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DECENTRALIZED DISPUTE RESOLUTION: USING BLOCKCHAIN TECHNOLOGY AND SMART CONTRACTS IN ARBITRATION

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ABSTRACT

Can blockchain technology and smart contracts be used in the context of alternative dispute resolution, particularly arbitration, turning traditional procedures on their head? This article discusses various possible applications of blockchain technology and smart contracts in ADR. In particular, it addresses the possibility of fully automated execution of arbitral awards using a smart contract through so-called escrow mechanisms. Subsequently, it presents two promising approaches of so-called Decentralized Dispute Resolution (DDR), including Expert-Pooling and Crowdarbitration. DDR generally involves decisions made jointly by multiple or even all participants in a network (usually a blockchain network), rather than by just one or two intermediaries, and is managed by a smart contract. In the first approach, jurors join together to form so-called "expert pools" and offer their services without the parties knowing the pool members. Crowdarbitration is based on game-theoretic approaches, namely the "Schelling Point Principle" and crowdjustice. In both approaches, arbitral awards are typically enforced by an escrow mechanism. The final section comments on and evaluates each of these approaches, in particular their

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advantages and disadvantages, as well as their potential scope and limitations.

I. INTRODUCTION: BLOCKCHAIN TECHNOLOGY IN THE CONTEXT OF ALTERNATIVE DISPUTE RESOLUTION (ADR)

Distributed Ledger Technology (DLT) systems, such as the blockchain technology, are perhaps one of the most revolutionary inventions of the last decade, already transforming numerous fields.[1] DLT is a technology for decentralized storage and management of information in a database.[2] In contrast to traditional approaches where the database is typically managed by a central administrator, with DLT an arbitrary number of the ledger copies, which in principle have equal rights, are managed de-centrally by numerous parties.[3] Cryptographic and game-theoretic techniques ensure that newly added information is propagated to all copies of the ledger, and that a consensus on the current state of the ledger is reached in the peer-to-peer network of participants by constantly synchronizing the copies.[4] In this way, DLT creates a shared, trusted ledger that can be accessed and verified at any time by any participant in the network, but is not controlled by any individual participant.[5] DLT's disruptive potential unfolds especially in combination with smart contracts, which enable automated contract execution, resulting in significant efficiency gains and cost reductions compared to traditional processes.[6] But despite the largely transparent and automated execution of contracts provided by DLT, through blockchain and smart contracts, new conflicts also arise in this context.[7]

At the same time, not only are state courts increasingly overburdened, mainly due to the growing number of cases resulting

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[1] Yan Chen & Cristiano Bellavitis, *Blockchain Disruption and Decentralized Finance: The Rise of Decentralized Business Models*, 13 J. BUS. VENTURING INSIGHTS 1, 1–8 (2020); Julie Frizzo-Barker et al., *Blockchain as a Disruptive Technology for Business: A Systematic Review*, 51 INT'L J. INFO. MGMT. 1, 1–14 (2020).

[2] Dirk Wiegandt, *Blockchain and Smart Contracts and the Role of Arbitration*, 39 J. INT'L ARB. 671, 673 (2022).

[3] *Id.*

[4] *Id.*

[5] *Id.*

[6] EMMANUELLE GANNE, CAN BLOCKCHAIN REVOLUTIONIZE INTERNATIONAL TRADE? xi–xii (World Trade Organization ed., 2018); Wiegandt, *supra* note 2, at 676.

[7] Darcy W. E. Allen et al., *The Governance of Blockchain Dispute Resolution*, 25 HARV. NEGOT. L. REV. 75, 75 (2019); Cemre C. Kadioglu Kumtepe, *A Brief Introduction to Blockchain Dispute Resolution*, 14 J. MARSHALL L.J. 138, 142–43 (2021).

from the crises of recent years,[8] but the number of international disputes has also risen sharply as a result.[9] Consequently, alternative dispute resolution methods are becoming increasingly popular.[10] Especially since the beginning of the pandemic, new models have emerged in the context of Online Dispute Resolution (ODR), which focus particularly on the implementation of basic information and communication technologies in the dispute resolution process.[11] However, the supply in general is far from sufficient to meet the demand.[12]

The question now is whether blockchain technology and smart contracts can also be used in the context of alternative dispute resolution, especially arbitration, turning traditional procedures on their head.[13] For example, the decentralized structure of the technology could lead to easier access to arbitration, which would also reduce the burden on state courts.[14] Previous research on dispute resolution and blockchain has primarily focused on resolving disputes arising in the blockchain context.[15] While general arbitration rules such as the "JAMS Smart Contract Clause and Rules"[16] or specific "Blockchain Arbitration Rules" have been drafted, which specify the arbitration procedure to be applied in this context, considerations regarding the use of decentralized technologies in support of dispute resolution proceedings and the

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[8] Orna Rabinovich-Einy & Ethan Katsh, *The New Courts*, 67 AM. U. L. REV. 165, 170–71 (2017).

[9] Nadia Hewett et al., *Bridging the Governance Gap: Dispute Resolution for Blockchain-based Transactions*, WORLD ECON. FORUM 5 (Dec. 2020), https://www3.weforum.org/docs/WEF_WP_Dispute_Resolution_for_Blockchain_2020.pdf.

[10] *Id.*; *see also* Rabinovich-Einy & Katsh, *supra* note 8, at 170–71.

[11] Janet K. Martinez, *Designing Online Dispute Resolution*, 2020 J. DISP. RESOL. 135, 135 (2019); Rabinovich-Einy & Katsh, *supra* note 8, at 188.

[12] Rabinovich-Einy & Katsh, *supra* note 8, at 170–71.

[13] *See generally* Peter Earle et al., *Decentralized Marketplaces with Privately Enforced Contracts: A Case Study of OpenBazaar*, 37 J. PRIV. ENTER. 43 (2022); Kevin Werbach, *Trust, but Verify: Why the Blockchain needs the Law*, 33 BERKELEY TECH. L.J. 487 (2018).

[14] *See* Earle et al., *supra* note 13, at 46–47; Werbach, *supra* note 13, at 546.

[15] *See, e.g.*, Federico Ast & Bruno Deffains, *When Online Dispute Resolution Meets Blockchain: The Birth of Decentralized Justice*, STAN. J. BLOCKCHAIN LAW & POL'Y 2021 1, 6–8 (June 30, 2021), https://stanford-jblp.pubpub.org/pub/birth-of-decentralized-justice;
Michael Buchwald, *Smart Contract Dispute Resolution: The Inescapable Flaws of Blockchain-Based Arbitration*, 168 UNIV. PA. L. REV. 1369, 1373–74 (2020).

[16] *See JAMS Smart Contract Clause and Rules (Draft)*, JAMS, https://www.jamsadr.com/rules-smart-contracts (last visited Mar. 26, 2024).

conduct of arbitration proceedings involving a blockchain ("on-chain") have received rather less attention in comparison.[17]

This article examines possible dispute resolution methods using blockchain technology and smart contracts. Existing approaches to blockchain-based arbitration models will also be considered and commented upon. But first, a brief overview of the basic operation of blockchain and smart contracts is provided.[18] The first part of the analysis will then be devoted to discussing the various possible applications of blockchain technology and smart contracts in ADR.[19] In particular, it addresses the possibility of executing arbitral awards fully automatically using a smart contract through so-called escrow mechanisms. Subsequently, it presents two promising approaches of so-called Decentralized Dispute Resolution (DDR). The second part of the analysis comments on the individual approaches, particularly their advantages and disadvantages, as well as a potential scope of application or limits.[20] The article concludes with a summary and final thoughts.[21]

II. BASIC FUNCTIONS OF BLOCKCHAIN AND SMART CONTRACTS

For a better understanding, it is useful to first give a brief overview of the basic functioning of blockchain and smart contracts. However, it does not require deep technical knowledge to understand how blockchain technology and smart contracts essentially work along with their key features.

A. BLOCKCHAIN

One (albeit the best-known) concrete manifestation of the so-called Distributed Ledger Technology (DLT) is blockchain technology.[22] In essence, a blockchain is a decentralized registry in the form of a database where information, data, events or transactions are stored in date "blocks" in a transparent but

[17] *See* Werbach, *supra* note 13, at 546; *see also* Sam Brown, *Arbitration of cryptoasset and smart contract disputes: arbitration unchained?*, THOMSON REUTERS PRAC. L. (July 19, 2023), https://uk.practicallaw.thomsonreuters.com/w-040-1142?transitionType=Default&contextData=(sc.Default)&firstPage=true
[18] *See infra* Part II.
[19] *See infra* Part III.
[20] *See infra* Part IV.
[21] *See infra* Part V.
[22] Wiegandt, *supra* note 2, at 673; Werbach, *supra* note 13, at 489.

encrypted manner.[23] Since the individual blocks are chronologically linked using hash functions, the result is an unalterable and traceable documentation of the information in the form of a "chain."[24] This chain of data ("blockchain") is not stored and managed centrally by an overarching entity, but rather de-centrally in a peer-to-peer network consisting of many distributed "nodes" (users).[25] Using encryption technologies and consensus mechanisms, these accounts ensure the authenticity of data on the network.[26] Because nodes verify and validate data, blockchains do not rely on centralized, trusted third parties to ensure high system security and data integrity.[27] At the same time, the more users that join a blockchain and validate new entries, the better protected blockchain is against manipulation.[28] Therefore, it often make sense to use existing and established blockchains as a base layer for smart contract projects.[29] In summary, blockchain technology enables the storage of data entries, such as transaction data, in a way that is unalterable, permanent, and verifiable by anyone.[30] Key benefits of the technology include fraud prevention and the establishment of trust.[31]

There are several different types of blockchains, which differ slightly in terms of (some) functions. For example, in private or permissioned Blockchains, access to the network—or at least the validation of new records—is generally restricted to certain network nodes.[32] In contrast, with public permissionless blockchains (like Bitcoin or Ethereum), anyone can participate or qualify as a

[23] Buchwald, *supra* note 15, at 1375; Amy J. Schmitz & Colin Rule, *Online Dispute Resolution for Smart Contracts*, 2019 J. DISP. RESOL. 103, 107 (2019).
[24] Rabinovich-Einy & Katsch, *supra* note 8, at 52; Schmitz & Rule, *supra* note 23, at 107.
[25] Wiegandt, *supra* note 2, at 673–74; Rabinovich-Einy & Katsch, *supra* note 8, at 52–53.
[26] Rabinovich-Einy & Katsch, *supra* note 8, at 54.
[27] Buchwald, *supra* note 15, at 1376–77; Wiegandt, *supra* note 2, at 674.
[28] Rabinovich-Einy & Katsch, *supra* note 8, at 53–54; Schmitz & Rule, *supra* note 23, at 107–08.
[29] *See* Schmitz & Rule, *supra* note 23, at 108–09; *see also infra* Part IV(D).
[30] Rabinovich-Einy & Katsch, *supra* note 8, at 52–54.
[31] *Id.*; *cf.* Buchwald, *supra* note 15, at 1378–79.
[32] Christine V. Helliar et al., *Permissionless and Permissioned Blockchain Diffusion*, 54 INT'L J. INFO. MGMT. 1, 4 (2020); Siamak Solat et al., *Permissioned vs. Permissionless Blockchain: How and Why There Is Only One Right Choice*, 16 J. SOFTWARE 95, 97 (2021); Ibrahim Mohamed Nour Shehata, *Three Potential Imminent Benefits of Blockchain for International Arbitration: Cybersecurity, Confidentiality & Efficiency*, 31 YOUNG ARB. REV. 32, 33–34 (2018).

validator.[33] Since the focus of this paper is on methods with the broadest possible applicability, only those mechanisms used on permissionless systems will be examined.

B. SMART CONTRACTS

Blockchains especially develop their full potential in combination with smart contracts.[34] Smart contracts are software codes typically stored on a blockchain which automatically execute or enforce pre-determined agreements in the form of if-then functions.[35] For example, pre-defined conditions can link transactions and trigger such agreements only when those conditions are met.[36] Smart contracts even enable self-execution of entire contracts.[37] These contracts can also apply automatic sanctioning in case of non-fulfillment of agreements.[38] However, they reach their limits when more complex actions are involved, such as responding to unforeseen events after a contract is signed.[39] In addition, smart contracts need an interface to interact with the world outside the blockchain, usually in the form of an external source that provides the required information (so called oracles).[40]

Ethereum is the most popular blockchain project that smart contracts can be used on.[41] Ethereum implements smart contracts

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[33] James Metzger, *The Current Landscape of Blockchain-Based, Crowdsourced Arbitration*, 19 MACQUARIE L.J. 81, 84 (2019); Helliar et al., *supra* note 32, at 3; Shehata, *supra* note 32, at 33.

[34] Metzger, *supra* note 33, at 85; Schmitz & Rule, *supra* note 23, at 107; Gerhard Wagner & Horst Eidenmüller, *Digital Dispute Resolution*, SSRN 1, 10 (June 22, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3871612.

[35] TIM SWANSON, GREAT CHAIN OF NUMBERS: A GUIDE TO SMART CONTRACTS, SMART PROPERTY AND TRUSTLESS ASSET MANAGEMENT 17–19 (2014); Metzger, *supra* note 33, at 85; Wiegandt, *supra* note 2, at 677.

[36] Schmitz & Rule, *supra* note 23, at 106–07; Pham Vu Hong Son & Pham Ngoc Lien, *Blockchain Crowdsourced Arbitration in Construction Project Delay Resolution*, 16 J. SCI. & TECH. CIV. ENG'G 1, 3 (2022).

[37] SWANSON, *supra* note 35, at 18; Kevin Werbach & Nicolas Cornell, *Contracts ex Machina*, 67 DUKE L.J. 313, 331 (2017); Wagner & Eidenmüller, *supra* note 34, at 12.

[38] Wagner & Eidenmüller, *supra* note 34, at 13; Wiegandt, *supra* note 2, at 677.

[39] Werbach & Cornell, *supra*, note 37, at 346–47.

[40] *Id.* at 335–36.

[41] *Id.* at 333; Werbach, *supra* note 13, at 505. Ethereum is a decentralized, open-source platform based on blockchain technology. Unlike the Bitcoin Blockchain, Ethereum focuses on programmable contracts (smart contracts) and decentralized programs (dApps). Like a smartphone, different applications can be installed on the Ethereum platform.

as separate cryptographic boxes that contain a value, typically in the form of a cryptocurrency.[42] This value is only released when predefined conditions are met.[43] The smart contract checks whether this condition is met completely independently and automatically.[44] Ethereum even makes it possible to implement entire applications on the blockchain that cannot be modified, authenticated, or subverted once launched.[45] Hence, Ethereum is often called the world computer.[46]

III. POSSIBLE APPLICATIONS OF BLOCKCHAIN TECHNOLOGY AND SMART CONTRACTS IN THE CONTEXT OF ADR

The first part of this section will address the question of whether blockchain technology and smart contracts can be used in the ADR context to achieve advantages over traditional models. Such dispute resolution systems are conceivable in a variety of forms and models, but often based on the use and combination of just a few different methods.[47] In addition to the use of general methods commonly applied in the blockchain context, such as encryption techniques like private/public key cryptography, three elements in particular seem to be useful in the arbitration context and will now be explored in more detail.[48]

Ultimately, Ethereum is just an operating system, not a cryptocurrency per se. Due to its wide range of applications, Ethereum has become the most widely used blockchain platform. The associated cryptocurrency is called Ether (ETH). *See* Wulf Kaal & Craig Calcaterra, *Crypto Transaction Dispute Resoution*, 73 BUS. LAW. 109, 111 (2018).

[42] Vitalik Buterin, *A Next-Generation Smart Contract and Decentralized Application Platform*, ETHEREUM WHITE PAPER 1, 13–17 (Aug. 20, 2018), https://finpedia.vn/wp-content/uploads/2022/02/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf

[43] *Id.*

[44] *Id.*; Son & Lien, *supra* note 36, at 3.

[45] *See* Buterin, *supra* note 42; Wiegandt, *supra* note 2, at 676–77; *see generally*, Werbach & Cornell, *supra* note 37, at 332.

[46] *See* Tina Amirtha, *Meet Ether*, *the Bitcoin-Like Cryptocurrency That Could Power the Internet of Things*, FAST CO. (May 21, 2015), http://www.fastcompany.com/3046385/meet-ether-the-bitcoin-like-cryptocurrency-that-could-power-the-Internet-of-things; Werbach & Cornell, *supra* note 37, at 334.

[47] *See* Buchwald, *supra* note 15, at 1385; Francisco Uribarri Soares, *New Technologies and Arbitration*, 7 INDIAN J. ARB. L. 84, at 91–94 (2018).

[48] Buchwald, *supra* note 15, at 1385–87, 1389–90.

A. AUTOMATED AND INDEPENDENT EXECUTION OF ARBITRATION AWARDS USING ESCROW MECHANISMS

Blockchain allows for decentralized enforcement mechanisms, which is particularly beneficial for enforcing arbitration awards.[49] More precisely, a user employing smart contracts in combination with blockchain technology enables fully automated and self-regulated execution of arbitration awards in conjunction with escrow mechanisms.[50] Designed specifically for cross-border transactions, the escrow mechanism is a direct law enforcement function.[51]

In general, if one party does not accept the arbitrator's award, the other party must take legal action to enforce the award.[52] In an escrow mechanism, the blockchain provides multi-signature ("multisig") addresses in the form of private keys that parties must use together to trigger a payment transfer.[53] For example, a smart contract might require the entry of at least two out of three private keys to execute the transaction.[54] Each party has one private key, and they may give an additional key to a third party, such as an arbitrator.[55] If both parties agree to the terms of the (smart) contract, they can each provide one key and initiate the transaction.[56] However, in case of a dispute between the two parties, such as where one party refuses to initiate the transaction because there is a disagreement about whether a party received a shipment, like the payment of goods, the parties may appeal to the arbitrator.[57] After each party has made their respective statements, the arbitrator and the prevailing party can initiate the transaction (on the adjusted terms) using their private keys.[58] Depending on the specific situation and the terms of the smart contract, the arbitrator may deny the use of his key in favor of a party to cancel the transaction.[59]

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[49] *See* Earle et al., *supra* note 13, at 49.
[50] *See id.* at 49–50; Werbach, *supra* note 13, at 546.
[51] *See* Koji Takahashi, *Blockchain Technology for Letters of Credit and Escrow Arrangements*, 135 BANKING L.J. 89, 101 (2018); Earle et al., *supra* note 14, at 47–50.
[52] *See* NIGEL BLACKABY ET AL., REDFERN AND HUNTER ON INTERNATIONAL ARBITRATION § 9.14 (6th ed. 2015).
[53] *See* Werbach & Cornell, *supra* note 37, at 346–47.
[54] *See* Werbach, *supra* note 13, at 546.
[55] *See* Earle et al., *supra* note 13, at 46–47; Werbach, *supra* note 13, at 546.
[56] *See* Earle et al., *supra* note 13, at 49; Takahashi, *supra* note 51, at 99.
[57] *See* Werbach & Cornell, *supra* note 37, at 546.
[58] *See* Earle et al., *supra* note 13, at 50–51; Werbach & Cornell, *supra* note 37, at 546.
[59] *See* Werbach, *supra* note 13, at 546.

However, the ability to directly enforce an award is not only limited to disputes involving digital assets on a blockchain.[60] Rather, disputants can optimize the (international) enforcement of an arbitral award, which is already easier than the (international) enforcement of a court judgment, by implementing automated and self-regulated execution through a smart contract based escrow mechanism.[61] Both parties would simply need to send the amount in dispute to the smart contract's wallet address either before or at the start of the arbitration.[62] The smart contract acts as a trustee and is programmed to automatically disburse the amount to the parties in accordance with the arbitration award.[63] This can be even more effective in combination with the mechanisms described below.[64] However, it is still mandatory that parties deposit the amount in dispute on the blockchain, otherwise it will not trigger a blockchain based enforcement.[65]

B. "ON-CHAIN" DECENTRALIZED DISPUTE RESOLUTION (DDR)

Decentralized dispute resolution involves decisions made jointly by multiple or even all participants in the network (usually a blockchain network) rather than by just one or two intermediaries.[66] The process is typically coordinated and managed, and the arbitration decision is automatically executed by a smart contract implemented on a blockchain ("on-chain").[67] In recent years of practice, disputants preferred two different approaches. In the first approach, jurors join together to form so-called "expert pools" and offer their services, without parties knowing the pool members.[68] In the second approach, algorithms randomly select jurors through so-called crowdsourcing.[69] In both approaches, algorithm selection procedures ensure anonymity, so the parties do not know the jurors, and the collection of evidence is voluntary, so unlike in classical

[60] *See* Earle et al., *supra* note 13, at 47.
[61] *See* Takahashi, *supra* note 51, at 98–100; Earle et al., *supra* note 13, at 46–47.
[62] *See* Earle et al., *supra* note 13, at 47; Buchwald, *supra* note 15, at 1386.
[63] *See* Buchwald, *supra* note 15, at 1386.
[64] *See* discussion *infra* Part III(B) on Decentralized Dispute Resolution (DDR).
[65] *See* Takahashi, *supra* note 51, at 97–98.
[66] *See* Ast & Deffains, *supra* note 15, at 248; Buchwald, *supra* note 15, at 1373–74.
[67] Marina Kasatkina, *Dispute Resolution Mechanism for Smart Contracts*, 16 MASARYK U. J. L. & TECH. 143, 149 (2022).
[68] Buchwald, *supra* note 15, at 1389–90.
[69] *Id.*

arbitration, the parties cannot be compelled to provide evidence.[70] In both approaches, parties typically enforce the decision on-chain through an escrow mechanism.[71]

1. EXPERT-POOLING

The expert-pooling process provides semi-anonymous decision making, with jurors joining together to form pools.[72] These pools often have a particular area of expertise.[73] As the process continues, the pool, as an entity, builds a reputation in that specialty through evaluations of parties served.[74] This reputation system serves as an indicator of trust by ensuring that, in order to be requested to serve in the future and build a good reputation, jurors must prove themselves in each dispute.[75] The parties are free to choose from the relevant pools and thus have a direct influence on the jurors' quality and expertise.[76] This mechanism not only preserves the jurors' anonymity, but also promotes the evolution of expertise within a dispute resolution system.[77] Transparent juror reputation scores help parties assess the jurors' professionalism, commitment, and help build trust.[78] Parties typically store the reputation score transparently and tamper-proof on a blockchain, ensuring independence from a central authority.[79] However, parties cannot choose between individual jurors, theoretically to preserve pseudonymity.[80] The platform "Openbazaar" was the first to offer this kind of distributed jurisdiction mechanism.[81] Openbazaar provided an option for private jurors, so-called notaries, to join different pools with different areas of expertise.[82] Even before signing a contract, the parties could designate one of the platform's notary pools as the controlling authority for the exchange of goods,

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[70] *See id.* at 1389–90, 1400–01.
[71] *See* Rabinovich-Einy & Katsch, *supra* note 8, at 56.
[72] *See* Kaal & Calcaterra, *supra* note 41, at 145–46; Kasatkina, *supra* note 67, 151–52.
[73] *See* Kaal & Calcaterra, *supra* note 41, at 145–46; Kasatkina, *supra* note 67, 151–52.
[74] *See* Kaal & Calcaterra, *supra* note 41, at 145–46; Kasatkina, *supra* note 67, 151–52.
[75] *See* Kaal & Calcaterra, *supra* note 41, 145–46.
[76] Kasatkina, *supra* note 67, at 151–52.
[77] *Id.* at 151.
[78] *See id.*
[79] *Id.*
[80] Kaal & Calcaterra, *supra* note 41, at 145–46.
[81] *See* Kaal & Calcaterra, *supra* note 41, at 145–46; Kasatkina, *supra* note 67, 151–52.
[82] *See* Kaal & Calcaterra, *supra* note 41, at 145–46; Kasatkina, *supra* note 67, 151–52.

which would then automatically step in as an arbitrator via a smart contract in the event of a conflict.[83]

2. "CROWDARBITRATION" BASED ON GAME THEORY

The implementation of crowdsourcing takes the expert-pooling approach another step further. Crowdsourcing describes an outsourcing paradigm in which clients (crowdsourcers) have a large group of individuals (the crowd) perform a specific task.[84] The so-called crowdworkers decide for themselves which tasks, if any, they will accept.[85] They contribute their services in the form of labor, knowledge, financial resources, or experience in exchange for compensation.[86] Since various fields have already developed their own corresponding technical terms (crowdfunding, crowdinvesting,[87] etc.), crowdarbitration is proposed to refer to the use of crowdsourcing methods in the field of decentralized dispute resolution.[88]

Crowdarbitration is based on game-theoretic approaches to reach a trustworthy majority decision.[89] The principle is simple: potential jurors typically require, and thus acquire, crypto tokens by depositing an appropriate number of these tokens ("stakes") as a security.[90] These jurors could be called "crowdjurors."[91] The higher

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[83] *See* Schmitz & Rule, *supra* note 23, at 117; Earle et al., *supra* note 13, at 47–50.

[84] *See* Enrique Estellés-Arolas & Fernando González-Ladrón-de-Guevara, *Towards an Integrated Crowdsourcing Definition*, 38 J. INFO. SCI. 189, 194 (2012).

[85] *Id.* at 192.

[86] *Id.*; Antonio Ghezzi et al., *Crowdsourcing: A Review and Suggestions for Future Research*, 20 INT'L J. MGMT. REVS. 343, 346–47 (2017); Payal Arora & Linnea Thompson, *Crowdsourcing as a Platform for Digital Labor Unions*, 12 INT'L J. COMMC'N 2314, 2316 (2018).

[87] *See* Dirk Zetzsche & Christina Preiner, *Cross-Border Crowdfunding: Towards a Single Crowdlending and Crowdinvesting Market for Europe*, 19 EUR. BUS. ORG. L. REV. 217, 220–22; Lars Hornuf & Armin Schwienbacher, *Market Mechanisms and Funding Dynamics in Equity Crowdfunding*, J. CORP. FIN. 1, 5– 6 (forthcoming).

[88] *See* Aleksei Gudkov, *Crowd Arbitration: Blockchain Dispute Resolution*, 3 LEGAL ISSUES DIGIT. AGE 59, 62–69 (2020).

[89] Metzger, *supra* note 33, at 83; Yann Aouidef et al., *Decentralized Jusice: A Comparative Analysis of Blockchain Online Dispute Resoution Projects*, 4 FRONTIERS IN BLOCKCHAIN 1, 4 (2021); Schmitz & Rule, *supra* note 23, at 118.

[90] Buchwald, *supra* note 15, at 1389; Clément Lesaege et al., *Short Paper v1.0.7* KLEROS 1, 4 (Sept. 2019), https://kleros.io/assets/whitepaper.pdf.

[91] The term crowdjurors is based on this author's own reflections and has not yet found its way into the literature.

the stake, the more likely it is for the juror to be selected for a specific case, but the greater potential loss if they make a "wrong" vote.[92] As soon as a randomized lottery mechanism assigns crowdjurors to a case, they can vote on a possible resolution in an anonymous ballot after reviewing the facts of the case.[93] The decision-making process itself is based on the "Schelling Point Principle" game-theoretical approach.[94] According to this principle, there is a tendency in decision-making behavior to follow the presumed majority.[95] This approach is reinforced by two factors. On one hand, crowdjurors receive a reward in the form of additional tokens if their voting result is in line with the prevailing opinion of all jurors.[96] On the other hand, if they assert the minority opinion, the system "penalizes" the jurors by depriving them of their tokens.[97]

CHART 1: PAYOFF TABLE FOR A BASIC SCHELLING GAME[98]

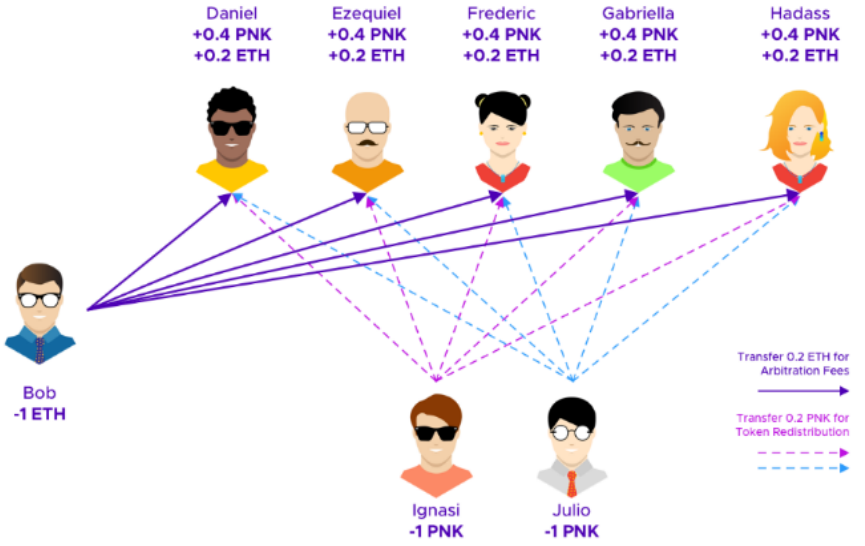
The majority votes \ You vote	YES	NO
YES	+0.1	-0.1
NO	-0.1	+0.1

The primary purpose of this incentive system is to prevent arbitrary voting.[99] In addition, to prevent "incorrect" decisions due to manipulation in the form of collusion among the jurors, it is essential jurors vote independently of each other and results are not

[92] Lesaege et al., *supra* note 90, at 4.; Buchwald, *supra* note 15, at 1369, 1389–90.
[93] *See* Buchwald, *supra* note 15, at 1389.
[94] *See* Rabinovich-Einy & Katsch, *supra* note 8, at 59; Schmitz & Rule, *supra* note 23, at 118.
[95] Lesaege et al., *supra* note 90, at 2.
[96] Buchwald, *supra* note 15, at 1390.
[97] *Id.*
[98] In this example, if the juror's vote is in line with the majority of the other jurors, the juror will receive a reward of 0.1 tokens after the secret ballot. However, if the vote is not in line with the majority, the juror will be penalized 0.1 tokens. This chart based on Lesaege et al., *supra* note 90, at 2, 6.
[99] Luis Bergolla et al., *Kleros: A Socio-Legal Case Study of Decentralized Justice & Blockchain Arbitration*, 37 OHIO ST. J. ON DISP. RESOL. 55, 65–66 (2022).

published until after the voting period has ended.[100] Dispute resolution providers Kleros[101] or Aargon[102] offer such a procedure.

CHART 2: EXAMPLE SCENARIO FOR TOKEN REDISTRIBUTION IN CROWDARBITRATION BASED ON THE SCHELLING POINT PRINCIPLE[103]



[100] *Id.* at 65–66; Rabinovich-Einy & Katsch, *supra* note 8, at 60; Buchwald, *supra* note 15, at 1390.

[101] *See* KLEROS, https://kleros.io/ (last visited Apr. 14, 2024); *infra* Part III(C); Lesaege et al., *supra* note 90, at 2, 6.

[102] *See* ARAGON, https://aragon.org/about-aragon (last visited Apr. 14, 2024); Luis Cuende & Jorge Izquierdo, *Aragon Network: A Decentralized Infrastructure for Value Exchange*, ARAGON WHITE PAPER 1, 29 (Apr. 20, 2017), https://www.allcryptowhitepapers.com/aragon-whitepaper/.

[103] In this example, seven jurors each deposit 1 PNK (the Kleros native cryptocurrency token built on top of the Ethereum platform) as a stake (security) before the arbitration begins. As the losing party in the arbitration, Bob bears the arbitration fee, here 1 ETH (the native cryptocurrency of the Ethereum platform), is distributed to the jurors. However, only those jurors who voted in line with the majority of the other jurors in the secret ballot will receive an equal share of the arbitration fee (+0.2 ETH). In this case, Daniel, Ezequiel, Frederic, Gabriella, and Hadass all voted for the same result and therefore represent the majority. Ignasi and Julio, on the other hand, did not vote in line with the rest of the judges, represent the minority, will not receive a share of the arbitration fee, and will also lose their previously deposited stake of 1 PNK each. This total of 2 PNK will also be divided equally among the other five jurors (+0.4 PNK each). This hypothetical is based on Lesaege et al., *supra* note 90.

As a further safeguard, parties can appeal.[104] In fact, some platforms already allow parties to appeal awards in practice; although, each level of appeal doubles the number of jurors and increases the cost of another trial.[105] However, platforms offering crowdarbitration should also provide an external, independent panel of experts in the event of fraud, disagreement or unforeseen errors in the process.[106]

C. KLEROS: AN EXAMPLE OF CROWDARBITRATION

Probably the best known blockchain arbitration platform at the moment is Kleros, a protocol based on the Ethereum blockchain that describes itself as a "decentralized arbitration service for the disputes of the new economy."[107] In 2020, the platform received the European Innovation Council (EIC) Prize on Blockchains for Social Good from the European Commission.[108]

Kleros uses crowdsourcing within the framework of blockchain technology and game-theoretic methods for jurors to analyze cases and decide consumer disputes using financial incentives.[109] In principle, anyone can register and serve as a juror; Kleros does not require a legal background, although some jurors have one.[110] When a party submits a case to the Kleros Arbitration Court—the smart contract decision-making process behind Kleros—this smart contract automatically forms a jury who then independently reviews and votes on the case.[111] Even though jurors can self-select into courts that specialize in certain areas of law, ensuring a certain level of expertise and quality, the final selection of jurors for a particular case is random.[112] Based on the Schelling Point Principle, jurors do not receive financial compensation unless

[104] *See* Buchwald, *supra* note 15, at 1391.
[105] *Id.*; Rabinovich-Einy & Katsch, *supra* note 8, at 61; *see also* Schmitz & Rule, *supra* note 23, at 118.
[106] Schmitz & Rule, *supra* note 23, at 123–24.
[107] KLEROS, *supra* note 101; Lesaege et al., *supra* note 90, at 1.
[108] *See The Commission's European Innovation Council Awards €5 Million to Blockchain Solutions for Social Innovations*, EUR. COMM'N (June 3, 2020), https://digital-strategy.ec.europa.eu/en/news/commissions-european-innovation-council-awards-eu5-million-blockchain-solutions-social-innovations.
[109] Rabinovich-Einy & Katsch, *supra* note 8, at 59–60; Wagner & Eidenmüller, *supra* note 34, at 13.
[110] Lesaege et al., *supra* note 90, at 9–10.
[111] *Id*. at 5–6; Schmitz & Rule, *supra* note 23, at 118.
[112] Rabinovich-Einy & Katsch, *supra* note 8, at 59–60.

their vote is in line with the majority of the other jurors.[113] To prevent collusion among the judges, the voting is anonymous and confidential, and the final result is published only after the end of the voting period.[114] This incentivizes each juror to vote honestly for the outcome he or she believes is fair.[115] On the one hand, blockchain technology prevents evidence tampering or manipulating jury selection.[116] On the other hand, smart contracts enable the automatic enforcement of awards and the payment of juror rewards.[117] Furthermore, as an additional safety mechanism, Kleros also enables the parties to appeal.[118] Each new appeal has twice the number of jurors than the previous, plus one more juror, which increases the cost of the trial for the appealing party.[119]

Kleros describes itself as a "justice-as-a-service platform," enabling the filing of cases in a wide range of legal areas, including small claims, insurance, e-commerce, finance, professional services, crowdfunding, token listings, and intellectual property disputes.[120] In fact, in 2022, a court in Mexico enforced a blockchain-based arbitral award issued on Kleros for the first time.[121] Kleros primarily touts the efficiency and transparency that collective intelligence and permissionless blockchain technology provide.[122] The platform also allows third-party marketplaces like Amazon to integrate Kleros into their platform to access the Kleros service in the event of a customer dispute.[123]

According to its own information on the homepage, 1,644 disputes have already been solved on the platform[124] and around

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[113] *See id.* For further discussion on the Schelling Point Principle, *see supra* Part III(B)(2).
[114] Lesaege et al., *supra* note 90, at 6; Rabinovich-Einy & Katsch, *supra* note 8, at 59–60.
[115] Buchwald, *supra* note 15, at 1390; Schmitz & Rule, *supra* note 23, at 118; Lesaege et al., *supra* note 90, at 7.
[116] Schmitz & Rule, *supra* note 23, at 108; Rabinovich-Einy & Katsch, *supra* note 8, at 59–60.
[117] Rabinovich-Einy & Katsch, *supra* note 8, at 61.
[118] *Id.*; Buchwald, *supra* note 15, at 1391; *see also* Schmitz & Rule, *supra* note 23, at 118
[119] Lesaege et al., *supra* note 90, at 7; Buchwald, *supra* note 15, at 1391.
[120] KLEROS, *supra* note 101; Lesaege et al., *supra* note 90, at 15.
[121] Maxime Chevalier, *Arbitration Tech Toolbox: Is a Mexican Court Decision the First Stone to Bridging the Blockchain Arbitral Order with National Legal Orders?*, KLUWER ARB. BLOG (Mar. 4, 2022), 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/.
[122] Lesaege et al., *supra* note 90, at 1.
[123] *Id.* at 10, 13.
[124] KLEROS, *supra* note 101.

$1,316,000 USD in Ether have been paid out as rewards to jurors.[125] Currently, there are approximately 733 active jurors registered, who have made deposits totaling the equivalent of approximately $5,949,500 USD by staking the platform's own cryptocurrency PNK.[126]

D. CROWDARBITRATION INCLUDING AUTOMATED REPUTATION DETERMINATION

It is conceivable to extend the crowdarbitration model to include a reputation system as an additional feature by measuring or rating jurors based on their past performance in previous arbitration cases on the platform (e.g., reliability).[127] In a further developmental stage, such a reputation system could even take the form of automated reputation determination using smart contracts.[128]

Reputation mechanisms are not a new phenomenon and are widely used by traditional arbitration providers.[129] However, reputation can also be falsified or manipulated in such mechanisms, for example by making inaccurate statements about the juror's skills or knowledge.[130] Additionally, reputation systems based on retrospective evaluations of the parties would not be representative. This is because in the context of arbitration, the outcome may not always satisfy both parties who may evaluate the process or the arbitrators negatively. Blockchain technology, combined with

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[125] *Id.* This number is based on 401 ETH tokens at a rate of 3,281.55 USD/ETH. *See ETH/USD: Convert Ethereum (ETH) to United States Dollar (USD)*, COINBASE, https://www.coinbase.com/converter/eth/usd (last visited Apr. 12, 2024).

[126] This number is based on 197,000,000 PNK tokens at a rate of $0.0302 USD/PNK. *See PNK/USD: Convert Kleros (PNK) to United States Dollar (USD)*, COINBASE, https://www.coinbase.com/converter/pnk/usd (last visited Apr. 12, 2024); KLEROS, *supra* note 101. PNK is the platform's own system token, which makes it easier to process transactions on the platform and at the same time creates an incentive as a staking reward to participate in the network. *See* Lesaege et al., *supra* note 90, at 4.

[127] *See generally* Ammar Battah et al., *Blockchain-Based Reputation Systems: Implementation Challenges and Mitigation*, 10 ELEC. No. 289, 1 (2021).

[128] *See* Ahmed Saud Almasoud, Smart Contracts for Blockchain-Based Reputation Systems 41–43 (May 2020) (Ph.D. dissertation, University of Technology Sydney), https://opus.lib.uts.edu.au/bitstream/10453/143883/2/02whole.pdf.

[129] *Id.* at 17; Battah et al., *supra* note 127, at 1, 2.

[130] *See* Almasound, *supra* note 128, at 36; Battah et al., *supra* note 127, at 4–5.

smart contracts, can help thwart such manipulations.[131] For example, the smart contracts can autonomously and automatically calculate the reputation score based on the success rate (i.e., how often the arbitration opinion was in line with the opinion of the majority of jurors).[132] Thus, the score would be a measure of the jurors' professionalism and honesty.

IV. APPLICATIONS OF DRR: ADVANTAGES, DISADVANTAGES & LIMITATIONS IN PRACTICE

The second part of this analysis will consider previous findings in more detail, particularly regarding the advantages and disadvantages as well as the models of expert pooling and crowdarbitration's possible application areas or limitations.

A. PSEUDONYMITY IN DDR

By relying on public and private key cryptography and digital signatures, public permissionless blockchains typically allow users to participate completely pseudonymously.[133] For example, users can conduct transactions and store or exchange information without revealing their true identities.[134] Although some may describe this feature as anonymity, strictly speaking, it is usually pseudonymity[135] because each user's account is typically still linked to, and thus symbolized by, a unique combination of numbers (public key).[136]

In the context of decentralized dispute resolution like crowdarbitration, using blockchain technology and smart contracts allows one to maintain a high degree of anonymity as pseudonymity.[137] For example, the court may no longer need to contact and instruct jurors in person, as the smart contract takes care of this task.[138] Using cryptocurrency also often completely automates and makes payment pseudonymous.[139] Additionally, parties may disclose as much or as little information as they wish

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[131] *See* Almasound, *supra* note 128, at 159–60.
[132] *See* Emanuele Bellini et al., *Blockchain-Based Distributed Trust and Reputation Management Systems: A Survey*, 8 IEEE ACCESS 21127, 21128 (2020); Battah et al., *supra* note 127, at 2–5; Almasoud, *supra* note 128, at 41–43.
[133] Buchwald, *supra* note 15, at 1401.
[134] *Id.*; Wiegandt, *supra* note 2, at 675.
[135] Buchwald, *supra* note 15, at 1400.
[136] Wiegandt, *supra* note 2, at 675.
[137] Buchwald, *supra* note 15, at 1400.
[138] *Id.* at 1400–01.
[139] *Id.*

during the process.[140] This distributed dispute resolution mechanism feature may be particularly attractive to parties already using distributed ledgers in other contexts, such as cryptocurrency transactions where pseudonymity is already the norm.[141]

B. CONFIDENTIALITY

On the other hand, this pseudonymity comes at the expense of confidentiality.[142] Generally, parties choose arbitration proceedings when disputes involve sensitive data, such as trade secrets, or when parties do not intend to make disputes public.[143] Thus, parties using arbitration procedures will regularly have a strong interest in having their data kept confidential even after resolving the dispute.[144]

However, in the models discussed above,[145] there are concerns about juror confidentiality when parties appear pseudonymously.[146] After the court closes the case and parties pay the reward, there is no incentive for jurors to keep sensitive information secret.[147] Therefore, it is difficult to assure parties their information will be kept confidential.[148] Thus, parties should be aware of what information they are disclosing.[149] However, these concerns also illustrate the need to limit these models' use in disputes involving sensitive data.[150]

Even if a corresponding confidentiality clause is agreed upon between the juror and the parties or the platform, there are justified doubts whether the juror will adhere to this clause due to their pseudonymity protection.[151] The only exception would be if jurors had to disclose their identity to the platform.[152] For example, this could be done as part of a know-your-customer procedure, in which the arbitration platform checks and records the identity of the

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[140] *Id.*
[141] Jonathan Schaffer-Goddard, *Digital Dispute Resolution Rules: Challenging Awards Under the Arbitration Act 1996*, SOC'Y FOR COMPUTS. & L. (Mar. 16, 2022), https://www.scl.org/articles/12544-digital-dispute-resolution-rules-challenging-awards-under-the-arbitration-act-1996.
[142] Wiegandt, *supra* note 2, at 686.
[143] *Id.*
[144] *See id.*
[145] *See* Part III(B)(1) & (2).
[146] *Id.*
[147] *Id.*
[148] *Id.*
[149] *Id.*
[150] *See* Shehata, *supra* note 32, at 35.
[151] *See* Gudkov, *supra* note 88, at 71.
[152] *Id.* at 72.

jurors.[153] In this context, a confidentiality agreement between the arbitration platform and the jurors could even be considered. In the event of a breach of confidentiality, the platform may take legal action against the juror.

C. TRUST

Trust is an essential condition for the legitimacy of a professional arbitration system, including trust in the appointed arbitrators to resolve the conflict.[154] However, in blockchain-based crowdarbitration like Kleros, because the selection of the jury is random, the jurors are unknown to the parties.[155] This can lead to parties lacking trust in not only the anonymous arbitrators, but also the process as a whole.[156] The parties may debate whether they really want an anonymous jury to decide their case.[157] But the actual question is whether the "real" identity of an arbitrator is relevant, or merely a proxy for obtaining greater trust in the arbitrator.[158] Interactions in virtual reality with anonymous participants are less trustworthy than face-to-face meetings, zoom conferences, or even phone calls.[159] It is not surprising anonymity is one of the reasons why the Internet is often used for fraud.[160] Therefore, establishing trust in virtual relationships between parties and arbitrators is an important factor for success.[161] While a reputation system can at least partially create trust in the anonymous juror, it is questionable whether this approach is sufficient considering "the vast amount of the disputes that happen in online transactions."[162] However, when

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[153] *See* Nikolaus Kapsoulis et al., *Know Your Customer (KYC) Implementation with Smart Contracts on a Privacy-Oriented Decentralized Architecture*, 12 FUTURE INTERNET 1 (2020).
[154] *See* Ast & Deffains, *supra* note 15, at 243.
[155] *Id.* at 251; Gudkov, *supra* note 88, at 71.
[156] *See* Aouidef et al., *supra* note 89, at 4; Elizabeth Chan & Graham Rhodes, *The Rise of Digital Identities and Their Implications for International Arbitration*, JURIST NEWS (Feb. 6, 2022), https://www.jurist.org/features/2022/02/06/the-rise-of-digital-identities-and-their-implications-for-international-arbitration/.
[157] *See* Chan & Rhodes, *supra* note 156.
[158] *Id.*
[159] *Id.*
[160] *See* H.L. Armstrong & P.J. Forde, *Internet Anonymity Practices in Computer Crime*, 11 INFO. MGMT. & COMP. SEC. 209, 212 (2003).
[161] *See* Ast & Deffains, *supra* note 15, at 242–43; Chan & Rhodes, *supra* note 156.
[162] *See* Aouidef et al., *supra* note 89, at 2 ("It is estimated that from 3 to 5% of online transactions end in a dispute. The transnationality of e-commerce combined with the requirements for shorter and cheaper

this approach is combined with a financial incentive system for jurors that is appropriate and adapted to the value in dispute, it addresses these concerns of trust.[163] Nevertheless, it will be difficult to establish the same relationship between arbitrators and parties found in face-to-face or online arbitration. The question remains, is the fact that an anonymous juror has a financial incentive to be professional enough to trust them?

D. PROMOTES ACCESSIBILITY TO ARBITRATION

Crowdarbitration platforms that use public permissionless blockchains primarily provide comparatively easy, transparent, and inexpensive access to arbitration.[164] Due to their decentralized and transparent structure, DLT systems such as the blockchain are particularly suitable as a transparent and independent platform for Crowdarbitration.[165] Otherwise, a central operator of a crowdarbitration platform taking over the initiation and handling of the arbitration process could not only set the costs for access (or even restrict access), but also exert sovereignty over all transactions and the logging of data.[166] Additionally, without DLT systems, there would not be a mechanism to clearly determine whether data was fully transmitted during the process or modified in favor of one party.[167]

Moreover, it is not necessary to establish completely new blockchain infrastructures of one's own; crowdarbitration platforms with appropriately programmed smart contracts can be set up on already existing, established, and secure blockchain networks with many participants, like Ethereum.[168] This set up is similar to the ease and ability of installing software on a hard drive.[169]

E. COMPATIBILITY OF PSEUDONYMITY WITH INTERNATIONAL ARBITRATION RULES

As previously described, due to encryption techniques of blockchain technology, the jurors as well as the parties can

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procedures give reason to expect rapid growth of the online dispute resolution industry.").

[163] *See* Ast & Deffains, *supra* note 15, at 249–51 (discussing decentralized justice systems that use strict economic incentives via cryptocurrency).

[164] *See* Gudkov, *supra* note 88, at 67–69.

[165] *See* Kumtepe, *supra* note 7, at 139; Son & Lien, *supra* note 36, at 1–3.

[166] *See* Werbach, *supra* note 13, at 507–09.

[167] *See* Gudkov, *supra* note 88, at 64.

[168] Schmitz & Rule, *supra* note 23, at 108–09.

[169] *See id.* at 114.

participate pseudonymously in these arbitration models.[170] The practice of pseudonymity can be problematic, particularly in light of many internationally recognized arbitration rules that require disclosure of the true identity and address of both the parties and their counsel. Some of these rules include: Article 3(1) and (2) of the 2021 International Chamber of Commerce (ICC) Rules of Arbitration;[171] Articles 1.1(i), 2.1(i), and 4.7 of the 2020 London Court of International Arbitration (LCIA) Rules;[172] Articles 2(3)(b) and 3(3) of the International Centre for Dispute Resolution (ICDR) 2021 International Arbitration Rules;[173] and Article 2.1(a) of the 2021 Judicial Arbitration and Mediation Services (JAMS) International Arbitration Rules & Procedures.[174] However, in blockchain-based crowdarbitration processes, relevant information and documents can be easily exchanged and made available pseudonymously in encrypted form using the blockchain as a database.[175]

Some online arbitration rules allow parties to remain anonymous in relation to each other, including Rule 13 of the 2021 Digital Dispute Resolution Rules (hereinafter "Rules") which provides for "optional anonymity."[176] However, even these Rules reject absolute anonymity and require parties to disclose their identity to at least the arbitrators, to comply with laws or other regulations, like those involving international sanctions or anti-

[170] *See infra* Part IV(A).

[171] *See 2021 Arbitration Rules*, INT'L CHAMBER COM. (last visited Mar. 29, 2024), https://iccwbo.org/dispute-resolution/dispute-resolution-services/arbitration/rules-procedure/2021-arbitration-rules/#block-accordion-3.

[172] *See LCIA Arbitration Rules 2020*, LONDON CT. INT'L ARB. (last visited Mar. 29, 2024), https://www.lcia.org/Dispute_Resolution_Services/lcia-arbitration-rules-2020.aspx#Article%201.

[173] *See International Dispute Resolution Procedures (Including Mediation and Arbitration Rules)*, INT'L CTR. FOR DISP. RESOL. 1, 17 (Mar. 1, 2021), https://www.adr.org/sites/default/files/ICDR_Rules_1.pdf.

[174] *See JAMS International Arbitration Rules & Procedures,* JAMS 1, 4 (June 1, 2021), https://www.jamsadr.com/files/Uploads/Documents/JAMS-Rules/JAMS-International-Arbitration-Rules-2021.pdf.

[175] *See* Jiapeng Wei et al., *The Adoption of Blockchain Technologies in Data Sharing: A State of the Art Survey*, WHICEB 2019 Proceedings: Wuhan International Conference on e-Business 54, 55–56 (2019), https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1027&context=whiceb2019.

[176] *See Digital Dispute Resolution Rules,* LAWTECH UK 1, 8 (2021), https://perma.cc/FT6E-CUD3.

money laundering.[177] It is also questionable whether the crowdarbitration procedures, and in particular, the automatic selection of jurors, are compliant with recognized international arbitration rules in practice.[178] Such compliance would strengthen the trustworthiness of such procedures. At least the new Rules address these procedures, defining an automatic dispute resolution process in Rule 2(c) as a process that is designed "to resolve a dispute between interested parties by the automatic selection of a person or panel . . . whose vote or decision is implemented directly within the digital asset system (including by operating, modifying, cancelling, creating or transferring digital assets)."[179] Furthermore, Rule 4 explicitly states if the parties agree on an automatic dispute resolution process, the results of such a procedure will be legally binding, which will often already be the case in practice due to the frequent use of corresponding self-executing smart contracts in this context.[180] It is worth noting that Rule 4 explicitly refers to an automatic "dispute resolution process" generally rather than to an arbitration procedure more specifically.[181] However, the Rules still provide that the parties may agree on an automatic dispute resolution process, which may include arbitration, and that outcome is binding on the parties.[182]

F. DIFFERENCES OF CROWDARBITRATION FROM TRADITIONAL ARBITRATION

The most distinguishing feature of the processes presented is that jurors do not need to have legal training to participate in the process.[183] None of the platforms that currently offer decentralized dispute resolution procedures require jurors to have the ability to perform legal analysis or simple legal tests.[184] This casts doubt on the ability of jurors to decide legal disputes, as the jurors' vote is based only on what they consider fair.[185] Furthermore, blockchain-based crowdarbitration involves extensive procedures.[186] Standardized and formalized processes are therefore inevitable, and

[177] *See* Schaffer-Goddard, *supra* note 141; *see also* Chan & Rhodes, *supra* note 156.
[178] *See supra* notes 171–74.
[179] *See* LAWTECH UK, *supra* note 176, at 5.
[180] *Id.* at 6.
[181] *Id.*
[182] *Id.*
[183] *See* Buchwald, *supra* note 15, at 1390–91.
[184] *Id.* at 1391
[185] *Id.*
[186] *See* Gudkov, *supra* note 88, at 74.

needed.[187] By comparison, traditional arbitration proceedings are relatively flexible and can be tailored to the needs of the parties. In addition, parties can exert more influence on the proceedings themselves, especially if the proceedings are already underway.[188] Additionally, compared to traditional arbitration proceedings which are typically limited to a single case, some crowdarbitration platforms allow for appeal proceedings.[189] However, an appeal often only increases the number of jurors but does not automatically increase their professional competence.[190]

Regarding the collection of evidence, there are not any differences between crowdarbitration from online arbitration.[191] While users of blockchain systems generally value their privacy, the transmission of evidence and testimony is just as easy as text or voice-based interrogation.[192] For example, all documents and pleadings can be made available to the parties using a blockchain as a verification tool.[193] Nevertheless, the purely digital process has its limitations, as witness interviews, for example, are not as easy to implement.[194] As a further suggestion for improvement, digital processes could introduce special, more comprehensive procedures, or adapt appeal processes[195] to allow for full oral hearings, including witness interviews.[196] As a result, the standard procedures could continue to offer corresponding cost savings. However, more extensive, but also more expensive, procedures could also be available for exceptional cases.

Furthermore, random selection of jurors is likely to result in even greater neutrality.[197] In particular, this could make it easier for

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[187] *Id.*
[188] *See* Buchwald, *supra* note 15, at 1388.
[189] *See* Schmitz & Rule, *supra* note 23, at 118.
[190] *See* Buchwald, *supra* note 15, at 1388.
[191] *Id.*; *see also* Amy J. Schmitz, *Arbitration in the Age of Covid: Examining Arbitration's Move Online*, 22 CARDOZO J. CONFLICT RESOL. 245, 266–67 (2020).
[192] *See* Buchwald, *supra* note 15, at 1388.
[193] *Id.*
[194] *Id.* at 1389; Nevena Jevremović, *2018 In Review: Blockchain Technology and Arbitration*, KLUWER ARB. BLOG (Jan. 27, 2019), https://arbitrationblog.kluwerarbitration.com/2019/01/27/2018-in-review-blockchain-technology-and-arbitration/.
[195] Kleros was one of the first platforms to implement an appeal system, *see* Lesaege et al., *supra* note 90, at 7.
[196] For example, the CodeLegit platform already has initial approaches to oral hearings, *see* Derric Yeoh, *Is Online Dispute Resolution The Future of Alternative Dispute Resolution?*, KLUWER ARB. BLOG (Mar. 29, 2018), https://arbitrationblog.kluwerarbitration.com/2018/03/29/online-dispute-resolution-future-alternative-dispute-resolution/.
[197] Schmitz & Rule, *supra* note 23, at 118.

parties to agree on a neutral arbitrator. Additionally, parties might also feel more fairly treated due to their anonymous appearance.[198]

G. SCOPE OF DECENTRALIZED DISPUTE RESOLUTION RESPECTIVE TO CROWDARBITRATION MODELS

Dispute resolution methods that rely on blockchain technology and smart contracts may be particularly popular in blockchain-related disputes.[199] While blockchain technology and smart contracts can prevent disputes by automating and significantly simplifying transactions, the use of these technologies cannot completely prevent all disputes.[200] Users of public blockchains, who deliberately chose to use such decentralized and pseudonymous systems like Bitcoin or Ethereum, are generally unlikely to want to use centralized jurisdictions like state courts, especially for on-chain disputes (i.e., disputes arising directly from blockchain-based transactions or actions).[201] Users would need to be willing to forego the more efficient processing of transactions in blockchains if they were to resort to off-chain dispute resolution.[202] In addition, blockchain and smart contracts are often used for cross-border transactions.[203]

Parties are more likely to consider crowdarbitration models for cases with smaller disputed amounts that can be settled on public blockchains.[204] However, crowdarbitration methods, which are primarily based on the Schelling Point Principle, can only be efficiently applied to cases involving binary decision making.[205] As soon as jurors have more than two possible options for solutions, risks in their decision-making increases and the financial incentive decreases.[206] For more complex transactions, the parties may prefer traditional arbitration because of its flexibility, adherence to basic procedural rules, and internationally enforceable decisions.[207]

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[198] *Id.* at 120.
[199] *See generally* Kumtepe, *supra* note 7, at 142–43; Wagner & Eidenmüller, *supra* note 34, at 12; Schmitz & Rule, *supra* note 23, at 105.
[200] *See* Allen et al., *supra* note 7, at 75; Kumtepe, *supra* note 7, at 142–43.
[201] *See* Wagner & Eidenmüller, *supra* note 34, at 12; Schmitz & Rule, *supra* note 23, at 105.
[202] *See generally* Wagner & Eidenmüller, *supra* note 34; Buchwald, *supra* note 15, at 1373.
[203] *See generally* Wagner & Eidenmüller, *supra* note 34.
[204] *See generally* Son & Lien, *supra* note 36, at 15.
[205] *See Kleros FAQ*, KLEROS, https://docs.kleros.io/kleros-faq (last visited Apr. 14, 2024) ("Can Kleros go beyond simple binary cases?").
[206] *See generally* Rabinovich-Einy & Katsch, *supra* note 8.
[207] *See* Bruce Greig, *What can mediators learn from Kleros, a platform which uses cryptocurrency and game theory to resolve disputes?,* KLUWER MEDIATION BLOG (Mar. 6, 2022),

However, Kleros has already successfully implemented an arbitration method based on the pendulum arbitration approach in which the Kleros jury is asked to choose between two (or more) sets of outcomes.[208]

V. CONCLUSION AND THE DEVELOPMENT OF AI-BASED DECENTRALIZED DISPUTE RESOLUTION

Trust is the most important requirement in decentralized dispute resolution on a crowdarbitration platform, especially because both parties and jurors can act pseudonymously.[209] By combining several existing approaches, this article demonstrates how the use of blockchain technology can reduce trust and reputation concerns. Frequently used terms, such as blockchain-based conflict resolution, go too far, as conflicts are not resolved through the blockchain; rather, blockchain technology and smart contracts are used as tools in the conflict resolution process. In this context, the two models presented already show some weak points. In particular, unlike traditional approaches, decentralized dispute resolution relies on society's sense of justice.[210] However, this is often at the expense of legal analysis because jurors do not need any legal training.[211] Furthermore, these models are only suitable for very simple disputes where confidentiality is not important.[212] In complex cases with sensitive data, parties should use classic arbitration models.[213] While there are predictions that through the increased use of blockchain and smart contracts, parties can avoid disputes altogether in the future, or at least resolve them automatically without a neutral third party, these ideas are still a long way from reality. [214]

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https://mediationblog.kluwerarbitration.com/2022/03/06/what-can-mediators-learn-from-kleros-a-platform-which-uses-cryptocurrency-and-game-theory-to-resolve-disputes/.

[208] For further information on the pendulum arbitration approach *see* KLEROS, *supra* note 205; Danilo Ruggero Di Bella, *"Final-Offer Arbitration": A Procedure to Save Time and Money?* KLUWER ARB. BLOG (Jan. 25, 2019), https://arbitrationblog.kluwerarbitration.com/2019/01/25/final-offer-arbitration-a-procedure-to-save-time-and-money/.

[209] *See generally infra* Part IV(C); Ast & Deffains, *supra* note 15.

[210] *See generally infra* Part IV(F); Lesaege et al., *supra* note 90; Ast & Deffains, *supra* note 15, at 247–49.

[211] *See* Buchwald, *supra* note 15, at 1390–91.

[212] *See generally infra* Part IV(B).

[213] *See* Buchwald, *supra* note 15, at 1400.

[214] Wiegandt, *supra* note 2, at 671; Wagner & Eidenmüller, *supra* note 34, at 10.

As evident with past inventions, and even in the models described in this article, one technology alone cannot accomplish this goal; rather, the combination and interaction of multiple technologies are needed to unleash their full potential. The use of machine learning and artificial intelligence, which are currently revolutionizing several fields, will certainly play an important role.[215] The drawbacks associated with these technologies can often be overcome by combining them with other innovations.[216] For example, the blockchain based models noted above could also implement AI, leading to even greater efficiency and expertise. At the same time, the use of blockchain technology could lead to more transparency with regard to the use of AI in arbitration.[217] However, implementing the idea of a fully fair, efficient, and independent AI-based Decentralized Dispute Resolution process still requires some development.

[215] *See* James Rogers & Matthew Buckle, *The future of arbitration in the world of Big Data*, NORTON ROSE FULBRIGHT INT'L ARB. REP 1, 12–14 (2017), https://www.nortonrosefulbright.com/-/media/files/nrf/nrfweb/imported/20170925---international-arbitration-report---issue-9.pdf?la=en&revision=c9a5375e-5aff-4a71-a492-18c9305047d6; Lucas Bento, *International Arbitration and Artificial Intelligence: Time to Tango?*, KLUWER ARB. BLOG (Feb. 23, 2018), https://arbitrationblog.kluwerarbitration.com/2018/02/23/international-arbitration-artificial-intelligence-time-tango/.

[216] *See generally* Schmitz & Rule, *supra* note 23.

[217] *See* Jeremy Barnett & Philip Treleaven, *Algorithmic Dispute Resolution—The Automation of Professional Dispute Resolution Using AI and Blockchain Technologies*, 61 COMPUT. J. 399, 403 (2018).