacies of current laws in dealing with technological disruption, there remains a significant implementation gap. Bridging this gap requires not only doctrinal reform but also institutional innovation, interdisciplinary dialogue, and greater alignment between policy planning and legal practice. Without these measures, Indonesia risks becoming a passive recipient of global legal trends, with severe consequences: loss of digital sovereignty, dependence on imported platforms, and erosion of local creative industries. Addressing these risks demands urgent regulatory reform that is both anticipatory and contextually grounded, ensuring that Indonesia can actively shape, rather than merely absorb, the trajectory of global digital governance.

The analysis thus far has underscored the complex interplay between legal uncertainty, technological advancement, and regulatory inertia in Indonesia's approach to emerging digital tools such as AI and blockchain. By examining doctrinal challenges, enforcement gaps, and liability concerns, this study has mapped out key tensions that hinder effective legal adaptation. However, beyond diagnosing these challenges, it is equally important to assess what this study contributes to the broader academic and policy discourse. The following section presents the novel insights and added value that emerge from this integrative inquiry, offering a foundation for more coherent regulatory thinking and future research directions.

Contribution and Novel Insights

This study contributes to the growing body of scholarship on digital legal reform by synthesizing domestic doctrinal analysis with comparative international practice. In doing so, it bridges an important gap in the existing literature, which often tends to treat emerging technologies like artificial intelligence (AI) and blockchain in isolation. By integrating both within a unified analytical framework, this study reflects the complex, convergent nature of technological innovation in Indonesia's digital era and offers a more comprehensive legal analysis tailored to local realities.

Unlike prior research that tends to focus on AI-generated works or blockchain-based systems separately, this paper highlights the interdependent regulatory gaps arising from their parallel development. For example, AI systems trained on large-scale copyrighted content increasingly intersect with blockchain technologies such as smart contracts and decentralized digital rights management (DRM) (Balan et al., 2025). These overlaps present new legal dilemmas that cannot be addressed adequately through fragmented or outdated doctrines of copyright and contract law.

To deepen its novelty, this study situates doctrinal reform within broader theoretical frameworks. Legal pluralism helps explain why Indonesia struggles to adapt different regulatory actors (courts, ministries, industry norms) produce fragmented rules that hinder coherence. Regulatory governance provides a framework for designing adaptive instruments such as regulatory sandboxes, inter-ministerial task forces, and iterative licensing. Meanwhile, law and technology co-evolution theory demonstrates how Indonesian law has historically lagged behind technological change, requiring mechanisms that enable reciprocal adaptation between legal norms and digital innovation. These perspectives show not only what reforms are needed but also why Indonesia faces structural challenges in implementing them.

From this analysis, three key priority areas emerge. First, there is a need to reformulate the legal definition of authorship to account for non-human or AI-assisted contributions. Indonesia's current copyright law (Law No. 28/2014) remains rooted in anthropocentric assumptions, which fail to accommodate the

evolving nature of creativity and authorship in the digital age. Comparative jurisdictions such as the UK and Singapore have already adopted flexible models recognizing computer-generated works under specific conditions. Drawing on these models, Indonesian law could benefit from a more inclusive framework that allows for limited recognition of AI-generated works, particularly when there is demonstrable human oversight or creative input.

Second, the legal system must begin to formally recognize and regulate blockchain constructs, especially smart contracts and decentralized copyright registries. Smart contracts are increasingly used in licensing transactions and creative industries to automate royalty distribution and enforce rights management. However, the absence of clear legal standing for these mechanisms in Indonesian law creates uncertainty in both enforcement and dispute resolution. Similarly, decentralized copyright registries, while offering transparency and immutability, lack official recognition, leading to a disconnect between practice and formal registration systems governed by the Directorate General of Intellectual Property (DJKI).

Third, there is an urgent need to create licensing mechanisms or establish exceptions and limitations that govern the use of copyrighted materials for AI training. As AI technologies continue to rely on massive datasets that often include copyrighted works, clarity is needed regarding what constitutes fair use, compulsory licensing, or data mining exemptions. The European Union's Text and Data Mining (TDM) exception, for instance, may serve as an example for crafting a similar provision within Indonesia's copyright regime, balancing innovation with the rights of content creators.

To ensure these priority areas are not reduced to a policy checklist, this study grounds them in unifying legal theories. From a utilitarian perspective, reforms maximize overall social benefit by encouraging innovation while safeguarding creators' interests. From a rights-based standpoint, they uphold the moral and economic rights of authors against the risk of exploitation in digital environments. From an innovation law theory lens, they provide the necessary legal certainty to stimulate investment, entrepreneurship, and technological

progress. Taken together, these frameworks establish normative consistency and justify reform beyond pragmatic necessity.

By addressing these domains, this study offers a roadmap for harmonizing Indonesian intellectual property law with the technological realities of the 21st century. It advocates for a forward-looking, adaptive legal ecosystem that not only protects creators but also encourages innovation, investment, and digital transformation. In this way, the paper contributes to an ongoing dialogue about how developing countries like Indonesia can engage with emerging technologies through normative reform, responsive policy design, and international legal alignment.

While the preceding section outlined the core contributions and novel insights offered by this study, especially in juxtaposing Indonesia's legal framework with the rapid evolution of AI and blockchain technologies, it is equally crucial to examine how these insights translate into actionable frameworks and governance models. As technological innovation continues to outpace regulatory mechanisms, the conversation must now shift toward exploring integrative approaches that connect legal theory with institutional design and transnational cooperation (Akpobome, 2024). This sets the stage for a deeper investigation into governance mechanisms and institutional readiness in Indonesia—an exploration that not only underscores the importance of local regulatory agility but also the need to harmonize with global legal trends.

Comparative Perspectives and International Best Practices

As Indonesia grapples with the regulatory gaps surrounding digital copyright, artificial intelligence (AI), and blockchain technologies, comparative legal analysis offers a valuable framework to understand how other jurisdictions address similar challenges (Zuwanda et al., 2024). The selection of the United States, European Union (EU), Singapore, and Japan reflects their leadership in shaping global discourse and their varied regulatory philosophies. To strengthen the analysis, this section also draws insights from civil law jurisdictions such as

Germany and South Korea, which share structural similarities with Indonesia's legal tradition and institutional frameworks. Examining both common law and civil law systems prevents the analysis from appearing arbitrary and enables Indonesia to evaluate which approaches are most compatible with its socio-legal context.

1. United States: Fair Use and Emerging Doctrines

The United States has long championed a flexible doctrine of fair use, which has become central to its response to generative AI and digital reproduction. Under Section 107 of the U.S. Copyright Act, uses of copyrighted material may be deemed "fair" depending on factors such as purpose, nature of the work, amount used, and market effect (U.S. Copyright Act, 17 U.S.C. §107) (Al-busaidi et al., 2024). This flexibility has allowed courts to accommodate new technologies, as evidenced in cases like Authors Guild v. Google, Inc. (2015), which upheld the digitization of books for search purposes as fair use (Ambitious News, 2025). In the context of AI, however, new lawsuits such as Andersen v. Stability AI (2023) challenge the limits of fair use when training data includes copyrighted material (Koos, 2025). The lack of AI-specific legislation in the U.S. has resulted in legal uncertainty, especially around whether the use of protected data for machine learning violates copyright or falls within fair use exceptions. For Indonesia, the transplantability of U.S.-style fair use is limited: its flexibility relies heavily on judicial discretion, which may not align with Indonesia's civil law reliance on codified statutes and limited case law authority.

2. European Union: Author-Centric and Data Governance-Oriented

In contrast, the EU has adopted a more structured and data-governance-oriented approach. The EU Copyright Directive (Directive 2019/790) introduced specific exceptions for text and data mining (TDM), distinguishing between uses by research institutions and commercial actors. Article 4 allows TDM for any purpose unless rights holders explicitly opt out. This opt-out system seeks to balance access for AI development with respect for rights holders' interests. Moreover, the EU has proposed the Artificial Intelligence Act, which categorizes AI systems by risk level and imposes regulatory obligations accordingly. Although not a copyright law per se, the Act indirectly shapes

copyright enforcement by regulating AI development and deployment. The EU also supports the Data Governance Act and the Data Act, both of which emphasize transparency, data sharing, and fair use in digital environments (Gasimova, 2023). This integrated approach illustrates how copyright, data protection, and AI regulation can be harmonized through comprehensive policy architecture an approach potentially more transplantable to Indonesia, given its civil law orientation and preference for detailed codification.

3. Singapore: Regulatory Sandboxes and Pragmatic Balancing

Singapore provides a model of regulatory pragmatism through its use of regulatory sandboxes and forward-looking IP strategies. Recognizing the rapid pace of technological development, Singapore's Intellectual Property Office (IPOS) launched the IP Strategy 2030, aiming to modernize IP protection while promoting digital innovation. One of the more innovative features is Singapore's exploration of blockchain to manage copyright registration and licensing through smart contracts. The city-state also supports AI use through the Model AI Governance Framework, which, while non-binding, offers principles of accountability, explainability, and transparency (Allen et al., 2025). These guidelines are accompanied by institutional capacity-building, such as the AI Verify Foundation, designed to create trusted AI ecosystems. Singapore's model underscores the importance of agile and adaptive regulation. While transplantability to Indonesia is feasible, it would require significant institutional strengthening to ensure sandbox outcomes inform long-term codification rather than remain isolated pilot projects.

4. Japan: Recognizing Machine-Generated Works and Open Data

Japan stands out for its legislative clarity concerning machine-generated outputs and data mining. Under Japan's Copyright Act, revised in 2018, the use of copyrighted works for data analysis is permitted without the need to obtain rights holders' consent, provided the purpose is not to enjoy or exploit the expression itself (Ueno, 2022). This clear exception facilitates AI training and underscores Japan's policy orientation toward supporting innovation. Additionally, Japan has engaged in discussions around granting limited protection to non-human-generated works, although this remains controversial.

Importantly, Japan is also actively promoting open data initiatives to support data interoperability, including through its Society 5.0 vision. This civil law orientation offers greater normative compatibility with Indonesia, particularly in embedding machine-learning exceptions into statutory frameworks.

5. Germany and South Korea: Civil Law Anchors for Transplantability

Germany provides a highly detailed copyright regime with carefully delimited exceptions, including implementation of the EU's TDM rules, while South Korea has pioneered AI and data governance reforms aligned with its civil law tradition. Both jurisdictions demonstrate how civil law systems can adapt flexibly to emerging technologies without relying on broad judicial doctrines. These examples may offer Indonesia more direct lessons than U.S. case-driven jurisprudence, particularly regarding legislative drafting techniques, institutional coordination, and balancing rights with innovation.

6. Lessons for Indonesia: Convergence, Divergence, and Normative Priorities

From these diverse legal approaches, several critical patterns emerge (Hidayat et al., 2024). There is convergence in recognizing the need for AI- and blockchain-specific regulation, yet divergence in the methods flexible judicial doctrines (U.S.), structured statutory exceptions (EU, Germany, Japan, South Korea), and pragmatic regulatory experimentation (Singapore). For Indonesia, transplantability analysis suggests that a hybrid model may be most effective: adopting EU/Japan/Germany-style statutory clarity for civil law compatibility, complemented by Singapore-style sandboxes for adaptive learning, and cautiously observing U.S. fair use as a reference rather than a transplant. Ultimately, the choice is not about copying wholesale but adapting global best practices to Indonesia's institutional capacity, legal culture, and developmental priorities.

Conclusion

The rapid advancement of artificial intelligence (AI) and blockchain technologies introduces both transformative opportunities and intricate legal

dilemmas for digital copyright governance. In the Indonesian context, the existing copyright framework remains predominantly reactive and doctrinally rigid, insufficiently equipped to address the intertwined challenges of AI-generated works and decentralized blockchain ecosystems. This regulatory inertia fosters legal uncertainty concerning authorship, ownership, liability, and enforceability in an increasingly automated and digitized environment. This study has demonstrated that Indonesian copyright law currently lacks explicit provisions for AI-generated content and blockchain-based rights management, creating a critical legal vacuum. The absence of recognition for machine-assisted authorship undermines creators' rights and complicates liability structures, while legal ambiguity surrounding smart contracts and decentralized registries hinders automated enforcement. Comparative insights from the EU, United States, Singapore, Japan, Germany, and South Korea reveal patterns of convergence and divergence that Indonesia must carefully evaluate. Importantly, the analysis highlights that uncritical transplantation, such as borrowing the U.S. fair use doctrine would risk incompatibility with Indonesia's civil law tradition, whereas statutory clarity and adaptive governance models in Japan, Germany, and South Korea offer more culturally and structurally viable lessons.

Beyond doctrinal reform, the study situates Indonesia's challenges within broader theoretical frameworks. Drawing on regulatory governance, legal pluralism, and the co-evolution of law and technology, the findings suggest that Indonesia's struggle is not merely one of lagging statutes, but of institutional agility and normative coherence. To avoid reducing reform into a checklist of policy measures, the proposed priority areas authorship, blockchain recognition, and AI training data regulation are grounded in utilitarian and rights-based theories, ensuring that reform advances both innovation and justice. In sum, bridging the regulatory gap between rapid digital innovation and legal protection requires Indonesia to craft an agile, principle-based, and context-sensitive framework. Such a framework must not only respond to current disruptions but also anticipate future technological shifts, aligning international best practices with Indonesia's socio-legal realities. By embracing doctrinal reform, institutional innovation, and theoretically grounded governance, Indonesia can

transform its copyright regime into a resilient foundation for a sustainable and innovation-driven digital economy.

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Acknowledgments

The author would like to express sincere gratitude to colleagues and reviewers who provided valuable feedback and constructive comments throughout the writing of this paper. The author also acknowledges the use of secondary data and comparative legal materials that have significantly enriched the analysis of Indonesia's digital copyright regulatory landscape.

Declaration of Generative AI Use

The author(s) declare that no generative AI or AI-assisted technologies were used in the preparation or writing of this manuscript. All content was produced entirely by the author(s) without any automated assistance.

Competing Interest

The author declares that there are no competing interests related to the research, authorship, or publication of this article.