Blockchain Arbitration: Navigating the Interface Between Digital Code and Legal Order

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This article explores the emerging practice of blockchain arbitration, focusing on the doctrinal and procedural tensions between decentralised digital infrastructure and traditional legal frameworks. It critically examines whether arbitration mechanisms can adapt to resolve disputes involving smart contracts and blockchain-based transactions, particularly where code supplants human intention and interpretive flexibility. The analysis addresses whether on-chain enforcement tools – such as automated decision execution – can coexist with the procedural guarantees central to conventional arbitration, including due process, reasoned awards, and judicial oversight. Key regulatory developments, including the EU's Markets in Crypto-Assets Regulation and the UK's Digital Dispute Resolution Rules, are evaluated alongside recent enforcement precedents and institutional rule adaptations. The article argues that hybrid models combining automation with human adjudication offer the most viable path forward, but also highlights ongoing uncertainties regarding enforceability under the 1958 New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards – especially Articles V(1)(b) and V(2)(b). It concludes that blockchain arbitration will only be viable if it can reconcile innovation with the procedural legitimacy required for cross-border recognition and enforcement.

INTRODUCTION

Blockchain technology has evolved from a niche innovation into a foundational infrastructure for global digital commerce. Initially created to support cryptocurrencies like Bitcoin, blockchain now facilitates decentralised finance ("DeFi"), tokenised asset transfers, and automated contractual performance through smart contracts.[1; 2] Its defining features – immutability, decentralisation, and automation—are increasingly embedded in commercial operations, often displacing traditional intermediaries. Yet these same features disrupt established legal norms, especially in the context of dispute resolution.

As blockchain technology has gained broader adoption, the complexity of disputes involving blockchain and smart contracts has also increased. Smart contracts – self-executing agreements written in code and deployed on distributed ledgers – can autonomously trigger legal consequences without human intervention.[3] Their use raises fundamental questions about contractual formation, intent, interpretation, and breach. Where code becomes the operative language of the contract, traditional judicial and

[1] A smart contract is a self-executing agreement written in code, deployed on a blockchain, which automatically enforces terms based on predefined conditions.

[2] Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration: A New Decentralised Approach Leading Towards the Blockchain Arbitral Order' (2021) 12 *Journal of International Dispute Settlement* 558, at 559–560.

[3] Nick Szabo, 'Smart Contracts: Building Blocks for Digital Markets' (1996) <https://perma.cc/YC35-2MXQ> accessed 23 March 2025.

arbitral methods struggle to assess intention, ambiguity, or equitable adjustment.[4] Moreover, the global and pseudonymous nature of blockchain transactions often renders state-based enforcement mechanisms inefficient or inaccessible.[5]

Arbitration has emerged as a compelling alternative. Its procedural flexibility, international enforceability under the New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards (hereinafter: the "New York Convention")[6] and ability to accommodate bespoke procedural designs make it well-suited to complex digital transactions.[7] Yet blockchain arbitration itself presents doctrinal challenges. It remains unclear whether coded arbitration agreements meet the "agreement in writing" requirement under Article II of the New York Convention,[8] whether fully automated, on-chain dispute resolution satisfies due process obligations under Articles V(1)(b) and V(2)(b),[9] or whether the absence of annulment or appellate mechanisms in decentralised protocols fatally undermines enforceability.[10]

I. THE GROWING MARKET OF BLOCKCHAIN AND CRYPTO DISPUTES: SPECIAL FEATURES AND REGULATORY GAPS

The evolution of blockchain technology from its origins as the underlying infrastructure for Bitcoin into a globally deployed digital architecture has transformed multiple sectors. Its applications now extend beyond finance to encompass supply chain management, intellectual property, digital identity, and healthcare[11]. Key developments such as the proliferation of DeFi[12], the emergence of digital asset exchanges[13], and the widespread deployment of smart contracts have reshaped not only commercial interactions but also the nature and scale of legal risk.[14] Token offerings, including initial coin offerings ("ICOs")

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4 Jerry I-H Hsiao, 'Smart Contract on the Blockchain—Paradigm Shift for Contract Law?' (2017) 14 *US-China Law Review* 685, at 690–693.

5 Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252.

6 New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958) <https://www.newyorkconvention.org/english>.

7 Gary B. Born, International Commercial Arbitration (3rd edn, Kluwer Law International 2020) chs 1, 22 and 26;

8 Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 2, paras 2.01–2.26, esp paras 2.13, 2.16 and 2.19.

9 Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

10 Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 10.

11 Fran Casino, Thomas K Dasaklis and Constantinos Patsakis, 'A Systematic Literature Review of Blockchain-Based Applications: Current Status, Classification and Open Issues' (2019) 36 *Telematics and Informatics* 55 <https://doi.org/10.1016/j.tele.2018.11.006> *accessed* 25 June 2025.

12 DeFi—or decentralised finance—represents a blockchain-based financial ecosystem wherein users can lend, borrow, trade, and manage assets via smart contracts, bypassing central intermediaries; its recent rapid proliferation—evidenced by expanding protocol volume, user adoption, and total value locked—poses novel challenges for traditional legal and enforcement frameworks. See Fabian Schär, 'DeFi's Promise and Pitfalls' (2022) *IMF Finance & Development* <https://www.imf.org/en/Publications/fandd/issues/2022/09/Defi-promise-and-pitfalls-Fabian-Schar> accessed 29 June 2025.

International Monetary Fund, *Global Financial Stability Report: Chapter 3 – The Rapid Growth of Fintech* (April 2022) <https://www.imf.org/-/media/Files/Publications/GFSR/2022/April/English/ch3.ashx> accessed 29 June 2025.

13 A digital asset exchange is a platform that enables the trading, custody, or transfer of blockchain-based assets, including cryptocurrencies, tokenised securities, and stablecoins. These exchanges may operate in a centralised form—where a legal entity facilitates transactions and holds custody of user assets—or in a decentralised manner, relying on smart contracts and peer-to-peer protocols without a central intermediary. See Boodle Hatfield, 'What Does It Mean? A Guide to Key Terms in Digital Asset Law' (Boodle Hatfield, no date) <https://www.boodlehatfield.com/what-does-it-mean-a-guide-to-key-terms-in-digital-asset-law/> accessed 29 June 2025; Congressional Research Service, *Digital Assets and SEC Regulation* (R46208, 2021) 7–8 <https://sgp.fas.org/crs/misc/R46208.pdf> accessed 29 June 2025.

14 Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252.

and security token offerings ("STOs"),[15] have introduced new investment models often operating at the edges—or outside—the scope of established regulatory frameworks.[16]

This expansion has corresponded with a marked increase in blockchain-related disputes, both in volume and complexity. While blockchain is often lauded for its immutability[17] and transparency, these same features pose unique evidentiary and interpretive challenges[18] when transactions are disputed. Errors in coding, ambiguity in smart contract logic, or conflicting off-chain representations of value and obligation frequently give rise to disputes that differ in nature from those encountered in conventional contract law.[19] Parties have litigated or arbitrated issues such as erroneous token valuations,[20] failed or delayed settlement executions,[21] and the

[15] An Initial Coin Offering (ICO) is a fundraising method used by blockchain-based projects to issue and sell digital tokens to investors, typically in exchange for cryptocurrencies like Bitcoin or Ethereum. ICOs function similarly to crowdfunding but often lack regulatory oversight, making them a high-risk investment. Tokens offered in an ICO may serve various purposes, such as granting access to a platform or service, but they do not necessarily confer ownership or financial rights. Due to their speculative nature and potential for fraud, many jurisdictions have introduced regulations or outright bans on ICOs to protect investors.

A Security Token Offering (STO) is a more regulated alternative to ICOs, where the issued tokens are classified as securities and subject to applicable financial laws. Security tokens represent ownership in an underlying asset, such as shares in a company, real estate, or other investment products. STOs provide investors with legal protections, such as compliance with securities regulations and investor rights, making them a more transparent and secure means of raising capital. However, their regulatory requirements also make STOs more complex and costly to launch compared to ICOs.

On ICO see Angelos Delivorias, 'Understanding Initial Coin Offerings' (European Parliamentary Research Service, July 2021) EPRSBRI(2021)696167 <https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/696167/EPRS_BRI(2021)696167_EN.pdf> accessed 29 June 2025. On STO see Kirill Shakhnov and Luana Zaccaria, 'Security Token Offerings' (2020) *Small Business Economics https://link.springer.com/article/10.1007/s11187-021-00539-9* accessed 29 June 2025.

[16] Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 560–561.

[17] Immutability refers to the characteristic of blockchain data that, once recorded, cannot be altered retroactively without consensus across the network.

[18] Disagreements over the interpretation and execution of smart contracts arise when there is a conflict between the coded logic of the contract and the parties' intended contractual relationship. Smart contracts operate on an "if-then" basis, and even slight ambiguities in code or unforeseen market conditions can trigger actions that may not align with the parties' original expectations. For example, a lending contract might include a clause for collateral liquidation, but a poorly defined threshold within the code could result in liquidation under conditions that the parties did not foresee or agree to. This divergence between automated execution and the nuanced intent of traditional contractual agreements poses significant challenges for legal interpretation and dispute resolution in the blockchain context. See *Interpreting Smart Contracts: The Reasonable Coder and the Need for a Stronger Contextual Approach* (discussion of divergence in hybrid contracts where natural language may conflict with coded terms leading to ambiguity and unintended execution) cjil.uchicago.edu+3law.ox.ac.uk+3digitalcommons.law.uw.edu+3; Jennifer Huang & Brendan Harrington, *"From Code to Court and Beyond: Alternative Dispute Resolution On and Off the Blockchain"* (*Dispute Resolution Journal*, Nov 2024) (explaining that smart contracts run purely as conditional "ifthen" sequences and may trigger unintended outcomes where the coded logic is misaligned with parties' expectations) mayerbrown.com+1mondaq.com+1.

[19] Nick Szabo, 'Smart Contracts: Building Blocks for Digital Markets' (1996) <https://perma.cc/YC35-2MXQ> accessed 23 March 2025.

[20] Erroneous token valuations occur when the pricing mechanism embedded in a smart contract fails to accurately reflect market conditions, resulting in token prices that deviate significantly from their intended value. For instance, a misconfigured pricing algorithm might underprice tokens during an initial coin offering, leading investors to receive tokens at a value considerably lower than that determined by market demand. This discrepancy not only undermines the economic rationale of the token sale but also raises legal questions regarding the platform's liability for the mispricing and the appropriate remedy for affected investors. See Ting Chen *et al.*, 'Under-Optimized Smart Contracts Devour Your Money' (2017) arXiv <https://arxiv.org/abs/1703.03994> accessed 30 June 2025; Siwei Wu *et al.*, 'DeFiRanger: Detecting Price Manipulation Attacks on DeFi Applications' (2021) arXiv *https://arxiv.org/abs/2104.15068* accessed 30 June 2025.

[21] Delays in transaction settlements refer to instances where technical malfunctions or network congestion hinder the prompt execution of blockchain transactions. In digital asset trading, the swift settlement of transactions is crucial due

unintended operation of automated contractual clauses triggered by volatile or unforeseen market conditions.[22]

The absence of a coherent cross-border regulatory framework compounds the problem.[23] Blockchain transactions frequently involve parties in multiple jurisdictions, each governed by divergent legal regimes concerning the classification, taxation, and enforceability of digital assets. Regulatory lag has created legal uncertainty in areas such as smart contract validity, consumer protection, and the jurisdictional reach of enforcement proceedings, thereby intensifying disputes over forum selection, governing law, and award recognition.[24] Even in well-resourced legal systems, courts and arbitrators face challenges in applying analog legal concepts to transactions encoded in deterministic programming logic.

The volatility of crypto markets is a persistent aggravating factor. Rapid fluctuations in token prices, gas fees, or liquidity conditions may impact contract performance and lead to opportunistic termination, attempted rescission, or challenges to the fairness of performance algorithms. Parties frequently contest whether the automated execution of obligations under a smart contract constituted full and fair performance, particularly where price instability or technical errors produced unexpected outcomes. Though many such disputes are resolved confidentially, public commentaries and institutional reports indicate a growing corpus of complex, high-value disputes arising from these factors.[25]

In sum, the increased commercial adoption of blockchain technologies, coupled with their technical and legal unpredictability, has produced a fertile environment for disputes. These disputes raise issues that strain the interpretative and procedural capacities of courts and tribunals accustomed to textual contracts and centralised systems. Arbitration, with its flexibility, enforceability, and transnational adaptability, is increasingly viewed as a suitable mechanism for resolving such disputes—provided that it can adapt to address the procedural, evidentiary, and normative complexities of blockchain-based transactions.

to the volatile nature of cryptocurrency markets. When delays occur—perhaps due to insufficient network capacity or errors in the underlying code—the resulting slow execution can cause significant financial losses for parties expecting immediate fulfillment of contractual obligations. Such delays highlight the tension between the idealised efficiency of blockchain systems and the practical limitations of current technology, thereby inviting scrutiny over the reliability of service-level commitments in crypto transactions. See Stijn Van Hove and Roderick J A van Tilburg, 'Quantifying the Loss from Blockchain Network Delay' (2023) SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4436697> accessed 30 June 2025; New York Federal Reserve, 'The Financial Stability Implications of Digital Assets' (2024) <https://www.newyorkfed.org/medialibrary/media/research/epr/2024/EPR_2024_digital-assets_azar.pdf> accessed 30 June 2025.

[22] Promise Okezie, 'Resolving Smart Contract Disputes Through Blockchain Arbitration' (2024) 90(1) *Arbitration: The International Journal of Arbitration, Mediation and Dispute Management* 73;Manyun Li, 'Legal Intervention in the Decentralised Era: A Sceptical Analysis of ADR's Feasibility in Resolving Blockchain Disputes' (2023) 25(2) *Asian Dispute Review* 63.

[23] While some jurisdictions have developed specific frameworks, there is no globally harmonized approach to blockchain regulation. The European Union has adopted MiCA, offering the most comprehensive regime to date for crypto-asset issuers and service providers—but its scope is limited to EU Member States.[1] The United Kingdom has recognized smart contracts and digital assets in law and introduced tools like the Digital Securities Sandbox and the UK Jurisdiction Taskforce's Digital Dispute Resolution Rules (DDRR), though it lacks a unified regulatory statute.[2] The United States follows a fragmented model: the SEC treats many tokens as securities, the CFTC views others as commodities, and FinCEN regulates for anti-money laundering—often with conflicting interpretations and no overarching crypto legislation.[3] Countries like Singapore, Switzerland, and Japan maintain relatively clear but nationally distinct regimes, while others, such as China and India, have imposed restrictions or bans.[4] At the international level, bodies like FATF, IOSCO, BIS, and the IMF have issued policy guidance, but their recommendations remain non-binding and unevenly implemented.[5]

[1] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on Markets in Crypto-assets [2023] OJ L150/40.

[2] UK Jurisdiction Taskforce, 'Digital Dispute Resolution Rules' (LawtechUK, April 2021) <https://www.lawtechuk.io/ddrr> accessed 3 June 2025; Law Commission of England and Wales, 'Smart Legal Contracts: Advice to Government' (Law Com No 401, 2021).

II. SMART CONTRACTS, ENFORCEMENT MECHANISMS, AND THE INTEGRATION CHALLENGE

Smart contracts, blockchain-based arbitration, and hybrid enforcement models represent both innovation and disruption at the intersection of code and law. A smart contract[26] is a self-executing set of instructions deployed on a blockchain, designed to automatically perform obligations upon the occurrence of predefined conditions.[27] Their use promises reduced transaction costs and mitigated risk of opportunistic behaviour due to their immutability and deterministic execution.[28] However, this automation also introduces rigidity: smart contracts lack interpretive discretion, cannot accommodate equitable adjustments, and often fail to anticipate legal exceptions or contextual nuance.[29]

In response to the procedural demands of disputes involving blockchain transactions, two principal enforcement models have emerged: on-chain arbitration[30] and off-chain arbitration.[31; 32] On-chain arbitration embeds the adjudicatory process within the blockchain itself. The arbitral outcome—whether reached by jurors, oracles, or algorithmic consensus—is executed automatically by smart contract code. While this model offers transparency and

[3] Securities and Exchange Commission v Coinbase Inc, Complaint, No 1:23-cv-04738 (SDNY, filed 6 June 2023); SEC, 'SEC Charges Decentralised Finance Lender with Misleading Investors' (Press Release 2023-121, 2023) <https://www.sec.gov/news/press-release/2023-121>; FinCEN, 'Application of FinCEN's Regulations to Certain Business Models Involving Convertible Virtual Currencies' (2019).

[4] Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252; Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 561–562.

[5] FATF, 'Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers' (October 2021); IOSCO, 'Decentralised Finance Report' (March 2022); BIS, 'Cryptoassets: Implications for Financial Stability' (January 2022); IMF, 'The Crypto Ecosystem and Financial Stability Challenges' (December 2021).

[24] Ritika Bansal, 'Enforceability of Awards from Blockchain Arbitrations in India' (2019) *Kluwer Arbitration Blog* <https://arbitrationblog.kluwerarbitration.com/2019/08/21/enforceability-of-awards-from-blockchain-arbitrations-in-india/> accessed 23 March 2025.

[25] ICC Commission on Arbitration and ADR, 'Leveraging Technology for Fair, Effective and Efficient International Arbitration Proceedings' (2021).

[26] Nick Szabo, 'Smart Contracts: Building Blocks for Digital Markets' (1996) <https://perma.cc/YC35-2MXQ> accessed 23 March 2025. A smart contract is a self-executing agreement with the terms directly written into code. Once deployed on a blockchain, it operates autonomously and immutably, triggering performance when predetermined conditions are met. While often described as contracts, they may not fulfill all legal requirements of contract formation under traditional legal principles. See also Jerry I-H Hsiao, 'Smart Contract on the Blockchain—Paradigm Shift for Contract Law?' (2017) 14 US-China L Rev 685, at 689.

[27] Nick Szabo, 'Smart Contracts: Building Blocks for Digital Markets' (1996) <https://perma.cc/YC35-2MXQ> accessed 23 March 2025.

[28] Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 559–560.

[29] Jerry I-H Hsiao, 'Smart Contract on the Blockchain—Paradigm Shift for Contract Law?' (2017) 14 *US-China Law Review* 685, at 690–693.

[30] Onchain arbitration refers to dispute resolution mechanisms that are fully embedded within blockchain technology. The arbitration process is integrated into the blockchain's architecture by way of smart contracts. When an arbitrator or a panel of jurors issues a decision, the outcome is automatically encoded and executed by the smart contract, thereby triggering the corresponding performance without any human intervention.

[31] Offchain arbitration relies on conventional procedures where disputes are resolved through traditional mechanisms, such as institutional arbitration or even litigation. The final award, although rendered by arbitrators with expertise in both the subject matter and blockchain technology, is enforced through established legal processes and national courts.

[32] For a discussion of on-chain and off-chain arbitration frameworks, see Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration, a New Decentralised Approach Leading Towards the Blockchain Arbitral Order' (2021) 12 Journal of International Dispute Settlement 558, 561. On-chain arbitration embeds dispute resolution into the blockchain, whereas off-chain arbitration uses traditional adjudicatory processes with enforcement outside the blockchain system.

speed, it is limited in its ability to satisfy procedural fairness standards, including reasoned decision-making, the right to be heard, and the opportunity to challenge decision-makers.[33] Moreover, the lack of appellate mechanisms or review procedures raises serious concerns regarding recognition and enforceability under the New York Convention and national arbitration laws.[34]

Off-chain arbitration, by contrast, follows conventional arbitral procedures. Arbitrators with subject-matter and technological expertise render awards based on evidence and legal argument, with enforceability ensured through national courts. This model permits discretionary remedies, compliance with *lex arbitri,* and post-award challenges or annulment proceedings. However, its formalism may reduce efficiency, and difficulties persist in verifying digital evidence and resolving interpretive conflicts between human-readable and machine-readable terms.[35] For example, disputes may arise over whether an NFT's metadata[36] forms part of the contractual agreement, or how on-chain time stamps[37] and wallet signatures[38] can be authenticated in accordance with evidentiary standards.[39]

Hybrid enforcement models[40] have emerged as a pragmatic compromise between procedural legitimacy and technological efficiency. These structures employ on-chain mechanisms for specific functions such as evidence gathering, interim execution, or initial determinations, while reserving final adjudication and enforceability to off-chain arbitrators or national courts. This model leverages blockchain's transparency and automation without displacing the safeguards of formal arbitral procedure. The Mexican court's recognition of a blockchain-assisted award illustrates such a

[33] Kleros White Paper (2019) <https://kleros.io/whitepaper.pdf> accessed 23 March 2025 (Note: This is a white paper and not a peer-reviewed source.)

[34] Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85. On evidentiary uncertainty and metadata in smart contracts, see Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 564–567.

[35] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) chs 13, 15, 22 and 25.

[36] An NFT's metadata consists of descriptive information that defines the characteristics and linked content of a non-fungible token, such as its name, description, media file reference (e.g. image or video), and additional attributes. This metadata is typically stored off-chain, often hosted on decentralised systems or centralised servers, and accessed via a URI embedded in the token. The metadata governs how the token is displayed and understood but is distinct from the NFT itself. See Boodle Hatfield, 'What Does It Mean? A Guide to Key Terms in Digital Asset Law' (Boodle Hatfield, no date) <https://www.boodlehatfield.com/what-does-it-mean-a-guide-to-key-terms-in-digital-asset-law/> accessed 29 June 2025.

[37] An on-chain timestamp refers to the time data recorded in the metadata of a blockchain block or transaction, indicating when a particular event—such as a smart contract execution or token transfer—was confirmed on the ledger. These timestamps are cryptographically secured and immutable once written to the chain, providing verifiable chronological evidence of events. However, they reflect network time rather than authoritative legal time and may vary slightly due to decentralised consensus mechanisms. See Boodle Hatfield, 'What Does It Mean? A Guide to Key Terms in Digital Asset Law' (Boodle Hatfield, no date) <https://www.boodlehatfield.com/what-does-it-mean-a-guide-to-key-terms-in-digital-asset-law/> accessed 29 June 2025.

[38] A wallet signature is a cryptographic proof generated by a blockchain wallet using the private key associated with a user's public address. It allows the user to sign messages or transactions without disclosing the private key, enabling authentication, consent, and non-repudiation in decentralised systems. Wallet signatures are increasingly used as functional equivalents of electronic signatures in blockchain-based arbitration and smart contract protocols. See Boodle Hatfield, 'What Does It Mean? A Guide to Key Terms in Digital Asset Law' (Boodle Hatfield, no date) <https://www.boodlehatfield.com/what-does-it-mean-a-guide-to-key-terms-in-digital-asset-law/> accessed 29 June 2025.

[39] On evidentiary uncertainty and metadata in smart contracts, see Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 564–567.

[40] Hybrid models refer to dispute resolution mechanisms that integrate automated on-chain processes with off-chain adjudication by human arbitrators.

hybrid: although the substantive determination was rendered through a blockchain-based protocol (Kleros), the final award was issued and signed by a human arbitrator and subsequently recognised by the judiciary in accordance with conventional legal standards.[41] Where such tools are embedded in the parties' agreed procedural framework, they operate not as extraneous delegations but as valid expressions of party autonomy within a technologically adapted arbitral process.

However, such hybridisation does not resolve the underlying doctrinal uncertainties. The determination of the arbitral seat remains problematic where parties, transactions, and dispute resolution mechanisms are dispersed across decentralised networks. The legal status of code-based arbitration agreements also remains unsettled: do they qualify as "agreements in writing" under Article II of the New York Convention? Can smart contract–embedded clauses satisfy the formal requirements of formation, consent, and jurisdiction? Where decision-makers are selected through algorithmic or token-weighted processes, how are independence, impartiality, and disclosure assured?

These unresolved issues underscore the central challenge of blockchain arbitration: whether legal systems can reconcile decentralised and automated decision-making with the procedural guarantees—such as due process, transparency, and reviewability—that underpin arbitral legitimacy. The remainder of this article explores these tensions through the lenses of enforceability, party autonomy, and regulatory alignment.

III. JURISDICTION, GOVERNING LAW, AND FOUNDATIONAL CHALLENGES

The decentralised and transnational character of blockchain transactions presents serious challenges to the foundational jurisdictional and procedural assumptions of international arbitration. Transactions occur pseudonymously and across decentralised networks, often without a fixed legal nexus to any state. In such contexts, territorial jurisdiction becomes conceptually and practically strained: traditional doctrines such as "minimum contacts" or "real and substantial connection"[42] have limited relevance where contractual performance and breach occur exclusively on a permissionless network.[43]

3.1 THE SEAT OF ARBITRATION: FUNCTIONAL OR FICTIONAL?

Under both the UNCITRAL Model Law and the New York Convention, the seat of arbitration plays a paramount procedural role: it determines the applicable *lex arbitri,* provides the jurisdiction for annulment proceedings, and anchors the legal identity of the arbitration for recognition and enforcement purposes.[44] However, in blockchain arbitration—particularly in on-chain systems lacking a physical procedural locus —the designated seat may become either notional or purely formal. That gives rise to critical questions: can a truly decentralised mechanism validly designate a seat in legal terms? Is such a designation enforceable, or merely strategic to satisfy enforcement formalities post hoc?

[41] Maxime Chevalier, 'Arbitration Tech Toolbox: Is a Mexican Court Decision the First Stone to Bridging the Blockchain Arbitral Order with National Legal Orders?' (2022) *Kluwer Arbitration Blog* <https://arbitrationblog.kluwerarbitration.com/2022/03/04/arbitration-tech-toolbox-is-a-mexican-court-decision-the-first-stone-to-bridging-the-blockchain-arbitral-order-with-national-legal-orders/> accessed 23 March 2025 (Note: This is a blog post and not a peer-reviewed source.)

[42] Friedrich Juenger, 'The Lex Mercatoria and Private International Law' (2000) 60 *Louisiana Law Review* 1133, 1144–1147.

[43] A permissionless network is a decentralised blockchain that allows anyone to participate in transactions and validation without prior approval.

[44] UNCITRAL Model Law on International Commercial Arbitration (as amended 2006), arts 1(2), 6, 34; Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) chs 14 and 26; Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 3.

Despite these ambiguities, doctrinal and practical consensus holds that parties must continue to expressly designate a seat of arbitration. Jurisdictions such as Singapore, Switzerland, and England and Wales offer technologically adaptive legal environments, judicial familiarity with digital evidence, and a record of pro-enforcement jurisprudence under the New York Convention.[45] Even in systems using smart contract-based performance, such designation remains essential for aligning enforcement expectations with procedural safeguards.

3.2. GOVERNING LAW: INTERPRETING BEYOND CODE

Smart contracts operate on deterministic logic: if pre-coded conditions are met, contractual performance is executed automatically without discretionary input.[46] Yet legal disputes frequently arise not from whether code was executed, but whether that execution reflected the parties' intent, fulfilled implied obligations, or adhered to equitable principles. In such instances, the governing law serves not merely as a procedural fallback, but as a substantive interpretive framework—crucial for addressing ambiguity, supplementing silent terms, and mediating the disconnect between automated outcomes and legal expectations.[47]

Moreover, in systems where doctrines such as contract formation, good faith, and unconscionability play a central interpretive role —particularly in civil law jurisdictions[48] — the rigid execution of smart contracts may fail to capture legally relevant nuances. This disconnect exposes a deeper tension between formal legal reasoning which accommodates intent, equity, and contextual interpretation, and the deterministic logic of code. Whereas courts and tribunals can resolve ambiguity or imply obligations in traditional contracts, smart contracts often preclude such flexibility by design.[49] Unless parties explicitly address how coded performance interacts with the governing legal framework, they risk outcomes that may be procedurally valid on-chain but

[45] Law Commission of England and Wales, Smart Legal Contracts: Advice to Government (2021); SIAC, *Arbitration Rules* (7th edn, 1 January 2025) <https://www.siac.org.sg/siac-rules-2025> accessed 23 March 2025.

[46] Nick Szabo, 'Smart Contracts: Building Blocks for Digital Markets' (1996) <https://perma.cc/YC35-2MXQ> accessed 23 March 2025.

[47] Jerry I-H Hsiao, 'Smart Contract on the Blockchain—Paradigm Shift for Contract Law?' (2017) 14 *US-China Law Review* 685, at 693–695.

[48] Civil law systems—such as those of Germany, France, the Netherlands, Greece, and Vietnam—require that contractual obligations be interpreted not only based on literal text, but also in accordance with good faith, fairness, and public policy. These systems may allow courts to override automated outcomes that violate equitable principles or appear unconscionable in context. This interpretive flexibility presents a structural tension with the rigidity of smart contracts, which execute deterministically and cannot account for intent, mistake, or imbalance. See François Schmitz, 'Unconscionability, Smart Contracts, and Blockchain Technology' (2019) 58 *Alabama Law Review* 811 <https://www.law.ua.edu/wp-content/uploads/archive/law-review-articles/Volume%2058/Issue%201/schmitz.pdf> accessed 27 June 2025; Simon Waddams, 'Good Faith, Unconscionability and Reasonable Expectations' (1995) 9 *Journal of Contract Law* 55 <https://alliancecontractingelectroniclawjournal.com/wp-content/uploads/2017/05/Waddams-S.-1995-%E2%80%98Good-Faith-Unconscionability-and-Reasonable-Expectations%E2%80%99.pdf> accessed 27 June 2025; Aziza Zakhidova, 'Smart Contracts in the Civil Law System: Problems of Legal Qualification' (2025) *International Journal of Legal Studies and Research* (forthcoming) <https://www.researchgate.net/publication/390055154_Smart_Contracts_in_the_Civil_Law_System_Problems_of_Legal_Qualification> accessed 27 June 2025; Martijn W Hesselink, 'The Interpretation of European Private Law in the Light of Market Freedoms and EU Fundamental Rights' (2013) 20(3) *Maastricht Journal of European and Comparative Law* 345; Shawn J Bayern, 'The Inverted Hierarchy of Contract Interpretation and Supplementation' (2022) 122 *Columbia Law Review* 1443, at 1777–1784. See also § 242 *German Civil Code*; Art. 1104 *French Civil Code*; Arts. 6:2 and 6:248 *Dutch Civil Code*; Arts. 200, 281, and 288 *Greek Civil Code*; Art. 3(3) *Vietnamese Civil Code*.

[49] Civil law systems often apply a multi-layered approach to contract and treaty interpretation, combining grammatical (textual), teleological (purposive), historical, and systematic (contextual) methods. These interpretative canons are foundational to both domestic and international adjudication. See Odile Ammann, *Domestic Courts and the Interpretation of International Law: Methods and Reasoning Based on the Swiss Example* (Brill 2020) ch 6, esp 192–221.

doctrinally vulnerable off-chain, particularly at the recognition or enforcement stage.

3.3. DUE PROCESS, TRANSPARENCY, AND DECENTRALIZATION THEORY

Decentralised dispute resolution ("DDR") protocols[50] are often promoted for their immutability and algorithmic transparency. However, decentralisation theory—which valorises non-hierarchical, crowd-sourced adjudication—frequently collides with fundamental arbitral norms. Key principles such as the right to be heard, an impartial tribunal, and procedural transparency are not guaranteed in systems that use anonymous juror pools, probabilistic reward systems, and token-based voting mechanisms.

Critics have identified three systemic deficiencies in leading DDR protocols, each stemming from the absence of core procedural guarantees. These design flaws not only challenge the legitimacy of outcomes but also pose significant barriers to recognition and enforcement concerns under international arbitration law:

3.3.1 Economic disincentives for dissent: platforms such as Kleros penalise jurors who vote against the majority, creating a chilling effect on independent reasoning and discouraging dissenting but principled positions. This structurally undermines juror independence by economically incentivising conformity.[51]

3.3.2.Token staking and wealth-weighted influence[52]: participation in decision-making is often conditioned on staking native tokens, introducing economic bias. In systems where voting power correlates with token holdings, there is a risk of vote capture by wealthy participants, compromising fairness and impartiality.[53]

3.3.3. Reputation-based bias[54]: juror credibility may be tied to previous voting behaviour or token-based reputational metrics. This incentivises alignment with expected outcomes rather than principled legal reasoning, thereby reinforcing systemic bias and diminishing procedural integrity.

These structural dynamics may violate not only international due process standards, but also render resulting decisions vulnerable to non-recognition under Article V(1)(b) or V(2)(b) of the New York Convention. Where decentralised protocols fail to provide parties a fair opportunity to be heard or operate with mechanisms that compromise impartiality and procedural transparency, courts may refuse recognition on public policy grounds. This risk is particularly acute when such systems are presented as arbitral frameworks yet fail to comply with the procedural safeguards expected under international enforcement regimes.[55]

3.4. ENFORCEMENT REDUNDANT IN A SELF-EXECUTING SYSTEM?

The increasing use of smart contracts in blockchain ecosystems has led some commentators to question the continued relevance of external enforcement mechanisms. Since smart contracts execute automatically upon the fulfilment of pre-defined conditions, it is argued that courts and arbitral tribunals are rendered redun-

[50] DDR protocols are blockchain-based systems that use decentralised mechanisms—such as token voting or crowd-sourced juries—to resolve disputes without traditional tribunals.

[51] Kleros White Paper (2019) <https://kleros.io/whitepaper.pdf> accessed 23 March 2025 (Note: This is a white paper and not a peer-reviewed source.)

[52] In token-weighted voting, participants' influence is proportional to the number of tokens they hold or stake.

[53] Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 563.

[54] Some DDR platforms assign credibility scores based on prior voting, which can incentivize conformity and suppress dissenting decisions.

[55] Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

dant.[56] However, this view misapprehends the limitations of automation within legal dispute resolution. While smart contracts may perform effectively in executing clearly defined and uncontested primary obligations, they are incapable of adjudicating disputes involving contractual validity, misrepresentation, mistake, fraud, or questions of legal capacity—issues that frequently arise in cross-border commercial disputes.[57]

Moreover, smart contracts operate according to binary logic and deterministic execution. They are structurally unsuited of interpreting ambiguity, evaluating party intent, or applying equitable doctrines. They also lack the capacity to award discretionary remedies such as moral damages, loss of opportunity, or injunctive relief— remedies that are integral to the practice of international commercial arbitration. Complex disputes often demand fact-sensitive analysis and normative judgment that require procedural flexibility and human adjudication.[58]

Importantly, enforcement is not limited to mechanical performance of obligations. It includes the ability to challenge or review decisions, and the legitimacy conferred by recognition under international legal instruments. Current blockchain arbitration protocols do not provide for annulment proceedings, appellate oversight, or institutional review, as envisaged under Article 34 of the UNCITRAL Model Law or Article V of the New York Convention[59]. In the absence of such safeguards, awards produced entirely on-chain are likely to face recognition and enforcement challenges in national courts.[60]

In short, automation may substitute for enforcement in simple, uncontested transactions, but it cannot displace the judicial and arbitral infrastructure required for complex, contested, or cross-jurisdictional disputes. Enforcement remains indispensable for producing outcomes that are legally binding, and capable of international recognition.

3.5. PARTY AUTONOMY AND THE LIMITS OF RECOGNITION AND ENFORCEMENT

While Section IV.D established that smart contracts cannot substitute for enforcement in complex disputes, this section addresses a related but distinct concern: the doctrinal limits of party autonomy. Even where parties expressly consent to automated or decentralised procedures, enforcement remains contingent on non-waivable procedural guarantees under international arbitration law.

Party autonomy is a foundational principle of international arbitration. It enables parties to determine procedural rules, select the applicable law, and designate the seat of arbitration, and is frequently cited as the contractual cornerstone of the arbitral process.[61] However, autonomy is not unbounded. Recognition and enforcement under the New York Convention are contingent on adherence to minimum procedural safeguards, including access to due process and judicial review.[62]

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[56] Dena Givari, 'How Does Arbitration Intersect with the Blockchain Technology that underlies Cryptocurrencies?' (2018) *Kluwer Arbitration Blog* <https://arbitrationblog.kluwerarbitration.com/2018/05/05/scheduled-blockchain-arbitration-april-17-2018/> accessed 23 March 2025.

[57] Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252.

[58] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) chs 13 and 15; Jerry I-H Hsiao, 'Smart Contract on the Blockchain—Paradigm Shift for Contract Law?' (2017) 14 *US-China Law Review* 685, at 690–692.

[59] UNCITRAL Model Law on International Commercial Arbitration (2006), art 34; Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), Revista Română de Arbitraj (2022) vol 16(4), 85..

[60] Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 10.

[61] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) chs 3, 4.

[62] New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958), arts V(1)(b), V(2)(b). Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) chs 3 and 10.

Many blockchain arbitration protocols obscure or eliminate such guarantees. Awards may be rendered by pseudonymous or anonymous decision-makers, using automated or token-weighted voting systems, with no opportunity for review or annulment. While such features may promote finality or resist manipulation within decentralised ecosystems, they conflict with the procedural architecture of international arbitration, which is premised on transparency, independence, and reviewability.[63]

Most notably, even where parties consent to such mechanisms, Article V(2)(b) of the New York Convention prohibits enforcement where the procedure is contrary to the public policy of the enforcing state. In other words, party autonomy cannot override the requirement for procedural legitimacy. Consent cannot validate an arbitration procedure that denies the right to be heard, lacks an impartial tribunal, or offers no opportunity for redress.

The suggestion that blockchain-based arbitration can dispense with judicial oversight challenges not only discrete statutory provisions but also the fundamental premise of arbitration as a state-supported mechanism of private dispute resolution. Smart contract logic and decentralised decision-making may enhance efficiency, but they do not eliminate the need for enforceable outcomes grounded in the rule of law. Party autonomy enables procedural choice; it does not license illegality. It is therefore essential that parties understand that any deviation from due process safeguards—even if mutually agreed—risks denial of recognition and enforcement under Articles V(1)(b) and V(2)(b) of the New York Convention.

IV. REGULATORY AND INSTITUTIONAL FRAMEWORKS GOVERNING BLOCKCHAIN ARBITRATION

The evolving regulatory landscape governing blockchain technologies and smart contracts is assuming increasing significance[64] in international arbitration, particularly with regard to the recognition and enforcement of arbitral awards. While existing frameworks are principally oriented towards market integrity, financial stability and consumer protection, they are progressively influencing the normative environment within which arbitrators operate. In disputes involving smart contracts, compliance obligations arising from statutory and regulatory instruments—particularly concerning public policy, procedural fairness or due process—may affect arbitral determination and judicial review under the New York Convention. Arbitrators, arbitral institutions and courts must therefore negotiate a complex legal terrain in which decentralised transactional logic interacts with evolving regulatory expectations and established principles of legitimacy.

4.1. EUROPEAN UNION

The European Union's Markets in Crypto-Assets Regulation ("MiCA"), adopted in 2023, establishes a harmonized framework for crypto-assets and related services across Member States.[65] While MiCA does not directly address arbitration, it introduces transparency and disclosure requirements that may influence arbitral assessments of good faith, misrepresentation, and contract validity in disputes involving digital assets.[66]

[63] Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) chs 9 and 10; Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

[64] Francis Gerard Bautista, 'ADR in the Blockchain Ecosystem: A Primer' (Kluwer Arbitration Blog, 14 December 2023) <https://arbitrationblog.kluwerarbitration.com/2023/12/14/adr-in-the-blockchain-ecosystem-a-primer/> accessed 30 June 2025.

[65] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on Markets in Crypto-assets [2023] OJ L150/40 (MiCA).

[66] MiCA, arts 6–15.

More relevant from a procedural standpoint is the EU Regulation on harmonised rules on fair access to and use of data ("Data Act"),[67] imposes mandatory design requirements for smart contracts used in data-sharing contexts. Article 30 requires such contracts to incorporate mechanisms for safe termination, access control, data integrity, and compliance with functional performance requirements. Although the provision applies to a narrow category of smart contracts, its regulatory signal is unambiguous: smart contract architecture is no longer a matter of unfettered private autonomy, but subject to enforceable safeguards.

For arbitrators, this introduces a new axis of procedural scrutiny: whether a smart contract complies not only with party consent but also with applicable regulatory expectations concerning system integrity and fail-safe operation.

These compliance benchmarks may affect enforceability in two key respects. First, non-compliance with mandatory design standards may trigger public policy objections under Article V(2)(b) of the New York Convention. Second, contracts that lack proper termination or access mechanisms may be considered procedurally unconscionable or contrary to due process—particularly where immutable execution deprives a party of effective redress.[68]

4.2. UNITED KINGDOM

The United Kingdom has taken a notably proactive approach to adapting its legal infrastructure to the challenges posed by blockchain technology and smart contracts. In 2019, the UK Jurisdiction Taskforce ("UKJT") published its *Legal Statement on Cryptoassets and Smart Contracts*, affirming that smart contracts are capable of giving rise to binding legal obligations under English law.[69] Building on this foundation, the UKJT released the *Digital Dispute Resolution Rules* ("DDRR") in 2021—a bespoke framework designed for resolving disputes involving digital assets, smart contracts, and decentralised technologies.[70]

The DDRR introduce arbitration-like procedures, including party anonymity, adjudicator control over digital assets (with party consent), and the potential for automatic on-chain enforcement of outcomes. While the DDRR do not constitute statutory arbitration under the Arbitration Act 1996, they signal a regulatory openness to procedural innovation, provided that core principles of impartiality, transparency, and procedural fairness are preserved.

For tribunals and courts, the DDRR operate as soft-law instruments that provide interpretive guidance on how dispute resolution may evolve in decentralised environments. However, outcomes produced under DDRR frameworks must still comply with international enforcement standards. In particular, recognition and enforcement under the New York Convention remain contingent on adherence to Articles V(1)(b) and V(2)(b), which enshrine minimum standards of due process and public policy compatibility.

4.3. UNITED STATES

In the United States, regulatory oversight of blockchain technologies remains decentralised, with agencies such the Securities and Exchange Commission ("SEC") asserting overlapping jurisdiction over crypto-assets, DeFi protocols,

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[67] Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data (Data Act), art 30.

[68] Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), Revista Română de Arbitraj (2022) vol 16(4), 85; Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 10.

[69] UK Jurisdiction Taskforce, *Legal Statement on Cryptoassets and Smart Contracts* (2019) <https://www.lawtechuk.io/reports/legal-statement-on-cryptoassets-and-smart-contracts> accessed 29 June 2025.

[70] UK Jurisdiction Taskforce, *Legal Statement on Cryptoassets and Smart Contracts* (2019) <https://perma.cc/FT6E-CUD3> accessed 29 June 2025.

and trading platform operations.[71] Although no unified regulatory framework currently governs smart contracts or blockchain arbitration, recent enforcement actions signal increasing scrutiny of code-based systems. The SEC has, in particular, taken the position that smart contract developers may incur liability where the code fails to disclose material risks or misrepresents the nature or functionality of digital assets.[72]

From an arbitral perspective, such regulatory positions may be invoked to challenge the validity, legality, or enforceability of smart contract-based transactions. They also raise the possibility that an award rendered without regard to these public obligations could be refused recognition and enforcement under Article V(2)(b) of the New York Convention for contravening the public policy of the enforcing state.[73]

4.4. INSTITUTIONAL ARBITRATION RULES AND SMART CONTRACT DISPUTE

Most established arbitration institutions—including the ICC, LCIA and HKIAC—maintain technology-neutral rules that do not expressly address blockchain, smart contracts, or DDR protocols. Nonetheless, a growing number of institutions have begun to engage proactively with emerging technologies through the issuance of reports, guidance notes, and soft-law instruments. For instance, the ICC has published its *Report on Leveraging Technology for Fair, Effective and Efficient International Arbitration Proceedings*[74] and its *Overarching Narrative on Artificial Intelligence*[75], while the SCC has released a *Guide to the Use of Artificial Intelligence in Cases Administered under the SCC Rules*.[76] Similarly, the Silicon Valley Arbitration & Mediation Center ("SVAMC") has released the *Guidelines on the Use of Artificial Intelligence in Arbitration*[77] and the Chartered Institute of Arbitrators (CIArb) has issued the *Guideline on the Use of Artificial Intelligence in Arbitration*.[78] Although these instruments do not address blockchain or smart contract arbitration, they reflect a growing institutional awareness of the broader procedural and ethical challenges posed by emerging technologies, particularly artificial intelligence.

In parallel, several institutions have modernised their procedural frameworks to accommodate remote hearings, digital filings, and electronic signatures. However, in respect to blockchain-specific disputes, they continue to rely on party autonomy and tribunal discretion to adapt existing rules to novel procedural contexts.

Yet, a number of specialised frameworks have recently emerged:

4.4.1. The Singapore International Arbitration Centre ("SIAC") addressed digital economy disputes through the 7th Edition of

[71] SEC v Coinbase Inc, Complaint, No 1:23-cv-04738 (SDNY, filed 6 June 2023).

[72] SEC, 'SEC Charges Decentralised Finance Lender with Misleading Investors' (Press Release 2023-121, 2023) <https://www.sec.gov/news/press-release/2023-121> accessed 23 March 2025.

[73] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) ch 26; Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), Revista Română de Arbitraj (2022) vol 16(4), 85.

[74] ICC Commission on Arbitration and ADR, *Leveraging Technology for Fair, Effective and Efficient International Arbitration Proceedings* (2022) <https://iccwbo.org/wp-content/uploads/sites/3/2022/02/icc-arbitration-and-adr-commission-report-on-leveraging-technology-for-fair-effective-and-efficient-international-arbitration-proceedings.pdf> accessed 29 June 2025.

[75] ICC, Overarching Narrative on Artificial Intelligence (2023) <https://iccwbo.org/global-insights/digital-economy/icc-overarching-narrative-on-artificial-intelligence/#block-accordion-5> accessed 29 June 2025.

[76] Stockholm Chamber of Commerce, *Guide to the Use of Artificial Intelligence in Cases Administered under the SCC Rules* (2023) <https://sccarbitrationinstitute.se/wp-content/uploads/2024/12/scc_guide_to_the_use_of_artificial_intelligence_in_cases_administered_under_the_scc_rules-1.pdf> accessed 29 June 2025.

[77] SVAMC, Guidelines on the Use of Artificial Intelligence in Arbitration (2024) <https://svamc.org/wp-content/uploads/SVAMC-AI-Guidelines-First-Edition.pdf> accessed 29 June 2025.

[78] CIArb, Guideline on the Use of Artificial Intelligence in Arbitration (2025) <https://www.ciarb.org/media/m5dl3pha/ciarb-guideline-on-the-use-of-ai-in-arbitration-2025-_final_march-2025.pdf> accessed 29 June 2025.

its Arbitration Rules, effective from 1 January 2025. These rules incorporate technological adaptations such as electronic filings, remote hearings, and provisions for the management of digital evidence, while preserving the core principles of transparency, procedural fairness, and judicial review.[79]

4.4.2. The Judicial Arbitration and Mediation Services ("JAMS") has issued Smart Contract Clause and Rules (Draft) that address the integration of arbitration clauses within code, and the appointment of arbitrators with appropriate technological expertise.[80]

4.4.3. The UKJT released its DDRR in 2021, which permit party anonymity, arbitrator control over digital assets (subject to consent), and enforcement mechanisms embedded in blockchain infrastructure. Crucially, the DDRR preserve requirements of arbitrator independence and procedural integrity, thereby underscoring the continuing centrality of due process in enforceability analysis.[81]

Despite these innovations, none of these frameworks permit the complete displacement of traditional arbitration norms. All maintain judicial oversight, mechanisms for party challenge, and compatibility with Article V of the New York Convention. Their structure supports the conclusion that while procedural innovation is welcome, foundational arbitral standards are procedurally indispensable.

This doctrinal conservatism is also evident in jurisdictions such as India, where the legal framework remains cautious in its reception of blockchain-based arbitral mechanisms. Although no reported judgment has yet ruled upon the legality of a blockchain-based arbitral award, academic commentary suggests emerging receptivity —albeit under conditions of strict procedural compliance.[82] The Arbitration and Conciliation Act, 1996, which incorporates the UNCITRAL Model Law with limited modifications, sets out mandatory formal requirements concerning the form of an award. Section 31(1) of the Act stipulates that "[a]n arbitral award shall be made in writing and shall be signed by the members of the arbitral tribunal."[83] Procedural requirements of this kind pose doctrinal challenges for blockchain arbitration protocols in which awards are rendered through anonymous, pseudonymous, or automated processes. These statutory requirements pose structural challenges for blockchain protocols that rely on anonymous or pseudonymous decision-makers and for awards executed or recorded entirely on-chain without human authorship or conventional signatures.

Concerns in the Indian context centre on the attribution of authorship, the verifiability of tribunal composition, and compliance with mandatory procedural formalities. While blockchain architecture may enable novel adjudicative forms, the statutory and doctrinal commitments of many jurisdictions—including India—signal that procedural innovation cannot come at the expense of arbitral legitimacy. As such, institutional rule development must proceed in tandem with a cautious recalibration of formal legal requirements to ensure enforceability within diverse legal systems.

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[79] SIAC, *Arbitration Rules* (7th edn, 1 January 2025) <https://www.siac.org.sg/siac-rules-2025> accessed 23 March 2025.

[80] JAMS, *Smart Contract Clause and Rules* (DRAFT) <https://www.jamsadr.com/rules-smart-contracts> accessed 3 June 2025.

[81] UK Jurisdiction Taskforce (UKJT), *Digital Dispute Resolution Rules* (2021) <https://27221500.fs1.hubspotusercontent-eu1.net/hubfs/27221500/UKJT%20work/Digital%20Dispute%20resolution%20rules.pdf?__hstc=251652889.7871b2339a4b99b13b711713ef78b87b.1749035834834.1749035834834.1749035834834.1&__hssc=251652889.4.1749035834834&__hsfp=1159230623> accessed 23 March 2025.

[82] Ritika Bansal, 'Enforceability of Awards from Blockchain Arbitrations in India' (2019) Kluwer Arbitration Blog <https://arbitrationblog.kluwerarbitration.com/2019/08/21/enforceability-of-awards-from-blockchain-arbitrations-in-india/> accessed 23 March 2025.

[83] *Arbitration and Conciliation Act 1996* (India), s 31(1), available at <https://www.indiacode.nic.in/bitstream/123456789/1978/3/a1996-26.pdf> accessed 29 June 2025.

4.5. DOCTRINAL GAPS AND ENFORCEMENT LIMITS

While the emergence of blockchain arbitration frameworks reflects commendable procedural innovation, many such protocols suffer from fundamental doctrinal deficiencies that challenge their compatibility with international enforcement regimes. Such protocols often lack transparent decision-making structures, effective mechanisms for assessing arbitrator independence or bias, and appellate or annulment review procedures. These omissions raise serious concerns on due process requirements embedded in Article 18 of the UNCITRAL Model Law and under Article V of the New York Convention, which collectively enshrine minimum standards of natural justice and procedural legitimacy.[84]

Decentralised adjudication protocols like Kleros exemplify these structural tensions. Their design typically involves anonymous juror pools, randomised selection, and token-based staking incentives—features that may compromise impartiality and suppress dissenting adjudication.[85] Where procedural architecture lacks avenues for challenge, independent oversight, or reasoned justification, the legitimacy of any resulting decision is placed in doubt. In these circumstances, courts may be compelled to deny recognition and enforcement, irrespective of party consent.

Gary Born[86] and other leading authorities emphasise that for an award to be internationally enforceable under the New York Convention, it is contingent upon compliance with a baseline of procedural guarantees. These include the right to be heard; equal treatment of the parties; independence and impartiality of a properly constituted tribunal; proper notice and the opportunity to present one's case; procedural transparency and fairness; and —unless explicitly waived by the parties in accordance with the applicable *lex arbitri*— the provision of a reasoned decision.[87] Such guarantees are widely regarded as foundational to the legitimacy of the arbitral process.[88] Their absence not only

[84] UNCITRAL Model Law on International Commercial Arbitration (as amended 2006), arts 18, 34(2)(a)(ii)–(iv);

[85] Kleros White Paper (2019) <https://kleros.io/whitepaper.pdf> accessed 23 March 2025.; Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 563.

[86] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) ch 26.

[87] "On the requirement of a reasoned decision", see UNCITRAL Arbitration Rules 2021, art 34(3): *"The arbitral tribunal shall state the reasons upon which the award is based, unless the parties have agreed that no reasons are to be given."* <https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/21-07996_expedited-arbitration-e-ebook.pdf>; ICC Rules of Arbitration 2021, art 32(2): *"The award shall state the reasons upon which it is based."* <https://iccwbo.org/dispute-resolution/dispute-resolution-services/arbitration/rules-procedure/2021-arbitration-rules/>; LCIA Arbitration Rules 2020, art 26.2: *"The Arbitral Tribunal shall make any award in writing and, unless all parties agree in writing otherwise, shall state the reasons upon which such award is based […]"* <https://www.lcia.org/Dispute_Resolution_Services/lcia-arbitration-rules-2020.aspx>; SIAC Arbitration Rules 2025,r 52.3: *"The award shall state the reasons upon which it is based, unless the award is by consent under Rule 43.2."* <https://siac.org.sg/siac-rules-2025>; HKIAC Administered Arbitration Rules 2024, art 35.4: *"An award shall state the reasons upon which it is based unless the parties have agreed that no reasons are to be given."* <https://www.hkiac.org/arbitration/rules-practice-notes/hkiac-administered-2024>; These institutional rules require tribunals to state the reasons upon which the award is based, unless the parties have agreed otherwise. See also UNCITRAL Model Law on International Commercial Arbitration 1985 (as amended in 2006), art 31(2) *"The award shall state the reasons upon which it is based, unless the parties have agreed that no reasons are to be given or the award is an award on agreed terms under article 30."*

National implementations include Singapore (Arbitration Act 2001) art 38 (2): *"The award must state the reasons upon which it is based, unless the parties have agreed that no grounds are to be stated or the award is an award on agreed terms under section 37."* <https://sso.agc.gov.sg/Act/AA2001?=&ProvIds=P11-#top>; Germany (Zivilprozessordnung, § 1054(2): *" The arbitral award shall state the reasons on which it is based, unless the parties have agreed that no reasons need be given or the award is based on agreed terms within the meaning of Section 1053."* <https://www.gesetze-im-internet.de/zpo/__1054.html>; and Australia (International Arbitration Act 1974 (Cth), s 4, art 48 (3): *"The award shall deal with every question submitted to the Tribunal, and shall state the reasons upon which it is based."* <https://www.legislation.gov.au/Details/C2022C00086>.

[88] Jan Paulsson (ed), *Redfern and Hunter on International Arbitration* (6th edn, OUP 2021) at 89–92; Emmanuel Gaillard, John Savage and Philippe Goldman (eds), *Fouchard, Gaillard, Goldman on International Commercial Arbitration* (Kluwer Law International 1999) pt III.

undermines procedural integrity, but also invites refusal of recognition and enforcement.[89]

Importantly, party autonomy —though a cornerstone of international arbitration—does not override these safeguards. Courts retain the discretion to refuse enforcement under Articles V(1)(b) and V(2)(b) where the procedure violates public policy or fails to afford a fair opportunity to present one's case, even in instances where parties have expressly consented to non-traditional or decentralised mechanisms. The proposition that automation can substitute for legal review is doctrinally untenable: code-based performance is not equivalent to procedural compliance. External oversight remains essential.[90]

This risk is exacerbated where blockchain arbitration frameworks dispense with reasoned awards. While Article 31(2) of the UNCITRAL Model Law[91] permits parties to waive the requirement of reasoning, such waivers— even if such a waiver is valid under the *lex arbitri*—are likely to be viewed with scepticism by national courts, particularly in consumer-facing or retail smart contracts. Where such clauses are unilaterally embedded in code, lack transparency, or operate in the presence of significant bargaining asymmetries, courts may invoke Article V(2)(b) to deny enforcement on public policy grounds. In these contexts, formal consent may be deemed insufficient to salvage procedural legitimacy.[92]

The elasticity of enforcement doctrine is further illustrated by divergent national approaches. Common law jurisdictions such as England and Wales have exhibited flexibility in recognising awards arising from unconventional procedural designs, provided that fundamental fairness is preserved. By contrast, civil law systems—most notably France and Germany—have traditionally adopted a more formalist posture, demanding greater precision in tribunal constitution and procedural transparency.[93] These differences underscore the importance of designing blockchain arbitration protocols that not only embrace innovation but also satisfy the core requirements of international enforceability.

This tension is vividly illustrated in the enforcement practice of national courts. In a widely cited case, a Mexican court[94]—operating

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[89] Franco Ferrari, Friedrich Rosenfeld and John Fellas, *International Commercial Arbitration: A Commentary on the New York Convention* (Elgar 2021) ch 12.

[90] Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2020) ch 26; Nigel Blackaby et al, *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 10; Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252.

[91] UNCITRAL Model Law on International Commercial Arbitration 1985 (as amended 2006), art 31(2)

[92] Pietro Ortolani, 'Blockchain Technology and Arbitration' in Pietro Ortolani, André Janssen and Pieter Wolters (eds), *International Arbitration and Technology* (Deventer, Wolters Kluwer 2022) 239–252; Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

[93] Law Commission of England and Wales, *Smart Legal Contracts: Advice to Governm*ent (2021); Born, I*nternational Commercial Arbitration* (3rd edn, Kluwer Law International 2020) ch 26; Arbitration Act 1996 (UK), s 33 <https://www.legislation.gov.uk/ukpga/1996/23/section/33> accessed 27 June 2025; Jan Paulsson (ed), *Redfern and Hunter on International Arbitration* (7th edn, OUP 2022) ch 10; Gary B. Born, *International Commercial Arbitration* (3rd edn, Kluwer Law International 2021) ch 26; Emmanuel Gaillard, John Savage and Philippe Goldman (eds), *Fouchard, Gaillard, Goldman on International Commercial Arbitration* (Kluwer Law International 1999) pt III; German Code of Civil Procedure (Zivilprozessordnung, ZPO) § 1059 <https://www.gesetze-im-internet.de/englisch_zpo/englisch_zpo.html#p4186>; French Code of Civil Procedure, arts 1520, 1525 <https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000042081101>.

[94] Mexican Company X v Mexican Company Y (Court of the State of Jalisco, 28 May 2021) recognition and enforcement resolution, Jus Mundi <https://jusmundi.com/en/document/decision/en-mexican-company-x-v-mexican-company-y-recognition-and-enforcement-resolution-of-the-court-of-the-state-of-jalisco-friday-28th-may-2021> accessed 27 June 2025; Mario Tenorio and Mauricio Virues Carrera, 'The Enforcement of a Kleros Decision as a National Award in Mexico: A Clever but Ineffective Solution' (2023) 5(2) *ITA in Review* 79 <https://www.cailaw.org/media/files/ITA/Publications/itair/2023/vol5-no2.pdf> accessed 27 June 2025.

within a UNCITRAL Model Law jurisdiction[95]—recognised and enforced an arbitral award that incorporated a decision rendered via the Kleros blockchain protocol. The dispute concerned a landlord–tenant disagreement, where the arbitration agreement authorised the arbitrator to seek a preliminary determination from Kleros jurors, which was then integrated into the final award.[96] The court upheld the award's enforceability, emphasising that while decentralised mechanisms may facilitate dispute resolution, final recognition depends on compliance with procedural safeguards under the national legal order and the New York Convention.[97]

The Mexican decision exemplifies a functionality-oriented approach to hybrid arbitration models. The tribunal's reliance on decentralised input did not, in itself, compromise enforceability, so long as human adjudication, accountability, and procedural form were preserved in the final instrument. This stands in contrast to jurisdictions such as India, where procedural formalism remains entrenched. The Arbitration and Conciliation Act 1996 requires that arbitral awards be made in writing and signed by the tribunal—requirements that are incompatible with pseudonymous or algorithmically generated awards lacking conventional attribution.[98] These statutory provisions reflect deeper doctrinal commitments to transparency and accountability in adjudication.

Although India has yet to adjudicate a blockchain-based award, academic commentary suggests emerging openness—albeit subject to strict procedural compliance.[99] The juxtaposition of India and Mexico illustrates the interpretive latitude afforded by the Model Law framework.[100] While the former prioritises statutory form, the latter adopts a more adaptive functionalism. This divergence reinforces the role of national courts in determining whether technologically novel arbitral mechanisms can meet the procedural minimums required for international enforceability.

4.5. CRITICAL ASSESSMENT

Notwithstanding notable procedural innovations, no jurisdiction has yet enacted a binding regulatory framework that prescribes enforceable procedural standards specifically tailored to blockchain arbitration or that modifies the recognition regime under the New York Convention or the UNCITRAL Model Law.[101] Existing legal instruments—whether legislative or institutional—focus primarily on the substantive legality and systemic architecture of smart contracts. They stop short of regulating arbitral procedure, evidentiary standards, or post-award enforceability in a blockchain context.

[95] UNCITRAL Model Law on International Commercial Arbitration 1985 (with amendments as adopted in 2006), art 31(1) <https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/19-09955_e_ebook.pdf> accessed 29 June 2025.

[96] Maxime Chevalier, 'Arbitration Tech Toolbox: Is a Mexican Court Decision the First Stone to Bridging the Blockchain Arbitral Order with National Legal Orders?' (2022) *Kluwer Arbitration Blog* <https://arbitrationblog.kluwerarbitration.com/2022/03/04/arbitration-tech-toolbox-is-a-mexican-court-decision-the-first-stone-to-bridging-the-blockchain-arbitral-order-with-national-legal-orders/> accessed 23 March 2025.

[97] Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

[98] Arbitration and Conciliation Act 1996 (India), s 31(1) <https://www.indiacode.nic.in/bitstream/123456789/1978/3/a1996-26.pdf> accessed 29 June 2025.

[99] Ritika Bansal, 'Enforceability of Awards from Blockchain Arbitrations in India' (2019) Kluwer Arbitration Blog <https://arbitrationblog.kluwerarbitration.com/2019/08/21/enforceability-of-awards-from-blockchain-arbitrations-in-india/> accessed 23 March 2025

[100] On India's adoption of the UNCITRAL Model Law, see Arbitration and Conciliation Act 1996; UNCITRAL, Status: UNCITRAL Model Law on International Commercial Arbitration (1985, with amendments as adopted in 2006) <https://uncitral.un.org/en/texts/arbitration/modellaw/commercial_arbitration/status> accessed 27 June 2025.

[101] See UK Law Commission, *Smart Legal Contracts: Advice to Government* (Law Com No 401, 2021), which affirms the validity of smart contracts under English law but does not prescribe procedural frameworks for arbitration or award enforcement <https://www.lawcom.gov.uk/project/smart-contracts/> accessed 30 June 2025.

An instructive exception is the United Kingdom, where the UKJT has taken a proactive position.[102] Its *Legal Statement on Cryptoassets and Smart Contracts* affirms the legal enforceability of smart contracts under English law, while its DDRR propose a bespoke procedural framework for resolving disputes arising from digital asset transactions. Although the DDRR are non-statutory, they enable quasi-arbitral processes that include party anonymity, adjudicator control over digital assets (with consent), and integrated blockchain enforcement. These features demonstrate a regulatory willingness to accommodate procedural experimentation, provided that fundamental guarantees of independence, impartiality, and transparency are preserved. Crucially, however, awards rendered under such frameworks remain subject to recognition and enforcement requirements under the New York Convention.

Beyond such isolated initiatives, a doctrinally significant regulatory vacuum persists. Arbitrators and national courts must increasingly adjudicate disputes where blockchain-based transactions are governed not only by the parties' procedural choices, but also by evolving regulatory expectations concerning legal design, system integrity, and transparency. In this environment, compliance with regulatory norms may emerge as a third axis of enforceability—complementing the arbitration agreement and the *lex arbitri*.

Accordingly, the arbitration community should not treat emerging instruments—such as technical standards, regulatory guidance, or soft-law frameworks—as peripheral or advisory. Rather, they may become critical to determining recognition and enforcement outcomes, particularly in jurisdictions that adopt a rigorous conception of public policy. The risk of fragmented interpretation across jurisdictions, coupled with increasing regulatory scrutiny, underscores the urgent need for doctrinal coherence and cross-border alignment in both arbitral and regulatory domains.

CONCLUSION AND FUTURE OUTLOOK

The arbitration of blockchain and crypto-related disputes presents a uniquely complex intersection of legal doctrine, automated code, and transnational commercial practice. As this article has demonstrated, the determinism of smart contract execution, the jurisdictional uncertainty inherent in decentralised systems, and the procedural deficiencies of on-chain adjudication challenge foundational principles of international arbitration. These tensions necessitate a re-examination of core doctrines—including party autonomy, due process, and enforceability—within digitally native contexts.

The future of blockchain arbitration will be shaped not only by technological innovation but by the legal and institutional responses that emerge to regulate it. Regulatory instruments such as the EU's MiCA Regulation and the Data Act, as well as enforcement actions by agencies like the US SEC and Commodity Futures Trading Commission("CFTC"), are beginning to impose compliance obligations on smart contract architecture, disclosure protocols, and functional integrity. In parallel, arbitral institutions such as the SIAC and JAMS have introduced frameworks responsive to digital economy disputes—demonstrating a cautious willingness to accommodate technological change without abandoning procedural fundamentals. [103]

Looking ahead, trends toward regulatory convergence may eventually facilitate recog-

[102] UK Jurisdiction Taskforce, *Digital Dispute Resolution Rules* (2021), which offer an optional procedural framework for digital asset disputes but do not constitute binding statutory regulation or modify the recognition regime under the Arbitration Act 1996 or the New York Convention <https://27221500.fs1.hubspotusercontent-eu1.net/hubfs/27221500/UKJT%20work/Digital%20Dispute%20resolution%20rules.pdf> accessed 30 June 2025.

[103] SIAC, *Arbitration Rules* (7th edn, 1 January 2025) <https://www.siac.org.sg/siac-rules-2025> accessed 23 March 2025.); JAMS, *Smart Contract Clause and Rules* (DRAFT) <https://www.jamsadr.com/rules-smart-contracts> accessed 3 June 2025.

nition of arbitration agreements embedded in code, standardise evidentiary treatment of blockchain records, and support procedural innovations in on-chain enforcement. However, the arbitration community must remain doctrinally vigilant. The doctrinal challenge remains acute: how to incorporate decentralised infrastructure into arbitration without undermining the procedural integrity upon which international recognition and enforceability depends.

Several critical questions remain unresolved:

- Does Article II of the New York Convention extend to arbitration agreements expressed in executable code?[104]
- Can decentralised arbitration protocols satisfy the minimum due process standards required under the New York Convention?[105]
- Is enforcement under the New York Convention redefined—or rendered redundant—when performance is fully automated?[106]
- Can procedural fairness be preserved in systems structured around token staking incentives or anonymised decision-making?[107]
- How should arbitration clauses be drafted to anticipate regulatory shifts, technological malfunctions, or evidentiary disputes?

Until national courts and arbitral institutions provide authoritative guidance on these issues, caution remains essential. Parties contemplating blockchain-based dispute resolution are advised to adopt hybrid models that combine on-chain automation with off-chain procedural oversight, designate seats in technologically receptive jurisdictions, and select governing laws capable of interpreting code within conventional legal frameworks.

In the final analysis, blockchain arbitration is not merely a technological experiment—it represents a legal inflection point. It compels the arbitration community to confront a fundamental question: *Can arbitration adapt to meet the needs of a decentralised digital economy without compromising the procedural guarantees that underpin its legitimacy?* The choice is not simply between code and law, or speed and scrutiny—but between *tradition and innovation*. The long-term viability of blockchain arbitration may well depend on its ability to reconcile both.

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[104] Gary B. Born, International Commercial Arbitration (3rd edn, Kluwer Law International 2020) chs 5 and 9; Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4) 85; Pietro Ortolani, 'Blockchain Technology and Arbitration' in Ortolani, Janssen and Wolters (eds), *International Arbitration and Technology* (Wolters Kluwer 2022) 239.

[105] Chandrika Sharma, 'Blockchain Arbitral Award: Potential Challenges in Recognition and Enforcement under the New York Convention' in Cristina Emilia Alexe (ed), *Revista Română de Arbitraj* (2022) vol 16(4), 85.

[106] Dena Givari, 'How Does Arbitration Intersect with the Blockchain Technology that underlies Cryptocurrencies?' (2018) *Kluwer Arbitration Blog* <https://arbitrationblog.kluwerarbitration.com/2018/05/05/scheduled-blockchain-arbitration-april-17-2018/> accessed 23 March 2025.

[107] Kleros White Paper (2019) <https://kleros.io/whitepaper.pdf> accessed 23 March 202 (Note: This is a white paper and not a peer-reviewed source.).; Maxime Chevalier, 'From Smart Contract Litigation to Blockchain Arbitration' (2021) 12 *Journal of International Dispute Settlement* 558, at 563.