Multidisciplinary Output Research For Actual and International Issue (MORFAI Journal) ISSN (e): 2808-6635
Volume 6 No. 5 (2026)

VALIDITY AND LEGAL POSITION OF ON-CHAIN DISPUTE RESOLUTION IN THE INDONESIAN ARBITRATION SYSTEM: A COMPARATIVE ANALYSIS WITH SINGAPORE LAW

Daffa Charisma Putra Ramadhon
Faculty of Law, Universitas Pembangunan Nasional "Veteran" Jakarta
Alamat: Jl. Pd. Labu Raya, Pd. Labu, Kec. Cilandak, Kota Jakarta Selatan, Daerah Khusus Ibukota Jakarta 12450
Korespondensi Penulis: charismadaffa@gmail.com, 2210611305@mahasiswa.upnvj.ac.id

Received : 01 June 2026 Accepted : 19 June 2026
Revised : 05 June 2026 Published : 07 July 2026

Abstract

The development of blockchain technology has given rise to on-chain dispute resolution (OCDR) as a dispute settlement mechanism that operates entirely through algorithms and anonymous jurors, without the involvement of any state judicial institution. This research aims to analyze the legal standing of OCDR within Indonesia's civil law system and examine its validity as a form of arbitration under Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution, enriched through a comparative analysis with Singapore's legal framework. This research employs a normative juridical method enriched with comparative elements, utilizing the theory of Lex Cryptographia, the theory of state sovereignty and legal positivism, and Satjipto Rahardjo's progressive law theory as analytical tools. The findings indicate that OCDR constitutes a sui generis legal phenomenon operating as Lex Cryptographia, an independent normative order born from algorithmic consensus rather than sovereign state authority. This characteristic causes OCDR to encounter structural deadlock when tested against the legal positivism paradigm underlying Indonesia's Arbitration Law, particularly concerning the validity of arbitration agreements and arbitrator qualifications, both of which remain fundamentally human-centric. Comparison with Singapore reveals that even a more technology-accommodating legal framework experiences similar normative friction, albeit at a lower intensity. This research argues that Satjipto Rahardjo's progressive law approach which prioritizes the law's benefits to humanity over their textual compliance, provides a relevant philosophical framework to justify the acceptance of a hybrid arbitration model, as successfully demonstrated in the Kleros case in Mexico, as a pragmatic solution to the legal gap currently faced by Indonesia.

Keyword: On-chain dispute resolution; Arbitration; Lex Cryptographia; Legal Positivism; Progressive Law.

Introduction

The rapid development of information technology in the 21st century has brought about transformations in various aspects of human life, including the legal realm and dispute resolution. The emergence of blockchain technology as a decentralized infrastructure has given rise to a new paradigm in digital transaction governance that transcends conventional jurisdictional boundaries. In this context, smart contracts running on blockchain networks not only function as digital agreement instruments but have also evolved into a dispute resolution mechanism known as on-chain dispute resolution (blockchain -based ODR). This phenomenon raises fundamental questions about whether the Indonesian legal system, which still relies on a conventional civil law framework, can accommodate and recognize the validity of a dispute resolution mechanism that fully operates within such a decentralized digital ecosystem. Conceptually, on-chain dispute resolution is a dispute resolution mechanism that uses blockchain protocols and smart contracts to automate the dispute adjudication process without the involvement of conventional judicial or arbitration institutions. This mechanism works through a decentralized voting system by randomly selected judges from the community, or through the automatic

execution of pre-programmed settlement clauses in smart contracts .[1] As Ortolani stated, blockchain -based online dispute resolution has the potential to revolutionize the way people resolve commercial conflicts, due to its trustless , transparent nature, and inability to be manipulated by any party. [2]Several blockchain- based ODR platforms operating globally, such as Kleros and Aragon Court, have handled thousands of digital contract disputes with significant economic impact, demonstrating that this mechanism is not merely a theoretical concept but a legal reality that requires a response from policymakers and legal academics. [3]In Indonesia, the urgency to study on-chain dispute resolution is increasing along with the significant growth of the digital economy ecosystem. Based on data published by Google, Temasek, and Bain & Company in the e-Conomy report SEA , Indonesia is Southeast Asia's largest digital economy with a market value projected to reach USD 130 billion by 2025. [4]This growth is accompanied by the increasing adoption of blockchain technology and crypto assets, marked by the issuance of various regulations from the Financial Services Authority (OJK) and the Commodity Futures Trading Regulatory Agency (BAPPEBTI) regarding crypto assets as tradable commodities. However, this massive growth in blockchain- based transactions is not matched by an adequate legal framework to anticipate disputes arising from this ecosystem, especially disputes that the parties desire to be resolved through on-chain mechanisms .

Indonesia's current civil dispute resolution legal system rests on two main pillars: digitization through general courts as stipulated in the Herzien Inlandsch Reglement (HIR) and Rbg, and alternative dispute resolution (ADR) as stipulated in Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution. The law recognizes several ADR mechanisms, including consultation, negotiation, mediation, conciliation, and expert assessment, as well as arbitration as a mechanism with binding legal force equivalent to a court decision. [5]The problem is that this law, which is more than two decades old, did not anticipate the emergence of blockchain technology and smart contracts , resulting in a substantial legal vacuum (rechtsvacuum) regarding the position of on-chain dispute resolution within the hierarchy of dispute resolution mechanisms recognized by Indonesian law. As argued by Wahyudi and Fuady, this regulatory vacuum in the field of information technology must not be allowed to continue because it can create legal uncertainty that is detrimental to the interests of business actors and consumers in the digital ecosystem.[6]

The issue of on-chain dispute resolution's validity becomes even more complex when linked to the legal requirements for arbitration under Law No. 30 of 1999. The law requires that the arbitration agreement be in writing and signed by the parties, the arbitrator must meet certain qualifications, the trial process must provide equal opportunity for the parties to be heard (audi alteram partem), and the arbitration award must contain a clear legal basis. [7]These requirements seem difficult to immediately apply to on-chain mechanisms that are anonymous, decentralized, and executed automatically by algorithms. According to Saumier, the main challenge in integrating technology-based ODR mechanisms into conventional legal systems is the gap between the principles of procedural law that guarantee due process and the efficiency of algorithms that are the system's main advantage. [8]This fundamental conflict is at the heart of the legal issues to be examined in this research.

---

[1] Maneesh Sahu, " *Blockchain* -Based Dispute Resolution: An Analysis of Smart Contract Arbitration," *Journal of International Arbitration* 38, no. 3 (2021): 287–312.

[2] Pietro Ortolani, "The Impact of *Blockchain* Technologies and Smart Contracts on Dispute Resolution: Arbitration and Court Litigation at the Crossroads," *Uniform Law Review* 24, no. 2 (2019): 430–431. https://doi.org/10.1093/ulr/unz017

[3] Federico Ast and William George, "Kleros: A Decentralized Court System for *Blockchain* Disputes," in *Proceedings of the 2018 Workshop on Decentralized Autonomous Organizations* (New York: ACM Press, 2018), 1–8.

[4] Google, Temasek, and Bain & Company, *e-Conomy SEA 2025: Through the Waves, Towards a Sea of Opportunity* (Singapore: Google Asia Pacific, 2025), 14. https://blog.google/intl/id-id/company-news/outreach-initiatives/e-conomy-sea-2025-ekonomi-digital-indonesia-mendekati-gmv-us100-miliar/

[5] Law of the Republic of Indonesia Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution, Article 1 number 10 and Article 6.

[6] Mochtar Wahyudi and Munir Fuady, *Information Technology Law and Electronic Transactions in Indonesia* (Jakarta: Prenada Media Group, 2020), 112.

[7] Law of the Republic of Indonesia Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution, Article 4, Article 12, and Article 32.

[8] Geneviève Saumier, "ODR and the Courts," in *Online Dispute Resolution: Theory and Practice* , ed. Mohamed Abdel Wahab, Ethan Katsh, and Daniel Rainey (The Hague: Eleven International Publishing, 2012), 189.

From a comparative perspective, Singapore has taken progressive steps in establishing a legal framework that accommodates the development of blockchain technology in the context of dispute resolution. The Singapore International Arbitration Centre (SIAC) has issued guidelines on arbitration involving smart contracts , while Singapore's Electronic Transaction Act (ETA) has been amended to explicitly recognize the validity of electronic agreements, including those based on blockchain technology . [9]Furthermore, Singapore has developed the Singapore Convention on Mediation , which strengthens the international dispute resolution ecosystem, and the IM8e Digital Asset Framework , which provides comprehensive guidance for blockchain industry players . [10]Singapore's approach, adopting the principle of technology-neutral regulation while maintaining high standards of legal protection, offers a relevant comparative model for Indonesia in formulating similar policies. As stated by Lim and Loi (2021), Singapore's competitive advantage as an international arbitration center is largely underpinned by its ability to quickly and adaptively respond to technological developments without sacrificing legal certainty.[11]

A comparison between the legal systems of Indonesia and Singapore in this context is relevant not only because of their geographical proximity and the intensity of their economic ties, but also because both are civil law countries that have adopted elements of common law into their legal systems, albeit at different rates and in different forms. Indonesia, with a strong Dutch legal heritage, tends to adopt new regulations gradually through formal legislation, while Singapore is more flexible in using a combination of legislation, regulatory guidelines, and soft law to respond to technological changes. [12]This comparison of regulatory approaches has direct implications for the speed and effectiveness of legal recognition of on-chain dispute resolution mechanisms in each jurisdiction.

Research on on-chain dispute resolution in Indonesia is still very limited. Most existing literature focuses on the technical aspects of blockchain technology or crypto asset regulation in general, while in-depth legal studies on the status and validity of on-chain dispute resolution are lacking. Dispute resolution as an ADR mechanism remains extremely rare. [13]Meanwhile, as Edelman and Garth argue, law and legal institutions must proactively adapt to social and technological changes, rather than simply react passively to emerging problems. [14]This academic vacuum also reflects a regulatory gap that needs to be filled immediately to ensure Indonesia remains on track to develop a digital economy ecosystem that is just and legally certain.

Based on the background described, this research focuses on two main issues: first, what is the legal status of on-chain dispute resolution in the Indonesian civil dispute resolution legal system; and second, whether this mechanism can be recognized as a valid form of arbitration under Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution. The scope of the research will be limited to the study of blockchain platforms such as Kleros and Aragorn Court as a form of Alternative Dispute Resolution in the civil law realm, excluding criminal, taxation, and blockchain programming techniques . The analysis is conducted comparatively in two jurisdictions, namely Indonesia and Singapore, with a temporal scope until April 2026. This research uses a normative juridical approach enriched with comparative elements. Normatively, the analysis is conducted on Indonesian positive legal norms, particularly Law No. 30 of 1999, as well as relevant civil law principles. A comparative approach is taken to Singapore's legal framework through a review of the International Arbitration Act (IAA) , SIAC Rules , progressive Singaporean court decisions related to blockchain technology , and the UNCITRAL Model Law on International Commercial Arbitration as a basis for contextual recommendations for the Indonesian legal system.

[9] Singapore International Arbitration Center (SIAC), *SIAC Rules 2016 and Guidelines for Arbitration Involving Blockchain and Smart Contracts* (Singapore: SIAC, 2022), 3–7.
[10] Monetary Authority of Singapore, *IM8e Digital Asset Framework: Consultation Paper* (Singapore: MAS, 2023), 5.
[11]David Lim and Shaun Loi, "Singapore as a Hub for International Commercial Arbitration: Legal Infrastructure and Technological Adaptation," *Asian International Arbitration Journal* 17, no. 1 (2021): 45–46.
[12] Hikmahanto Juwana, "Comparative Legal Systems: An Introduction," in *Anthology of Economic Law and International Law* (Jakarta: Lentera Hati, 2002), 78.
[13] Shinta Dewi Rismawati, "The Challenges of Crypto Asset Regulation and *Blockchain Technology* in the Indonesian Legal System," *Journal of Law and Development* 51, no. 2 (2021): 389.
[14] Lauren Edelman and Bryant Garth, "Law and Social Science: The Next Generation," in *The New Legal Realism*

Research Results and Discussion

The Legal Status of On-Chain Dispute Resolution in the Indonesian Civil Law System

Technically, blockchain is a distributed ledger that records transactions in an encrypted, transparent, and immutable manner without the network's consent. [15]Based on this infrastructure , the concept of smart contracts was born : a computational protocol that encodes the terms of an agreement in programming code and executes them automatically when the required conditions are met, without the need for intermediaries. As autonomously implemented blockchain- based agreements , smart contracts offer efficiency, openness, and a broad reach. In the Indonesian legal system, smart contracts are defined as an extension of conventional contract law with the advancement of modern technological regulations. Indonesian civil law explains that the validity of an agreement requires the fulfillment of four conditions as stipulated in Article 1320 of the Civil Code: the consent of those who bind themselves, the capacity of the parties, a specific matter, and a lawful cause.[16] The ITE Law is a law that regulates information and electronic transactions, or information technology in general. This law has jurisdiction over anyone who commits a legal act as stipulated in this law, whether within or outside of Indonesian jurisdiction, that has legal consequences within Indonesian jurisdiction and/or outside of Indonesian jurisdiction and is detrimental to Indonesia's interests.[17] Smart contracts are generally subject to the legal umbrella for the use of information technology as regulated in Law Number 11 of 2008 concerning Electronic Information and Transactions, as last amended by Law Number 1 of 2024 (ITE Law). The existence of smart contracts in Indonesia obtains legal legitimacy by being equated with "electronic contracts". Because smart contracts are algorithmic programming codes that run on an electronic system (blockchain), their legal basis is attached to the Articles of the ITE Law such as: (1) Legal legitimacy based on Article 1 number 17 which explains that an Electronic Contract is an agreement between parties made through an electronic system; (2) Legitimacy of binding power through Article 18 paragraph 1 which confirms that electronic transactions set out in an electronic contract bind the parties; (3) Legitimacy of the validity of evidence & systems as regulated in Article 5 paragraph (1) of Law No. 1/024 (Latest ITE Law) which states that Electronic Information and/or Electronic Documents are valid legal evidence in court; and (4) Supporting Regulations such as PP No. 71 of 2019 (PP PSTE) concerning the valid operational requirements for digital contracts.

The widespread use of electronic contracts and smart contracts has led to the need to resolve disputes at lower costs and in a shorter time. Online dispute resolution (ODR) is a dispute resolution method conducted via the internet, meaning that the resolution process is carried out by parties located across national borders (borderless) without the need for face-to-face meetings. [18]In the early stages, electronic contract dispute resolution used online dispute resolution only as a "connecting medium" so that the outcome of the decision still depended on the voluntary actions of the parties and conventional court authorities. The characteristics of smart contracts based on code in the blockchain , gave rise to the idea of dispute resolution that takes place entirely within the blockchain by relying on algorithms or voting by anonymous juries, from this the creation of a system called on-chain dispute resolution or blockchain-based dispute resolution . On-chain dispute resolution is conceptually fundamentally different from conventional Online Dispute Resolution (ODR) that has been known so far. While conventional ODR simply transfers common dispute procedures (such as negotiation, mediation, or arbitration) to a digital medium while still involving an identified human third party, on-chain dispute resolution represents a far more revolutionary paradigmatic leap.

The development of on-chain dispute resolution began around 2017 with pioneering projects such as Kleros, which introduced the concept of decentralized justice to address the growing Decentralized Finance ecosystem and the legal needs of the crypto world (Lex Cryptographia). The platform's operational mechanism is driven automatically through smart contracts , where crowdsourced jurors are randomly selected based on the number of Pinakion tokens (cryptocurrency) they stake. The theoretical foundation used by Kleros rests on game theory, specifically the Schelling Point concept , where the system relies on game theory- based incentives to motivate anonymous jurors to decide cases

[15]Don Tapscott & Alex Tapscott, *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World* (New York: Portfolio/Penguin, 2016), p. 6–8.
[16]Article 1320 of the Civil Code (KUH Perdata).
[17]Ramadhan, NR, Alvito, HR, Matondang, TI, & Nugroho, AA (2024). General Regulations Regarding Investment and Electronic Finance in Technology and Information Law. *Socius: Journal of Social Sciences Research* , *1* (12).
[18]Yuliani, AA (2021). Analysis of the Validity of Online Dispute Resolution Arbitration in Its Implementation in Indonesia. *Simbur Cahaya* , 323-336.

appropriately. According to Hendri (2009, in Saifuddin et al., 2018), Game Theory is a mathematical theory used to determine, formulate, and study conflict or competition situations involving two or more parties in order to reach an optimal decision for each party. Game theory can also be defined as a technique used to analyze situations in which two or more individuals or institutions determine the outcome of an action by one of them, not only its own actions but also the actions of the other individual or institution. [19]In this situation, the strategic plans of the individuals concerned will depend on expectations about what the other individual will do (Charmichael, 2005). The fairness generated by on-chain dispute resolution does not come from positive law, material justice, and equity, but rather from the consensus voting of a majority of jurors and economic incentives. This economic incentive scheme is designed to encourage jurors to be objective and honest, as jurors who agree with the majority will receive financial rewards, while jurors who deviate from the consensus truth will face penalties in the form of confiscation of their staked tokens. This [20]is very different from conventional arbitration, which requires human expertise to weigh written legal arguments and provides space for both parties to defend their rights verbally and documentary before a binding decision.

Unlike conventional arbitration, where decisions are independent, final, and binding without a vertical appeal mechanism, on-chain dispute resolution allows for continuous horizontal appeal escalation by multiplying the number of new anonymous adjudicator panels. If a disputing party is dissatisfied with the initial panel decision, the system provides a right of appeal, activated by depositing a crypto token fee. This fee is algorithmically designed to increase exponentially at each stage to filter out and prevent frivolous appeals .[21] Once an appeal is filed, the protocol will conduct a random draw to recruit a new, larger panel of anonymous judges, typically formulated as two times n + 1the previous number of judges, to ensure an odd number of judges and more than double the number of judges to assess the disputed evidence. This quantitative escalation process can be repeated many times, potentially leading to a General Court involving all token holders on the network, creating an absolute layer of economic defense that makes systematic manipulation or bribery (Sybil attack) to overturn an objective decision extremely costly and financially irrational for bad-faith parties. [22]As one of the world's leading implementations of on-chain dispute resolution, Kleros has seen significant adoption growth. According to official data listed on the main dashboard of the Kleros website, this decentralized justice platform has successfully processed and resolved over 900 disputes.

[23]Thus, the settlement mechanism driven by game theory incentives and the concept of Schelling points has evolved into an independent and effective decentralized arbitration institution, as long as the disputed object is purely a digital asset within the blockchain ecosystem . Due to its autonomous nature, this system is able to operate independently outside the reach of any country's positive laws. However, legal ambiguity or gray areas arise when this system is faced with hybrid-concept disputes involving physical assets or real-world (off-chain) interactions . A concrete manifestation of this hybrid dispute is often found in the phenomenon of real-world asset tokenization, better known as Real World Assets (RWA) . Tokenization is the process of converting rights to tangible or intangible assets from the real world, such as property, commodities, and financial instruments, into a digital token represented on a blockchain network.[24] Through RWA, fractional ownership of physical assets can be traded globally with high liquidity. This integration still leaves a massive legal loophole. When a physical breach occurs (e.g., damage to a transacted commodity or a dispute over ownership of tokenized land), the smart contract 's self-enforcing power is immediately halted because computer code lacks coercive jurisdiction over real-world material objects. The need to register an OCDR decision with the District Court is a prerequisite for obtaining real enforceable power, as legal enforcement over physical assets in the real world (off-chain) is a monopoly of state judicial authorities, which blockchain systems lack .

---

[19]Saifuddin, A., Tastrawati, NKT and Sari, K., 2018. Application of game theory concepts in selecting political campaign strategies. *E-Jurnal Matematika [online journal]* , *7* (2), pp.173-179.

[20]Luis Bergolla, Karen Seif, and Can Eken, "Kleros: A Socio-Legal Case Study of Decentralized Justice & *Blockchain* Arbitration," *Ohio State Journal on Dispute Resolution* 37, no. 1 (2022): 55–58.

[21]Ortolani, P. (2019). "The impact of *blockchain* technologies and smart contracts on dispute resolution: arbitration and court litigation at the crossroads". *Uniform Law Review* , 24(2), p. 430–448.

[22]Dimitropoulos, G. (2020). "The Law of *Blockchain* ". *Washington Law Review* , 95(3), p. 1117-1191.

[23]Kleros Official Website, "The Justice Protocol: Kleros Homepage," accessed May 23, 2026, https://kleros.io/ .

[24]Boston Consulting Group (BCG) and ADDX, *Relevance of On-Chain Asset Tokenization in Crypto Winter* , (Industry Research, 2022)

Arbitration is a form of alternative dispute resolution recognized in Indonesian law. Arbitration is based on an agreement between the parties in an agreement contained in a dispute resolution clause, or an agreement that only arises when a dispute arises regarding the agreement (a deed of compromise). The legal framework for arbitration in Indonesia is comprehensively regulated through Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution (APS Law), which establishes arbitration as a mechanism for resolving civil disputes outside the general courts based on a written agreement agreed upon by the disputing parties. [25]Jurisdictionally, the scope of cases that can be tried through an arbitration institution is limited exclusively to disputes in the commercial sector and those concerning rights that, according to law, are fully controlled by the disputing parties. [26]The national arbitration legal regime offers various procedural advantages that are essential for the business order, including the application of the principle of confidentiality (closed hearings), the autonomy of the parties in appointing arbitrators with specific expertise, and the guarantee of legal certainty through independent, final, and binding decisions .

[27]Although leading domestic arbitration institutions such as the Indonesian National Arbitration Board (BANI) have absolute independence and authority to decide disputes without regular judicial intervention in their examinations, the executorial power of the award still depends on the registration process with the District Court of the respondent's domicile so that a request for forced execution can be made if the losing party does not comply voluntarily. [28]To accommodate cross-border commercial dynamics, Law No. 30 of 1999 (APS Law) expressly regulates the recognition and enforcement of international arbitration awards as a form of compliance with the 1958 New York Convention, which has been ratified by Indonesia through Presidential Decree No. 34 of 1981; where absolute authority regarding the recognition of foreign awards is mandated to the Central Jakarta District Court with the limitation that the award must fall within the scope of commercial law and not conflict with public order (public policy). [29]This legislative construction integrally forms a civil law enforcement system that prioritizes time efficiency, equality, and flexibility to maintain the stability of the business ecosystem and investment climate in Indonesia.

In the regional commercial landscape, the flexibility of Indonesia's domestic legal framework is often highlighted by comparison with Singapore, which has progressively positioned itself as a hub for international arbitration in Asia through its International Arbitration Act (IAA). [30]In contrast to the procedural rigidity of some developing countries, the IAA legal framework Singapore, adopting the UNCITRAL Model Law, offers a highly accommodating ecosystem for cross-border disputes, supported by minimal judicial intervention and the active role of the Singapore International Commercial Court (SICC) and the Singapore International Arbitration Centre (SIAC). When faced with the disruption of Web3 technologies, particularly blockchain- based dispute resolution mechanisms where disputes are processed decentralized through algorithms or virtual adjudicators, Singaporean law demonstrates responsive adaptability.[31]

The Validity of On-Chain Dispute Resolution Based on Law Number 30 of 1999

Analyzing the validity of on-chain dispute resolution will refer to the Indonesian legal basis, including Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution as the main reference for arbitration requirements, and Law Number 11 of 2008 concerning Electronic Information and Transactions to provide the validity

[25]Republic of Indonesia, *Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution* , State Gazette of the Republic of Indonesia 1999 Number 138, Supplement to the State Gazette of the Republic of Indonesia Number 3872.
[26]I *bid.* , Article 5 paragraph (1) and paragraph (2).
[27]Yamin, AF (2024). "Effective Business Dispute Resolution Strategies and Their Implications for Business Continuity in Indonesia: An Analysis Based on Law Number 30 of 1999 Concerning Arbitration and Alternative Dispute Resolution." *Meraja Journal* , 7(1), pp. 36–47.
[28]RY, MI, Abdallah, R., & Nugraha, JMA (2023). The Relevance of Executorial Power to the Independent Nature of Arbitration Decisions Reviewed from Law Number 30 of 1999 Concerning Arbitration and Alternative Dispute Resolution. *Padjadjaran Law Review* , *11* (2), 201-213.
[29]Republic of Indonesia, *Presidential Decree Number 34 of 1981 concerning Ratification of the Convention on the Recognition and Enforcement of Foreign Arbitral Awards in conjunction* with Articles 65, 66, and 67 of Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution.
[30]Republic of Singapore, *International Arbitration Act 1994* (IAA).
[31] Bhatt & Joshi Associates. (2024). *Singapore International Arbitration Centre* . AWS Publications, p. 1-4.

of electronic documents and contracts that are characteristic of blockchain . This test is not merely a theoretical study detached from reality, but rather an urgent legal need driven by the undeniable growth of Indonesia's digital economy. Bappebti data records that the value of crypto asset transactions in Indonesia between January and November 2024 reached IDR 556.53 trillion, a 356.16% increase compared to IDR 122 trillion in the same period in 2023, with 22.1 million active users.[32] In an ecosystem that operates entirely on blockchain and smart contract infrastructure , and which inherently generates disputes that cannot be adequately resolved by conventional arbitration mechanisms. Indonesia's regulatory response to this reality, so far, has been incremental and limited to the financial oversight dimension, with the transfer of authority from Bappebti to the Financial Services Authority (OJK) as of January 10, 2025, and the issuance of POJK No. 27 of 2024, which classifies crypto assets as Digital Financial Assets (DFA) . [33]This is an important step, but it completely fails to address the question of how disputes arising from this ecosystem are resolved. The absence of a clear dispute resolution pathway directly erodes market confidence and hinders institutional participation in Indonesia's digital asset ecosystem. [34]This situation has become increasingly costly, given the choice of arbitration. is increasingly emerging as the preferred forum for disputes arising from crypto transactions, DeFi, and many blockchain- based projects worldwide.[35]

As previously discussed, the characteristics of on-chain dispute resolution present a challenge to the Indonesian arbitration legal regime in adapting its regulations to recognize on-chain dispute resolution. The first test is the validity of the arbitration agreement in the context of on-chain dispute resolution. Article 1 number 3 of the Arbitration Law defines an arbitration agreement as "an agreement in the form of an arbitration clause contained in a written agreement made by the parties before the dispute arises, or a separate arbitration agreement made by the parties after the dispute arises." [36]Other names for this form of arbitration agreement are: pactum de compromittendo (a clause in the main agreement before the dispute arises) and akta compromits (a separate agreement after the dispute exists). In blockchain-based smart contracts , dispute resolution clauses are generally embedded directly in the program code (self-executing code) before the dispute arises, which is functionally identical to a pactum de compromittendo . Does a smart contract qualify as a “written agreement” within the meaning of Article 4 paragraph (2) of the Arbitration Law, which requires the document to be “signed by the parties?”

[37]Literally, a smart contract does not use a wet signature , but rather public-private key cryptography , which functions as an identity authentication mechanism in the blockchain network . A textualist interpretation of the phrase “signed” in Article 4 paragraph (2) would reject the validity of this on-chain clause . However, based on PP No. 71 of 2019 Article 1 number 25 and Article 61 Paragraph (3) letter a, it is acknowledged that cryptography-based signatures are recognized in Indonesia, and purposive and functional interpretations can view public -private key cryptography as the functional equivalent of a signature. Article 18 paragraph (1) of the ITE Law states that “Electronic Transactions set out in an Electronic Contract bind the Parties.” Furthermore, comprehensive normative legal research proves that electronic agreements (including those in digital form) “fulfil the requirements for the validity of an agreement as regulated in Article 1320 of the Civil Code, particularly regarding agreement, legal capacity, certain objects, and lawful causes,” [38]so that theoretically the arbitration clause in a smart contract can fulfill the four material requirements for the validity of the agreement. The second test focuses on the elements of the arbitrator and the arbitration decision. within the framework of on-chain dispute resolution . Article 1 number (7) of the Arbitration Law defines an arbitrator as “one or more persons selected by the disputing parties or appointed by the District Court or by an arbitration institution, to

[32]Chambers and Partners, " *Blockchain* 2025 – Indonesia ," Global Practice Guides, https://practiceguides.chambers.com/practice-guides/ *blockchain* -2025/indonesia/trends-and-developments.
[33]Global Legal Insights, "Indonesia: *Blockchain* & Crypto Assets – Country Comparative Guides," https://www.legal500.com/guides/chapter/indonesia- *blockchain* -crypto-assets/
[34]Tandfonline, "Institutional Framework for NFT Governance in Indonesia: A Proposal for a Specialized NFT Authority," Cogent Social Sciences (2025), https://www.tandfonline.com/doi/full/10.1080/23311886.2025.2579523.
[35]Kennedys Law, “Arbitration, Crypto Assets, and the Courts: Adapting Dispute Resolution for a Digital Economy,” January 16, 2026, https://www.kennedyslaw.com/en/thought-leadership/article/2026/arbitration-crypto-assets-and-the-courts-adapting-dispute-resolution-for-a-digital-economy/.
[36]Law Number 30 of 1999, Article 1 number 3
[37]Law Number 30 of 1999, Article 4 paragraph (2)
[38]Indonesian Journal of Law and Justice, "The Legal Force of Electronic Agreements from the Perspective of the Civil Code and the ITE Law," https://journal.pubmedia.id/index.php/lawjustice/article/view/4320 (2025).

render a decision on a particular dispute whose resolution has been submitted to arbitration." [39]In more detail, Article 12 regulates personal and humane qualification requirements: an arbitrator must be an individual who is competent to carry out legal actions, at least 35 years old, not have a family or marriage relationship up to the second degree with any of the disputing parties, have at least 15 years of experience in the relevant field, and be free from conflicts of interest. [40]This entire normative construction is based on the ontological assumption that arbitrators are human beings with the capacity for deliberation and the legal responsibilities inherent in them, but this assumption is fundamentally "demolished" by the on-chain dispute resolution mechanism , where the decision-making role is carried out by a deterministic and automatic algorithm with anonymous judges who make it almost impossible to determine whether each judge meets the qualifications required by the Arbitration Law. This situation is not merely a technical issue, but also touches on the juridical-philosophical question once raised by the dissenting judge Mance IJ in the case of Quoine v B2C2 : "can conventional legal principles work, or need to adapt, when parties entrust their affairs to a computer operating based on an algorithm?" The answer to this question becomes more challenging in the context of Indonesian law, considering that the Arbitration Law does not provide any space for non-human decision-makers . In the perspective of De Filippi and Wright, blockchain code operates as a form of normative order in itself (Lex Cryptographia) that inherently challenges the conceptual boundaries of formal state law.

[41]This challenge becomes even more apparent when faced with the execution regime of arbitral awards in the Arbitration Law. Article 59 requires every arbitral award to be registered with the District Court Clerk's Office within 30 days of the award being pronounced; failure to fulfill this obligation results in the award being unenforceable. [42]Article 60 affirms the final and binding nature of arbitral awards, while Article 61 stipulates that if the parties do not voluntarily implement the award, enforcement can only be carried out "based on an order from the Chief Justice of the District Court at the request of one of the parties." [43]At this point, on-chain dispute resolution faces a significant incompatibility with the architecture of the Arbitration Law, where on-chain execution proceeds automatically and irreversibly within the blockchain network without going through any of the required procedural steps. There is no registration with the Court, no order from the Chief Justice of the District Court, and no state oversight mechanism. The total independence that is the selling point of this technology actually becomes the source of the greatest incompatibility with the national arbitral award enforcement regime, which still relies on judicial intervention to filter legitimacy.

While formal requirements such as document authenticity and the clarity of the jurors' identities have been discussed in the context of on-chain disputes with local arbitration regimes, these normative clashes have equivalent legal consequences when transferred to the context of recognizing on-chain dispute resolution decisions as foreign arbitration decisions under Law No. 30 of 1999. While in the domestic context the primary obstacle is formal legality, in the international realm on-chain platforms immediately run up against the requirement of Article 65 concerning the requirement for a seat of arbitration in a country bound by a bilateral or multilateral agreement with Indonesia, something that is impossible to fulfill in a borderless , distributed network . Furthermore, the requirement to complete authentic physical documents for an exequatur application to the Central Jakarta District Court (Article 67) completely contradicts on-chain decisions that take the form of automated code execution. Decisions based on voting by anonymous jurors or based on algorithms also contradict the principle of public order in Indonesian law, which is highly human-centered and born from legal arguments, logical reasoning , and justice. From the two normative tests above, a structural legislative lacunae in the Arbitration Law regarding the phenomenon of on-chain dispute resolution has been identified . This legal gap is not merely partial, lacking one or two articles governing a particular aspect, but rather total and systemic. The Arbitration Law is built on a human-centric paradigm that places individual will, capacity, and responsibility as the foundation of the entire arbitration structure, from the terms of the agreement and the qualifications of the arbitrator to

[39]Law Number 30 of 1999, Article 1 number 7

[40] Law Number 30 of 1999, Article 12 paragraph (1)

[41]Primavera De Filippi & Aaron Wright, *Blockchain* and the Law: The Rule of Code (Cambridge: Harvard University Press, 2018), p. 80–81.

[42]B P Lawyers, "Procedure for Registering an Arbitration Decision in the District Court," accessed May 20, 2025, https://bplawyers.co.id/2016/07/12/prosedur-mendaftarkan-putusan-arbitrase-di-pengadilan-negeri/ .Article 59 paragraph (1) Law 30/1999

[43]SIP Law Firm, "The Process of Recognizing Arbitration Awards in Indonesia," accessed May 20, 2025, https://siplawfirm.id/resources/proses-pengakuan-putusan-arbitrase-di-indonesia. Article 61 of Law 30/1999

the mechanism for executing the decision. Meanwhile, on-chain dispute resolution operates on a completely opposite paradigm: it is decentralized, automated, trustless , and self-enforcing without any institutional mediation. This conflict creates a paradox that hinders the practice of blockchain-based dispute resolution . Research in the Indonesian legal context confirms that "the main challenges include the lack of a specific regulatory framework, inadequate technical standards, and minimal consumer protection." This [44], in turn , leads to the unpreparedness of the regulatory ecosystem as a whole, not just the Arbitration Law. In international legal literature, Pietro Ortolani has emphasized that blockchain technology and smart contracts are bringing arbitration and court litigation to an unprecedented crossroads , [45]leaving neither conventional arbitration systems nor formal courts adequately equipped to address questions about the validity, authority, and enforceability of decisions rendered by anonymous adjudicators and algorithms. Since its enactment more than two decades ago, Law Number 30 of 1999 concerning Arbitration and Alternative Dispute Resolution remains the sole source of law that has never been amended, a situation that makes it increasingly feel “outdated” in the face of technological advances.

Singapore consistently adheres to the principle of technology-neutral regulation , an approach in which laws are not designed for a specific technology, but rather to regulate permanent legal principles and functions, so that any new technology, when it enters the existing framework, does not require special legislation every time there is an innovation. The main foundation of Singapore's arbitration legal framework is the International Arbitration Act 1994 (IAA) , which has directly incorporated the UNCITRAL Model Law on International Commercial Arbitration as binding positive law in Singapore. This means that all the flexibility and principles contained in the UNCITRAL Model Law automatically apply as Singapore's national law without the need for re-legislation, including the definition of arbitration that does not require the existence of a "permanent institution" and which gives broad autonomy to the parties in designing their dispute resolution mechanisms. This is fundamentally different from Indonesia's position, which, despite having Law Number 30 of 1999, has not directly adopted the UNCITRAL Model Law as part of its positive law, so that interpretation of the new mechanisms must be carried out separately and independently.

On that foundation, IAA as amended in 2012 introduced Article 2A paragraphs (4) and (5) which explicitly address the question of the validity of arbitration agreements in digital format. Article 2A paragraph (4) stipulates that an arbitration agreement is deemed to meet the requirement of being “in writing” if its contents are recorded in any form, regardless of whether the agreement was originally made orally, through acts, or by other means. Furthermore, Article 2A paragraph (5) emphasizes that the written requirement is met by electronic communication as long as the information contained therein is accessible for future reference purposes. This article is in line with Smart Contracts and on-chain dispute resolution practices where all transactions, including dispute resolution clauses embedded in smart contracts, are permanently stored and can be accessed at any time by anyone with access to the network. Thus, arbitration clauses written in Smart Contract code technically meet the requirement of being “in writing and accessible for future reference” as referred to in Article 2A (5) of the IAA.

When examining arbitrator requirements, the Singaporean legal framework demonstrates greater flexibility than Article 12 of the Indonesian Arbitration Law, which specifies detailed personal and human qualifications. Neither the Singapore AA nor the IAA contain specific qualification requirements for an arbitrator; this non-prescriptive approach allows the parties maximum flexibility in determining the arbitrator's qualifications according to their own needs. [46]Unless the parties agree on specific qualifications, the only applicable normative limitation is that an arbitrator may be challenged if there is justifiable doubt about their impartiality or independence, or if they do not meet the qualifications agreed upon by the parties. [47]This provision theoretically opens up greater scope for the recognition of crowdsourced jurors as "arbitrators" within the meaning of Singapore law, provided the parties have agreed to use this mechanism as the forum for resolving their disputes. This flexibility is simply not available under the human-centric arbitrator paradigm

[44]*Blockchain* Implementation in Improving Legal Certainty and Contract Dispute Resolution in Indonesia," ResearchGate (2024), https://www.researchgate.net/publication/391339548.
[45]Pietro Ortolani, The impact of *blockchain* technologies and smart contracts on dispute resolution: arbitration and court litigation at the crossroads, *Uniform Law Review* , Volume 24, Issue 2, June 2019, Pages 430–448, https://doi.org/10.1093/ulr/unz017
[46] Clyde & Co, "The Landscape of Arbitrators in Singapore" (2023), https://www.clydeco.com/en/insights/2023/10/the-landscape-of-arbitrators-in-singapore
[47] *Ibid.* An arbitrator can be questioned "if (a) there are circumstances giving rise to justifiable doubts as to his or her impartiality or independence; or (b) he or she does not possess the qualifications agreed to by the parties."

of the Indonesian Arbitration Law. However, as Wu notes in his comparative study of Algorithmic Justice in Hong Kong and Singapore, the validity of arbitration agreements that designate artificial intelligence algorithms as final decision-makers remains subject to significant uncertainty, not because of the absence of arbitrator qualification requirements, but because of more fundamental issues related to the authenticity of party consent , attribution of liability, and guarantee of due process , all of which are prerequisites under the IAA and the New York Convention regardless of the identity of the arbitrator selected. [48]Similarly, the crowdsourced jurors paradigm, with its principles of anonymity and economic incentives, is in Decentralized Justice . In other words, Singapore does not offer complete uncertainty, but rather offers a wider interpretative space for finding answers.

In the examination of arbitration awards and enforcement, conflicts emerged between on-chain dispute resolution and the Singaporean legal framework, albeit to varying degrees. The IAA grants direct legal force to the UNCITRAL Model Law, including Articles 35 and 36 of the Model Law, which regulate the recognition and enforcement of awards and the grounds for refusing recognition. This framework is much more modern than Articles 59-61 of the Indonesian Arbitration Law concerning registration and the 30-day time limit. [49]However, this procedural flexibility does not mean that the automatic execution characteristic of on-chain dispute resolution is completely free from normative friction. When disputed crypto assets have irreversibly changed hands through a smart contract immediately after a consensus vote is reached, Singaporean courts, through the filter of Article 36 of the Model Law, still have the potential to encounter a situation where the disputed object has permanently changed status before there is an opportunity to examine whether the award is contrary to public order.

It can be concluded that Singapore's legal framework, considered more advanced and superior in addressing technological developments and the surge in business engagements, still faces obstacles when dealing with on-chain dispute resolution mechanisms. In purely on- chain disputes , a self- enforcing mechanism may be sufficient because the disputed object and its enforcement mechanism are within the same ecosystem. However, it must be acknowledged that on-chain dispute resolution is a sui generis phenomenon , functionally parallel to arbitration, but structurally fundamentally different from all arbitration instruments recognized by positive law when dealing with obligations that cannot be enforced through code. Chevalier, in the Journal of International Dispute Settlement (Oxford University Press, 2021), argues that blockchain arbitration should not be equated with traditional arbitration, as it need not and may never fully fit into the conventional international arbitration framework. [50]This argument is theoretically appealing, but it is unlikely to be implemented quickly. Fundamental legal changes take a long time, while the parties involved in a dispute need a solution that can be implemented immediately without having to wait for major system changes.

Pragmatic steps are needed to keep this mechanism running. A proven practice is a hybrid model that places on-chain dispute resolution as a technological component within the arbitration process while still meeting formal legal requirements. Concrete empirical evidence comes from Mexico. On May 28, 2021, a Mexican court became the first jurisdiction in the world to uphold a Kleros award through a two-stage mechanism. The dispute stemmed from a property lease agreement, where the arbitration clause expressly instructed a single arbitrator to use the Kleros protocol to decide the underlying issue. When rent arrears arose and both parties submitted their respective claims and evidence, the arbitrator issued a Procedural Order on November 3, 2020, defining the underlying issue as Kleros, an Ethereum-based decentralized application . Three jurors randomly selected from among Pinakion token holders reviewed the uploaded evidence and communicated a ruling in favor of the property owner to the arbitrator on November 23, 2020. Four days later, the arbitrator issued a formal award in Guadalajara incorporating the decision. This incorporation construction is key to the model's success: the Kleros process and decision are described only in the " Arbitral Procedure " section of the award, while the operative section makes no mention of Kleros' role and appears to be solely the arbitrator's decision. This construction effectively separates the substantive adjudication function, which is actually performed by the algorithm and anonymous jurors, from the formal legitimation function, which remains with an identified and

[48]Yuhang Wu, "Algorithmic Justice: A Comparative Study on the Validity and Enforceability of AI Arbitration Agreements and Awards in Hong Kong and Singapore,", https://law1a.nus.edu.sg/asli_abstract/view_abstract_d.aspx?abno=627
[49]ICLG, "International Arbitration Laws and Regulations Report 2025-2026: Singapore," https://iclg.com/practice-areas/international-arbitration-laws-and-regulations/singapore
[50] Maxime Chevalier, "From Smart Contract Litigation to Blockchain Arbitration, a New Decentralized Approach Leading Towards the Blockchain Arbitral Order," *Journal of International Dispute Settlement* 12, no. 4 (December 2021): 558, https://doi.org/10.1093/jnlids/idab025 .

accountable human arbitrator. Armed with this procedurally "legitimized" award , the executory petition filed with the Mexican civil court was ultimately granted on May 28, 2021, after the court determined that neither the clause nor the entire arbitration process was contrary to public order. [51]Thus, what is recognized and executed is not the raw output of the Kleros protocol, but rather a conventional arbitration award whose substance is driven by technology but still formally framed by a human arbitrator.

Conclusion

This research demonstrates that on-chain dispute resolution cannot be adequately understood if it is forced into existing legal categories, but rather must be understood through a theoretical framework that more accurately explains its ontological character. In De Flippi and Wright's view, the blockchain code that runs on-chain dispute resolution operates as Lex Cryptographia , a distinct normative order born from the technical-algorithmic agreements of its users, not from any state authority. This framework precisely explains why on-chain dispute resolution is able to operate autonomously and self-enforcingly in purely on-chain disputes , as evidenced by the growing adoption of Kleros, which has resolved over 900 disputes without the intervention of any state judicial authority.

However, problems arise when Lex Crypographia intersects with the state legal paradigm rooted in the theory of sovereignty and legal positivism. As taught by John Austin, a new order can only be considered valid law if its authority comes from a state that has full sovereignty, while Hans Kelsen emphasized that law is a norm that originates from a clear hierarchy and can be traced back to the grundnorm . Measured from this framework lies the fundamental problem of on-chain dispute resolution , the decision produced by an anonymous jury based on algorithmic consensus does not have a source of authority that can be traced to the sovereignty of any state, so from the perspective of legal positivism that is the foundation of Law Number 30 of 1999. On-chain dispute resolution is structurally not classified as "law" in the formal sense, but rather merely a private agreement that only gains legal force when "interpreted" by an institution recognized by state sovereignty, as evidenced in the Mexican case where the Kleros decision only gained validity after being reframed by a human arbitrator whose authority is recognized by the state.

This research answers two research questions , including: first, the legal status of on-chain dispute resolution in the Indonesian civil law system is sui generis and exists within a structural legal vacuum (lacuna legis). It operates as a technically-functionally legitimate Lex Cryptographia in the blockchain ecosystem , but has not yet received any formal recognition from the Indonesian positive legal system, so its current status is outside the umbrella of civil law and applicable procedural law. Second, on-chain dispute resolution cannot yet be recognized as a valid form of arbitration based on Law Number 30 of 1999, because two normative tests of the elements of the arbitration agreement, the qualifications of the arbitrator, and the registration of the decision prove a fundamental incompatibility with the human-centric paradigm underlying the law. This incompatibility is also demonstrated by a comparative analysis of Singapore, where it still appears, albeit with less intensity, in jurisdictions that adhere to the principle of technology-neutral regulation .

This normative need demands a more advanced response than mere textual examination. The progressive legal thinking pioneered by Satjipto Rahardjo offers a relevant philosophical framework for addressing this. Law exists to serve humanity, not to force humans to conform to rigid and formalistic legal schemes. Rahardjo explicitly criticized legal positivism as an approach that dismisses aspects beyond the logic of law itself, such as societal needs and human welfare, and urged law enforcers to boldly step " beyond the call of rules " when the textual formulation of the law is no longer able to meet the needs of the times. This principle is directly relevant to the findings of this study, rather than waiting for on-chain dispute resolution to fully comply with the textual formulation of Articles 4 and 12 of the Arbitration Law, which are structurally unattainable given the fundamental paradigm differences. The progressive approach leads to the acceptance of a hybrid model, as demonstrated in Mexico, as a pragmatic solution that respects the need for legal certainty while still recognizing the reality of technological change that serves the interests of justice seekers in the digital economy. This study recommends that Indonesian policymakers consider explicitly regulating a hybrid technology-based arbitration model through implementing regulations, rather than waiting for a comprehensive revision of Law No. 30 of 1999, which would require a lengthy legislative process. Further research is needed to more specifically

[51]Kleros, "How to Enforce Blockchain Dispute Resolution in Court? The Kleros Case in Mexico," *Kleros Blog* , January 10, 2022, https://blog.kleros.io/how-to-enforce-blockchain-dispute-resolution-in-court-the-kleros-case-in-mexico/ .

examine how hybrid disputes involving tokenized real-world assets can be accommodated within this model, given the limited scope of this study, which focuses solely on aspects of validity and legal standing.

REFERENCES

Sumber Hukum

Republik Indonesia. (1981). *Keputusan Presiden Nomor 34 Tahun 1981 tentang Mengesahkan Convention on the Recognition and Enforcement of Foreign Arbitral Awards*.

Republik Indonesia. (1999). *Undang-Undang Republik Indonesia Nomor 30 Tahun 1999 tentang Arbitrase dan Alternatif Penyelesaian Sengketa*.

Republik Singapura. (1994). *International Arbitration Act 1994*.

Buku

Bhatt & Joshi Associates. (2024). *Singapore International Arbitration Centre*. AWS Publications.

De Filippi, P., & Wright, A. (2018). *Blockchain and the law: The rule of code*. Cambridge, MA: Harvard University Press.

Hikmahanto Juwana. (2002). Perbandingan sistem hukum: Suatu pengantar. Dalam *Bunga rampai hukum ekonomi dan hukum internasional* (hlm. 78). Jakarta: Lentera Hati.

Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world*. New York, NY: Portfolio/Penguin.

Bab Buku

Saumier, G. (2012). ODR and the courts. Dalam M. Abdel Wahab, E. Katsh, & D. Rainey (Eds.), *Online dispute resolution: Theory and practice* (hlm. 189). The Hague, Netherlands: Eleven International Publishing.

Jurnal

Ast, F., George, W., Kamalova, J., Sharma, A., & Aouidef, Y. (2023). Decentralized justice: State of the art, recurring criticisms and next-generation research topics. *Frontiers in Blockchain, 6*, 1204090.

Bergolla, L., Seif, K., & Eken, C. (2022). Kleros: A socio-legal case study of decentralized justice blockchain arbitration. *Ohio State Journal on Dispute Resolution, 37*(1), 55–58.

Chevalier, M. (2021). From smart contract litigation to blockchain arbitration, a new decentralized approach leading towards the blockchain arbitral order. *Journal of International Dispute Settlement, 12*(4), 558–584.

Dimitropoulos, G. (2020). The law of blockchain. *Washington Law Review, 95*(3), 1117–1191.

Indonesian Journal of Law and Justice. (2025). *Kekuatan hukum perjanjian elektronik dalam perspektif KUH Perdata dan UU ITE*.

Lim, D., & Loi, S. (2021). Singapore as a hub for international commercial arbitration: Legal infrastructure and technological adaptation. *Asian International Arbitration Journal, 17*(1), 45–46.

Ramadhan, N. R., Alvito, H. R., Matondang, T. I., & Nugroho, A. A. (2024). Pengaturan umum mengenai investasi serta keuangan elektronik dalam hukum teknologi dan informasi. *Socius: Jurnal Penelitian Ilmu-Ilmu Sosial*.

Rismawati, S. D. (2021). Tantangan regulasi aset kripto dan teknologi blockchain dalam sistem hukum Indonesia. *Jurnal Hukum dan Pembangunan, 51*(2), 389.

Sari, K. (2018). Penerapan konsep teori permainan (game theory) dalam pemilihan strategi kampanye politik: Studi kasus strategi pemenangan Pemilukada DKI Jakarta tahun 201. *E-Jurnal Matematika*.

Yamin, A. F. (2024). Strategi efektif penyelesaian sengketa bisnis dan implikasinya terhadap kelangsungan usaha di Indonesia: Analisis berdasarkan Undang-Undang Nomor 30 Tahun 1999 tentang Arbitrase dan Alternatif Penyelesaian Sengketa. *Meraja Journal, 7*(1), 36–47.

Yuliani, A. A. (2021). Analisis keabsahan online dispute resolution arbitrase dalam pelaksanaannya di Indonesia. *Simbur Cahaya*, 323–336.

Laporan / Report

Boston Consulting Group, & ADDX. (2022). *Relevance of on-chain asset tokenization in crypto winter*.

Google, Temasek, & Bain & Company. (2025). *e-Conomy SEA 2025: Through the waves, towards a sea of opportunity*. Singapore: Google Asia Pacific.

ICLG. (2025–2026). *International arbitration laws and regulations report: Singapore*.

Monetary Authority of Singapore. (2023). *IM8e digital asset framework: Consultation paper*.

Artikel Web

BP Lawyers. (2025, May 20). *Prosedur mendaftarkan putusan arbitrase di pengadilan negeri*.

Chambers and Partners. (2025). *Blockchain 2025: Indonesia*.

Clyde & Co. (2023). *The landscape of arbitrators in Singapore*.

Kennedys Law. (2026, January 16). *Arbitration, crypto assets, and the courts: Adapting dispute resolution for a digital economy*.

SIP Law Firm. (2025, May 20). *Proses pengakuan putusan arbitrase di Indonesia*.

Tandfonline. (2025). *Institutional framework for NFT governance in Indonesia: A proposal for a specialized NFT authority*.

Wu, Y. (n.d.). *Algorithmic justice: A comparative study on the validity and enforceability of AI arbitration agreements and awards in Hong Kong and Singapore*.

Situs Resmi

Kleros. (n.d.). *The justice protocol: Kleros homepage*. Retrieved May 23, 2026, from https://kleros.io/

SIAC. (2022). *SIAC Rules 2016 and guidelines for arbitration involving blockchain and smart contracts*.