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Online Dispute Resolution for Smart Contracts

Amy J. Schmitz
University of Missouri School of Law, SCHMITZAJ@MISSOURI.EDU

Colin Rule
Tyler Technologies

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By Amy J. Schmitz[*] and Colin Rule[*]

Smart contracts built in the blockchain are quietly revolutionizing traditional transactions despite their questionable status under current law. At the same time, disputes regarding smart contracts are inevitable, and parties will need means for dealing with smart contract issues. This Article tackles this challenge, and proposes that parties turn to online dispute resolution ("ODR") to efficiently and fairly resolve smart contract disputes. Furthermore, the Article acknowledges the benefits and challenges of current blockchain ODR start-ups, and proposes specific ideas for how designers could address those challenges and incorporate ODR to provide just resolutions that will not stymie efficiencies of smart contracts. Nonetheless, the Article also raises pivotal cautions and questions for ensuring the fairness and transparency of these solutions over the longer term.

I. INTRODUCTION

It is no secret that technology is disrupting many industries, including law.[1] In fact, technology is revolutionizing the art of deal-making by leaps and bounds. Gone are the days when most deals were negotiated in person and sealed with a handshake.[2] Instead, we now expect to make most purchases online through e-contracts, sealed with a click on the "accept" button.[3] Even corporate leaders now use e-mails and texts to negotiate deals, which they eventually "sign" online through services like Docusign.[4]

Despite our current comfort with these new types of online contracts, "smart contracts" on the blockchain push the envelope even further into the digital age. Smart contracts are different from traditional or common e-contracts in that they are essentially computer code.[5] Those with no coding background cannot easily interpret a smart contract in its rawest form. Instead, these contracts are spread across blockchain nodes distributed throughout the world.[6] In other words, they are

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* Elwood L. Thomas Missouri Endowed Professor of Law at the University of Missouri School of Law. I thank Catherine Picht, Andrew Johnson, and Michael Castleman for their research assistance.

* Vice-President, Online Dispute Resolution at Tyler Technologies.

1. *See generally* RICHARD SUSSKIND, TOMORROW'S LAWYERS: AN INTRODUCTION TO YOUR FUTURE (Oxford Univ. Press 2013).

2. AMY J. SCHMITZ & COLIN RULE, THE NEW HANDSHAKE: ONLINE DISPUTE RESOLUTION AND THE FUTURE OF CONSUMER PROTECTION, at ix (2017).

3. *Id.*

4. *Companies Using Verisign*, IDATALABS (2017), https://idatalabs.com/tech/products/verisign.

5. David Zaslowsky, *What to Expect When Litigating Smart Contract Disputes*, LAW360 (Apr. 4, 2018, 5:11 PM), https://www.law360.com/articles/1028009/what-to-expect-when-litigating-smart-contract-disputes.

6. *Id.*

made up of "nodes" which consist of computer coded algorithms that live in a decentralized ledger (blockchain).[7] Indeed, even attempting to summarize an explanation of smart contracts in an article Introduction seems foolish, and thus greater explanation is provided in Part II of this article.

Although most do not fully understand smart contracts, hype about their use is building. Futurists predict that smart contracts will create efficiencies and resolve transactional trust issues.[8] Smart contracts may largely eliminate the need for complicated and costly letters of credit, bonds, and security agreements by digitizing automatic enforcement, or payment.[9] For example, the *Consensus 2018* conference brought together thousands of industry leaders interested in blockchain, including companies like FedEx, which are exploring blockchain as a logistics utility.[10] Furthermore, at the conference Microsoft announced the Azure Cloud Blockchain Workbench, and automobile manufacturer Renault unveiled its plan to use blockchain for supply chain management. At the same time, Ripple announced the expansion of the XRP cryptocurrency via its new initiative X-Spring, and made a splash with Snoop Dog performing at the XRP Community Night after party.[11]

Despite this kind of hype around blockchain, however, these new approaches raise new dilemmas. As Ethan Katsh, the Father of Online Dispute Resolution, has put it: the power of technology to resolve disputes is exceeded by the power of technology to generate disputes.[12] Inevitably, disagreements will arise regarding the coding and content of smart contracts.[13] Trade disputes may arise within information placed in the blockchain, or smart contracts may be manipulated by fake data, which will require quick and effective resolution to prevent major financial loss.[14] For example, a 2016 study revealed that there are 100 errors per 1,000 lines of coding. [15] Extrapolated to smart contracts, this means that many smart contracts may not be accurately coded to encompass the parties' original intentions.[16] Indeed, coders may be sued for liability as a result of inaccurate smart contracts, or hackers prosecuted for interfering with or manipulating smart contracts.[17]

At the same time, there is no articulated and clear system of rules that apply to smart contracts.[18] Civil law only recognizes contracts that are in written or documentary form, and common law contract rules dependent on choice of law do not

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7. Jakub J. Szczerbowski, *Place of Smart Contracts in Civil Law. A Few Comments on Form and Interpretation*, SSRN 333 (Jan. 8, 2018), https://ssrn.com/abstract=3095933.

8. *Id.* at 333, 337.

9. *Id.* at 335.

10. Nikhilesh De, *FedEx Joins Hyperledger in Blockchain Consortium's Latest Expansion*, COINDESK (Sept. 26, 2018), https://www.coindesk.com/fedex-joins-hyperledger-in-blockchain-consortiums-latest-expansion/.

11. Nikhilesh De, *Snoop Dogg to Perform at Ripple's Blockchain Week NYC Party*, COINDESK, https://www.coindesk.com/snoop-dogg-to-perform-at-ripples-blockchain-week-party/ (last updated Ap r. 25, 2018).

12. *See* ETHAN KATSH & ORNA RABINOVICH-EINY, DIGITAL JUSTICE: TECHNOLOGY AND THE INTERNET OF DISPUTES 1-25 (2017).

13. Pindar Wong, *Making Trade Wars Obsolete*, CONSENSUS 2018 at 40-46 (May 9, 2018), https://media.coindesk.com/uploads/events/2018/consensus/magazine/consensus-2018-magazine.pdf.

14. *Id*. at 41.

15. Zaslowsky, *supra* note 7.

16. *Id.*

17. *Id.*

18. Szczerbowski, *supra* note 9, at 335.

fit the decentralized blockchain model.[19] It also may be difficult to fit square concepts of offer, acceptance and consideration into the round hole of smart contracts. Additionally, if a matter falls under the statute of frauds, it is unclear whether a coded transaction will constitute a "writing" and whether the keys to encrypt the smart contracts will constitute signatures of the parties.[20]

Nonetheless, even if one could get past civil and contract law principles in establishing agreement underlying smart contracts, that does not mean that classical rules will provide remedies if problems develop.[21] What remedies exist for the smart contract party who wants to prevent or reverse enforcement? If this were a traditional contract, a party could rescind it in court, but smart contracts on the blockchain present a different set of challenges. Enforcement is automatic, and the code is immutable. Again, these are not really "contracts" in the true sense of the word, understood by most as negotiated terms in an arms-length transaction (or "meeting of the minds"). Thus, users may have different expectations, which means disputes will be inevitable.

That again raises the question: Where will parties turn to resolve their smart contract disputes? Litigation seems nonsensical since it is unclear whether or how contract law should apply, what laws govern the transaction, and what evidence could be collected to adjudicate the matter. Plus, offline litigation undermines the efficiency and scalability of smart contracts. Furthermore, the anonymous nature of smart contracts and the fluidity of online identities make it difficult to determine who the parties actually are. Meanwhile, the decentralized nature of smart contracts prevents courts from exercising jurisdiction or determining choice of law.[22] At the same time, it is difficult to conceptualize how judges could fashion remedies that consist of developing new code to update a smart contract deployed on a blockchain.[23]

The dilemma of dealing with smart contract disputes therefore remains. Courts and traditional processes simply do not work for resolving smart contract disputes, making it imperative to invent the future. Bill Gates famously said, "Let's go invent tomorrow instead of worrying about what happened yesterday."[24] This Article therefore envisions a solution for smart contract dispute resolution, and proposes online dispute resolution ("ODR") built into smart contracts to efficiently and fairly resolve disputes that arise along the way. The Article also raises cautions that developers and policymakers must consider as they build these ODR solutions.

This Article proceeds from description to prescription in light of the confusion surrounding smart contracts. Accordingly, Part II of the Article will take a step back and provide greater explanation and background on the evolution of smart contracts, and their rise amidst the growth of cryptocurrencies. Part III further tackles questions regarding the complexities of smart contracts and their status under current law. Part IV then expands the conversation to consider new means for dealing with smart contract issues. This will include discussion of current innovations, as well as new prescriptions for incorporating ODR in the blockchain to provide

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19. *Id.* at 336.
20. Zaslowsky, *supra* note 7.
21. Szczerbowski, *supra* note 9, at 335.
22. *Id.*
23. Zaslowsky, *supra* note 7.
24. *Inspirational Quotes*, INSPIRATIONAL QUOTES.GALLERY, http://inspirationalquotes.gallery/lets-go-invent-tomorrow-instead-of-worrying-about-what-happened-yesterday/ (last visited Dec. 1, 2018).

fast and fair resolution. Part V will add cautions for policymakers and businesses to consider as they build these ODR solutions, and will envision next steps for robust smart contract solutions. Part VI will summarize conclusions.

II. THE RISE OF SMART CONTRACTS

A. Contracts vs. Smart Contracts

Smart contracts are confusing. Many, if not most, people have heard the term, but are unclear what it means or why smart contracts are revolutionary. Accordingly, the first challenge is to explain how smart contracts work, what benefits they provide, and why they may offer a better option for efficient and secure transactions in particular contexts.

Nearly everyone knows what a traditional legal contract entails. Whether we buy "101 Business Contracts" off the shelf at Office Depot or pay a white-shoe law firm thousands of dollars to negotiate a contract, we generally understand "deals," aka contracts. Most see a contract as a document that details an agreement that parties execute with the expectation that it is legally binding. Whether it is an agreement to open a bank account, buy stock, or work at a restaurant, most view the structure and cadence of contracts to include offer, acceptance, and consideration, with signature and date at the bottom.

This model of making and enforcing agreements is closely tied to the judicial system. Judicial enforcement is the endgame. Accordingly, if a party violates the terms, she can go to court and insist that the other party perform or pay damages for breach. Furthermore, if parties disagree about the interpretation of the contract terms, the court has power to decipher the parties' arguments and make final determinations regarding the parties' obligations. It is a highly manual process, often involving expensive lawyers and slow-moving courts.

The traditional contract model is nonetheless changing in the digital age. As noted above, many consumers agree to contracts each day by clicking a button and "accepting" terms they never read, while purchasing goods and services on the internet.[25] As one study of end user license agreements from 2003–2010 showed, online contracts have become an accepted norm. Furthermore, they have become longer and increasingly less favorable to consumers.[26] Nonetheless, courts have generally enforced these "clickwrap" and "browsewrap" contracts in the name of efficiency.[27] In a sense, it is considered consumers' own fault if they end up bound to unfavorable contracts they failed to read.

In contrast to traditional paper and e-contracts, smart contracts bypass and ignore the legal model. Judicial enforcement is not their endgame. Instead of paying lawyers to write paper documents filled with complex legalese, parties use technology to draft agreements in code so that there is no ambiguity around the parties' obligations. These agreements involve no paper-shuffling or ink signatures at the bottom. Instead, smart contracts are computer programs filled with "if/then" clauses laying out each obligation and eventuality. These computer programs, once created and formally accepted by both parties, can be self-enforcing, running in the

25. Zaslowsky, *supra* note7.
26. *Id.*
27. *Id.*

cloud. Continuous monitoring of key performance metrics determines when one of the "if/then" clauses suddenly switches from false to true, triggering automatic enforcement.

Through auto-enforcement, smart contracts can add efficiencies for many kinds of agreements. This includes rental, intellectual property, financing, shipping, and manufacturing contracts. Parties need not worry about facing the inefficiencies of litigation or fighting for payment when the terms and enforcement are already predetermined and established in the computer coding per "if/then" rules. *If* event "x" happens (e.g. a website is launched), *then* "y" occurs (e.g. payment is made). Having this built into unchangeable computer code, with assured payment upon performance, addresses trust issues that often stymie traditional deals based on a handshake.[28] Again, this means that smart contracts largely eliminate the need for the complicated and costly means for securing payment such as letters of credit, bonds, and security agreements.

B. The Role of the Blockchain in Smart Contracts

One of the key technologies behind smart contracts is the blockchain. A blockchain is a distributed ledger (like a distributed database) spread across the internet. It allows for information to be entered into the system and stored in different, redundant locations located throughout the world. When a document is put into the blockchain, it is replicated across every archival node, so even if half of the nodes go down for some reason, the data is still available. Imagine if you had a notepad where everything you wrote in the notepad would be duplicated exactly in other notepads around the world (and everything written in those notepads would appear in your notepad as well). Even if your notepad was destroyed, the other notepads around the world would have everything you wrote in it, so the contents would never be lost.

Also, imagine if there were global rules that governed what could be written in the notepads. If someone tried to write something in a notepad that didn't follow the rules, then all the other notepads would reject it. This is another feature of the blockchain: if someone provides an update that doesn't follow the network rules, then the other nodes will evaluate the contribution and determine the update doesn't comply, so they will not add it to the definitive ledger. That makes spoofing or editing information previously submitted into the blockchain extremely difficult, if not impossible. Moreover, the complexity of coordinating changes across all nodes in the blockchain is so significant that any would-be hackers would have an almost insurmountable challenge in front of them.

This makes smart contracts built into the blockchain incredibly powerful. As noted above, smart contracts are already self-enforcing computer programs, but they become more secure when programmers drop them into the blockchain. Smart contracts eliminate the need for paper documents, wet ink signatures, and for the most part—courts. This new system, built on smart contracts and blockchain, enforces agreements through code instead of judges and jails. Jurisdiction and legal

28. Szczerbowski, *supra* note 9, at 333.

rules become largely irrelevant because the system itself establishes the basis for enforcement.[29]

In this new structure, a computer network manages all contracts across jurisdictions. That means that contract information is not housed in one central location, vulnerable to outages and hackers. This can enhance trust and enforceability, while reinforcing privacy and security. The blockchain provides encryption with public and private keys, which are blockchain–based identification numbers provided by the network.[30]

That said, it is important to note that blockchain is not impenetrable. It is more secure than general cloud-based systems, but it can be "hacked" and has its own risks.[31] Proponents of the blockchain claim that the distributed ledger is "immutable," "secure," and "trustless."[32] However, hackers could manipulate the technology by, for example, using a "hard fork" to essentially create a copy of the blockchain which might allow unscrupulous parties to manipulate the data and essentially "steal" information. Indeed, a well-executed "hard fork" could even make a blockchain vulnerable to corruption and collapse.[33]

At the same time, blockchain is evolving in ways that make it less susceptible to attacks, and thus more reliable and trustworthy. It is moving far beyond its origins in cryptocurrencies like Bitcoin. The central objective of the blockchain was to create a self-regulating network that would enable the transfer of property between peers without the oversight of a third party, namely the courts and regulators.[34] However, the original Bitcoin system has been improved in newer platforms like Ethereum, which built on the initial Bitcoin architecture to allow for faster execution and more flexible integration. This moved the ball forward, but opening the door wider also enabled less experienced coders to leverage tools to design their own smart contracts, perhaps raising the risk of programming bugs and coding errors.[35]

These risks have not slowed the blockchain boom.[36] In 2017, venture capitalists invested $1 billion in start-up blockchain companies.[37] At the same time, blockchain companies offered $5 billion in initial coin offerings ("ICOs"), which are now recognized by the Securities and Exchange Commission and regulated as securities.[38] Other noteworthy initiatives include the "Dubai Blockchain Strategy," which is a multi-pronged initiative by the Dubai Future Foundation and the Smart Dubai Office, to make Dubai the first city run essentially on the blockchain by the year

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29. Marco Dell'Erba, *Demystifying Technology. Do Smart Contracts Require a New Legal Framework? Regulatory Fragmentation, Self-Regulation, Public Regulation* 27-28 (Aug. 20, 2018), https://ssrn.com/abstract=3228445.

30. *Id.* at 9.

31. Angela Walch, *Blockchain's Treacherous Vocabulary: One More Challenge for Regulators*, 21 J. INTERNET L. 1, 5-7 (2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3019328.

32. *Id.* at 5.

33. *Id.* at 2-7. Instead of claiming the technology is "tamper-proof," some proponents now call it "tam per-resistant." *Id.*

34. *See generally* Walch, *supra* note 33.

35. *Id.*

36. Brant Carson et al., *Blockchain Beyond the Hype: What is the Strategic Business Value?*, MCKINSEY DIGITAL (June 2018), https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value.

37. *Id.*

38. *Id.*

2020.[39] Dubai therefore plans to move all essential records to the blockchain, including health records, title transfers, identification verification data, wills, and data related to financing and exchanging goods.[40]

Dubai is not alone in exploring blockchain to increase operational efficiency and reduce costs by eliminating intermediaries.[41] For example, law firms are building blockchain departments.[42] Their business clients have been experimenting with blockchain through venues like the Accord Project consortium.[43] Meanwhile, major tech companies like IBM and standard setting groups like the IEEE have been working to set common data and performance standards for smart contracts, which are crucial for wide acceptance.[44] In fact, ninety percent of Australian, European and North American banks are "experimenting" with using blockchain to verify and transfer financial "information and assets."[45] Additionally, twenty-five governments are piloting blockchain platforms.[46]

Nonetheless, blockchain is still in its infancy, and will need to gain credibility and acceptance before it will truly scale.[47] It will take some time for competitors to cooperate on issues regarding the system, the data, and the investments necessary to ensure system operation.[48] However, blockchain technologies are becoming more robust and accessible, which is part of what is pushing smart contracts into wider use.

C. The Emerging New Normal

Over the past year, smart contracts have leaped into the mainstream. RocketLawyer announced a partnership with smart contract pioneer OpenLaw and blockchain developer ConsenSys to bring blockchain-based products to the online consumer space. This includes a "Rocket Wallet" that links RocketLawyer contracts to the Ethereum blockchain.[49] Soon after, RocketLawyer's main competitor, LegalZoom, announced a partnership with the company Clause to provide blockchain-based smart contracts to their customers as well.[50] The move toward smart contracts

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39. Saqr Ereiqat, *Blockchain in Dubai: Smart Cities from Concept to Reality*, IBM (Apr. 10, 2017), https://www.ibm.com/blogs/blockchain/2017/04/blockchain-in-dubai-smart-cities-from-concept-to-reality/.

40. *Id.* See also Samburaj Das, *Opening Shop? Dubai Government Launches Blockchain Business Registry*, CCN (May 5, 2018), https://www.ccn.com/dubai-government-launches-blockchain-business-registry/. This gave rise to Global Blockchain Council, bringing together a consortium of government entities, UAE banks, blockchain technology firms and major companies, like IBM and Consensys.

41. Carson et al., *supra* note 38.

42. Roger Aitken, *Accord Project's Consortium Launching First Legal 'Smart Contracts' with Hyperledger*, FORBES (July 26, 2017), https://www.forbes.com/sites/rogeraitken/2017/07/26/accord-projects-consortium-launching-first-legal-smart-contracts-with-hyperledger/#34781496472c.

43. *Id.*

44. *IBM Joins Accord Project Smart Contract Consortium*, ARTIFICIAL LAW. (June 28, 2018), https://www.artificiallawyer.com/2018/06/28/ibm-joins-accord-project-smart-contract-consortium.

45. Carson et al., *supra* note 38.

46. *Id.*

47. *Id.*

48. *Id.*

49. *What the Rocket Lawyer/OpenLaw Smart Contract Deal Means*, ARTIFICIAL LAW. (Sept. 7, 2018), https://www.artificiallawyer.com/2018/09/07/what-the-rocket-lawyer-openlaw-smart-contract-deal-means/.

50. *LegalZoom Offers Smart Contracts with Pioneer Clause*, ARTIFICIAL LAW. (Sept. 17, 2018), https://www.artificiallawyer.com/2018/09/17/legalzoom-offers-smart-contracts-with-pioneer-clause/.

is significant when the two largest online legal services companies in the United States take such steps forward in the mainstreaming of blockchain and smart contracts in everyday legal services.

These recent moves are also important in that they indicate how smart contracts integrate with standard currencies. In other words, these moves open doors to smart contracts for those who have not embraced cryptocurrencies.[51] As noted above, blockchain-based smart contracts initially evolved out of virtual currencies like Bitcoin and Ethereum. Accordingly, one had to own these cryptocurrencies in order to participate in smart contracts. However, ventures like OpenLaw, noted above, allow individuals and small businesses to make use of blockchain-based smart contracts without the use of any cryptocurrency. They are free to use United States dollars or British pounds (referred to as "fiat currencies" in the blockchain world). These tools therefore allow almost anyone to use a smart contract, even if they know nothing about blockchain and hold no cryptocurrency.[52]

In sum, big and small businesses alike are trying to make smart contracts the new normal. Integrating blockchain-based agreements into everyday legal tasks is a big step in that direction. Individuals can leverage these technologies to establish trusted payments without need for traditional secured transactions. Individuals may use smart contracts for day to day legal issues like employment contracts, rental agreements, and wills. Once these approaches cross the tipping point, they will become commonplace in every sector of the economy.

III. COMPLEXITIES AND CONFLICTS AROUND SMART CONTRACTS

A. Unclear Legal Status

Despite the hype around blockchain's potential, smart contracts raise many unanswered questions. Unforeseen disputes will almost certainly arise regarding contract coding and execution. As noted above, there is even a risk that fake data will improperly trigger, or fail to trigger, smart contract clauses. This may result in major financial losses.[53] Computer programmers, or coders, also may face liability for erroneous coding.[54] Coders working in concert with smart contract drafters could face damages for creating improperly structured contracts, while hackers may attempt to manipulate data to the advantage of one or the other party.[55]

At the same time, there is no articulated and clear system of rules that apply to smart contracts.[56] At the core of "contract law" is the concept of consent. This idea of consent requires some effective communication of an intentional transfer of rights and obligations between parties.[57] Presumably the parties to a smart contract, like any contract, will have consented to the terms underlying the code.[58] However,

51. *What the Rocket Lawyer/OpenLaw Smart Contract Deal Means*, *supra* note 51.

52. *Id. See also Bringing Real World Value Onto the Blockchain with OpenLaw and ChainLink*, BITCOINS CHANNEL (Aug. 19, 2018), https://bitcoinschannel.com/bringing-real-world-value-onto-the-blockchain-with-openlaw-and-chainlink.

53. Wong, *supra* note 15.

54. Zaslowsky, *supra* note 7.

55. *Id.*

56. Szczerbowski, *supra* note 9, at 335.

57. Meg Leta Jones & Elizabeth Edenberg, *The Legal Roots and Moral Core of Digital Consent*, SSRN (Feb. 27, 2018), https://ssrn.com/abstract=3131392.

58. *See* Szczerbowski, *supra* note 9.

as noted earlier, smart contracts are translated into code without the same pageantry of traditional contracts.[59] This means that it may be difficult for the parties to understand whether the code accurately memorializes their agreement. In this way, smart contracts lack the usual cautionary, evidentiary, and channeling functions of written contracts in the traditional system.[60]

By their nature, smart contracts codify agreement outside of the legal system.[61] Smart contracts may therefore allow parties to circumvent legal rules.[62] This is why lawyers debate whether smart contracts are "contracts" in the legal sense.[63] In common law, it is unclear that code constitutes true offer, acceptance and consideration. Civil lawyers then argue whether there is sufficient documentary evidence to support legal enforcement.[64] Moreover, as of the time of the Article, no United States court has reviewed blockchain or smart contracts.[65] No precedent has been set.

Additionally, as noted above, even if one gets past contract formation questions by looking back to the originating documents, jurisdiction and other legal questions create hurdles for litigating smart contracts.[66] Smart contracts on a blockchain are generally anonymous, and become even more anonymous when they use cryptocurrencies that make it nearly impossible to discover identities of the parties or their computers.[67] Without knowing the identity and domicile of the parties, courts are unable to establish jurisdiction using traditional rules based on minimum contacts or physical presence.[68]

Furthermore, even if a court could determine jurisdiction of the parties, it would be difficult for a court to interpret a smart contract, because the code is written to be understood by programmers, not lawyers and judges.[69] At the same time, it would be difficult for a court to intervene to prevent or reverse automatic contract executions.[70] Furthermore, it is difficult to see how courts will be able to fill gaps in smart contracts, especially given that blockchain does not generally allow for modifications.[71]

That said, some argue that governance standards around the blockchain will emerge to promote "confidence in the technology and the legal and regulatory environment."[72] They see government or other standards groups dictating rules that will govern smart contracts. In the United States, states are beginning to introduce

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59. Mark Verstraete, *The Stakes of Smart Contracts*, SSRN (May 17, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3178393.

60. Duncan Kennedy, *From the Will Theory to the Principle of Private Autonomy: Lon Fuller's "Consideration and Form"*, 100 COLUM. L. REV. 94, 103 (2000); Lon L. Fuller, *Consideration and Form*, 41 COLUM. L. REV. 799, 800-01.

61. Verstraete, *supra* note 61.

62. *Id.*

63. Szczerbowski, *supra* note 9, at 33-35.

64. *Id.* at 33-40.

65. *Id.*

66. Wulf A. Kaal & Craig Calcaterra, *Crypto Transaction Dispute Resolution*, 73 BUS. LAW. 1, 37-38 (2018).

67. *Id.* at 4.

68. *Id.* at 36.

69. *Id*. at 39.

70. *Id*. at 40.

71. Usha Rodrigues, *Law and the Blockchain*, SSRN 5 (May 6, 2018), https://ssrn.com/abstract=3127782.

72. JOSEPH J. BAMBARA & PAUL R. ALLEN, BLOCKCHAIN: A PRACTICAL GUIDE TO DEVELOPING BUSINESS, LAW, AND TECHNOLOGY SOLUTIONS 84-95 (2018).

and pass legislation regarding enforcement of smart contracts.[73] Some commentators also have proposed that legal rules could be coded into the blockchain contracts themselves.[74]

The problem with these ideas for governmental regulation, however, is that blockchain technology is advancing at breakneck speed. Meanwhile, traditional legal systems are notoriously reactive and slow to act.[75] Furthermore, regulations would have to be international and widely accepted because blockchain contracts are cross–jurisdictional and international, among parties of varying nationalities.[76]

Accordingly, smart contracts need their own dispute resolution systems.[77] Interest in smart contracts will continue to grow, meaning more and more smart contracts will be created, and as is true with any form of contract (smart or otherwise) some disputes are inevitable. Coding for possible breaches of contract can only go so far because there will always be a lack of foresight and information, as well as unpredictable human behavior.[78] There also will be technical problems and mistakes in the coding.[79] Furthermore, traditional litigation fails to address smart contracts' need for remedies that preserve anonymity and fit within the blockchain.[80] Courts and traditional processes simply will not work for resolving smart contract disputes.

B. Automation Concerns

As our lives have moved online, artificial intelligence ("AI") and automation have infiltrated everything from the movies we watch to the contracts we conclude.[81] AI-powered marketing tracks what we watch on services like Netflix, and delivers suggestions for future viewing.[82] AI thus recognizes patterns of behavior, generates new knowledge from these patterns, and makes predictions, often using algorithms.[83] Among other things, AI has been applied to power self-driving cars and targeted consumer advertising.[84]

However, automation has a different meaning in smart contracts. As Nick Szabo has explained, a smart contract is "a set of promises specified in digital form" carried out automatically by an algorithm.[85] Smart contracts do not operate on mere predictions. Instead, once a smart contract is created and put on the blockchain,

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73. Zaslowsky, *supra* note 7, at 2.
74. Kaal & Calcaterra, *supra* note 68, at 44.
75. *Id.* at 45.
76. *Id.* at 45-46.
77. *Id.* at 46.
78. *Id.* at 46-47.
79. *Id.* at 47.
80. Kaal & Calcaterra, *supra* note 68, at 47.
81. Kal Raustiala & Christopher Jon Sprigman, *The Second Digital Disruption: Streaming & the Dawn of Data-Driven Creativity*, SSRN 6-16 (Aug. 8, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3226566.
82. *Id.* at 29.
83. *Id.* at 1-2.
84. *Id.* at 2.
85. Dell'Erba, *supra* note 31, at 2-12.

execution is automated and irrevocable, or at least prohibitively expensive to revoke.[86] As such, smart contracts essentially eliminate "do-overs." They are self-governing and self-executing.[87]

One scholar has compared smart contracts to vending machines: the product is delivered once money is received with no ability for human intervention.[88] In other words, the terms are "embedded" in the machine, and it performs (delivers a product) in response to receiving the requisite amount of money.[89] The machine cannot refuse to perform, and its structure (thick glass face) protects the product from theft or fraud.[90] This means that one cannot make post hoc changes to her selections. If one chooses chips, she is stuck with chips. This is very efficient because the self-execution eliminates transaction costs. However, the consumer may grow angry when the chips get stuck and they don't fall all the way down to the doorway where they can be retrieved.

Smart contracts are similarly self–executing. As noted above, this automation makes smart contracts very attractive in terms of efficiency and diminished enforcement costs. Cryptoeconomists, or proponents of smart contracts, therefore argue that smart contracts beneficially replace contract law, based on the belief that circumventing the legal system is desirable.[91] They claim that smart contracts increase efficiency, lower transaction costs, and largely eliminate the need for lawyers or courts.[92]

However, scholars such as Verstraete argue that smart contracts are "normatively illegitimate."[93] Their principle criticism of smart contracts is that they are founded on "classical legal thought" that aims to eliminate state involvement in private law.[94] Cryptoeconomists, like classical legal thinkers, essentially applaud smart contracts' circumvention of government control.[95] In contrast, Legal Realists argue that the state has a necessary role in regulating the fairness of the private marketplace, including contracts.[96] They worry that powerful parties and unscrupulous dealers will hijack smart contracting, and their automatic and extra-legal nature will leave victims with no recourse.[97]

An example of automatic enforcement gone awry is the 2016 DAO (or decentralized autonomous organization) debacle. Blockchain enthusiasts created the 2016 DAO using blockchain and a web of smart contracts as the foundation for what was to be a tamper-proof extra-legal company on the blockchain.[98] The 2016 DAO was a literal autonomous organization that would continue without the need

86. *Id.* at 14.
87. *Id.*
88. Verstraete, *supra* note 61, at 13.
89. *Id.*
90. *Id.*
91. *Id.* Three justifications underlie this belief: 1) smart contracts can be a tool favoring consumers to overcome doctrines that now give an advantage to firms; 2) the transaction costs of forming and enforcing smart contracts is lower than traditional contracts; and 3) smart contracts allow individuals to set the terms of their agreement without state interference. *Id.* at 5-20.
92. *Id.* at 7-8.
93. Verstraete, *supra* note 61, at 3.
94. *Id.* at 19.
95. *Id.* at 23.
96. *Id.* at 20.
97. *Id.*
98. Rodrigues, *supra* note 73, at 12.

for code changes once it began its operations.[99] A flaw in the DAO design, however, allowed an individual to withdraw $50 million from the DAO without any real "breach" or fraud. Moreover, the DAO's self-enforcing code and lack of applicable legal rules eliminated means for reversal or traditional remedies.[100] The only recourse was to completely terminate the DAO and admit defeat.[101]

Some also raise the "oracle problem" as a hindrance for fair smart contracting. This refers to the lack of a reliable and secure delivery mechanism that exchanges real time information with blockchain data systems.[102] Currently, there is no clearly secure delivery of information among systems.[103] For example, most existing oracles are run on centralized or single source services which have the same security issues as most traditional data systems that can be "hacked" centrally.[104]

Nonetheless, some companies are working to address this issue. For example, ChainLink is working on fixing this problem by combining its software with a hardware system called Town Crier. ChainLink is a group that connects smart contracts with off-chain resources by selling usage of data feeds, APIs, and other payment capabilities to smart contracts on a decentralized network.[105] Town Crier uses a process that cannot make system calls but can take in data from outside a protected address, to protect the data connection from outside attacks and keep the information confidential using cryptography.[106] Accordingly, this is just one example of how smart contracts problems are being addressed with technology.

Despite these advances, smart contracts remain in a cloud of legal and technological uncertainty. Although smart contracts provide efficiencies and cost-savings, they create risks related to automation and limited remedies. The questions therefore focus on likely remedies and means for smart contract dispute resolution.

IV. BRINGING ONLINE DISPUTE RESOLUTION INTO SMART CONTRACTS

Developers and entrepreneurs are moving quickly to create solutions for resolving smart contract disputes. They realize that these disputes demand non-judicial remedy systems that are cross-jurisdictional, extra-legal, and efficient. Accordingly, start-up companies are creating online dispute resolution ("ODR") systems in the blockchain. The primary ODR models to date have been online arbitration, crowd-sourced dispute resolution, and AI-powered resolutions. Developments in each of those areas are discussed below.

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99. *Id.* at 29.
100. *Id.* at 33.
101. *Id.* at 36. Of course, the DAO could be resurrected with new coding using a corporate structure to shield liability, but the fact remains that coding is king in blockchain–but there must be means for resolving disputes along the way without dissolving the smart contract at the core.
102. Mike Orcutt, *Blockchain Smart Contracts are Finally Good for Something in the Real World*, MIT TECH. REV. (Nov 19, 2018), https://www.technologyreview.com/s/612443/blockchain-smart-contracts-can-finally-have-a-real-world-impact/.
103. *Id.*
104. Steve Ellis, Ari Juels, & Sergey Nazarov, *ChainLink: A Decentralized Oracle Network*, CHAIN LINK (Sept. 4, 2017), https://link.smartcontract.com/whitepaper.
105. *Id.* at 3.
106. *Id.* at 6; Fan Zhang et al., *Town Crier: An Authenticated Data Feed for Smart Contracts*, CORNELL U., https://eprint.iacr.org/2016/168.pdf (last visited Nov 29, 2018).

A. Arbitration

Arbitration "took its rise in the very infancy of Society" as a private and self-contained process, outside of the courts.[107] Communities created arbitration systems designed to quickly and efficiently determine disputes in accordance with local norms and accepted equitable principles.[108] These self-contained arbitration systems served community needs for efficient, economical, equitable and private proceedings.[109] By the early twentieth century, nearly every trade or profession had developed its own machinery for arbitration.[110] Indeed, the New York Chamber of Commerce arbitration panels were independent from the judiciary and continued to resolve disputes between American and British merchants during and after the American Revolution.[111] Given this history of resorting to extra-legal resolutions, it is no surprise that developers have turned to online arbitration for resolving blockchain disputes.

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107. JULIUS HENRY COHEN, COMMERCIAL ARBITRATION AND THE LAW 25 (1918) (quoting JOHN MONTGOMERIE BELL, TREATISE ON THE LAW OF ARBITRATION IN SCOTLAND 1 (2d ed. 1877)).

108. *Id.* at 22-27 (emphasizing special utility of arbitration despite the development of a reputable judicial system in mercantile cases in which arbitrator expertise in technical matters is essential). *See also* James A.R. Nafziger, *Arbitration of Rights and Obligations in the International Sports Arena*, 35 VAL. U. L. REV. 357 (2001) (demonstrating communal concepts of arbitrations based on equity, norms and standards in modern international sports arbitrations); Earl S. Wolaver, *The Historical Background of Commercial Arbitration*, 83 U. PA. L. REV. 132, 144 (1934) (quoting MALYNES, LEX MERCATORIA 303 (1622)).

109. "Of all mankind's adventure in search of peace and justice, arbitration is among the earliest. Long before law was established, or courts were organized, or judges had formulated principles of law, men had resorted to arbitration for the resolving of discord, the adjustment of differences, and the settlement of disputes." FRANCES A. KELLOR, AMERICAN ARBITRATION: ITS HISTORY, FUNCTIONS AND ACHIEVEMENTS 3 (1948). *See also* Paul L. Sayre, *Development of Commercial Arbitration Law*, 37 YALE L. J. 595, 597 (1928); Margit Mantica, *Arbitration in Ancient Egypt*, 12 ARB. J. 155, 155-59 (1957) (noting scarcity of records of early arbitrations because arbitrations generally involved purely private disputes that had little public significance); WILL DURANT, THE STORY OF CIVILIZATION VOLUME 1: OUR ORIENTAL HERITAGE 645-47, 795-97 (1954) (describing arbitration systems in early Chinese civilization that provided means for "a wholesome compromise" and means for the people to end "minor" disputes in accordance with face-saving compromise).

110. Harry Baum & Leon Pressman, *The Enforcement of Commercial Arbitration Agreements in the Federal Courts*, 8 N.Y.U. L.Q. REV. 238, 247 (1930) (reporting that the following trade associations had active arbitration facilities: Automotive Industry, Bottlers Association, Clothing and Dry Goods, Construction Industries, Cotton and By-Products, Financial Organizations, Food Industries, Fuel, Heat, Light and Power, Fur, Grain, Hay and Seed, Hardware, Import and Export, Jewelers, Leather Hides and Skins, Lumber and Allied Industries, Manufacturers, Medical, Motion Pictures, Music, Paint, Oil and Varnish, Paper and Pulp, Printing and Engraving, Real Estate, Rubber, Silk, Theatre, Transportation, Warehousing, Wool. Professional communities with arbitration mechanisms included: Dental, Rotary, International, Legal Aid, Civil Engineers, American Institute of Accountants).

111. William Catron Jones, *Three Centuries of Commercial Arbitration in New York: A Brief Survey*, 1956 WASH. U. L. REV. 193, 207 (1956). Chamber arbitrations continued during the British occupation in 1779, after the Chamber's need for arbitration prompted a special meeting that produced a letter to the British Commander requesting arbitrations to resolve mercantile disputes. *Id.* at 208. The Commander acquiesced in the request, and arbitration served as the only means for resolution of civil disputes during the British occupation. Arbitration continued to thrive after the revolution in both England and North America. *Id.* at 209-12.

1. Sagewise

Sagewise is a Los Angeles-based start-up aiming to provide dispute resolution infrastructure for smart contract disputes.[112] Notably, the Sagewise platform does not itself provide arbitration or have ODR capability. Instead, Sagewise's technology is integrated into a smart contract via a coded clause in which users pre-set certain parameters, such as when and how long the smart contract execution should be delayed and who will resolve any disputes that may arise.[113] Accordingly, this clause allows a party to freeze contract execution and activate the Sagewise "Dispute Resolution Mode" if a dispute develops.[114] The party can then choose various dispute resolution processes for solving smart contract problems and enforcing online judgments.[115]

In this way, Sagewise claims to be "dispute resolution agnostic."[116] In other words, although Sagewise appears to be leaning in the direction of incorporating online arbitration as the final, and definitive, step for resolving disputes, it also allows parties to incorporate online mediation or other resolution processes into the contracts.[117]

The process begins with what Sagewise calls its "contract canary," which is a notification and monitoring system like Google Alerts, for smart contracts. Through this system, execution of the smart contract is delayed for a short period of time while parties are notified of imminent execution. If the smart contract appears to be executing in an unintended fashion, users can "freeze" execution of the smart contract before it is too late, and take the time to resolve the issue. At that point, parties may use negotiation and other means for seeking mutual resolution. If that does not end the dispute, parties then move on to resolve their dispute with their pre–appointed dispute resolution provider, who was selected from a marketplace of providers during initial smart contract set–up. Users may also return to the marketplace to the extent the third-party provider is unable to resolve the dispute—i.e., if the provider has a conflict of interest or is no longer in business. Providers on the marketplace may range from resolution by an automated bot to a traditional panel of arbitration judges.[118]

Sagewise aims to distinguish itself by also being blockchain and distributed ledger agnostic. Currently, the company intends to support Ethereum and Hedera

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112. *Smart Contract Checker, Sagewise, Links with Hedera Hashgraph*, ARTIFICIAL LAW. (June 8, 2018), https://www.artificiallawyer.com/2018/06/08/smart-contract-checker-sagewise-links-with-hedera-hashgraph/ (noting that variability in coding means that self-executing contracts may veer from their agreed-upon course either because they were flawed to begin with or were subverted during operation).

113. *Id.*

114. *Id.*

115. *Id.*

116. *Sagewise Puts Focus on Blockchain Immutability and Dispute Resolution*, THE DAILY HODL (May 11, 2018), https://dailyhodl.com/2018/05/11/sagewise-puts-focus-on-blockchain-immutability-and-dispute-resolution/.

117. *Id.* (noting that the company believes that humans are superior to robots in "sorting information, parallel processing and analyzing context").

118. *Sagewise's Vision to Build the Safety Net for Smart Contracts*, SAGEWISE (May 8, 2018), https://www.sagewise.io/tag/sdk. Sagewise also provides collection tools, and permits use of a crowd jury, although it is not crowdsourced per se. At the time of writing this article, Sagewise is still in early stages of filing patents and getting investors.

Hashgraph, and helps chair the Dispute Resolution and Arbitration Working Group for the EOS Alliance.[119]

2. OpenBazaar Dispute Resolution

OpenBazaar is a market platform for the sale of goods and services using bitcoin, and requiring online arbitration to ensure that exchanges between parties are conducted with minimal risk.[120] It states that it uses an open marketplace for arbitration to "facilitate a polycentric merchant law to accommodate the requirements and preferences of each individual."[121] In particular, OpenBaazar allows users to decide at the start if they wish to have an anonymous third party, called a notary, verify the contract, the funds, and find out if the parties believe that each has fulfilled its obligations.[122] Users opting for the notary pay a fee and deposit bitcoin into an escrow.[123] The notary will then verify transactions and release funds as directed.[124]

If either party is unsatisfied, the notary becomes an arbitrator, and determines the dispute based on evidence presented.[125] These transactions on OpenBazaar are not entirely self-executing, and extra layers of verification may impede the platform's efficiency.[126] However, OpenBazaar claims to choose qualified professionals in order to produce quality outcomes.[127] It also boasts of transparency regarding its arbitration market. It states: "These agents will list the duties they perform, the estimated response-time for their services, and fees. In addition to these, arbitration service providers can also display a list precedents that they themselves have established or other arbiters have published in order to give an expectation of service process and quality." [stet.][128] Accordingly, OpenBazaar seems to set up a fairly traditional arbitration mechanism.

B. Crowdsourcing

In contrast to simple online arbitration, crowdsourced dispute resolution uses what could be seen as "mob justice" by allowing anonymous users to vote on "winners" on the blockchain. Crowdsourced dispute resolution is not new. For example, more than twenty years ago iCourthouse pioneered the notion of online crowdsourcing in civil cases[129] and ten years ago eBay India's Community Court leveraged the best judgement of other eBay users to decide whether a contested eBay review should be deleted.[130] The following examples of crowdsourced dispute resolution

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119. EOS ALL., https://eosalliance.io/ (last visited Mar. 6, 2018).
120. *Dispute Resolution in OpenBazaar*, GITHUB GIST, https://gist.github.com/drwasho/405d51bd1b1a32e38145 (last visited Oct. 10, 2018).
121. *Id.*
122. Kaal & Calcaterra, *supra* note 68, at 50-52.
123. *Id.*
124. *Id.*
125. *Id.*
126. *Id.* at 53-55.
127. *Dispute Resolution in OpenBazaar*, *supra* note 122.
128. *Id.*
129. ICOURTHOUSE (Mar. 6, 2019), http://www.icourthouse.com/main.taf.
130. Colin Rule & Chittu Nagarajan, *Crowdsourcing Dispute Resolution Over Mobile Devices*, *in* MOBILE TECHNOLOGIES FOR CONFLICT MANAGEMENT: ONLINE DISPUTE RESOLUTION, GOVERNANCE,

on the blockchain go even further with this model, however, by tokenizing the process. In other words, jurors vote with funds (generally cryptocurrency) which they lose if they are on the losing side. In contrast, jurors on the winning side generally gain some reward. This creates a market for accurate crowdsourced resolution outcomes. The nuances of each system differ, as do the approaches utilized to address fraud and promote gamification.

1. Kleros

Kleros is a crowdsourced online arbitration "court" built on Ethereum for resolution of smart contract disputes.[131] Applications for Kleros include managing disputes over escrow accounts and insurance payments, and resolving claims of abuse on social networks. Kleros's quest is to be "[a] fast, inexpensive, transparent, reliable and decentralized" ODR system built on game theory, and discovering a "Schelling point" for resolving disputes.[132] This builds on Thomas Schelling's theory that in the absence of communication and trust, people will nonetheless choose "Focal Points" to reach consensus.[133]

Specifically, Kleros enlists random "jurors" from around the world based on the number of "Pinakion" tokens (cryptocurrency) they deposit to show their availability and interest in resolving a given dispute.[134] Parties to a dispute present their cases to the jurors, and jurors secretly make a "commitment" to vote for a particular party—with the proviso that they cannot change or reveal their votes before the voting is closed.[135] Jurors are penalized for communicating with each other, and must "justify" their votes so that the parties can later understand their decisions.[136] After the vote is closed, the jurors reveal their votes and the resolution with the most juror support wins.[137]

Jurors benefit from "winning" resolutions by taking the tokens of jurors who sided with the "losing" party.[138] Additionally, jurors are paid from the arbitration fee the parties pay to use the Kleros court.[139] These fees rise as parties appeal jury decisions.[140] However, it is unclear that fees are paid with the Pinakion tokens. Instead, Kleros requires jurors to use Pinakion as "work tokens" designated for indicating interest in being selected for jury duty and voting, in order to discourage

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PARTICIPATION 93, 93-100 (Marta Poblet ed., 2011). When a seller receives a bad review on eBay that she doesn't believe she deserves, she may submit a claim to the Community Court. At that point, she and the buyer submit evidence, such as photos or explanatory text, through an online portal. Twenty-one eBay jurors are randomly selected from a pool of applicants, who are eBay users that have met eligibility requirements. These jurors all submit impartial votes, and whichever side gets more than half of the votes will win the case.

131. Clement Lesaege & Federico Ast, *Kleros* 1 (Nov. 2018), https://kleros.io/assets/whitepaper.pdf.

132. *Id.*

133. *Id.* at 2. According to Schelling, the focal points reflect each person's expectation of what another person expects him to do. In this game theoretic model, even people who do not trust one another will decide to work together and be truthful because it is at this focal point that parties reach "win-win" results.

134. *Id.* at 4.

135. *Id.* at 7.

136. Lesaege & Ast, *supra* note 133, at 7.

137. *Id.*

138. *Id.* at 8. Under its proposed governance, Kleros will create subcourts and update and adapt the program as necessary.

139. *Id.* at 7.

140. *Id.* at 8.

fraud.[141] Kleros theorizes that staking Pinakions to show interest will prevent attackers who would have to buy 51% of the staked tokens in order to "buy" the jury.[142] Furthermore, as more jurors buy tokens, these tokens will become scarce and more expensive, making it even more difficult to amass the power necessary to take over the system.[143] In addition, Kleros can fork the system if necessary because it controls the tokens.[144]

Kleros also launched a study as a means for testing its system.[145] The study asked voters to evaluate pictures featuring cats and/or dogs, and to vote "dog" or "not dog."[146] After tabulating the votes, the researchers found that 70% of the cases resolved in favor of the plaintiff, and in the majority of those cases, by a unanimous vote.[147] The study also looked at the effect of bribes on the voting outcomes, and determined that if a case proceeded to appeal, the honest voter received a substantial payout.[148] This disincentives bribery. In other words, one would have to buy and stake a great deal of tokens in order to even "bet" on overtaking the honest voters.[149] Regardless, these jurors need not have any substantive knowledge related to the cases. They simply need to stake tokens to show interest.

2. Aragon

Aragon Network also uses crowdsourced ODR. At its core, however, Aragon is a blockchain application that allows users to enforce smart contracts and develop DAOs, mentioned above, which are autonomous organizations that can own property and take action through digitized processes.[150] Aragon aims to create flexible human-readable agreements that parties can enforce via Ethereum by depositing collateral in the form of digital assets, namely the Aragon Network Token ("ANT").[151] Furthermore, users of the network agree to Aragon's online arbitration mechanism for resolving disputes, which uses crowdsourcing similar to Kleros.[152] However, Aragon argues that its process is unique because it "separates juror reputation from collateral and introduces a novel escalation metagame that makes the

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141. William George, *Why Kleros Needs a Native Token?*, MEDIUM (June 7, 2018), https://medium.com/kleros/why-kleros-needs-a-native-token-5c6c6e39cdfe.
142. *Id.*
143. *Id.*
144. *Id. See also* Clement Lesaege & William George, *Kleros and Augur—Keeping People Honest on the Blockchain Through Game Theory*, MEDIUM (Feb. 11, 2018), https://medium.com/kleros/kleros-and-augur-keeping-people-honest-on-ethereum-through-game-theory-56210457649c (explaining why the Kleros system is more just than over crowdsourced dispute resolution in the founders' estimation).
145. E-mail from William George, Cryptoeconomist with Kleros, to Amy J. Schmitz, Professor at University of Missouri (Oct. 9, 2018) (on file with author).
146. *Observations from Doge Pilot* 1 (Oct. 15, 2018), dogeobservations.pdf (on file with author).
147. *Id.*
148. *Id.* at 5.
149. *Id.* The Kleros system thus assumes that the appeal process is an additional check on the system, as it is too costly to overcome the honest voters.
150. Bennett Garner, *What is Aragon (ANT)?*, COIN CENT. (Nov. 5, 2018), https://coincentral.com/aragon-ant-beginners-guide/.
151. Aragon Network, GITHUB, https://github.com/aragon/whitepaper (last visited Oct. 10, 2018) (noting that ANT "utilizes a stability reserve to optimize for usage in governance of the network and as a reserve currency for collateralizing agreements.").
152. *Id.*

schelling point for jurors more resistant to bribery attacks while minimizing reliance on victims paying appeal fees."[153]

More particularly, Aragon allows a user to bring a claim by posting a bond (typically ANT) with a brief of the complaint.[154] Five anonymous jurors are selected from among the users and also post bonds (again, using ANT cryptocurrency).[155] Jurors who side with the winning party receive a monetary reward, while those who are not in the majority do not get their bonds back.[156] A party can appeal by posting an even larger bond as the complaint moves up the process, and finally may reach the Aragon "supreme court" judges—these judges are those with the highest success rates on the network.[157]

Aragon's ultimate goal is to become fully autonomous through connected smart contracts and decentralized dispute resolution.[158] Proponents of Aragon argue that this voting and decentralization will prevent most disputes. Furthermore, the decentralized arbitration process noted above will render government unnecessary in the operation of DAOs.[159] Despite the many potential benefits of Aragon, however, even its supporters have questioned whether its arbitration system is truly unbiased and whether it effectively prevents "gaming" of the system by repeat players.[160] In addition, it is unclear whether robust mechanisms are in place to fix software bugs and deter attackers from exploiting those bugs.[161]

3. Jur.io

Like Kleros, Jur promises fast and fair online dispute resolution using crowdsourcing and game theory. Jur operates much like Kleros in that disputing parties offer resolutions along with a number of tokens to "stake" their proposals.[162] Voters decide which proposal to uphold and a decision is rendered at the end of twenty-four hours, or longer if parties so choose.[163] Other token holders vote for one of the options, and the option that receives the majority of the votes wins. Like Kleros, voters who vote against the majority are penalized by losing tokens. The theory is that this will encourage fair voting, while discouraging dishonesty. Jur advertises itself as a free service to users for creating and securing smart contracts, and resolving contract disputes within 24 hours.[164]

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153. *Id.*
154. Kaal & Calcaterra, *supra* note 68, at 49-50.
155. *Id.*
156. *Id.* at 50.
157. *Id.* Garner, *supra* note 152. "Courts are organized into a hierarchical structure, with more specific and specialized contexts at the bottom and more broad and general contexts at the top. As agents participate as jurors in a court they earn reputation in the court as well as any courts directly above in the hierarchical structure. At the very top of this structure is a supreme court that enforces and encodes the community values of the Aragon Network." GITHUB, *supra* note 153.
158. Luis Cuende & Jorge Izquierdo, *Aragon Network: A Decentralized Infrastructure for Value Exchange*, ARAGON WIKI (Apr. 20, 2017), https://www.chainwhy.com/upload/default/20180705/49f3850f2702ec6be0f57780b22feab2.pdf.
159. *Id.*
160. *Id.*
161. *Id.*
162. *Id.*
163. *Id.*
164. Introductory Video, JUR.IO, https://jur.io/ (last visited Oct. 10, 2018).

Accordingly, Jur's key promise seems to be speed and security in smart contracting.[165] Jur's dispute resolution system can be open or closed, allowing random token-holders to vote or only particular voters who are vetted.[166] Jur claims to be unique in offering users the opportunity to create their own hub (a "specialized oracle") which operates on special rules that users in particular industries will create to fit their contexts.[167] Additionally, the Jur platform provides tools for signing contracts, and creating and reselling contract templates.[168]

Nonetheless, Jur acknowledges that two parties can use its platform to create an illegal contract or contract that is substantially unfair to one party.[169] It uses the same economic incentive system that guides its oracles in order to reject unethical disputes.[170] Like other voters, those who prevail in the "reject" decision earn tokens for being on the winning side.[171]

C. "Bot" Resolutions

As noted above, AI is growing in acceptance. In fact, it is even entering the courtroom and disrupting the law.[172] AI is helping judges set bail, and lawyers do legal research.[173] Ideally, algorithms may assist fair and efficient dispute resolution for smart contracts by providing predictive analysis and quickly suggesting resolutions that may be subsequently entered into the blockchain. Furthermore, these algorithms will likely become "smarter" with the infusion of more data.

Nonetheless, use of AI can be problematic, and can even potentially worsen the risk of bias in determinations.[174] First, there is evidence that people tend to defer to statistical data instead of using the data to help form an independent judgment.[175] Accordingly, use of AI to provide "bot" predictions to judges or arbitrators could essentially mean bots actually decide cases, when the determining parties "rubber stamp" these predictions. This is made worse when AI algorithms rely on data that reflects human prejudice.[176] This is the "garbage in, garbage out" problem that occurs when AI "learns" from biased information. Some also worry that use of AI for "bot" resolutions may take on a life of its own, rendering it harder to identify the factors leading to a particular outcome as machine learning progresses.[177]

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165. J*UR*, White Paper, JUR.IO, https://jur.io/content/uploads/2018/07/JUR-WhitePaper-v0.3-eng.pdf (last updated July 2, 2018).
166. *Id.* at 15.
167. *Id.*
168. *Id.* at 17.
169. *Id.* at 46.
170. *Id.*
171. *JUR*, *supra* note 167, at 46.
172. Matt O'Brien & Dake Kang, *AI in the Court: When Algorithms Rule on Jail Time*, PHYS.ORG (Jan. 31, 2018), https://phys.org/news/2018-01-ai-court-algorithms.html.
173. *Artificial Intelligence and Lights-Out Court Document Processing*, COMPUTING SYS. INNOVATIONS (Nov. 6, 2017), http://csisoft.com/artificial-intelligence-and-lights-out-court-document-processing; *see* Hal Marcus, *Court Supports eDiscovery Machine Learning, Addresses AI Transparency*, OPENTEXT (Dec. 12, 2017), https://blogs.opentext.com/court-supports-ediscovery-machine-learning-addresses-ai-transparency/.
174. Stephen Buranyi, *Rise of the Racist Robots—How AI is Learning All Our Worst Impulses*, THE GUARDIAN (Aug. 8, 2017), https://www.theguardian.com/inequality/2017/aug/08/rise-of-the-racist-robots-how-ai-is-learning-all-our-worst-impulses.
175. *Id.*
176. *Id.*
177. *Id.*

Of course, the day may come when predictive analytics and AI are capable of rendering quick and fair resolutions in all smart contract cases. Furthermore, AI may have a place in providing predictions of how best to resolve disputes, which the parties may consider in crafting their own resolutions. Nonetheless, AI is currently not sufficiently advanced to provide "bot" resolutions with no human input for most smart contract disputes.

V. ENVISIONING A ROBUST ODR SYSTEM FOR SMART CONTRACTS

It has become common in many traditional contracts to include "dispute resolution clauses" or "arbitration clauses" that specify the redress process that will be utilized should a disagreement arise regarding the contract. More than half of the employment agreements drafted in the U.S. contain such clauses[178] and hundreds of millions of consumer contracts contain such clauses as well.[179] If you go to an office supply store and buy a book of useful business contract templates, odds are they will have embedded arbitration clauses (usually specifying the American Arbitration Association). There is a reason for this: specifying dispute resolution procedures in contracts can streamline resolutions and minimize the risk of resource-consuming litigation. Any General Counsel worth his or her salt knows this, and will guide executives to be proactive in inserting such clauses.

The wisdom of this advice is equally relevant in smart contracts. When agreements are made between individuals or organizations, problems will inevitably arise, no matter how much careful planning is present at the creation of the agreement. But because smart contracts operate so differently than traditional contracts, we need to envision resolution systems that are similarly different in their operation.

As we have described, ODR is a good fit with smart contracts because it works the way the internet works. Redress processes can be built directly into the agreements themselves, independent of legal jurisdiction. If technology is used to craft the smart contract (maybe within a marketplace or a legal services website) then a clause can be inserted at creation specifying the use of an ODR system within that software platform should any dispute eventually arise. For example, if a party uses RocketLawyer to draft a reseller agreement as a smart contract, the contract can specify the use of the RocketLawyer Resolution Center for dealing with any disputes in the performance of the contract.

In smart contracts, the ODR clause can operate in the same manner as the *Andon System* in the field of quality control. The Andon System is an element of the Jidoka quality-control method pioneered in Japan by Toyota.[180] It says that any worker on a production line has the authority to push a button to stop the line if they

178. Alexander J.S. Colvin, *The Growing Use of Mandatory Arbitration*, ECON. POL'Y INST. (Apr. 6, 2018), https://www.epi.org/publication/the-growing-use-of-mandatory-arbitration-access-to-the-courts-is-now-barred-for-more-than-60-million-american-workers/.

179. *CFPB Issues Rule to Ban Companies from Using Arbitration Clauses to Deny Groups of People Their Day in Court*, CONSUMER FIN. PROT. BUREAU (July 10, 2017), https://www.consumerfinance.gov/about-us/newsroom/cfpb-issues-rule-ban-companies-using-arbitration-clauses-deny-groups-people-their-day-court/.

180. *"Andon"—The Definition*, SAGECLARITY, https://sageclarity.com/solutions/andon-system/ (last visited Jan. 17, 2018).

identify a problem.[181] In the smart contract context, an ODR clause coded into the smart contract can enable both parties to push a similar (perhaps virtual) button to stop the execution of the smart contract, triggering the ODR process. The ODR process could then follow in accordance with the parties' previous agreement (perhaps mediation, arbitration, or crowdsourced resolutions). Depending on the outcome achieved, the smart contract may then resume operation along the previous lines, or perhaps it will be left inactive and replaced by a new agreement that will also be coded into a smart contract and put on the blockchain.

In this way, the ODR clause in the smart contract can operate like an escrow arrangement. Instead of only two parties to the agreement, the inclusion of the ODR clause creates a role for a third party, the dispute resolution service provider. If either of the first two parties presses the Andon button, the role of the third party is automatically invoked. In an escrow arrangement, a trusted third party holds payment until the payor indicates that it is satisfied, at which point the payment is released to the payee. In a smart contract ODR clause, either party can invoke the ODR process at any time. This freezes the execution of the smart contract and gives the neutral third party the power to determine the appropriate path forward from that point.

Nonetheless, this process should not allow a party to use the type of delay and hindrance tactics that currently plague litigation. In other words, parties should not thwart efficiency of smart contracts with continual and/or frivolous "freezes." Strict time limits must be embedded in the ODR process, and penalties applied against those who misuse the ability to freeze smart contract execution. There could also be limits on when parties are able to use a freeze. For example, the smart contract code could include examples of when a freeze is proper—such as where there is an indication that something is awry with the performance or code in the blockchain.

At the same time, another way to ensure enforcement is to require the parties to maintain a deposit balance in escrow for the term of the contract. For example, payors could put the required funds into a neutrally administered account to ensure that a) they would be able to reclaim the funds should they not be satisfied with the performance of the payee, and b) payees would be assured that the funds were available and the payors would not default on their debts. The escrowed funds could also be released in stages upon the achievement of pre-determined milestones. This also obviates the need for any collection enforcement, which consumes great amounts of time and resources in traditional contracts.[182]

The ideas and providers noted above for resolving smart contracts demonstrate the range of possibilities and opportunities for creativity. Any of the methods described could work as the redress process for smart contract disputes. Some parties may opt for human-driven resolution systems, such as assisted negotiation or fast arbitrations by experts in the field. For example, there would be panels of neutrals for the various types of smart contract disputes that are likely to arise, such as a panel of neutrals who understand computer coding, who could offer solutions to coding disputes. Additionally, other ODR panels would include shipping experts

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181. Gwynn Guilford, *GM's Decline Truly Began with its Quest to Turn People into Machines*, QUARTZ (Dec. 30, 2018), https://qz.com/1510405/gms-layoffs-can-be-traced-to-its-quest-to-turn-people-into-machines/. The Andon cord is "a sort of emergency brake that would, once pulled, immediately stop the assembly line." *Id.*

182. We understand that these are novel ideas, and do not yet exist. However, part of blockchain's allure is that it allows for reinvention to further innovations.

who can address supply chain issues. There may also be a need for legal experts who can quickly respond to contract defenses, such as unconscionability, that are certain to arise. Other parties may opt for crowdsourced systems, as described above, or machine–learning/AI powered systems that can deliver quicker decisions in lower value, less complex cases.

In fact, having a range of options ensures that each individual smart contract can be best matched with an ODR process that the parties feel is appropriate. As we say in the face-to-face dispute resolution field, it is important to "fit the forum to the fuss."[183] Having variety in ODR processes and procedures will ensure every type of smart contract can be matched with an appropriate redress design. In fact, as smart contracts and blockchain evolve, innovation will continue within the ODR provider community, ensuring that ODR options remain innovative, modern, relevant, and easy to use.

One body that has thought through these designs in a detailed fashion is EOS. EOS.IO is a blockchain protocol powered by the native cryptocurrency, EOS. EOS.IO operates as a smart contract platform and decentralized operating system intended for high volume commercial transactions. The system is designed to eliminate transaction fees and conduct millions of transactions per second.[184] The initial EOS whitepaper envisioned that fast and fair resolutions would be essential to promote trust and stability within the EOS framework. This created a dispute resolution body tasked with resolving dispute claims upon network launch.

EOS' Standards for Dispute Resolution are intended to serve as fundamental ethical guidelines for dispute resolution providers and to transparently lay out the resolution process for any disputes that arise. The Standards are enforced by the EOS governing bodies, and if any ODR provider is determined to violate the standards, they may be subject to suspension, fines, or ejection from the provider marketplace. The Standards require ODR providers to be impartial, free from conflicts of interest, competent, fair, transparent, and committed to preserving the confidentiality of the parties. These Standards preserve enough flexibility for ODR providers to offer a variety of innovative approaches to redress, while ensuring a level of baseline quality and trust that will attract and retain users of the EOS platform. It is likely that their foresight in creating these Standards will lead other blockchain and smart contract systems to follow suit.

VI. CONCLUSION

Smart contracts and blockchain are growing fast, but for now they represent only a tiny portion of the massive $450 billion global legal marketplace. It remains to be seen how long it will take them to (or in fact, if they will ever) reach the tipping point of widespread adoption. Advocates of innovation often have projections around adoption rates that are clouded by self-interest. If the growth of ODR in e-commerce is any indication, it may take ten to fifteen years before smart contracts are commonly utilized in everyday legal agreements.

But one development that will be essential to widespread adoption is fast and fair redress. Early adopters may be willing to risk some growing pains in making

183. FRANK E. A. SANDER, FITTING THE FORUM TO THE FUSS: A USER-FRIENDLY GUIDE TO SELECTING AN ADR PROCEDURE (1994).

184. *EOS.IO*, WIKIPEDIA, https://en.wikipedia.org/wiki/EOS.IO (last visited Jan. 9, 2019).

the decision to use smart contracts for their agreements. However, the vast majority of contract signatories will wait until smart contracts are stable, proven, tested, and trustworthy. Building effective ODR into smart contracts will be a crucial step in achieving that level of certainty.

Of course, there will be horror stories that emerge along the way. Just as cryptocurrencies had to endure fiascos like Silk Road,[185] Mt. Gox,[186] and the 2018 "coinpocalypse"[187] on their way to acceptance, smart contracts will raise their own stories of gloom and doom. There will be abusive smart contracts, and kangaroo-court processes for resolving disputes. However, the efficiency and safety of smart contracts will become increasingly sophisticated, and intelligent ODR providers will emerge to resolve related disputes. Ethical standards for ODR promoted by organizations like the EOS Standards for Dispute Resolution and the International Council for Online Dispute Resolution will go a long way toward building parties' confidence in ODR.[188] Additionally, innovation and competition among startups designing and providing ODR systems will promote best practices. Accordingly, unscrupulous actors will remain exceptions that fuel learning opportunities on the path to more trustworthy and ethical smart contract redress systems.

185. Steven Buchko, *A Brief History of the Silk Road: Drugs, (Non)Violence, and Video Games*, COIN CENT. (July 29, 2018), https://coincentral.com/silk-road-history/.

186. Darryn Pollock, *The Mess that was Mt. Gox: Four Years On*, COIN TELEGRAPH (Mar. 9, 2018), https://cointelegraph.com/news/the-mess-that-was-mt-gox-four-years-on.

187. Billy Bambrough, *Update: Bitcoin Falls Further, Hitting Ripple (XRP) and Ethereum—And Tron Turns Red*, FORBES (Jan. 10, 2019), https://www.forbes.com/sites/billybambrough/2019/01/10/bitcoin-falls-suddenly-dragging-ripple-xrp-and-ethereum-down-but-tron-leaps-higher/#53dbaf0f27df. *See also And So the CoinPocalypse Begins*, REDDIT (Nov. 22, 2018), https://www.reddit.com/r/CryptoCurrency/comments/9z9esj/and_so_the_coinpocalypse_begins/; *The Coinpocalypse*, INVESTING IN CHINESE STOCKS (Aug. 13, 2018), http://investinginchinesestocks.blogspot.com/2018/08/the-coinpocalypse.html.

188. INT'L COUNCIL FOR ONLINE DISP. RESOL., icodr.org (last visited Mar. 7, 2019).