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# Smart Contracts: Legal Agreements for the Blockchain

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# SMART CONTRACTS: LEGAL AGREEMENTS FOR THE BLOCKCHAIN

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## I. INTRODUCTION

Bitcoin, blockchain, and smart contracts—these are terms that one hears with increasing frequency in the banking and financial press. The blockchain technology underlying the digital currency Bitcoin is widely touted to solve a number of seemingly intractable and longstanding problems, such as reducing transaction costs, speeding up processing time, expanding financial services, and empowering consumers.[1] Smart contracts are envisioned as potentially eliminating the need for extrinsic enforcement of legal agreements, thereby making business transactions cheaper, quicker, and more efficient.[2] The World

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1. DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN IS CHANGING MONEY, BUSINESS, AND THE WORLD 17–20 (2016). Bitcoin is a peer-to-peer electronic cash system using a digital or cryptocurrency, which is not created or controlled by a governmental entity. *Id*. at 5. Bitcoin was developed during the 2008 global financial crisis. *Id*. Its popularity has tended to rise with concerns about government control and manipulation of the monetary supply. *Id.* For example, when India's government removed 86% of the nation's money supply from circulation on November 8, 2016, without notice, and Venezuela announced it was eliminating the country's largest circulating bank note. *See, e.g.*, *The Dire Consequences of India's Demonetisation Initiative*, THE ECONOMIST (Dec. 3, 2016), http://www.economist.com/news/finance-and-economics/21711035-withdrawing-86-value-cash-circulation-india-was-bad-idea-badly?fsrc=scn/tw/te/bl/ed/; Anatoly Kurmanaev & Kejal Vyas, *Currency Ban Racks Venezuelans*, WALL ST. J., Dec. 14, 2016, at A8. Bitcoin prices in late 2016 reached three-year highs. Hudson Lockett, *Bitcoin Price Rises to 2014 High as Chinese Stocks Suffer*, FIN. TIMES (Dec. 12, 2016), https://www.ft.com/content/c27e8345-a763-3761-adb6-9e5f44e4f5f6.

2. *Not-So-Clever Contracts*, THE ECONOMIST (July 30, 2016), http://www.economist.com/news/business/21702758-time-being-least-human-judgment-still-better-bet-cold-hearted. The use of blockchain technology and smart contracts was also cited approvingly in the 2016 Annual Report of the Financial Stability Oversight Council ("FSOC"). FIN. STABILITY OVERSIGHT COUNCIL, 2016 ANNUAL REPORT 127 (2016). FSOC, however, also noted potential risks including operational incidents, collusive fraud, and the

Economic Forum has speculated that smart contracts utilizing blockchain technology could codify financial agreements in a shared platform and guarantee execution.[3] This would significantly reduce the manual effort required to support the execution of financial agreements and thereby accelerate business processes.[4] Other commentators have suggested that if blockchain will allow financial transactions without banks, smart contracts may lead to contracts that no longer need courts to enforce them.[5]

Blockchain and smart contracts have led to many lofty goals and predictions, but how realistic are these aspirations? Not everyone thinks they are realistic, and have suggested that smart contracts are neither smart, nor true contracts.[6] If smart contracts are going to become important business tools, additional legal and regulatory frameworks may be necessary to mitigate any negative impacts and facilitate full achievement of their potential. While there is certainly great promise in these emerging technologies, they have also demonstrated potential technological and legal pitfalls.

This Article is organized as follows: Part II examines the origins of smart contracts and blockchain, or distributed ledger, technology and how they work.[7] Part III explores in greater detail potential uses of this new technology as well as technical limitations or barriers.[8] Part IV describes the legal and regulatory issues associated with greater adoption of smart contracts.[9] Finally, the Conclusion recommends legal changes that should be enacted in order to realize the benefits of this technology sooner while also mitigating against its potential risks.[10]

need for regulatory coordination across borders. *Id.*

3. WORLD ECON. FORUM, THE FUTURE OF FINANCIAL INFRASTRUCTURE: AN AMBITIOUS LOOK AT HOW BLOCKCHAIN CAN RESHAPE FINANCIAL SERVICES 29 (2016).

4. *Id.*

5. *See* Joshua A.T. Fairfield, *Smart Contracts, Bitcoin Bots, and Consumer Protection*, 71 WASH. & LEE L. REV. ONLINE 35, 39 (2014), http://scholarlycommons.law.wlu.edu/wlulr-online/vol71/iss2/3/ ("If financial transactions can be freed of banks as intermediaries, then contracts can be freed of courts as intermediaries.").

6. Daniel Cawrey, *Why Ethereum Needs 'Dumb' Contracts*, COINDESK (June 29, 2016, 6:50 PM), http://www.coindesk.com/ethereum-dao-dumb-smart-contracts/.

7. *See infra* Part II.

8. *See infra* Part III.

9. *See infra* Part IV.

10. *See infra* Part V.

## II. SMART CONTRACTS AND BLOCKCHAIN

Smart contracts are self-executing electronic instructions drafted in computer code.[11] This allows a computer to "read" the contract and, in many cases, effectuate the instruction—hence the "smartness" of the contract.[12] The term was first developed by Nick Szabo in the mid-1990s.[13] Variations of smart contracts, such as transaction processing systems that compute daily payments and receipts for financial institutions, have existed for decades.[14] The concept has taken on new relevancy and possibilities, however, with the advent of Bitcoin and its underlying technology called blockchain.[15] Blockchain technology provides the security and accuracy needed for a platform to be able to more fully utilize smart contracts.[16]

Smart contracts self-execute the stipulations of an agreement when predetermined conditions are triggered.[17] The parties "sign" the smart contract using cryptographic security and deploy it to a distributed ledger, or blockchain.[18] When the conditions in the code are met, the program triggers the required action. For example, once a good or service has been delivered, the smart contract could enforce payment through the distributed ledger. In the event of nonpayment, it could initiate recovery of the good or suspension of the service. This technology has a large and expanding number of potential uses, such as trading in financial instruments, syndicated lending transactions, and securities settlement.[19]

Blockchain is the technology underlying the cryptocurrency, or electronic money, Bitcoin.[20] Bitcoin was launched in 2008 by an

11. SAMUEL BOURQUE & SARA FUNG LING TSUI, *A LAWYER'S INTRODUCTION TO SMART CONTRACTS* 4 (2014).

12. *Id.*

13. TAPSCOTT & TAPSCOTT, *supra* note 1, at 101.

14. Allan I. Mendelowitz & Willi Brammertz, *Smart Contracts Were Around Long Before Cryptocurrency*, AM. BANKER (Nov. 17, 2016).

15. TAPSCOTT & TAPSCOTT, *supra* note 1, at 102.

16. INST. OF INT'L FIN., GETTING SMART: CONTRACTS ON THE BLOCKCHAIN 2 (2016).

17. *Id.*

18. *Id.*

19. *See* WORLD ECON. FORUM, *supra* note 3, at 39–40 (describing the various functions that distributed ledger technology can perform within the financial system, benefits that can be achieved, and conditions and implications of implementation).

20. John Lanchester, *When Bitcoin Grows Up*, LONDON REV. OF BOOKS (Apr. 21, 2016), https://www.lrb.co.uk/v38/n08/john-lanchester/when-bitcoin-grows-up.

unknown person calling himself or herself, Satoshi Nakamoto.[21] While the popularity of Bitcoin as a medium of payment has ebbed and flowed over the years, much of the recent focus, particularly in the banking and financial space, has been on its enabling technology—blockchain.

> Blockchain is a register, or ledger, of all bitcoin transactions that have ever occurred.[22] Each transaction, or block, is authenticated by a network of computers before it is added to the chain of all prior transactions using cryptographic techniques and a large amount of computing power.[23] The blockchain, or distributed ledger, is open and transparent for all to see, although addresses shown do not necessarily indicate the person to whom the address is associated, as the system is also designed to be anonymous.[24] The record is intended to be permanent and immutable.[25] The combination of attributes in this technology—secure, permanent and immutable—has attracted the attention of the largest banks in the world as well as financial startups.[26]

Blockchain uses encryption and a combination of public and private "keys" for security.[27] The system utilizes mathematical techniques to match a public address with a private security access key for each participant in a transaction.[28] If these two items match, the transaction is broadcast to the other participants in the blockchain for verification and entry into the ledger.[29] Bitcoin utilizes this "proof of work" methodology for security purposes, but other techniques exist for making sure transactions are valid and not duplicated.[30] It has been

21. *Id.*
22. *Id.*
23. *Id.*
24. *Id.*
25. TAPSCOTT & TAPSCOTT, *supra* note 1, at 7.
26. *See, e.g.*, Lucinda Shen, *Blockchain Will Be Used By 15% of Big Banks By 2017*, FORTUNE.COM (Sept. 28, 2016, 2:08 PM), http://fortune.com/2016/09/28/blockchain-banks-2017/.
27. TAPSCOTT & TAPSCOTT, *supra* note 1, at 6.
28. Lanchester, *supra* note 20.
29. Lanchester, *supra* note 20.
30. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. Under the proof-of-work protocol, to verify that transactions are legitimate and not fraudulent takes a lot of effort, or work, from a distributed network of participants due to the complexity of the security protocol. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. Participants in the Bitcoin Network, called miners, have to expend resources in the form of computer hardware and electricity to solve a mathematical puzzle to find the correct unique identifier for a block of transactions before the new block of transactions can be verified and thus added to the list of all prior transactions, i.e., the blockchain. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. Once the

suggested that blockchain involves two innovations—the ability to track ownership and transfers of property without need of a trusted intermediary and the ability to transfer property directly from peer to peer.[31]

Smart contracts are intended to work in concert with blockchain technology to enforce transactions on the blockchain. Smart contracts are a step beyond typical electronic contracts in that the actual agreement is embodied in computer code, rather than English or another traditional language.[32] In many other ways, however, smart contracts are not novel, in that they must consist of a discernible agreement between parties with capacity to make that agreement.[33] In addition, financial institutions have been using automated computer protocols to settle transactions without human intervention for several decades.[34]

## III. TECHNOLOGICAL AND BUSINESS OPPORTUNITIES AND IMPEDIMENTS

There is no shortage of potential uses for blockchain, or distributed ledger technology, and smart contracts. The World Economic Forum has suggested that they could be used in enhancing global payments, syndicated credit, collateral management, proxy voting, securities issuance, and regulatory and compliance activities.[35] For example, syndicates of lenders could be formed using smart contracts, and smart contracts could perform funding and servicing activities for the syndicates.[36] Central banks are exploring issuing

unique identifier is discovered, it is relatively easy for other participants in the network to verify its accuracy. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. The miners who discover the unique identifiers receive bitcoins as the reward for their work. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. Other methods for verifying transactions for posting on the blockchain include proof of stake, in which the verifiers invest in and hang on to some store of value on the network; proof of activity, in which proof of work and proof of stake are combined; and proof of storage, which requires the verifiers to allocate and share disk space in a distributed cloud. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31. All of these methods are designed to ensure trust in the accuracy of the distributed ledger system, and prevent fraud by the participants or outside parties, without requiring a trusted third-party intermediary to administer the ledger. TAPSCOTT & TAPSCOTT, *supra* note 1, at 31.

31. Fairfield, *supra* note 5, at 40–41.
32. BOURQUE & TSUI, *supra* note 11, at 5.
33. BOURQUE & TSUI, *supra* note 11, at 6–7.
34. Mendelowitz & Brammertz, *supra* note 14.
35. WORLD ECON. FORUM, *supra* note 3, at 39–44.
36. WORLD ECON. FORUM, *supra* note 3, at 41.

digital currencies, possibly using blockchain technology.[37] Smart contracts could be used to monitor collateral posted for transactions, and facilitate the clearing and settlement of collateral transactions.[38]

The British bank Barclays has led an effort that envisions derivatives documentation—such as ISDA master agreements, credit support annexes, and confirmations—being reconstituted into automated smart contracts.[39] In the Barclays template, smart contracts would be provided for counterparties to download and use with the master agreements stored on a centralized distributed ledger.[40] The technology behind the Barclays initiative has now been released as open source to encourage innovation and interoperability in the financial industry's development of blockchain technology.[41] Several large banks, including JP Morgan and Credit Suisse, recently completed a successful test of a smart contract prototype for equity swaps, which included complex post-trade services such as margin payment transfers and corporate action processing.[42] The French bank BNP Paribas is also exploring automating legal contracts.[43]

Smart contracts have been suggested for consumer transactions as well.[44] Potentially, consumers could benefit from more parity in bargaining power with corporations in negotiating business terms for online transactions.[45] In this scenario, consumers may be able to use automated purchasing agents to negotiate online transactions with

37. *E.g.*, Richard Milne, *Sweden's Riksbank Eyes Digital Currency*, FIN. TIMES (Nov. 15, 2016) (noting that Sweden's central bank is debating issuing digital currency).

38. WORLD ECON. FORUM, *supra* note 3, at 44.

39. Pete Rizzo, *How Barclays Used R3's Tech to Build a Smart Contracts Prototype*, COINDESK (Apr. 26, 2016, 9:27 PM), http://www.coindesk.com/barclays-smart-contracts-templates-demo-r3-corda/.

40. *Id.*

41. Tanaya Macheel, *R3 Makes Code for Financial Agreements Platform Open Source*, AM. BANKER (Nov. 30, 2016). As an aside, several large banks supporting this blockchain initiative, including Goldman Sachs and Santander, have announced they are withdrawing from the alliance of large banks supporting its development. Tanaya Macheel, *Another Bank (Santander) Quits Blockchain Alliance R3*, AM. BANKER (Nov. 22, 2016).

42. Michael del Castillo, *JP Morgan, Credit Suisse Among 8 in Latest Bank Blockchain Test*, COINDESK (Oct. 18, 2016, 4:28 AM), http://www.coindesk.com/jp-morgan-credit-suisse-among-8-in-latest-bank-blockchain-test.

43. Jean-Pierre Buntinx, *BNP Paribas Sees Smart-Contracts in the Future of Legal Code*, BITCOIN.COM (Mar. 29, 2016), https://news.bitcoin.com/bnp-paribas-smart-contracts-legal-code/.

44. Fairfield, *supra* note 5, at 39.

45. Fairfield, *supra* note 5, at 41.

vendors, which also may be using automated agents of their own.[46] This could create an online world in which the smart contracts negotiate with each other. Other potential consumer uses of smart contracts include automatically enforcing car payments or gaining immediate access to rental housing units.[47]

The perceived benefits of smart contracts include increased speed and accuracy of business transactions, more efficient business operations, and better, quicker, and cheaper enforcement of contracts.[48] Financial institutions are expected to spend over $1 billion on blockchain projects in 2017, making it one of the fastest developing enterprise software markets.[49] This is on top of the $1.4 billion invested so far over the last three years.[50] Most global banks expect to roll out blockchain technology in 2017.[51] However, analysts have suggested that many of the potential uses for blockchain technology and smart contracts are very complex and potentially expensive.[52] The initial uses of blockchain technology are expected to be internal and involve transfer of data rather than payments. These initial uses are unlikely to deliver the full benefits of blockchain technology, which will only be achieved when there is a large-scale adoption of common platforms—or at least platforms capable of communicating with each other—across the financial services industry.[53] At this point, the cost-benefit equation and future scope of technological adoption has not been fully settled or

46. Fairfield, *supra* note 5, at 39.

47. Judith Lee et al., *Blockchain Technology and Legal Implications of 'Crypto 2.0'*, 104 Banking Rep. (BNA) No. 654, at 4 (Mar. 31, 2015).

48. *See* TAPSCOTT & TAPSCOTT, *supra* note 1, at 103 (relating to better contractual enforcement); Morgan H. McKenney, *The Opportunities, Implications and Challenges of Blockchain in Financial Services*, CITIGROUP (June 21, 2016), https://www.citibank.com/tts/corporations/online_academy/docs/blockchain.pdf (identifying potential financial impacts).

49. *Blockchain in Banking: Disruptive Threat or Tool?*, MORGAN STANLEY GLOBAL INSIGHT 5 (Apr. 20, 2016), http://www.the-blockchain.com/docs/Morgan-Stanley-blockchain-report.pdf.

50. Richard Lumb, *Downside of Bitcoin: A Ledger that Can't be Corrected*, N.Y. TIMES: DEALBOOK (Sept. 9, 2016), https://www.nytimes.com/2016/09/10/business/dealbook/downside-of-virtual-currencies-a-ledger-that-cant-be-corrected.html?_r=0.

51. Paul Schaus, *Blockchain Projects Will Pay Off—10 Years from Now*, AM. BANKER (Dec. 2, 2016).

52. *Id*.

53. *Id*. One report forecasts that the banking industry could save $20 billion per year by eliminating central authorities and clearing mechanisms and adopting peer-to-peer blockchain technology instead. *Id*.

identified.[54] Some commentators have claimed, in fact, that the "blockchain hype" may have already peaked due to the difficulty of integrating the technology into the security and trust requirements of heavily regulated financial institutions.[55]

While the benefits would certainly be welcome, there are significant potential drawbacks to smart contracts as well. One of the biggest questions surrounding smart contracts is cybersecurity. Can these automated contracts be hacked and manipulated for improper ends? Further, without mechanisms to amend and enforce them, can they really substitute for traditional paper agreements?[56] Unfortunately, one recent episode does not bode well in this regard.

In July 2016, in an inside job, a hacker exploited code vulnerabilities in the so-called Decentralized Autonomous Organization ("DAO") to redirect $50 million into the hacker's own account.[57] The DAO was an investment fund designed to run automatically, without management or a board, utilizing the Ethereum platform, which develops and deploys smart contracts.[58] Notably, the hacker was not an unknown outsider, but a participant in the enterprise.[59] The hack was corrected and the funds recovered, but only after a subsequent code

54. *Id*. The initial benefits from internal adoption of blockchain technology may be limited to indirect benefits, such as higher customer satisfaction or more accurate reporting. *Id.*

55. Phillip Stafford & Hannah Murphy, *Has the Blockchain Hype Finally Peaked?*, FIN. TIMES (Nov. 29, 2016) (arguing that the true future of blockchain technology may lie in initiatives developed by consortia of large financial institutions working together in private blockchain networks due to cost and security needs).

56. *See* Larry D. Wall, *"Smart Contracts" in a Complex World*, FED. RES. BANK OF ATL. (July 2016), https://www.frbatlanta.org/cenfis/publications/notesfromthevault/1607.aspx (discussing potential impacts of coding errors).

57. THE ECONOMIST, *supra* note 2. One commentator has pointed out that some participants and observers do not consider this situation to be a "hack" at all, but rather the enforceable implementation of the terms of the smart contract. Matt Levine, *Blockchain Company's Smart Contracts Were Dumb*, BLOOMBERG VIEW (June 17, 2016). In this view, the terms of the smart contract *are* the code itself, and to the extent that a participant in the platform makes the code operate in a specified way, then that operation within the code becomes the enforceable terms of the smart contract. *Id.* Ex ante descriptions in natural language of how the code is expected to operate, nor ex post examination of the intent of the parties, is relevant in this context with respect to the terms of the smart contract, nor should they be enforceable on the parties to the smart contract. *Id.* Ultimately, this view did not prevail in the context of the DAO hack, nor should it have, for smart contracts to be viable tools for business in a wider context. *Id.*

58. THE ECONOMIST, *supra* note 2.

59. *See* Levine, *supra* note 57 (noting that the smart contract code allowed the hack to occur).

change that was controversial among some participants in the DAO because it seemed to undermine the immutable characteristic of the blockchain and smart contract technology.[60] As one commentator noted, "[e]ven the smartest contracts can be susceptible to human error . . . ."[61]

## IV. LEGAL ISSUES

### *A. Contract Law*

One initial question regarding smart contracts is whether they are really contracts. A contract is a legally enforceable promise or promises.[62] To be legally enforceable, the contract must meet a number of conditions imposed by law, such as multiple parties,[63] the capacity of the parties,[64] mutual assent,[65] and consideration.[66] In addition, there are number of defenses to the enforcement of contracts, such as mistake,[67] misrepresentation, duress, undue influence,[68] and unenforceability on public policy grounds.[69] While, in general, a contract may be oral,[70] certain contracts must be in tangible form,[71] and as a practical matter, most business-related contracts are in tangible form, whether in a traditional written document, or in an electronic form, such as electronic terms and conditions.[72]

60. THE ECONOMIST, *supra* note 2.
61. Lumb, *supra* note 50.
62. RESTATEMENT (SECOND) OF CONTRACTS § 1 (AM. LAW INST. 1981).
63. *Id.* § 9.
64. *Id.* § 12.
65. *Id.* § 3.
66. *Id.* § 17.
67. *Id.* § 152.
68. *Id.* §177.
69. *Id.* § 194.
70. *Id.* § 4.
71. *Id.* § 110.
72. The Uniform Commercial Code ("UCC") requires certain commercial contracts be in writing, including those for the sale of goods in excess of $500, U.C.C. § 2-201(1) (AM. LAW INST. & UNIF. LAW COMM'N 1977), liens in personal property, or fixtures not in the possession of the secured party. *Id.* § 9-203(b)(3)(A). The UCC defines "written" or "writing" to include printing, typewriting, or any other intentional reduction to tangible form. *Id.* § 1-201(43). The UCC also broadens the concept of tangible form in other contexts, such as defining a "record" as "information that is inscribed on a tangible medium or which is stored in an electronic or other medium and is retrievable in perceivable form." *Id.* § 9-102(70).

In order to be enforceable, a smart contract would have to meet all of the traditional requirements of a valid contract. One area that may be especially tricky for a smart contract is showing "mutual assent" to the contract. Mutual assent must be manifested by making a promise and/or rendering performance.[73] Manifestation of mutual assent may be written or spoken,[74] but as noted above, some contracts must be in tangible form. Manifestation of mutual assent is traditionally based on the concepts of offer and acceptance by the parties to the contract.[75]

Several recent cases have explored the concepts of contract formation in the electronic age, but have consistently fallen back on traditional principles of contract formation, such as manifestation of mutual assent.[76] Contracts entered into on the internet typically fall into either "clickwrap" or "browsewrap" categories.[77] In a clickwrap agreement, the website user must affirmatively click on a box that he agrees to the terms, while in a browsewrap agreement, the terms are posted on the website and do not require affirmative assent from the user.[78] Typically, courts have required a showing of "actual notice" of the contractual terms.[79] Without actual notice of the contractual terms, the user must be put on inquiry notice of such terms.[80] This typically requires that the terms be conspicuous, and effective notice be given that continued use of the website will bind the user to the terms.[81] The Ninth Circuit recently held that conspicuous terms alone are not enough to manifest mutual assent.[82]

It is clear from this line of cases that an enforceable smart contract must have a clear record of mutual assent to the terms—such as clicking on an "agree" button—and it must clearly disclose the terms to

73. RESTATEMENT (SECOND) OF CONTRACTS § 18.

74. *Id.* § 19(1).

75. *Id.* § 22(1).

76. *See, e.g.*, *Nguyen v. Barnes & Noble, Inc.*, 763 F.3d 1171, 1175 (9th Cir. 2014) (citations omitted) (noting approvingly that while internet commerce has presented novel situations, it has not "fundamentally changed the principles of contract," including "[m]utual manifestation of assent").

77. *Id.* at 1175–76.

78. *Id.*

79. *Id.* at 1176. Actual notice can include an admission by the user, written notification of the terms after which the breach persists, or an acknowledgment that the user is aware of the terms before proceeding on the website. *Id.*

80. *Id.* at 1177.

81. *Id.*

82. *Id.* at 1178–79.

the contracting parties. Courts have been more likely to uphold agreements that meet these conditions.[83] In a recent case, a court found manifestation of mutual assent in an online transaction when three factors were present: (1) a conspicuous notice of the terms of use for an online transaction, (2) an express warning that proceeding further with the transaction would bind the party to the terms, and (3) an express agreement by the user to the terms and conditions at the time of account creation.[84]

Commercial law allows a court to deny enforcement to certain otherwise valid legal agreements based on public policy grounds, such as unconscionability.[85] Review and subsequent non-enforcement of a smart contract after it is created may be at odds with the immutable character of blockchain.[86] One of the most widely heralded features of blockchain is its immutability, forming an inviolable record of transactions. In addition to public policy concerns with a smart contract transaction, mistakes may be made in connection with a transaction that later need to be reversed by a court or the parties to the agreement.[87] It seems unlikely that large financial institutions, regulators, and government officials will embrace a technology that cannot be changed later if necessary.[88] One commentator has recommended that smart contracts preserve the best features of traditional contracts, including the ability to be renegotiated in the future if necessary.[89]

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83. *Id.*

84. *Nicosia v. Amazon.com, Inc.*, 84 F. Supp. 3d 142 (E.D.N.Y. 2015), *vacated*, 834 F.3d 220 (2d Cir. 2016).

85. U.C.C. § 2-302 (AM. LAW INST. & UNIF. LAW COMM'N 1977).

86. DAVID MILLS ET AL., DIVS. OF RESEARCH & STATISTICS AND MONETARY AFFAIRS, FED. RESERVE BD., DISTRIBUTED LEDGER TECH. IN PAYMENTS, CLEARING AND SETTLEMENT 28–29 (2016), https://doi.org/10.17016/FEDS.2016.095.

87. *See* Kadhim Shubber, *Banks Find Blockchain Hard to Put into Practice*, FIN. TIMES (Sept. 12, 2016), https://www.ft.com/content/0288caea-7382-11e6-bf48-b372cdb1043a (noting immutable characteristics result in errors that cannot be easily reversed).

88. Accenture has announced development of technology that will allow editing of blockchain transactions. *See* Martin Arnold, *Accenture to Unveil Blockchain Editing Technique*, FIN. TIMES (Sept. 20, 2016), https://www.ft.com/content/f5cd6754-7e83-11e6-8e50-8ec15fb462f4 (highlighting regulators' need to quickly correct errors on the blockchain before using it in securities markets). A system of editing blockchain transactions has been applauded by financial participants, but others in the blockchain community have criticized editing technology as antithetical to the blockchain and symptomatic of large financial entities attempting to expropriate the blockchain for themselves in contravention of the technology's original intent. *Id.*

89. Wall, *supra* note 56. Wall argues persuasively that traditional legal agreements are often intentionally written without contemplating every future contingency because it would

The federal Electronic Signatures in Global and National Commerce Act ("E-SIGN Act") generally prohibits courts from denying enforcement of electronic signatures and contracts solely on the basis of their electronic form.[90] The E-SIGN Act also requires that certain conditions be met in electronic transactions, such as consumer notifications in certain cases,[91] and that electronic contracts be held in a form that is retained and reproducible in readable form.[92] Finally, the E-SIGN Act also permits states to develop alternative electronic signature and record laws, such as the Uniform Electronic Transactions Act ("UETA").[93]

UETA was the first comprehensive attempt to prepare state law for the electronic commerce era and provide uniform rules for electronic commerce transactions.[94] UETA is intended to govern electronic records and signatures relating to transactions not governed by any article of the Uniform Commercial Code ("UCC"), other than Article 2 and 2A.[95] UETA also only applies where all parties to the transaction have agreed to conduct it electronically.[96] Consistent with the approach of courts in applying existing legal principles to electronic transactions, UETA was not intended to create an entirely new system of legal rules for the electronic marketplace, but rather to make sure electronic transactions were fully enforceable on the same terms as non-electronic transactions.[97] UETA is structured to provide a set of rules to apply existing legal concepts to electronic transactions.[98]

Section 9 of UETA provides rules of attribution for electronic signatures in which any evidence that the signature is the act of a person may be shown, including any security protocol used to verify the

be uneconomic in many cases to do otherwise, and it is more efficient to renegotiate traditional agreements, or arbitrate or litigate disputes related to such agreements, if highly uncertain future events do, in fact, occur. *Id*.

90. 15 U.S.C. § 7001(a) (2015).

91. *Id.* § 7001(c).

92. *Id.* § 7001(e).

93. *Id.* § 7002(a).

94. *Electronic Transactions Act Summary*, UNIF. LAW COMM'N, http://www.uniformlaws.org/ActSummary.aspx?title=Electronic%20Transactions%20Act (last visited Feb. 6, 2017).

95. *Id.*

96. *Id.*

97. *Id*.

98. *Id.*

signature or assent.[99] Section 16 of UETA provides for "transferable records" as a supplement to the concept of a "note" under Article 3 of the UCC,[100] but requires that such electronic notes be maintained as the sole and unique token of the obligations and rights embodied in the note.[101] Section 14 of UETA deals with contracts made through electronic agents, such as computer programs, and provides for the validity of such electronic agreements.[102] This provision of the law may be especially useful as parties begin to adopt and utilize artificial intelligence and robotic technology in the negotiation process.[103]

It seems clear from the adaptation of legal principles to electronic transactions that smart contracts will not require any special set of new laws or regulations. Instead, existing legal principles will be adapted and perhaps modified, either statutorily or judicially, to deal explicitly with smart contracts and other emerging technologies—albeit most likely with a substantial lag time between adoption of the technology and adjustment of the law. In order to be valid, smart contracts will have to be constructed in such a way as to meet long-established legal norms for contracting, such as showing clear manifestation of mutual assent to the contract terms. This could be done by having the parties click on a button agreeing to the contractual terms along with a link to those terms in natural language form. The contractual terms would need to be preserved in a secure environment in which they could not be altered without further permission of the parties. Smart contracts would also have to comply with all existing federal and state law governing electronic transactions, such as UETA and the E-SIGN Act.

### *B. Evidentiary and Enforcement Issues*

While smart contracts should be as fully enforceable as

99. Uniform Electronic Transactions Act ("UETA") § 9 (1999).

100. UETA § 16(a) (defining a "transferable record" as an electronic record that would be a note under [U.C.C. § 3-104(e)] if the electronic record were in writing, and the issuer has expressly agreed it is a transferable record).

101. *Id.* §16 cmt. 3; *Electronic Transactions Act Summary*, UNIF. LAW COMM'N, http://www.uniformlaws.org/ActSummary.aspx?title=Electronic%20Transactions%20Act (last visited Feb. 6, 2016).

102. UETA § 14.

103. *See, e.g.*, Fairfield, *supra* note 5, at 38–39.

traditional contracts if crafted in conformity with federal and state law, they may present special challenges in such enforcement, including evidentiary issues, enforceability of waivers of defenses, and jurisdictional and choice-of-law questions. The central idea of a smart contract is that it is self-executing and eliminates the need to resort to human intervention, so some of these challenges in enforcement may reduce the prospective benefits of smart contracts. While countless undisputed transactions utilizing smart contracts are likely to move forward on the basis of such automatic, electronic enforcement, there will likely always be the need for human intervention to settle legal disputes. In those cases, the courts will need to determine the terms of a smart contract using many of the traditional legal principles described above and utilized in adjudicating disputes involving electronic contracts currently.

Smart contracts may pose particular evidentiary issues given that the contract is written in computer code. This code would need to be produced in natural language for a court to review as part of a dispute, since it is unlikely that courts would possess the requisite expertise to review the code directly. This problem could be handled prospectively by developing and maintaining an isolated version of the code translated into natural language when the smart contract goes into effect, which could be updated as changes to it are made. This should not be burdensome to developers of this technology in that they will need to provide a natural language version of the contract to the parties to obtain mutual consent. Furthermore, additional expertise and specialization in smart contract technology would be needed to validate the smart contract in any litigation, including verifying that the security protocols are sufficient to maintain the code in its agreed upon state.[104]

Beyond evidentiary questions, external dispute resolution of smart contracts also poses questions related to the enforceability of waivers of defenses. It is likely that these aspects of smart contracts would also be adjudicated through application of existing legal principles. For instance, waivers would be enforced to the extent—but no greater than—they would be if embodied in a traditional written contract. This may pose additional technological challenges to obtain

104. BOURQUE & TSUI, *supra* note 11, at 11; *see also* Wall, *supra* note 56 (suggesting placing jurisdiction of smart contracts in particular jurisdictions that have developed well-known expertise in adjudicating disputes).

and maintain appropriate records of such waivers, consents, and agreements among all parties to a transaction. Consumer and commercial contracts are also likely to be reviewed under the same existing standards as those applicable to paper contracts, unless legislatures adopt new legal standards applicable to smart contracts, which seems unlikely in today's political and regulatory environment.

Finally, there are jurisdictional questions with respect to smart contracts, because they operate in connection with a distributed ledger, such as blockchain.[105] For instance, where is the distributed ledger located if a dispute arises? Blockchain also poses questions concerning the ability to identify the parties to a transaction, to the extent a system utilizing this technology remains anonymous, which may raise a host of additional issues related to dispute resolution.[106] Going forward, the operator of the blockchain platform should be identifiable and could serve as the counterparty in a dispute scenario, but this is not assured depending upon the financial strength of the operator. The identity of the operator or counterparty could also serve to establish the appropriate venue for external dispute resolution.

The operator of the platform may establish a governing law provision in the terms of use for the platform and all associated smart contracts at the time the platform is established. The specification of the governing law and venue for dispute resolution would need to be clearly disclosed and agreed to by the parties to the smart contracts to be enforceable. Depending upon the size of the platform, participants may enter into traditional agreements at the time of establishment of the platform by agreeing to basic overarching legal provisions, such as dispute resolution, governing law, and venue. Without express agreement, many of the evidentiary issues described above, such as the "location" of the platform and transactions, would also come into play in establishing governing law and venue. Leaving these issues to be determined after the contract is entered into would not be desirable for larger, more sophisticated transactions.

105. BOURQUE & TSUI, *supra* note 11, at 13–14.
106. BOURQUE & TSUI, *supra* note 11, at 13.

### *C. Financial Crimes Enforcement Challenges*

Smart contracts may also present special challenges with regard to compliance with anti-terrorism laws and money laundering rules.[107] These rules typically require participants in financial transactions to know and verify the identity of counterparties and report "suspicious activity" to law enforcement[108] or prohibit transfers of funds to proscribed persons.[109] Since smart contracts are designed to be self-executing without human intervention, users of these smart contracts may need to build in controls that allow them to comply with these laws by verifying identities and blocking unlawful transfers and transactions, including interfaces with other systems that automatically update lists of prohibited transactions.

### *D. Ethical Issues for Lawyers*

Smart contracts may present interesting professional responsibility issues in the future, such as with regard to the unauthorized practice of law. Legal ethics prohibit lawyers from aiding in the unauthorized practice of law.[110] In many states, lawyers are also prohibited from sharing legal fees with non-lawyers or forming partnerships with non-lawyers.[111]

Beyond the canons of legal ethics, most state laws also prohibit the unauthorized practice of law.[112] The practice of law includes preparing legal instruments, rendering opinions, and performing legal services or giving legal advice.[113] The law permits attorneys to engage third parties to assist them in the practice of law, but the attorney is required to maintain full professional and direct responsibility for the information and services received.[114]

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107. Trevor I. Kiviatt, *Beyond Bitcoin: Issues in Regulating Blockchain Transactions*, 65 DUKE L. J. 569, 589–594 (2015).

108. Financial Recordkeeping and Reporting of Currency and Foreign Transactions Act, 31 U.S.C. § 5311 (2015) (declaration of purpose); Due Diligence Requirements, 31 C.F.R. §§ 1010.220, 1020.600 (2016).

109. 31 C.F.R. § 501 (2016).

110. MODEL RULES OF PROF'L CONDUCT r. 5.5 (AM. BAR ASS'N 2016).

111. *Id.* r. 5.4.

112. *See, e.g.*, N.C. GEN. STAT. §§ 84-4, 84-5 (2016); O.C.G.A. § 15-19-51 (2016).

113. *See, e.g.*, N.C. GEN. STAT. § 84-2.1; O.C.G.A. § 15-19-50.

114. *See, e.g.*, MODEL RULES OF PROF'L CONDUCT r. 5.3; O.C.G.A. § 15-19-54.

These provisions provide a potential challenge when implementing smart contract technology in which the contract is in the form of computer code and that code is deemed to be the legal contract. An attorney on these projects will need to work closely with computer specialists to ensure that the code accurately embodies the natural language legal terms and agreements. While this work can draw on much of the work in the online electronic marketplace space, such as drafting legal terms and conditions, many smart contracts are envisioned between sophisticated parties, such as large banks and other financial counterparties, and may be bespoke, heavily negotiated transactions. Both sides will be represented by counsel and that counsel will need to understand the technology behind the smart contract process. Finally, the lawyer will need to verify that the contract terms are embodied in the computer code and will remain secure and unaltered during the term of the agreement.

## V. CONCLUSION

Blockchain technology and smart contracts have the potential to transform financial markets and the business of banking. At this point, however, this technology is still developing and has not been widely tested in a regulated environment, which leaves open the possibility of unknown operational flaws and vulnerabilities. It is still too early to tell how widely this technology will be adopted and the scope of potential uses.

Assuming the technology is widely adopted, smart contracts will need to meet many of the same legal standards as traditional paper agreements. Smart contracts will benefit from the legal precedent established in the electronic marketplace including the acceptance of electronic signatures and promissory notes. At least initially, legislatures and regulators are not likely to enact entirely new statutory and regulatory schemes to accommodate smart contracts. Far more likely, public entities, including courts, will fashion new legal rules from existing constructs and adapt them to the new technology. This may present some growing pains along the way and could slow the adoption of blockchain technology and smart contracts, particularly in highly regulated financial institutions.

Alternatively, it may make sense for state and federal

governments—and eventually international counterparts—to adopt new or revised rules specifically applicable to blockchain technology and smart contracts. These rules would deal specifically with the mechanics of contract formation, enforceability, jurisdictional issues, and legal ethics related to smart contracts. However, adoption of new rules presents a proverbial chicken and the egg issue. It is unlikely that these rules can be developed adequately until the technology is more fully completed. However, the developers of the technology need some degree of certainty around the legal structure when developing the technology. This conundrum will probably result in legal counsel being closely involved in the development of this new technology, particularly as prototypes are developed in new markets. While potentially inefficient and suboptimal from a development standpoint, it may bode well for the career prospects of those lawyers who understand and embrace this new technology.