

More Legal Aspects of Smart Contract Applications

Token Sales, Capital Markets, Supply Chain Management, Government and Smart Cities, Real Estate Registries, and Enabling Self-Sovereign Identity



J. DAX HANSEN | PARTNER
+1.206.359.6324
DHansen@perkinscoie.com

Laurie Rosini | ASSOCIATE
+1.206.359.3052
LRosini@perkinscoie.com

CARLA L. REYES | ASSISTANT PROFESSOR OF LAW
Director of Legal RnD - Michigan State University College of Law
Faculty Associate - Berkman Klein Center for Internet & Society at Harvard University
carla.reyes@law.msu.edu

[PerkinsCoie.com/Blockchain](https://perkinscoie.com/Blockchain)



Table of Contents

INTRODUCTION	3
I. A (VERY) BRIEF INTRODUCTION TO SMART CONTRACTS	3
THE ORIGINS OF SMART CONTRACTS.....	3
SMART CONTRACTS IN A DISTRIBUTED LEDGER TECHNOLOGY WORLD	4
II. CURRENT ACADEMIC LITERATURE AND INDUSTRY INITIATIVES RELATING TO SMART CONTRACTS	6
SMART CONTRACTS AND CONTRACT LAW	6
TECHNICAL DIFFICULTY POSED BY SMART CONTRACT DEVELOPMENT.....	6
INDUSTRY INITIATIVES RELATING TO LEGALLY ENFORCEABLE COMPUTATIONAL CONTRACTS.....	7
STATE LEGISLATIVE EFFORTS RELATED TO SMART CONTRACTS.....	8
III. EXPLORING THE LEGAL ASPECTS OF SMART CONTRACT APPLICATIONS	9
SMART CONTRACTS IN TOKEN SALES.....	9
SMART CONTRACTS IN CAPITAL MARKETS.....	15
SMART CONTRACTS FOR SUPPLY CHAIN MANAGEMENT	16
SMART RECORDS FOR GOVERNMENT AND SMART CITIES	18
SMART CONTRACTS FOR REAL ESTATE REGISTRIES.....	20
SMART CONTRACTS FOR ENABLING SELF-SOVEREIGN IDENTITY.....	22
IV. AN INITIAL RISK MITIGATION CHECKLIST FOR BUSINESSES DEVELOPING SMART CONTRACTS APPLICATIONS	24
V. CONCLUSION	24



Introduction

Smart contracts have received significant attention from legal academics and attorneys for the impact they may have on contract law and the role of lawyers. Some have also identified and described a series of use cases for smart contracts. However, the literature currently lacks a comprehensive discussion of the legal implications of use cases that are unrelated to contract law. To fill that gap, in May 2017 we first published a white paper entitled “Legal Aspects of Smart Contract Applications,” which offered an initial analysis of the legal aspects of five prominent smart contract use cases. This updated edition of the white paper offers new analysis refined by the regulatory and industry activity undertaken since May 2017 through six use cases: token sales, capital markets, supply chain management, smart government records and smart cities, real estate land registries, and self-sovereign identity. We continue to maintain that legal risk is inherent in each of these subject areas, but with careful risk mitigation planning, companies can overcome many of those hurdles to offer effective products and services.

This updated white paper proceeds in four parts. Part I defines the terms blockchain and distributed ledger technology as used for the purposes of this white paper and then briefly surveys the relevant technological characteristics of smart contracts, the platforms upon which they operate, and the challenges that face those creating and executing them. In Part II we review the current literature from both leading industry groups and academia regarding smart contracts and acknowledge emerging industry efforts to build platforms for legally enforceable computational contracts. Part III introduces six uses of smart contracts in business and government processes, and examines the legal regime(s) applicable to each. Finally, in Part IV we offer insight into practical steps a business may take to mitigate legal risk when launching a product or service that uses smart contracts.

I. A (VERY) BRIEF INTRODUCTION TO SMART CONTRACTS

The term “smart contract” is widely used, and at times misused. For example, the term is frequently used when considering whether natural language contracts can be adequately translated into computer code, or whether computer programs can themselves represent a legally binding contract.¹ Although interesting questions, these are not the primary issues in play for most smart contract implementations. To avoid adding to the definitional confusion that often plagues smart contract discussions, and to provide a common starting point for the rest of our analysis regarding the legal aspects of smart contract applications, this white paper begins by offering a brief introduction to smart contracts.

THE ORIGINS OF SMART CONTRACTS

The idea of smart contracts originated as early as 1994 when Nick Szabo first coined the term, using it to refer to “a set of promises, specified in digital form, including protocols within which the parties perform on these promises.”² Szabo’s original idea of smart contracts was broad enough that some smart contracts will fulfill the requirements of a legally enforceable contract while others will not.³ Szabo’s idea lay dormant for many years because the technology did not yet exist to support the implementation of smart contracts.⁴ Then, in 2009, the Bitcoin blockchain emerged—itsself a limited form of a smart contract.⁵ Later, Ethereum offered an enhanced ability to build more complex smart contracts by using a specific smart contract language (Solidity) to enable developers to write complex processes in a short span of code.⁶ The rise of these protocols led to the resurgence of the smart contract idea and its increasing popularity as a tool for enhancing business processes and efficiencies. Integrating Szabo’s original idea into the new technological age of blockchains, however, has proved more difficult than perhaps initially anticipated.

¹ For a detailed review of the contract law questions, what smart contracts can teach about contract law, and the limits of smart contracts to achieve relational contracting goals, see Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313 (2017) and Norton Rose Fulbright, *Can smart contracts be legally binding contracts?* (Nov. 2016), <http://www.nortonrosefulbright.com/knowledge/publications/144559/can-smart-contracts-be-legally-binding-contracts>. For projects investigating the link between natural language contracts and computer coded contracts, see Stanford Law School, Stanford Computable Contracts Initiative, <https://law.stanford.edu/projects/stanford-computable-contracts-initiative/> (last visited Mar. 28, 2018).

² Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets* (1996), http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html; Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, FIRST MONDAY (Sept. 1, 1997), <http://firstmonday.org/ojs/index.php/fm/article/view/548/469>.

³ Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 396 (2017).

⁴ William Mougayar, *9 Myths Surrounding Blockchain Smart Contracts*, COINDESK (Mar. 23, 2016), www.coindesk.com/smart-contract-myths-blockchain/.

⁵ Reyes, *supra* note 3, at 396-97; Richard Gendal Brown, *A Simple Model for Smart Contracts*, (Feb. 10, 2015), <http://gandal.me/2015/02/10/a-simple-model-for-smart-contracts/>.

⁶ WILLIAM MOUGAYAR, *THE BUSINESS BLOCKCHAIN: PROMISE, PRACTICE AND APPLICATION OF THE NEXT INTERNET TECHNOLOGY* (2016).

More Legal Aspects of Smart Contract Applications



SMART CONTRACTS IN A DISTRIBUTED LEDGER TECHNOLOGY WORLD

The Bitcoin blockchain, Ethereum, and other similar software protocols—which we refer to generally in this white paper as distributed ledger technology (“DLT”)—reignited the viability and usefulness of smart contracts. We use the term “DLT” broadly to refer to “computer software that is distributed, runs on peer-to-peer networks, and offers a transparent, verifiable, tamper-resistant transaction-management system maintained through a consensus mechanism rather than by a trusted third-party intermediary that guarantees execution.”⁷ We recognize that there exists a vivid debate about the appropriate use of the terms “blockchain” and “DLT” to describe various applications in the industry. We do not intend to engage in that debate here, nor does our adoption of the term “DLT” in this white paper reflect a position on that debate. Rather, we use the term “DLT” with the intention that it broadly encompass various forms of decentralized and distributed technology that have relevance to smart contract applications. The term “DLT” is increasingly used in academic literature and among standard-setting bodies as the broadest term, covering the Bitcoin blockchain, the Ripple protocol, Ethereum, and others.⁸ Further, DLT is broad enough to capture emerging platforms such as R3’s Corda. DLT also encompasses both proprietary (permissioned) DLT⁹ and open source (permissionless)¹⁰ DLT.¹¹ For the purposes of this white paper, using the broadest possible term allows us to convey the important reality that the legal issues discussed here are equally applicable to smart contract applications built on any blockchain protocol or platform.¹²

In the world of DLT, a smart contract is “a computer protocol—an algorithm—that can self-execute, self-enforce, self-verify and self-constrain the performance of” its instructions.¹³ So conceived, it is clear that smart contracts are not the same as blockchain applications; rather, “smart contracts are usually part of a decentralized (blockchain) application.”¹⁴ The Bitcoin blockchain itself is a smart contract with the limited purpose of executing transactions that involve the exchange of assets.¹⁵ However, DLT also enables smart contracts that go beyond simple funds transfers by embedding more extensive instructions into their computer code. In fact, some DLT protocols are specifically designed to enhance the ability of software developers to build applications that rely on more complex smart contracts. For example, Ethereum, with its smart contract-specific programming language Solidity, “allows you to program the future, to implement rules governing the array of possibilities that fan out from the present.”¹⁶

⁷ Reyes, *supra* note 3, at 390-91 (citations omitted).

⁸ See, e.g., Werbach & Cornell, *supra* note 1, at 325-26 (noting that Bitcoin uses a technology called “distributed ledgers,” which is more commonly referred to as the blockchain); Kevin D. Werbach, *Trust, But Verify: Why the Blockchain Needs the Law* 1 n.1 (last revised Sept. 15, 2017) (forthcoming 2018, Berkeley Technology Law Journal), <https://ssrn.com/abstract=2844409> (“There is not yet agreement on terminology. Technically, a blockchain (sometimes rendered as block chain) is a data storage system using sequentially signed blocks ‘The Blockchain’ may describe the universe of blockchains (similar to ‘the internet’), the subset of public blockchains, or just the public ledger for Bitcoin. . . . The more accurate term for this class of systems is distributed ledger technology.”); Hossein Kakavand & Nicolette Kost De Sevres, *The Blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies* 4 (Jan. 1, 2017), <https://ssrn.com/abstract=2849251> (“Blockchain, the technology underlying Bitcoin, is a type of Distributed Ledger Technology (‘DLT’).”); Sinclair Davidson, Primavera De Filippi & Jason Potts, *Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology* (July 19, 2016), <https://ssrn.com/abstract=2811995>; Andrea Pinna & Wiebe Ruitenberg, *Distributed Ledger Technologies in Securities Post-Trading*, European Central Bank (Apr. 2016), <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>; Carla L. Reyes, Nizan Geslevich Packin & Benjamin P. Edwards, *Distributed Governance*, 59 WM. & MARY L. REV. ONLINE 1, at 5-7 (2017).

⁹ “Permissioned DLT” is used here to refer to DLT that is developed and used on a proprietary basis, and that is often not public. Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 NYU J. LEGIS. & PUB. POL’Y 837, 840-41 n.15 (2015).

¹⁰ “Permissionless DLT” is used here to refer to open source DLT—generally public ledgers, open for anyone to inspect. *Id.*

¹¹ We also recognize that an ongoing debate exists regarding the terms “distributed” as opposed to “decentralized,” and “transparent” as opposed to “public.” Again, we adopt “distributed” and “transparent” for the purposes of this white paper without any intention to engage in or state a position in that debate. For the purposes of our legal analysis, it is useful to recognize that even when DLT is permissioned, it is possible to give certain outsiders (e.g., regulators) keys to the protocol for the purpose of inspection and audit. As such, permissioned DLT remains transparent, even if it is not public in the same way as permissionless DLT. Similarly, although we are aware that many object to the basic premise of permissioned DLT insofar as the concept necessarily means the protocol is not as decentralized as the permissionless originals, we use “distributed” as opposed to “decentralized” because permissioned DLT exists and is in use. As a result, the legal discussion in this white paper must consider both forms of DLT; otherwise, our analysis would only partially address the current landscape of the technology and the law. For further discussion and rationale on the definitional choices made here, see Reyes, *supra* note 3, at 390-91 n.29.

¹² By remaining neutral but using DLT as an umbrella term, our approach is in keeping with other leading work in this area. See Dr. Garrick Hileman & Michel Rauchs, *Global Cryptocurrency Benchmarking Study*, CAMBRIDGE CTR. FOR ALT. FIN. 21-24 (2017), https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-global-cryptocurrency-benchmarking-study.pdf.

¹³ TIM SWANSON, GREAT CHAIN OF NUMBERS: A GUIDE TO SMART CONTRACTS, SMART PROPERTY AND TRUSTLESS ASSET MANAGEMENT 312 (2014).

¹⁴ Mougayar, *supra* note 4.

¹⁵ Brown, *supra* note 5.

¹⁶ HENNING DIEDRICH, ETHEREUM 67 (2017). “Ethereum has its focus on smart contracts instead of on being exclusively a digital currency. And as part of that, Ethereum transactions can be way more sophisticated than Bitcoin’s: full-fledged, high language programs, some many thousand lines long, which can call on each other, almost ad infinitum.” *Id.* at 39.

More Legal Aspects of Smart Contract Applications



More specifically, “[a] smart-contract is an event-driven program, with state, which runs on a replicated, shared ledger and which can take custody over assets on that ledger.”¹⁷ This definition can be broken down into smaller parts as follows:

- Smart contracts are software programs that run on certain DLT protocols;
- Smart contracts are usually part of an application running on DLT, rather than standing alone as a DLT application;
- Smart contracts offer event-driven functionality—when triggered by external data (which may or may not require human input), smart contracts will modify other data;
- External data can be supplied by “oracles”—trusted data sources that send information to smart contracts (but not all smart contracts rely on oracles);
- Smart contracts can, acting on information provided by oracles, “enforce a functional implementation of a particular requirement, and can show proof that certain conditions were met or not met”;¹⁸
- Smart contracts can track changes in “state” over time;¹⁹
- Smart contracts are not the same thing as Ricardian contracts, which are digitized versions of natural language contracts that are linked to an automated function;²⁰
- Smart contracts are autonomous in that the software developer who created them need not actively maintain, monitor, or even be in contact with them while they operate;²¹
- Once executed, smart contracts may be self-sufficient, in that they can be programmed to “marshal resources—that is, raising funds by providing services or issuing equity, and spending them on needed resources, such as processing power or storage”;²²
- Smart contracts are distributed because they exist as software running on a DLT protocol that itself is distributed across a variety of network nodes;²³ and
- Smart contracts guarantee execution of the contemplated transaction once the required conditions are met.²⁴

Clearly, smart contracts offer the capacity to revolutionize any number of traditional processes, and as technologists and businesses craft new and existing uses of this technology, the law will struggle to keep pace. Our aim in this white paper is to provide an initial consideration of several smart contract application uses under current legal regimes. We also offer reflections and predictions on which legal issues and questions will be most important for smart contract applications moving forward. We begin our investigation of the legal aspects of smart contracts with a review of the currently available literature and current initiatives from academics and legal professionals regarding smart contracts.

¹⁷ Brown, *supra* note 5.

¹⁸ Mougayar, *supra* note 4. Ricardian contracts are “semantic representations that can track the liability of an actual agreement between parties.” For example, a Ricardian contract might represent the legal conditions of a digitized bond. *Id.* (citing Ian Grigg, *The Ricardian Contract* (2004), http://iang.org/papers/ricardian_contract.html).

¹⁹ DIEDRICH, *supra* note 16, at 20. “State” refers to “all or part of the data that a program deals with.” *Id.* Computer code that remembers things, then, is “stateful” computer code. DLT in general, and Ethereum in particular, is for stateful applications. As Vitalik Buterin explains, “[a]ll blockchains have a notion of a history—the set of all previous transactions and blocks and the order in which they took place—and the state—currently relevant” data that determines whether or not a given transaction is valid and what the state after processing a transaction will be. Blockchain protocols also have a notion of a state transition rule: given what the state was before and given a particular transaction, (i) is the transaction valid, and (ii) what will the state be after the transaction?” Vitalik Buterin, *Ethereum: Platform Review, Opportunities and Challenges for Private and Consortium Blockchains* 1 (2015), https://static1.squarespace.com/static/55f73743e4b051cfcc0b02cfl/v57506f387da24ff6bdec3c1/1464889147417/Ethereum_Paper.pdf.

²⁰ Mougayar, *supra* note 4.

²¹ MELANIE SWAN, *BLOCKCHAIN: BLUEPRINT FOR A NEW ECONOMY* 16 (2015).

²² *Id.*

²³ *Id.*

²⁴ DIEDRICH, *supra* note 16.



II. CURRENT ACADEMIC LITERATURE AND INDUSTRY INITIATIVES RELATING TO SMART CONTRACTS

To date, most of the discussion regarding smart contracts among attorneys and academics centers on contract law. Because of its prominence in the marketplace and the literature, we review that discussion here. We also review prominent literature regarding the difficulty of safely implementing smart contracts. Since we published the first version of this white paper, a number of industry initiatives relating to platforms for creating legally enforceable computational contracts have emerged. As any discussion of the current literature would be incomplete without a review of those efforts, we include a summary discussion of a few of those initiatives here. We also review the ongoing efforts in many states to adopt legislation relating to the legal enforceability of smart contracts. Finally, we highlight the differences between the contract law discussion and the legal aspects of smart contract applications that emerging use cases will confront in the near term.

SMART CONTRACTS AND CONTRACT LAW

Much of the current legal analysis of smart contracts centers on contract law.²⁵ Such analysis focuses on smart contracts in a narrower sense than described above, focusing on “the use of computer code to articulate, verify and execute an agreement between parties.”²⁶ Under a contract law analysis, key legal issues include notice, consent, and consumer protection—similar to the oft-litigated issues in the click-wrap and browse-wrap context.²⁷ Others consider challenges under traditional concepts of fraud, force majeure and frustration.²⁸ Still others view smart contracts, when used to automate the execution of a legal agreement, as merely a new form of self-help that fits rather neatly within existing contract law.²⁹ Finally, several commentators consider the possible conflict between smart contracts and relational contract theory.³⁰ Essentially, these authors recognize that a smart contract is merely a type of computer code, which may represent all, part, or none of a valid legal contract under U.S. law. Thus, even where a smart contract represents the entirety of an enforceable legal contract (often referred to as a “smart legal contract”), it remains subject to the same body of contract law as any other contract written in natural language.

As a result, most of the literature concludes that traditional contract law will continue to apply in a smart contract era, and that “smart contracts will never fully replace natural-language law.”³¹ Nonetheless, many authors also predict that smart contracts can bring clarity, predictability, auditability, and ease of enforcement to contractual relations.³² While the analysis of smart contracts as varying forms of legal contracts offers both useful and productive insights into the changing legal landscape, many of the current use cases for smart contracts involve proprietary platforms offered in the manner of software as a service, and do not purport to serve as a proxy for a traditional legal contract. This white paper offers an overview of the additional legal regimes that will bear upon such service offerings.

TECHNICAL DIFFICULTY POSED BY SMART CONTRACT DEVELOPMENT

A second set of literature involves substantial research demonstrating the challenges in correctly coding smart contracts to perform as intended, which can often be more difficult than programming traditional software.³³ Furthermore, the self-executing nature of smart contracts causes even small errors to have significant consequences.³⁴

For example, the Ethereum-based decentralized autonomous organization, commonly referred to as “The DAO,”³⁵ operated pursuant to a smart contract computer code. The code contained a known bug (that programmers were actively working to fix), which ultimately allowed

²⁵ See, e.g., Chamber of Digital Commerce, Smart Contracts Alliance, *Smart Contracts: 12 Use Cases for Business & Beyond* 40 (Dec. 2016), https://digitalchamber.org/wp-content/uploads/2018/02/Smart-Contracts-12-Use-Cases-for-Business-and-Beyond_Chamber-of-Digital-Commerce.pdf; Alexander Savelyev, *Contract Law 2.0: Smart Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016 (Dec. 14, 2016), https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2885241; Werbach & Cornell, *supra* note 1; Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305 (2017); Karen Levy, *Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and the Social Workings of Law*, 3 ENGAGING SCI., TECH. & SOC'Y 1 (2017); Note, Jeremy M. Sklaroff, *Smart Contracts and the Cost of Inflexibility*, 166 U. PA. L. REV. 263 (2017).

²⁶ Josh Stark, *How Close Are Smart Contracts to Impacting Real-World Law?*, COINDESK (Apr. 11, 2016), <http://www.coindesk.com/blockchain-smarts-contracts-real-world-law/>.

²⁷ Chamber of Digital Commerce, *supra* note 25.

²⁸ Lee Bacon, Nigel Brook & George Bazinas, “Smart Contracts: Where Law Meets Technology,” CLYDE&CO (June 22, 2016), <http://www.clydeco.com/insight/article/smart-contracts-where-law-meets-technology>.

²⁹ Raskin, *supra* note 25.

³⁰ Levy, *supra* note 25; Sklaroff, *supra* note 25.

³¹ Stark, *supra* note 26.

³² *Id.*

³³ Kevin Delmolino, Mitchell Amett, Ahmed Kosba, Andrew Miller & Elaine Shi, *Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab* (Nov. 18, 2015), <https://eprint.iacr.org/2015/460.pdf> (“Our lab experiences show that even for very simple smart contracts (e.g., a ‘Rock, Paper, Scissors’ game), designing and implementing them correctly was highly non-trivial.”)

³⁴ *Id.*

³⁵ “The DAO” is the name of a particular DAO, conceived of and programmed by the team behind German startup Slock.it—a company building ‘smart locks’ that let people share their things (cars, boats, apartments) in a decentralized version of Airbnb.” David Siegel, *Understanding the DAO Attack*, COINDESK (June 25, 2016), <http://www.coindesk.com/understanding-dao-hack-journalists/>. Generally speaking, however, “A DAO is a Decentralized Autonomous Organization. Its goal is to codify the rules and decisionmaking apparatus of an organization, eliminating the need for documents and people in governing, creating a structure with decentralized control.” *Id.*

More Legal Aspects of Smart Contract Applications



one of The DAO's participants to divert 3.6 million ether ("ETH"), roughly valued at \$50 million, into a "child DAO" controlled only by that participant.³⁶ The DAO programmer, Christoph Jentzsch, was considered an Ethereum veteran at the time, demonstrating that even experienced programmers with a deep understanding of Ethereum can make mistakes when programming with smart contracts.³⁷ In fact, because of the difficulty of coding smart contracts, leaders in the industry are advancing efforts to develop standard smart contract code audits. The point here is that, in addition to any other substantive legal issues triggered by the particular smart contract use case, businesses offering smart contract-based services should remain mindful of potential legal liability arising from programming mistakes, which may include product liability, breach of (the software as a service) contract, unfair and deceptive trade practices, and cybersecurity, among others.

INDUSTRY INITIATIVES RELATING TO LEGALLY ENFORCEABLE COMPUTATIONAL CONTRACTS

Despite the difficulty of programming smart contracts, academics and industry actors alike continue to see potential value in melding enforceable legal contracts with smart contract computer code. To realize this potential, and in light of the technical difficulty in making smart legal contracts commercially viable, several industry initiatives emerged to pursue platforms and standards to facilitate their broader adoption. We introduce several such initiatives here.

THE ACCORD PROJECT. Led by legal-technology startup Clause,³⁸ the Accord Project is a consortium of technology and legal experts focused on developing the Accord Protocol—a series of legal and technical standards for developing and implementing smart legal contracts across multiple platforms.³⁹ The project seeks "to integrate computable functionality into legally-enforceable contracts, while drawing upon a range of experts to establish an industry-first set of standards for the inevitable transition to computable contracting."⁴⁰ The Accord Project spearheads the development of an open source implementation of the Accord Protocol called "Cicero," which offers a smart contract template system that enables the transformation of legally enforceable natural language agreements into smart legal contracts by connecting them "to a wide variety of software systems and platforms, including blockchain" and enabling execution "in response to external data."⁴¹

OPENLAW. OpenLaw seeks to create "a technology stack to help power next generation 'smart' legal agreements."⁴² More specifically, OpenLaw offers a "blockchain-based protocol for the creation and execution of legal agreements" that interacts with blockchain-based smart contracts, allowing the legal community to "more efficiently engage in transactional work and digitally sign and store legal agreements in a highly secure manner."⁴³ OpenLaw has developed a repository of legal agreement templates that can be modified using OpenLaw's "Legal Markup" language to "create and manage the execution of legal documents, and, if desired, embed Ethereum-based smart contracts into legal agreements."⁴⁴ OpenLaw is also working to enable contract negotiation between OpenLaw users via the Ethereum blockchain, and integration with Stripe payments to facilitate payouts in fiat currency.⁴⁵

STANFORD COMPUTABLE CONTRACTS INITIATIVE. A third initiative comes from Stanford University. In connection with the broader work related to legal analytics and computational law at Stanford's CodeX,⁴⁶ the Stanford Computable Contracts Initiative works "on legal technology that will help move the world from natural language based contracts toward a world of computable contracts."⁴⁷ With the dual aims of reducing legal transaction costs and enabling better contracts, the Computable Contracts Initiative "works on developing a Universal Contract Definition Language that will allow terms and conditions to be represented in [a] machine-understandable way."⁴⁸ The Contract Definition Language aims to provide a uniform expression of contractual and legal terms in the form of executable computer code that can be employed across legal domains, with the goal of facilitating more efficient and optimal decision-making.⁴⁹

³⁶ *Id.*

³⁷ DIEDRICH, *supra* note 16, at 54.

³⁸ Clause, <http://clause.io/> (last visited Mar. 28, 2018).

³⁹ 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/#24b89b59472c>.

⁴⁰ *The Accord Project Launches Tools and Standards for Smart Legal Contracts with Hyperledger and IACCM*, MEDIUM (July 26, 2017), <https://medium.com/accord-blog/the-accord-project-launches-industry-first-tools-and-standards-for-smart-legal-contracts-with-2e67b2b6f2fd>.

⁴¹ Dan Selman & Housman Shadab, *Making Legal Contracts Smart*, HYPERLEDGER (Jan. 11, 2018), <https://www.hyperledger.org/blog/2018/01/11/making-legal-contracts-smart>.

⁴² OpenLaw, <https://docs.openlaw.io/> (last visited Mar. 28, 2018).

⁴³ *Introducing OpenLaw*, MEDIUM (July 25, 2017), <https://media.consensys.net/introducing-openlaw-7a2ea410138b>; see also OpenLaw, *supra* note 42.

⁴⁴ *Introducing OpenLaw*, *supra* note 43.

⁴⁵ *OpenLaw Development Update (02/17/18)*, MEDIUM (Feb. 17, 2018), <https://medium.com/@OpenLawOfficial/openlaw-development-update-02-17-18-d9e578fb5f30>.

⁴⁶ CodeX, Stanford Center for Legal Informatics, <https://law.stanford.edu/codex-the-stanford-center-for-legal-informatics/> (last visited Mar. 29, 2018).

⁴⁷ Stanford Law School, Stanford Computable Contracts Initiative, <https://law.stanford.edu/projects/stanford-computable-contracts-initiative/> (last visited Mar. 29, 2018).

⁴⁸ Stanford Computable Contracts Initiative, *Computable Contracts*, <http://compk.stanford.edu/> (last visited Mar. 29, 2018).

⁴⁹ *Id.*

More Legal Aspects of Smart Contract Applications



STATE LEGISLATIVE EFFORTS RELATED TO SMART CONTRACTS

A variety of state legislatures have introduced legislation that purports to clarify that contracts cannot be denied legal effect, validity or enforceability merely because the contract is processed, executed, or otherwise enforced via smart contract computer code. States that have enacted, are considering, or have considered such laws include Arizona,⁵⁰ California,⁵¹ Florida,⁵² Nebraska,⁵³ Nevada,⁵⁴ and New York,⁵⁵ among others. Some of these statutes contain definitions of terms such as “blockchain,” “distributed ledger technology” and “smart contracts” that have come under significant fire by academics.⁵⁶ For example, the Arizona statute, signed into law in 2017, defines “blockchain technology” as “distributed ledger technology that uses a distributed, decentralized, shared and replicated ledger, which may be public or private, permissioned or permissionless, or driven by tokenized crypto economics or tokenless.”⁵⁷ The definition also provides that “[t]he data on the ledger is protected with cryptography, is immutable and auditable and provides an uncensored truth.”⁵⁸ One critique of such definitions centers on the use of terms, such as immutable, without accounting for the technical limitations of the technology.⁵⁹

Irrespective of the relative accuracy of the definitions contained in such laws, it is not at all clear that such legislation is necessary to render smart contracts legally enforceable. As discussed above, the leading academic scholarship in this area concludes that contracts processed, executed, or otherwise enforced via smart contract technology remain subject to existing contract laws, just like any other technologically enhanced contracts. Among the laws that apply are the federal Electronic Signatures in Global and National Commerce Act (“ESIGN Act”)⁶⁰ and the Uniform Electronic Transactions Act (“UETA”), which nearly all states have enacted.⁶¹ The ESIGN Act and the UETA ensure that: if a law requires a signature, an electronic signature suffices; and if a law requires a record to be in writing, an electronic record suffices. A contract, signature, or related record may not be deemed unenforceable or to be without legal effect merely because it is in electronic form; and the use of an electronic record in the formation of the contract is insufficient, standing alone, to deny legal effect to the contract. Cryptographic signatures fit the definition of “electronic signature” contained in the ESIGN Act and the UETA. As a result, it is not at all clear that a new legal framework is required to ensure the validity or enforceability of signatures, records, or contracts that use smart contracts. Instead, commentators worry that the types of legislation currently under consideration are not only unnecessary, but may serve to create confusion rather than clarity.

EMERGING USE CASES TOUCH ON ENTIRELY DIFFERENT LEGAL REGIMES

With this existing landscape of legal and computer science research in mind, this white paper uses as its starting point reports of developing smart contracts use cases. In the subsequent section, we offer an overview of six such use cases, explain how smart contracts make them possible, and provide an introductory discussion of the applicable legal regimes.

⁵⁰ See H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017), <https://legiscan.com/AZ/text/HB2417/id/1588180>; see also Stan Higgins, *Arizona Governor Signs Blockchain Bill into Law*, COINDESK (Mar. 31, 2017), <https://www.coindesk.com/arizona-governor-signs-blockchain-bill-law/>.

⁵¹ See Assemb. B. 2658, Reg. Sess. (Cal. 2018), <https://legiscan.com/CA/text/AB2658/2017> (introduced Feb. 15, 2018); see also Annaliese Milano, *California Bill Would Legally Recognize Blockchain Data*, COINDESK (Feb. 20, 2018), <https://www.coindesk.com/california-lawmaker-files-bill-legally-recognize-blockchain-data/>.

⁵² See H.B. 1357, Reg. Sess., (Fla. 2018), <https://legiscan.com/FL/text/H1357/id/1676376> (introduced Jan. 8, 2018, dies on calendar Mar. 10, 2018); see also Nikhilesh De, *Florida Bill Would Legally Recognize Blockchain Signatures, Smart Contracts*, COINDESK (Jan. 11, 2018), <https://www.coindesk.com/florida-bill-legally-recognize-blockchain-signatures-smart-contracts/>.

⁵³ See L.B. 695, 105th Leg. (Neb. 2018), <https://legiscan.com/NE/bill/LB695/2017> (introduced Jan. 3, 2018).

⁵⁴ See S.B. 398, 79th Leg. (Nev. 2017), <https://www.leg.state.nv.us/App/NELIS/REL/79th2017/Bill/5463/Overview> (signed into law by the governor on June 5, 2017); see also Nevada Passes Pro-Blockchain Law, THE NAT'L L. REV. (June 13, 2017), <https://www.natlawreview.com/article/nevada-passes-pro-blockchain-law>.

⁵⁵ See Assemb. B. 8780, Gen. Assemb., Reg. Sess. (N.Y. 2018), <https://legiscan.com/NY/text/A08780/id/1658675> (introduced Jan. 3, 2018); see also Alexis Kramer, *More States Eye Blockchain for Records, Businesses*, BLOOMBERG LAW (Feb. 22, 2018), <https://biglawbusiness.com/more-states-eye-blockchain-for-records-businesses/>.

⁵⁶ See, e.g., Angela Walch, *The Path of Blockchain Lexicon (and the Law)*, 36 REV. BANKING & FIN. L. 713, 734, 743-45 (2017) (critiquing the use of fluid blockchain terminology in legislation and regulation, arguing, among other things, that “a diverging terminology can lead to inconsistent regulation across jurisdictions or subject matter areas, due to different ways of talking about (and potentially different understandings of) the technology, rather than differing underlying policy choices by regulators,” and criticizing the February 2017 Arizona law defining signatures “secured through a blockchain” as “electronic signatures” for its definition of the term “blockchain technology”).

⁵⁷ *Id.* at 743-44 (quoting H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017)).

⁵⁸ *Id.* at 744 (quoting H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017)).

⁵⁹ *Id.* at 744-45.

⁶⁰ 15 U.S.C. §§ 7001 *et seq.*

⁶¹ The states that have not enacted the UETA include New York, Washington, and Illinois, and each of those states have adopted alternative statutes which give legal effect to electronic contracts and signatures.



III. EXPLORING THE LEGAL ASPECTS OF SMART CONTRACT APPLICATIONS

This section explores six emerging uses of smart contracts: token sales, capital markets, supply chain management, smart government records and smart cities, real estate registries, and self-sovereign identity. We first provide the context that led to the application of smart contracts in each area. We then offer a brief discussion of potential legal issues that may arise as projects in each area become more prominent and more frequent.

SMART CONTRACTS IN TOKEN SALES

How Are Smart Contracts Used in Token Sales?

The uses of smart contract applications in token sales that feature most prominently in the existing news cycle and regulatory debates include sales of tokenized goods and services, crowd sales, venture capital fundraising, and tokenized securities. However, a growing number of projects use smart contracts to create new offerings that operate more like a layered protocol than a decentralized application. In this section, we offer a short discussion of both token sales involving tokenized goods and services, and token sales involving this emerging class of protocol, governance, and autonomous tokens. The differences between types of tokens may have implications for the applicability of existing law to any given token sale.

DLT protocols, including the Bitcoin and Ethereum blockchains, represent what many refer to as “cryptoeconomic protocols”⁶² that rely on intrinsic tokens (e.g., bitcoin and ether, respectively) to encourage users to validate transactions, impose minor transaction costs to prevent spam without discouraging legitimate activity, and grant the token holder the right to participate in the network.⁶³ The industry increasingly refers to tokens intrinsic to DLT protocols, such as bitcoin and ether, as “protocol tokens.”⁶⁴ These intrinsic protocol tokens, sometimes referred to as tokens for native protocols,⁶⁵ are far from the only type of token operating in the cryptocurrency ecosystem.

For example, smart contracts enable non-intrinsic tokens to exist on top of blockchains. Many recent token sales involve tokens that adhere to an Ethereum-based standard known as “ERC20.”⁶⁶ Tokens designed in accordance with the ERC20 token standard (referred to as “ERC20 tokens”) are not intrinsic to the Ethereum blockchain, but are compatible with an Ethereum wallet and can readily implement other Ethereum token smart contracts.⁶⁷ Although most tokens are built with the ERC20 token standard, the uses and purposes of ERC20 tokens vary significantly. For example, an ERC20 token may represent fungible goods, such as coins, gold certificates, loyalty points, IOUs, or in-app credits.⁶⁸ Or, an ERC20 token may represent a tokenized right to a good or service within a decentralized application.⁶⁹ When application tokens represent a tokenized good or service, they are increasingly referred to as “utility tokens.”⁷⁰ Brave Browser’s Basic Attention Token (“BAT”) represents an example of a utility token.⁷¹ Brave Browser users earn BAT for watching advertisements, and can use earned BAT to access premium content.⁷²

⁶² In this context, the term “protocol” refers to “the set of cryptoeconomic rules that maintain distributed consensus across a peer-to-peer network.” Will Warren, *The Difference Between App Coins and Protocol Tokens*, MEDIUM (Feb. 1, 2017), <https://blog.0xproject.com/the-difference-between-app-coins-and-protocol-tokens-7281a428348c>. Such cryptoeconomic protocols can be distinguished from the more general “network protocol,” which simply sets the rules that allow networked computers (nodes) to communicate with each other. *Id.* For example, the Internet Protocol is a network protocol that defines the digital message formats and rules for communication among connected computers. Internet Protocol (IP), TECHNOPEEDIA, <https://www.techopedia.com/definition/5366/internet-protocol-ip> (last visited Mar. 29, 2018). Email is also built on a protocol that allows users to communicate with one another; “[i]t’s just a way for two computers to talk to one another.” Ryan Shea, *When to Use Protocol Tokens*, MEDIUM (Nov. 13, 2017), <https://medium.com/@ryanshea/protocol-tokens-1ed44fa89453>.

⁶³ Jonathan Rohr & Aaron Wright, *Blockchain-Based Token Sales, Initial Coin Offerings, and the Democratization of Public Capital Markets* 9-11 (Oct. 4, 2017) (unpublished manuscript), <https://ssrn.com/abstract=3048104>.

⁶⁴ *Id.* at 14.

⁶⁵ Warren, *supra* note 62.

⁶⁶ Rohr & Wright, *supra* note 63, at 21.

⁶⁷ The technical functions associated with the ERC20 Token Standard appear at: https://theethereum.wiki/w/index.php/ERC20_Token_Standard.

⁶⁸ This list of tokenized goods appears at: <https://www.ethereum.org/token>, and is not meant to be exhaustive.

⁶⁹ Such “application tokens” or “app tokens,” are defined as “tokens that are native to decentralized applications and have a cryptographic asset associated with their use or monetization, without locking value in its parent protocol.” Rafael Delfin, *A General Taxonomy for Cryptographic Assets*, BRAVE NEW COIN (2018), <https://bravenewcoin.com/general-taxonomy-for-cryptographic-assetsk>.

⁷⁰ Rohr & Wright, *supra* note 63, at 22 (defining “utility tokens” as app tokens that “grant holders the right to access, use, and enjoy a given technology or participate in an online organization”).

⁷¹ *Id.* at 23. BAT would fall within the definition of application token in the Brave New Coin General Taxonomy. See Delfin, *supra* note 69, at 18 (including tokens for digital advertising in the category of application tokens).

⁷² Rohr & Wright, *supra* note 63, at 23. Other examples of application tokens offered by the Brave New Coin General Taxonomy include DigixDAO, CoEval, APX Ventures, Civic, Aragon, and AdEx. See, Delfin, *supra* note 69, at 17.

More Legal Aspects of Smart Contract Applications



Increasingly, a new class of tokens is emerging in the ecosystem—namely, tokens that operate as a form of layered protocol token, built on top of a native cryptoeconomic protocol like Ethereum, that are imbued with governance attributes or sold in an entirely autonomous manner. At least one commentator refers to such protocols as “non-native” cryptoeconomic and network protocols.⁷³ The Ox protocol offers an example of a non-native network protocol, operating through a system of smart contracts on top of the Ethereum native cryptoeconomic protocol, that is designed explicitly for the decentralized exchange of tokens using publicly accessible smart contracts.⁷⁴ The Ox protocol is entirely open source, and is maintained in part by proceeds earned in a public token sale of the Ox protocol token—ZRX.⁷⁵ Holders of ZRX are granted governance rights concerning ongoing maintenance and updates to the Ox protocol.⁷⁶ In addition, participants in the Ox ecosystem may choose to adopt ZRX for payment of transaction fees and other services offered within a proprietary platform.⁷⁷

Another example of a smart contract-based token that is markedly different from the ERC20 application tokens, utility tokens and capital raising tokens that have received so much recent attention include Metronome, a cross-chain monetary system⁷⁸ operated entirely through autonomous smart contracts.⁷⁹ The discussion of the legal issues relating to token sales described below focuses heavily on the types of tokens currently garnering the most regulatory attention: ERC20 tokens used to raise capital, including application tokens and utility tokens. The application of the laws discussed below to new and emerging types of protocol and autonomous tokens represents a further layer of regulatory complexity that merits careful attention and further industry and academic research.

Legal Aspects of Using Smart Contracts in Token Sales

Given the recent prominence of tokens and token sales, the legal issues that are currently at the forefront and which will continue to arise most frequently in the near term involve analysis as to the legal nature of a smart contract-based token and whether a token sale constitutes an offering of securities, a commodities contract, or some other regulated financial transaction. Depending on the legal nature of the token, particularly in the context of a crowd sale, the resulting tax consequences may also present novel issues for those interested in buying or selling tokens.

Although token sales are often intended to create ecosystems for accessing services through the tokens, the sales pose a significant risk of offering a security for sale and selling securities without proper authorization. If a token sale represents offering a security for sale, Section 5 of the Securities Act of 1933 generally requires that all securities offered for sale be registered with the Securities and Exchange Commission (“SEC”) unless an exemption applies. The federal securities laws define the term “security” very broadly to cover virtually all types of commercial financial instruments.⁸⁰ What is covered by this definition can be vague in certain contexts, and thus the U.S. Supreme Court has developed a number of tests to determine whether a particular instrument is a security. Of such tests, the Supreme Court has made clear that the *Howey* investment contract test is applicable to cases involving “unusual instruments not easily characterized as ‘securities.’”⁸¹ The factors for the *Howey* test involve (i) an investment of money, (ii) in a common enterprise, (iii) with an expectation of profits, (iv) derived solely from the efforts of others.⁸² *Howey* is very dependent upon specific facts, however; depending on the circumstances of their issuance and the expectations of the parties, token sales could potentially be construed as “investment contracts,” and thus securities, under the federal securities laws. In fact, the SEC used the *Howey* investment contract test to determine that the tokens issued by the decentralized venture capital firm “The DAO” constituted securities.⁸³

⁷³ Warren, *supra* note 62.

⁷⁴ Will Warren & Amir Bandeali, *Ox: An Open Protocol for Decentralized Exchange on the Ethereum Blockchain* 11 (Feb. 21, 2017), https://www.oxproject.com/pdfs/Ox_white_paper.pdf (“While Ox is fundamentally a network protocol used to facilitate signaling between buyers and sellers (rather than a cryptoeconomic protocol), it is intended to serve as an open standard for dApps that incorporate exchange functionality.”).

⁷⁵ Blake Henderson, *Welcome to the Ox Community*, MEDIUM (Aug. 8, 2018), <https://blog.oxproject.com/welcome-to-the-ox-community-9d99dfe0a52b>.

⁷⁶ Will Warren & Amir Bandeali, *x: An Open Protocol for Decentralized Exchange on the Ethereum Blockchain* 11 (Feb. 21, 2017), https://oxproject.com/pdfs/Ox_white_paper.pdf

⁷⁷ *Id.*

⁷⁸ Robin Davids, Mark Jedd & Eugene Tartakovsky, *Metronome (MTN) ICO: Cross-Blockchain Cryptocurrency*, MEDIUM (Dec. 3, 2017), <https://medium.com/research-center/metronome-mtn-ico-cross-blockchain-cryptocurrency-10300e90c1b0>.

⁷⁹ Jeff John Roberts, *Bitcoin Alums Announce New Digital Currency Metronome*, FORTUNE (Oct. 24, 2017), <http://fortune.com/2017/10/24/bitcoin-metronome/>; Metronome, <https://metronome.io/> (last visited Mar. 29, 2018).

⁸⁰ Section 2(a)(1) of the Securities Act of 1933 (the “Securities Act”) and Section 3(a)(10) of the Securities Exchange Act of 1934 (the “Exchange Act”) generally define the term “security,” among other things, as any note, stock, bond, debenture, evidence of indebtedness, certificate of interest or participation in any profit-sharing agreement, transferable share, investment contract, certificate of deposit, or, in general, any interest or instrument “commonly known as a ‘security.’” See 15 U.S.C. § 77b(a)(1); 15 U.S.C. § 78c(a)(10). The Securities Act includes short-term instruments with maturities of less than nine months in its definition of “security,” while the Exchange Act excludes such short-term instruments.

⁸¹ See *Landreth Timber Co. v. Landreth*, 471 U.S. 681, 690 (1985).

⁸² See *SEC v. W.J. Howey Co.*, 328 U.S. 293, 299 (1946).

⁸³ *Report of Investigation Pursuant to Section 21(a) of the Sec. Exch. Act of 1934: The DAO*, Exchange Act Release No. 81207, 1-2 (July 25, 2017) [hereinafter “SEC DAO Report”].

More Legal Aspects of Smart Contract Applications



Although many industry actors seemed surprised by the SEC's position, consideration of the specific elements of the *Howey* test reveals just how easily a token sale could fall into the investment contract category. For many token sales, the "investment of money" and "common enterprise" prongs are satisfied, because to purchase a token you make an investment of money, and the result of your investment is correlated to the results of other investors (i.e., token holders) or to the expertise of the token issuer. As a result, the "expectation of profits" and "solely from the efforts of others" elements of the test are often pivotal in determining whether a token sale constitutes an investment contract under federal securities laws. For an expectation of profits to exist, "the purchaser's motivation in participating in the transaction must be securing 'a financial return.'"⁸⁴ When the purchaser buys the item for the purpose of consuming or using it, case law indicates that the transaction may not be treated as a security.⁸⁵ The requirement that the expectation of profits be for profits generated by the efforts of others requires a similarly fact-dependent inquiry. Because the *Howey* test and, in particular, its "expectation of profits" prong, is so fact dependent, the outcome for any given token sale may be different, but that outcome will influence whether a token issuer ought to register with the SEC or else avail itself of an appropriate exemption before offering the token for public sale.

Recent SEC token sale enforcement activity prominently features the facts-and-circumstances nature of this analysis. For example, the SEC's move to freeze the assets of both PlexCorps⁸⁶ and RECoin⁸⁷ rested on false promises of a thirteen-fold profit in less than one month and false disclosures regarding the nature of operations and the team consulting on the project.⁸⁸ That the SEC took action against those that allegedly lied to investors is unsurprising.

A third enforcement action, however, offers additional insight into the multi-faceted nature of the fact-dependent inquiry undertaken by the SEC with regard to digital token sales. On December 11, 2017, the SEC announced that Munchee Inc. ("Munchee") halted its token sale and refunded all token purchases after the SEC raised securities regulatory concerns.⁸⁹ Munchee intended its token, MUN, to be a utility token, a token to incentivize honest and helpful reviews of restaurants through the pre-existing Munchee mobile app.⁹⁰ Munchee's white paper even acknowledged the *Howey* test and offered the utility token rationale as to why the MUN token did "not pose a significant risk of implicating federal securities laws."⁹¹ In the enforcement order issued on December 11, 2017 ("the Munchee Order"), however, the SEC nevertheless unequivocally determined that "MUN tokens were securities pursuant to Section 2(a)(1) of the Securities Act. MUN tokens are 'investment contracts' under *SEC v. W.J. Howey Co.*, 328 U.S. 293 (1946), and its progeny, including the cases discussed by the Commission" in the SEC DAO Report.⁹² The Munchee Order found that MUN token purchasers would have had a reasonable expectation of receiving future profits from the efforts of others through the revision of the Munchee mobile app and Munchee's creation of an ecosystem for use of the tokens.⁹³ The SEC specifically noted that at the launch of its ICO efforts, Munchee announced, among other things, "the way in which MUN tokens would increase in value, and the ability for MUN token holders to trade MUN tokens on secondary markets."⁹⁴ The SEC further noted that although MUN token purchasers were promised the ability to use MUN tokens to buy goods and services through the Munchee app in the future, no such functionality was available at the time of the token sale.⁹⁵ Further, the Munchee Order focused on Munchee's description of building an ecosystem and the resulting increase in value of MUN tokens that would allegedly result.⁹⁶ Other important factors included Munchee's marketing statements indicating that the company expected MUN tokens to rise in value and the ways in which Munchee would work to ensure as much, including arranging for MUN tokens to be traded on secondary markets.⁹⁷

⁸⁴ Rohr & Wright, *supra* note 63, at 51 (citing *SEC v. Life Partners, Inc.*, 87 F.3d 536, 547 (D.C. Cir. 1996)).

⁸⁵ *Id.* (citing *Rice v. Branigar Org.*, 922 F.2d 788, 791 (11th Cir. 1991) and *Libaire v. Kaplan*, No. 06-1500, 2008 WL 794973 (E.D.N.Y. Mar. 24, 2008)); see also CommunityEnterpriseLaw.org, *A Securities Law Primer*, http://communityenteriselaw.org/financing-topics/securities/#When_the_Investors_Primary_Motivation_Is_Consumption_of_a_Commodity_or_Service (last visited Mar. 29, 2018) (citing *United Hous. Found., Inc. v. Farman*, 421 U.S. 837 (1975)).

⁸⁶ Press Release, U.S. Sec. & Exch. Comm'n, SEC Emergency Action Halts ICO Scam, 2017-219 (Dec. 4, 2017), <https://www.sec.gov/news/press-release/2017-219>.

⁸⁷ Press Release, U.S. Sec. & Exch. Comm'n, SEC Exposes Two Initial Coin Offerings Purportedly Backed by Real Estate and Diamonds, 2017-185 (Sept. 29, 2017), <https://www.sec.gov/news/press-release/2017-185-0>.

⁸⁸ For a short summary of these enforcement actions, see Keith Miller, *SEC Files Emergency Action to Halt Alleged ICO Scam*, PERKINS COIE VIRTUAL CURRENCY REPORT (Dec. 4, 2017), <https://www.virtualcurrencyreport.com/2017/12/sec-files-emergency-action-to-halt-alleged-ico-scam/>.

⁸⁹ Press Release, U.S. Sec. & Exch. Comm'n, Company Halts ICO After SEC Raises Registration Concerns, 2017-227 (Dec. 11, 2017), <https://www.sec.gov/news/press-release/2017-227>.

⁹⁰ Dr. Sanjeev Verma, Nghi Bui & Chelsea Lam, *Munchee Token: A decentralized Blockchain based food review/rating social media platform* (Oct. 16, 2017), <https://www.theventurealley.com/wp-content/uploads/sites/5/2017/12/Munchee-White-Paper.pdf>.

⁹¹ *Id.* at 3-4.

⁹² *In re Munchee, Inc.*, No. 3-18304, Order Instituting Cease-and-Desist Proceedings Pursuant to Section 8A of the Securities Act of 1933, Making Findings, and Imposing a Cease-and-Desist Order, at 2 (Dec. 11, 2017), <https://www.sec.gov/litigation/admin/2017/33-10445.pdf>.

⁹³ *Id.*

⁹⁴ *Id.* at 3.

⁹⁵ *Id.* at 4.

⁹⁶ *Id.*

⁹⁷ *Id.* at 4-5.

More Legal Aspects of Smart Contract Applications



Taken together, the SEC determined that, despite an apparent use for MUN tokens in the future, MUN token purchasers had a reasonable expectation of profits from the efforts of Munchee, making the MUN tokens an investment contract under *Howey*, and thus a security.⁹⁸ Particularly noteworthy for future token sales, the SEC explained that “[e]ven if MUN tokens had a practical use at the time of the offering, it would not preclude the token from being a security. Determining whether a transaction involves a security does not turn on labeling—such as characterizing an ICO as involving a ‘utility token’—but instead requires an assessment of ‘the economic realities underlying a transaction.’ All of the relevant facts and circumstances are considered in making that determination.”⁹⁹ All told, those considering the launch of a token sale should consult legal counsel at every step of the sale in order to minimize regulatory risk, as the analysis must broadly account for all of the seller’s communications about the token sale, not just formal materials such as the white paper and terms of sale.

Moreover, state law may play a role in the level of risk for any given token sale under U.S. securities laws. Every state maintains its own securities laws, known as “Blue Sky Laws,” which aim to protect investors from fraud. Although the SEC garners most of the attention when it comes to securities regulations as applied to token sales in the United States, the state of Texas reminded the industry that token sale operators should also mind state Blue Sky Laws. The Texas Securities Commissioner issued an emergency cease and desist order on January 4, 2018 requiring BitConnect to stop offering any securities for sale in Texas until BitConnect either registers with the Texas Securities Commissioner or receives an exemption under the Texas Securities Act.¹⁰⁰ The Texas Securities Commissioner determined that BitConnect should have registered in Texas before making sales to Texas residents and that BitConnect failed to disclose material information to the investors it solicited in Texas.¹⁰¹ The action against BitConnect reminds those operating a token sale in the United States that state regulators have both similar concerns and similar enforcement tools as their federal counterparts.

On the other hand, tokens that do not constitute investment contracts under U.S. securities law may constitute commodities, which fall under the jurisdiction of the Commodity Futures Trading Commission (“CFTC”). The Commodity Exchange Act (“CEA”)¹⁰² gives the CFTC jurisdiction over certain kinds of transactions involving commodities, generally those involving commodities derivatives, future delivery, or financing, leverage, or margin. As a point of reference, the CFTC has stated that a virtual currency is a commodity for purposes of the CEA.¹⁰³ The question of whether the CFTC would assert jurisdiction over smart contract-based tokens thus turns on whether (i) the CFTC would construe a particular token as either a virtual currency or other commodity under its purview, and/or (ii) whether transactions involving such tokens fit into any of the types of transactions over which the CFTC has jurisdiction. On December 15, 2017, the CFTC issued a proposed interpretation of the term “actual delivery” as used in the provision of the CEA that grants the CFTC explicit authority to oversee the marketplace for “retail commodity transactions.”¹⁰⁴ Commentators believe that it is not merely a coincidence that the proposed interpretation was issued just days after trading in bitcoin futures contracts began.¹⁰⁵ Rather, the two are connected by the regulatory principle underlying the CFTC’s oversight of retail commodity transactions: “such arrangements are speculative in nature and have indicia of futures contracts by virtue of the use of leverage, margining or financing.”¹⁰⁶ Thus, “[m]argined, leveraged or financed transactions involving virtual currency entered into by retail investors are regulated by the CFTC as ‘retail commodity transactions.’ When a centralized virtual currency exchange or trading platform (‘Platform’) offers margin trading, or facilitates margined, leveraged or financed virtual currency transactions on behalf of its retail investors, the Platform is subjected to CFTC oversight unless there is ‘actual delivery’ of the purchased virtual currency within 28 days of the transaction.”¹⁰⁷

⁹⁸ *Id.* 5-8.

⁹⁹ *Id.* at 9 (citing *Forman*, 421 U.S. at 849; *SEC v. C.M. Joiner Leasing Corp.*, 320 U.S. 344, 352-53 (1943) (indicating the “test . . . is what character the instrument is given in commerce by the terms of the offer, the plan of distribution, and the economic inducements held out to the prospect”).

¹⁰⁰ *In re BitConnect*, No. ENF-18-CDO-1754 (Tex. State Sec. Bd. Jan 4, 2018), at 9 (emergency cease and desist order), https://www.ssb.texas.gov/sites/default/files/BitConnect_ENF-18-CDO-1754.pdf.

¹⁰¹ *Id.* at 5-8.

¹⁰² 7 U.S.C. § 1 *et seq.*

¹⁰³ See *In re BFXNA Inc.*, CFTC No. 16-19 (June 2, 2016), <http://www.cftc.gov/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfbfxnaorder060216.pdf>.

¹⁰⁴ Andrew P. Cross, Laurie Rosini & Thomas Ahmadifar, *Retail Commodity Transactions Involving Virtual Currencies: An Overview of the CFTC’s Proposed Interpretation (Part 1)*, PERKINS COIE DERIVATIVES & REPO REPORT (Dec. 16, 2017), <https://www.derivativesandrepo.com/2017/12/retail-commodity-transactions-involving-virtual-currencies-an-overview-of-the-cftcs-proposed-interpretation-part-1/>.

¹⁰⁵ *Id.*

¹⁰⁶ *Id.*

¹⁰⁷ Andrew P. Cross, Laurie Rosini & Thomas Ahmadifar, *CFTC Virtual Currency Proposed Interpretation – Part 2*, PERKINS COIE DERIVATIVES & REPO REPORT (Dec. 19, 2017), <https://www.derivativesandrepo.com/2017/12/cftc-virtual-currency-proposed-interpretation-part-2/>.

More Legal Aspects of Smart Contract Applications



To determine whether virtual currency is actually delivered within 28 days, the CFTC intends to take a “functional approach.”¹⁰⁸ By taking a functional approach, the CFTC means that actual delivery in the context of virtual currency will be met by the following requirements: “1. there be a record on the relevant *public* distributed ledger network or blockchain of the transfer of the entire quantity of the virtual currency to the purchaser’s blockchain wallet; 2. the purchaser be able to freely use the virtual currency (both within and away from any particular Platform); 3. neither the counterparty seller nor the Platform retains any interest in or control over the transferred virtual currency; and 4. the counterparty seller has transferred title to the purchaser, which may be reflected by linking the purchaser with proof of ownership of the wallet into which the virtual currency is transferred.”¹⁰⁹ This interpretation of the term “actual delivery” is merely a proposed interpretation, and the public has 90 days from the date the proposal is published in the Federal Register to comment.¹¹⁰

This proposed interpretation is not the only way the CFTC is demonstrating active policing of the virtual currency market. On January 19, 2018, the CFTC filed two civil enforcement actions—one in Colorado¹¹¹ and one in New York¹¹²—both alleging deceptive and fraudulent conduct on the part of purported virtual currency-related business operators.¹¹³ Then, on January 24, 2018, the CFTC announced an enforcement action against two individuals and My Big Coin Pay, Inc., alleging commodity fraud and misappropriation in connection with selling a fake virtual currency.¹¹⁴ The two individuals and My Big Coin Pay, Inc. allegedly misappropriated over \$6 million from consumers by accepting the funds without actually providing a service or product to the consumers in return, and then siphoned the funds off for personal use.¹¹⁵ These enforcement actions came in quick succession and were made public right around the same time that CFTC Enforcement Director James McDonald and SEC Enforcement Co-Directors Stephanie Avakian and Steven Peikin made a joint statement emphasizing that “[w]hen market participants engage in fraud under the guise of offering digital instruments—whether characterized as virtual currencies, coins, tokens, or the like—the SEC and the CFTC will look beyond form, examine the substance of the activity and prosecute violations of the federal securities and commodities laws.”¹¹⁶ The SEC and CFTC also issued a joint op-ed around the same time that emphasized their mutual intent to more strictly monitor token sales and enforce against unregistered sales of tokens deemed to be securities, in addition to fraudulent and other criminal activities.¹¹⁷ Then, in early February 2018, the Chairman of the SEC and the Chairman of the CFTC both testified at a hearing of the United States Senate Committee on Banking, Housing and Urban Affairs entitled “Virtual Currencies: The Oversight Role of the U.S. Securities and Exchange Commission and the U.S. Commodity Futures Trading Commission.”¹¹⁸ The testimony evidenced continued collaboration between the two agencies and a commitment to the enforcement of existing laws in the token sale space.¹¹⁹ Regulatory activity by both the SEC and the CFTC therefore remains an issue to watch carefully, and by no means does it exhaust the regulatory quagmire potentially applicable to token sales.

For example, in other scenarios, where a smart contract or token serves as a digital representation of ownership of goods, the token may simply represent an electronic “document of title” as described in Article 7 of the Uniform Commercial Code.¹²⁰ Other legal constructions that may be appropriate for DLT tokens include that of a system license or a franchise law framework.¹²¹

¹⁰⁸ *Id.*

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Charges Colorado Resident Dillon Michael Dean and His Company, The Entrepreneurs Headquarters Limited, with Engaging in a Bitcoin and Binary Options Fraud Scheme, 7674-18 (Jan. 19, 2018), <http://www.cftc.gov/PressRoom/PressReleases/pr7674-18>.

¹¹² Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Charges Patrick K. McDonnell and his Company CabbageTech, Corp. d/b/a Coin Drop Markets with Engaging in Fraudulent Virtual Currency Scheme, 7675-18 (Jan. 19, 2018), <http://www.cftc.gov/PressRoom/PressReleases/pr7675-18>.

¹¹³ For a summary of the civil enforcement actions and links to the complaints, see Kendra Haar, *Blockchain Week in Review January 8th-January 19th*, PERKINS COIE VIRTUAL CURRENCY REPORT (Jan. 30, 2018), <https://www.virtualcurrencyreport.com/2018/01/blockchain-week-in-review-january-8th-january-19th/#more-3473>.

¹¹⁴ Keith Miller, Andrew P. Cross & J. Dax Hansen, *CFTC Flexes Its Regulatory Muscle in a Case Involving a Virtual Currency*, PERKINS COIE VIRTUAL CURRENCY REPORT (Jan. 29, 2018), <https://www.virtualcurrencyreport.com/2018/01/cftc-flexes-its-regulatory-muscle-in-a-case-involving-a-virtual-currency/>.

¹¹⁵ Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Charges Randall Crater, Mark Gillespie, and My Big Coin Pay, Inc. with Fraud and Misappropriation in Ongoing Virtual Currency Scam, 7678-18 (Jan. 24, 2018), <http://www.cftc.gov/PressRoom/PressReleases/pr7678-18>.

¹¹⁶ U.S. Commodity Futures Trading Comm’n, Joint Statement from CFTC and SEC Enforcement Directors Regarding Virtual Currency Enforcement Actions (Jan. 19, 2018), <http://www.cftc.gov/PressRoom/SpeechesTestimony/mcdonaldstatement011918>.

¹¹⁷ Jay Clayton & J. Christopher Giancarlo, *Regulators Are Looking at Cryptocurrency*, WALL ST. J. (Jan. 24, 2018), <https://www.wsj.com/articles/regulators-are-looking-at-cryptocurrency-1516836363?mg=prod/accounts-wsj>.

¹¹⁸ For a detailed summary of the testimony each provided at the hearing, see Keith Miller & Conor O’Hanlon, *Open Session of the U.S. Senate’s Committee on Banking, Housing and Urban Affairs Hears Joint Testimony from Heads of the SEC & CFTC*, PERKINS COIE, THE FINTECH REPORT (Feb. 7, 2018), <https://www.fintechlegalreport.com/2018/02/open-session-of-the-u-s-senates-committee-on-banking-housing-and-urban-affairs-hears-joint-testimony-from-heads-of-the-sec-cftc/>.

¹¹⁹ *Id.*

¹²⁰ See U.C.C. § 1-201(b)(16), U.C.C. § 1-201(b)(31), and U.C.C. § 7-101 *et seq.*

¹²¹ *A Securities Law Framework for Blockchain Tokens*, an initiative of Coinbase, Coin Center, Union Square Ventures, and Consensus 20-22 (Dec. 7, 2016), <https://www.coinbase.com/legal/securities-law-framework.pdf>.



Furthermore, those offering either a protocol token or a utility token as part of their product and service model should carefully consider the potential application of money transmission laws. Although the securities and commodities issues receive much of the current public attention, the issuance of protocol tokens, whether consumable or not, may trigger regulation as a money transmitter or prepaid access provider under relevant federal and state laws. In March 2013, the U.S. Treasury Department's Financial Crimes Enforcement Network ("FinCEN") issued its seminal guidance on the application of the Bank Secrecy Act ("BSA") and its implementing regulations to virtual currencies (the "Virtual Currency Guidance").¹²² The Virtual Currency Guidance outlines the applicability of the BSA regulations relating to anti-money laundering ("AML") requirements to decentralized virtual currencies, "and concludes that administrators and exchangers of such currencies are subject to the AML requirements to the extent that they transmit decentralized virtual currency or legal tender from one user to another, or from one location to another."¹²³ "As explained in the [Virtual Currency] Guidance, a person is an exchanger and a money transmitter if the person accepts convertible virtual currency from one person and transmits it to another person [or location] as part of the acceptance and transfer of currency, funds, or other value that substitutes for currency."¹²⁴ FinCEN takes the position that even if the transmission of value is between two different accounts (or wallets) of the same person, the BSA AML regulations apply.¹²⁵ Thus, a token sale may trigger regulation under the BSA as a money transmission. Some states take a similar position.¹²⁶ In the context of a token sale, the token seller typically accepts convertible virtual currency from one person and transmits a token back to that person. The extent to which this exchange triggers money transmission regulation in any given token sale may rest on the technical details of the token sale, such as how an ERC20 contract used for Ethereum-based tokens is constructed. In general, the more control the token seller has over the smart contract, the greater the risk. As a result, those conducting token sales should carefully consider their legal obligations under both state and federal money transmission laws, in addition to the securities and commodities law considerations discussed above. In particular, with respect to state law, industry participants should remain vigilant for changes to the state money transmitter laws that may impact their operations. Some of these changes may involve increased uniformity of state laws. For example, the Uniform Law Commission approved and recommended the enactment of the Uniform Regulation of Virtual-Currency Business Act ("URVCBA") in July 2017,¹²⁷ and two states—Hawaii and Nebraska—introduced the URVCBA for consideration by their legislatures in the first months of 2018.¹²⁸

In addition, depending on the nature and legal characterization of a token based on smart contract functionality, sales of tokens present novel tax questions—whether as part of a crowd sale or fundraising effort or as an independent transaction. These tax issues include questions such as how to characterize the digital asset for taxation purposes, how to assign a value or cost basis to token sales when only digital assets (i.e., no fiat currencies) are exchanged (particularly in the context of a crowd sale), and how to assign a jurisdiction to the issuance or exchange for taxation purposes. Answers to these tax questions may, in turn, influence the jurisdiction in which development teams who are building smart contract platforms and applications may choose to incorporate.

Finally, all U.S. citizens and legal permanent residents (i.e., green card holders) anywhere in the world, all companies organized in the United States, all foreign branches of U.S. companies, and any person or entity located in the United States ("Covered Persons") involved in a token sale with worldwide scope must remember that they are subject to the regulations enforced by the Office of Foreign Assets Control ("OFAC Regulations") governing U.S. sanctions. Covered Persons may not be involved in, or in any way facilitate, a transaction that violates OFAC Regulations and U.S. sanctions. Although the specific OFAC Regulations vary by sanctions program, in general, they prohibit Covered Persons from brokering, financing, guaranteeing, approving, or selling anything to persons residing in sanctioned jurisdictions or that are identified on the Specially Designated Person's List.

¹²² U.S. Dep't of Treasury, FinCEN, Admin. Ruling No. FIN-2013-G001, Application of FinCEN's Regulations to Persons Administering, Exchanging, or Using Virtual Currencies (Mar. 18, 2013), https://www.fincen.gov/statutes_regs/guidance/pdf/FIN-2013-G001.pdf [<https://perma.cc/49PB-SU55> [hereinafter FinCEN, Virtual Currency Guidance]].

¹²³ Carla L. Reyes, *Moving Beyond Bitcoin to an Endogenous Theory of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 *VILL. L. REV.* 191, 204 (2016) (citing FinCEN, Virtual Currency Guidance, *supra* note 122, at 4). For a detailed description of the Virtual Currency Guidance, see generally J. Dax Hansen, Carla L. Reyes & Joseph P. Cutler, *New FinCEN Guidance Changes Regulatory Landscape for Virtual Currencies and Some Prepaid Programs*, Perkins Coie (Mar. 22, 2013), <https://www.perkinscoie.com/en/news-insights/new-fincen-guidance-changes-regulatory-landscape-for-virtual.html>; see also Stephen T. Middlebrook & Sarah Jane Hughes, *Virtual Uncertainty: Developments in the Law of Electronic Payments and Financial Services*, 69 *BUS. LAW.* 263, 264-69 (2013).

¹²⁴ U.S. Dep't of Treasury, FinCEN, Admin. Ruling No. FIN-2014-R011, Request for Administrative Ruling on the Application of FinCEN's Regulations to a Virtual Currency Trading Platform (Oct. 27, 2014), http://www.fincen.gov/news_room/rp/rulings/pdf/FIN-2014-R011.pdf (citing FinCEN, Virtual Currency Guidance, *supra* note 122).

¹²⁵ FinCEN, Virtual Currency Guidance, *supra* note 122.

¹²⁶ See, e.g., Wash. State Dep't of Fin. Insts., Interim Regulatory Guidance on Virtual Currency Activities 3 (Dec. 8, 2014), <http://dfi.wa.gov/documents/money-transmitters/virtual-currency-interim-guidance.pdf> (explaining that the exchange of one virtual currency for another virtual currency constitutes money transmission under Washington law).

¹²⁷ Uniform Law Comm'n, Regulation of Virtual-Currency Businesses Act, [http://www.uniformlaws.org/Act.aspx?title=Regulation of Virtual-Currency Businesses Act](http://www.uniformlaws.org/Act.aspx?title=Regulation%20of%20Virtual-Currency%20Businesses%20Act) (last visited Mar. 29, 2018).

¹²⁸ *Id.*

More Legal Aspects of Smart Contract Applications



SMART CONTRACTS IN CAPITAL MARKETS

How Are Smart Contracts Used in Capital Markets?

The potential uses of smart contract applications in capital markets include tokenized securities, syndicated loans, cash equities, collateral tracing, and leveraged loan trading. With regard to cash equities specifically, a recent Goldman Sachs report details the potential for smart contracts to “drive greater efficiencies in the US cash equities market, primarily through streamlining the post-trade settlement and clearing processes.”¹²⁹ Goldman Sachs envisions smart contracts will be used to “eliminat[e] duplicative confirmation/affirmation steps, shrink[] the settlement cycle, and reduc[e] trading risk, which in turn should lower the industry’s cost and capital needs.”¹³⁰ In total, Goldman Sachs estimates that the use of smart contracts in these ways could result in approximately \$2 billion in cost savings in the United States alone, with approximately \$6 billion in cost savings globally.¹³¹ Market participants are already exploring these applications. In particular, “issuers have contemplated the issuance of securities represented digitally rather than by a share certificate.”¹³² Additionally, the “DTC and its parent, Depository Trust & Clearing Corporation (DTCC), have committed to achieve blockchain-based enhancements to their processes.”¹³³

Some actors are pursuing the issuance of tokenized securities in order to leverage the token sale trend to sell what is explicitly recognized as a security by everyone involved. For example, the venture capital firm Blockchain Capital sought to conduct its own, regulatory-compliant sale of tokenized securities. The venture capital firm released the offering memorandum for a \$10 million fundraise through a month-long sale of tokenized securities in early April 2017;¹³⁴ the tokenized security sale began April 10, 2017,¹³⁵ with token issuance to occur on May 10, 2017, and the firm raised its \$10 million in just six hours. The sale was conducted by an entity incorporated in Singapore, where the Monetary Authority of Singapore’s 2014 guidance on token sales helped provide regulatory clarity.¹³⁶ Blockchain Capital availed itself of the registration exemptions afforded by the SEC under Regulations S and D to allow the sale to raise money from international investors and U.S. accredited investors.¹³⁷

The idea of issuing securities represented digitally rather than by a share certificate made significant advancements in 2017. After the entry of a class settlement in the Delaware Court of Chancery shareholder action *In re Dole Food Co.*,¹³⁸ the court, class action attorneys and the Depository Trust Company (“DTC”) were unable to determine which individuals were the current owners of the class shares.¹³⁹ *In re Dole Food Co.*’s main culprits for the discrepancy were delays in registering trades and short-selling.¹⁴⁰ In a footnote, *In re Dole Food Co.*’s presiding judge commented that blockchain technology could be put to use in alleviating these problems.¹⁴¹ In response, after significant study and consideration, the Delaware legislature recently amended the Delaware General Corporate Law to recognize tokenized securities issued by companies incorporated in Delaware.¹⁴² The DLT-related changes include amendments to Sections 151(f), 202(a), 219(a), 219(c), 224, 232(c) and 364 of the Delaware General Corporate Law. “Amendments to Sections 219, 224 and 232 and related provisions are intended to provide specific statutory authority for Delaware corporations to use [DLT] for the creation and maintenance of corporate records, including a corporation’s stock ledger.”¹⁴³ Other amendments specify the requirements for a stock

¹²⁹ James Schneider et al., Goldman Sachs Group, Inc., Profiles in Innovation—Blockchain: Putting Theory into Practice 44 (May 24, 2016), <https://msenterprise.global.ssl.fastly.net/wordpress/2017/07/Goldman-Sachs-Blockchain-putting-theory-to-practice.pdf>.

¹³⁰ *Id.*; see also Chamber of Digital Commerce, *supra* note 25.

¹³¹ Schneider et al., *supra* note 129, at 44.

¹³² Jesse P. Kanach, Andrew P. Cross & Mary C. Moynihan, *As Fintech Platforms Grow Up, Investment Management Firms Face the ‘Problems of Tomorrow’*, 24 INV. L.W. 7 (Mar. 2017), <https://dptax5jbd3l.cloudfront.net/images/content/1/6/v2/168892/IL-0317-Kanach.pdf>.

¹³³ *Id.*

¹³⁴ Richard Kastelein, *Blockchain Capital Releases Offering Memorandum for Its \$10 Million Digital Token Offering*, BLOCKCHAIN NEWS (Apr. 4, 2017), <http://www.the-blockchain.com/2017/04/04/blockchain-capital-releases-offering-memorandum-10-million-digital-token-offering/>.

¹³⁵ Brian Patrick Eha, *Why this venture capitalist wants to make traditional VC obsolete*, AMERICAN BANKER (Apr. 3, 2017), <https://www.americanbanker.com/news/why-this-venture-capitalist-wants-to-make-traditional-vc-obsolete>.

¹³⁶ *Id.*

¹³⁷ *Id.* Regulation S exempts sales of securities that occur outside of the United States (17 C.F.R. § 230.901 *et seq.*), and Regulation D exempts sales of securities within the United States under specific circumstances, such as when the amount offered for sale falls below a specific dollar amount and/or the amount sold is limited, in whole or in part, to certain accredited or otherwise sophisticated investors (17 C.F.R. § 230.501 *et seq.*).

¹³⁸ No. 8703-VCL, 2017 Del. Ch. Lexis 25 (Del. Ch. Feb. 15, 2017).

¹³⁹ Joanna Diane Caytas, *Blockchain in the U.S. Regulatory Setting: Evidentiary Use in Vermont, Delaware, and Elsewhere*, COLUM. SCI. & TECH L. REV. (May 30, 2017), <http://stlr.org/2017/05/30/blockchain-in-the-u-s-regulatory-setting-evidentiary-use-in-vermont-delaware-and-elsewhere/>.

¹⁴⁰ *Id.*

¹⁴¹ *Id.* (citing *Dole Food Co.*, 2017 Del. Ch. LEXIS 25, at *11 n.1).

¹⁴² Matthew Leising, Annie Massa & Jef Feeley, *Fixing the Stock Market’s ‘Clogged toilet’ Starts in Delaware*, BLOOMBERG MARKETS (Sept. 12, 2017), <https://www.bloomberg.com/news/articles/2017-09-12/fixing-the-stock-market-s-clogged-toilet-starts-in-delaware>.

¹⁴³ Lowell D. Ness & Valeria R. Bystrowicz-Liendo, *Delaware Law Embraces Digital Securities*, PERKINS COIE VIRTUAL CURRENCY REPORT (Aug. 1, 2017), <https://www.virtualcurrencyreport.com/2017/08/delaware-law-embraces-digital-securities/>.



ledger, which are intended to ensure that only DLT protocols that possess certain characteristics will suffice for use in issuing corporate shares.¹⁴⁴

Legal Aspects of Using Smart Contracts in Capital Markets

Although the changes to the Delaware General Corporate Law represent a significant advance in the ability of companies to consider issuing shares through DLT, challenges remain. First, the amendments “only facilitate issuance of new shares registered on a distributed ledger. For existing shares, transition to distributed ledger would be more complicated, since only uncertificated shares would qualify.”¹⁴⁵ Further, since the state corporate statute only affects transfers of record, trading shares on secondary markets seem to be unaffected by the changes to the Delaware law.¹⁴⁶ It is unclear how and whether secondary markets will be open to Delaware companies that elect to issue shares through DLT. In particular, “none of the existing Stock Exchanges are currently set up to trade digital securities.”¹⁴⁷ One alternative can be found in Overstock’s Alternative Trading System [(“ATS”)] that is designed to trade digital securities, which was created as an SEC-regulated broker-dealer trading system.¹⁴⁸ Others could use that ATS or create similar ATS vehicles if a demand emerged.¹⁴⁹ In other words, although obstacles remain, the amendments to the Delaware General Corporate Law appear to create a viable pathway from a legal perspective. As a result, the effective adoption of digital shares under the Delaware amendments “will depend on the perceived value of this new paradigm compared to the challenges it poses.”¹⁵⁰

SMART CONTRACTS FOR SUPPLY CHAIN MANAGEMENT

Why Are Smart Contracts of Interest for Supply Chain Management?

The “supply chain” refers to “all the links involved in creating and distributing goods, from raw materials to the finished product that goes into the possession of the consumer.”¹⁵¹ When the idea of the supply chain originally emerged, it “was a revolutionary idea that would improve visibility and control on goods and products as they moved from point A to point B.”¹⁵² Today’s economy involves a new type of supply chain—one that is more fragmented, more complicated, and more geographically diffuse.¹⁵³ “In effect, the supply chain is now an opaque and faulty process that is extremely hard to manage.”¹⁵⁴ As a result, neither intermediate buyers nor the ultimate consumers are able to reliably confirm the value of the goods and services they purchase.¹⁵⁵ Further, attempts to enforce laws relating to counterfeit goods, forced labor, poor working conditions, or connections to criminal activities are stymied due to the global reach and massive scale of most supply chains.¹⁵⁶ In other words, a new technology is needed to help control the effects of the technology at work in today’s global supply chains. Many believe DLT can be that technology.¹⁵⁷

¹⁴⁴ *Id.*

¹⁴⁵ Caytas, *supra* note 139 (citing Matthew J. O’Toole & Michael K. Reilly, *The First Block in the Chain: Proposed Amendments to the DGCL Pave the Way for Distributed Ledgers and Beyond*, HARV. L. SCH. F. ON CORP. GOVERNANCE & FIN. REG. (Mar. 16, 2017), <https://corpgov.law.harvard.edu/2017/03/16/the-first-block-in-the-chain-proposed-amendments-to-the-dgcl-pave-the-way-for-distributed-ledgers-and-beyond/>).

¹⁴⁶ *Id.*

¹⁴⁷ Ness & Bystrowicz-Liendo, *supra* note 143.

¹⁴⁸ *Id.*

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ Ben Dickson, *Blockchain has the potential to revolutionize the supply chain*, TECHCRUNCH (Nov. 24, 2016), <https://techcrunch.com/2016/11/24/blockchain-has-the-potential-to-revolutionize-the-supply-chain/>.

¹⁵² *Id.*

¹⁵³ *Id.*

¹⁵⁴ *Id.*

¹⁵⁵ *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ See, e.g., Giulio Prisco, *Walmart Testing Blockchain Technology for Supply Chain Management*, BITCOIN MAG. (Dec. 21, 2016), https://bitcoinmagazine.com/articles/walmart-testing-blockchain-technology-for-supply-chain-management-1482354996/?q=G&hPP=5&idx=articles&p=0&is_v=1 (describing Walmart’s plans to use DLT to trace pork in China and produce in the United States).

More Legal Aspects of Smart Contract Applications



According to IBM, “[o]ptimizing a supply chain on the blockchain makes new things possible, such as the real-time synchronization of decisions with supply chain partners.”¹⁵⁸ By doing so, companies may be able to significantly mitigate many routine difficulties in supply chain management. Specifically, a bitcoin or other decentralized virtual currency would serve as a unit of inventory, and a wallet would serve as an inventory-keeping location, such as a store, distribution center, or truck trailer.¹⁵⁹ Under such an arrangement, the blockchain “could be used to record the balances and transfers of inventory across a distributed supply chain network.”¹⁶⁰ DLT could also be used to help asset owners trace the quantity and transfer of assets as they move between elements in the supply chain.¹⁶¹ In supply chains where provenance is important, DLT could also be used to prove the source of materials, prevent fraud and enhance capacity for accurate freight audits.¹⁶²

In one implementation of this idea, a service “enables every physical product to come with a digital ‘passport’ that proves authenticity (Is this product what it claims to be?) and origin (Where does this product come from?), creating an auditable record of the journey behind all physical products.”¹⁶³ The service “details four key properties concerning all materials and consumables it covers: the nature (what it is), the quality (how it is), the quantity (how much of it there is), and the ownership (whose it is at any moment). Key attributes may be read and linked from pre-existing datasets such as barcodes, or newly ascribed along the way.”¹⁶⁴ The idea is that this system allows for an unprecedented breakthrough in supply chain management—“the *uninterrupted* chain of custody from the raw materials to the end sale.”¹⁶⁵

In a concrete example, IBM announced a program in 2017¹⁶⁶ in which, in partnership with Walmart, Nestle, Dole, Tyson Foods, and Kroger (among others), it is building a platform “to use blockchain technology to track food throughout the complex global supply chain.”¹⁶⁷ The goals of such programs include reduction or elimination of fraud and errors, improved inventory management, reduced courier costs, reduced delays from paperwork, faster identification of issues, and enhanced consumer and partner trust.¹⁶⁸ Ultimately, the IBM program, like the other programs discussed above, seeks to use blockchain to “digitally trace and authenticate . . . products from an ecosystem of suppliers to store shelves and ultimately to consumers.”¹⁶⁹

Legal Aspects of Using Smart Contracts in Supply Chain Management

The Dodd-Frank Wall Street Reform and Consumer Protection Act imposes supply chain responsibility obligations on all publicly held companies. Additionally, the California Transparency in Supply Chains Act imposes obligations on entities that “do business” in California and have annual sales of \$100 million or more. Furthermore, companies importing or exporting products across borders must deal with shipping regulations, embargo laws and regulations, export sanctions, anti-corruption and foreign corrupt practices laws, anti-money laundering requirements, anti-boycott laws and regulations, and trade remedy laws and regulations.

Additional compliance concerns are raised by the Foreign Corrupt Practices Act, the U.K. Bribery Act, the U.S. Federal Acquisition Regulations on Trafficking in Persons in Federal Contracts, the U.K. Modern Slavery Act of 2015, the European Union’s Directive on Transparency and its amendments, and the proposed U.S. Business Transparency on Trafficking and Slavery Act, among other laws.¹⁷⁰ A business that is developing and providing DLT-based supply chain management software would be well served by staying informed of the legal context in which its supply chain clients must operate to ensure that the software it provides sufficiently enables such clients to comply with the relevant regulatory obligations.

¹⁵⁸ IBM INSTITUTE FOR BUSINESS VALUE, TRUST IN TRADE: TOWARD STRONGER SUPPLY CHAINS 5 (2016), https://public.dhe.ibm.com/common/ssi/ecm/gb/en/gbe03771usen/gbe03771usen-00_GBE03771USEN.pdf.

¹⁵⁹ Adrian Gonzalez, *One More Prediction for 2016: Blockchain Technology Will Make its Debut in Supply Chain Management*, Talking Logistics with Adrian Gonzalez (Dec. 21, 2015), <http://talkinglogistics.com/2015/12/21/one-more-prediction-for-2016-blockchain-technology-will-make-its-debut-in-supply-chain-management/>.

¹⁶⁰ *Id.*

¹⁶¹ *Id.*

¹⁶² *Id.* See also Adrian Gonzalez, *Bitcoin: A New Supply Chain Operating System?*, Talking Logistics with Adrian Gonzalez (Jan. 26, 2015), <http://talkinglogistics.com/2015/01/26/bitcoin-new-supply-chain-operating-system/>.

¹⁶³ Benjamin Herzberg, *Blockchain: The solution for transparency in product supply chains*, Provenance (Nov. 21, 2015), <https://www.provenance.org/whitepaper>.

¹⁶⁴ *Id.*

¹⁶⁵ *Id.* For other services in the supply chain space, see Blockverify (<http://www.blockverify.io/>), which is trying to provide a simple way to verify the authenticity of medicine; Everledger (<https://www.everledger.io/>), which is trying to bring transparency to the diamond supply chain; and Kouvola Innovation (<https://www.kinno.fi/en>), which seeks to provide a smart tendering solution for the supply chain.

¹⁶⁶ See IBM Blockchain, *Blockchain for supply chain*, <https://www.ibm.com/blockchain/supply-chain/> (last visited Apr. 2, 2018).

¹⁶⁷ Chase Purdy, *Supermarkets are now using blockchain to keep food fresh*, QUARTZ (Aug. 24, 2017), https://qz.com/1060607/supermarkets-are-now-using-blockchain-to-keep-food-fresh/?utm_source=pdb&utm_medium=email&utm_campaign=08252017&variable=197f11db593fb0a28e8dd29ef58ce7a6.

¹⁶⁸ See IBM Blockchain, *supra* note 167.

¹⁶⁹ *Id.* at Blockchain and Food Traceability Infographic.

¹⁷⁰ For further information see Perkins Coie, *Supply Chain Compliance & Corporate Social Responsibility*, <https://www.perkinscoie.com/en/practices/government-regulatory-law/white-collar-investigations/supply-chain-compliance-corporate-social-responsibility.html> (last visited Apr. 2, 2018).

More Legal Aspects of Smart Contract Applications



SMART RECORDS FOR GOVERNMENT AND SMART CITIES

What Role Do Smart Contracts Play in Smart Government Records and Smart Cities?

Reports of governments investigating the use of recordkeeping systems deployed on the blockchain abound; such governments include the United Kingdom,¹⁷¹ Estonia,¹⁷² Dubai,¹⁷³ the U.S. federal government,¹⁷⁴ and various state governments in the United States (e.g., Vermont,¹⁷⁵ Delaware,¹⁷⁶ and Illinois¹⁷⁷). Some government interest can be attributed to a belief in DLT's capacity "to vastly reduce the cost and complexity of getting things done."¹⁷⁸ Generally speaking, government leaders expect that a DLT-based system "will be faster and cheaper than the existing process since it automates a number of processes."¹⁷⁹ Others feel that in addition to enhancing the transparency, security, and efficiency of existing government services, DLT-based government records may create opportunities to offer additional government services not previously possible.¹⁸⁰ Possibilities for revamping the U.S. personal property filing system used to record secured transactions conducted under Article 9 of the Uniform Commercial Code ("UCC") and for making Bank Secrecy Act compliance less burdensome have also been suggested.¹⁸¹ In fact, the European Union is presently exploring DLT's potential to lessen compliance burdens in the financial services industry.¹⁸²

Delaware again offers a prime example of a state government moving toward smart governance through DLT. In addition to the changes made to its corporate law, Delaware, through its Blockchain Initiative, piloted a program to store the Delaware public archives on a DLT recordkeeping system.¹⁸³ Delaware then used that system as the basis for building a DLT-based filing system for the receipt and management of UCC-1 forms.¹⁸⁴ Lenders with security interests in the property of a debtor file UCC-1 forms under UCC Article 9 to establish priority in repayment and to announce to any other interested parties the existence of the loan and their interest in the collateral.¹⁸⁵ The existing UCC-1 filing system is beset by a number of inefficiencies that make it cumbersome and expensive to use effectively.¹⁸⁶ A DLT-based UCC-1 filing system offers hope for reducing those inefficiencies, lowering costs, and improving access to information, thereby reducing related litigation.¹⁸⁷

In another very concrete example, the State of Illinois' Department of Innovation and Technology put out a request for information that designated four specific areas of interest: (1) identity, attestation, and ownership registries; (2) compliance and reporting ledgers; (3) benefit and entitlement ledgers; and (4) new products and other areas of interest.¹⁸⁸ With regard to the first area of interest, Illinois is investigating how it could use DLT "to consolidate disparate data that currently exists across multiple agencies and layers of government into a single self-sovereign network centered around the citizen," and whether "a persistent, secure identity layer [could] allow Illinois to more efficiently deliver private, secure, reliable, and integrated services."¹⁸⁹

¹⁷¹ Emily Spaven, *UK Government Exploring Use of Blockchain Recordkeeping*, COINDESK (Sept. 1, 2015), <http://www.coindesk.com/uk-government-exploring-use-of-blockchain-recordkeeping/>.

¹⁷² Medha Basu, *Estonia using Blockchain to secure health records*, GOV. INSIDER (Mar. 6, 2016), <https://govinsider.asia/innovation/estonia-using-blockchain-to-secure-health-records/>.

¹⁷³ Michael del Castillo, *Dubai Wants All Government Documents on Blockchain By 2020*, COINDESK (Oct. 5, 2016), <http://www.coindesk.com/dubai-government-documents-blockchain-strategy-2020/>.

¹⁷⁴ Pete Rizzo, *Department of Homeland Security Calls for Blockchain Research*, COINDESK (Dec. 15, 2015), <http://www.coindesk.com/department-of-homeland-security-calls-for-blockchain-research/>.

¹⁷⁵ Brian Cohen, *Vermont Considering Blockchain Tech for State Records, Smart Contracts*, COINTELEGRAPH (Aug. 5, 2015), <https://cointelegraph.com/news/vermont-considering-blockchain-tech-for-state-records-smart-contracts>.

¹⁷⁶ Giulio Prisco, *Delaware Blockchain Initiative to Streamline Record-Keeping for Private Companies*, BITCOIN MAG. (May 9, 2016), <https://bitcoinmagazine.com/articles/delaware-blockchain-initiative-to-streamline-record-keeping-for-private-companies-1462812187>.

¹⁷⁷ Craig Holloway, III, *Dep't of Innovation & Tech., State of Illinois: Request for Information (RFI)—Distributed Ledger and Blockchain Applications in the Public Sector* (Dec. 1, 2016), <https://www2.illinois.gov/sites/doit/Documents/BlockchainInitiative/RFI+Blockchain+and+Distributed+Ledger+Applications+in+the+Public+Sector.pdf>.

¹⁷⁸ Brian Robinson, *Blockchain on the government horizon*, GCN MAG. (Mar. 22, 2016), <https://gcn.com/articles/2016/03/22/blockchain-government.aspx>.

¹⁷⁹ Prisco, *supra* note 177.

¹⁸⁰ Blake Carpenter & Adam Hughes, *Can blockchain spark a government services revolution?*, GCN MAG. (Sept. 27, 2016), <https://gcn.com/articles/2016/09/27/blockchain-government-services-revolution.aspx>.

¹⁸¹ Reyes, *supra* note 3.

¹⁸² DIEDRICH, *supra* note 16.

¹⁸³ Andrea Tinianow & Caitlin Long, *Delaware Blockchain Initiative: Transforming the Foundational Infrastructure of Corporate Finance*, HARV. L. SCH. FORUM ON CORP. GOVERNANCE & FIN. REG. (Mar. 16, 2017), <https://corp.gov.law.harvard.edu/2017/03/16/delaware-blockchain-initiative-transforming-the-foundational-infrastructure-of-corporate-finance/>.

¹⁸⁴ *Id.* For further analysis of the Delaware Blockchain Initiative and other similar government endeavors, see Carla L. Reyes, *Blockchain-Based Agencies*, 42 ADMIN & REGULATORY L. NEWS 9 (Summer 2017).

¹⁸⁵ Reyes, *supra* note 3, at 402 (citing Lynn M. LoPucki, *Computerization of the Article 9 Filing System: Thoughts on Building the Electronic Highway*, 55 L. & CONTEMP. PROBS. 5, 5 (1992); LYNN M. LOPUCKI, ELIZABETH WARREN & ROBERT LAWLESS, *SECURED TRANSACTIONS: A SYSTEMS APPROACH* 281 (8th ed. 2016)).

¹⁸⁶ *Id.* at 402-03 (citing LOPUCKI ET AL., *supra* note 187, at 281-82, 294-95).

¹⁸⁷ *Id.* at 408; Tinianow & Long, *supra* note 185.

¹⁸⁸ Holloway, *supra* note 178, at 5-6.

¹⁸⁹ *Id.* at 5.

More Legal Aspects of Smart Contract Applications



With regard to compliance and reporting, Illinois queries whether DLT can “enable businesses and individuals either required to report information or voluntarily providing information, a more trusted, transparent yet anonymous way of doing so,” and whether “these reporting ledgers [could] help limit reporting to one trusted, verifiable source provided by the entity involved.”¹⁹⁰

In the realm of benefits and entitlements, Illinois hopes to leverage DLT to reduce fraud and allow more efficient distribution while also increasing transparency.¹⁹¹ Finally, the State of Illinois also indicated a broader interest in learning about (a) other DLT-as-a-service products, including escrow, digital notaries, public records management, and digital identities; (b) possibilities for a public permissioned blockchain with network nodes and participants authenticated by the state government; and (c) using DLT to secure IoT infrastructure from cybersecurity threats.¹⁹²

The most expansive plans to use DLT and smart contracts to enable smart government and smart cities belong to the Dubai government. Dubai’s stated goal is to be the first government in the world to execute all applicable transactions on DLT-based systems by 2020.¹⁹³ Achieving this goal would make Dubai the first government to pioneer DLT on a citywide scale. To that end, Dubai launched a program of flying startup companies from around the world to pilot blockchain use cases for its government. In a coordinated government agency effort, Dubai hopes to enable DLT-based systems for energy and water, transport and logistics, economic development, tourism, safety and justice, municipality and land, health, social services, and smart districts.¹⁹⁴ Ultimately, Dubai envisions its DLT-based government smart record and smart city program as the path to achieving key policy objectives, including creating a lean, connected government, enabling a globally competitive economy, supporting a high quality of life, enhancing financial and economic efficiency, and improving resource and infrastructure efficiency.¹⁹⁵ Key components of this plan involve using smart contracts in several of the other ways discussed in this white paper: to protect identity, to trace property ownership, to improve supply chain management, and to disrupt capital markets.¹⁹⁶

Since its launch of this effort in October 2016, Dubai has established the Smart Dubai Office Blockchain Challenge in partnership with global accelerator 1176, launched its own Smart Dubai Office Accelerator at the Dubai Future Accelerators, and announced initial contract awards for IBM and Consensys.¹⁹⁷ In March 2017, Dubai officially kicked off “Smart Dubai”—a citywide effort to implement blockchain.¹⁹⁸ In the months that followed, Smart Dubai held multi-stakeholder workshops to create a work plan for the services best suited to reform by DLT.¹⁹⁹ Smart Dubai hopes to roll out initial pilot systems this year, and to build a “Blockchain as a Service” platform for various Dubai governmental entities to use in building their own pilot projects.²⁰⁰ In one example of such efforts, in October 2017, Dubai announced plans to launch “emCash,” a digital currency rooted in DLT.²⁰¹ Built by Emcredit, a subsidiary of Dubai Economy (an arm of the Dubai government), and Object Tech Grp. (a UK-based startup), emCash will be redeemable for services offered by both government and private sector providers.²⁰² Essentially, emCash can be seen “as a local currency with a fixed price backed by the government and accepted by all merchants in the city built on a blockchain.”²⁰³ By all accounts, Dubai’s plans for smart government recordkeeping and a smart city are moving forward according to schedule.

The extent to which any government incorporates smart contracting features into the DLT-based smart records application it chooses to adopt depends entirely on the government, its goals, and the particular needs of the application. At one end, a smart records program might focus entirely on the time-stamping and immutability functionality of DLT protocols; such programs might be considered a highly efficient notary and recordkeeping service with extreme transparency. At the other extreme, “an enterprising locality could offer a blockchain-based municipal bond that automatically accrues and pays interest to its holder on a pre-determined schedule.”²⁰⁴

¹⁹⁰ *Id.*

¹⁹¹ *Id.* at 6.

¹⁹² *Id.*

¹⁹³ Statement attributed to His Highness Sheikh Hamdan bin Mohammed Al Maktoum from a speech made on the launch of the Dubai Blockchain Strategy, October 5, 2016, in “Smart Dubai: Dubai Blockchain Roadmap” (slide deck on file with authors).

¹⁹⁴ “Smart Dubai: Dubai Blockchain Roadmap,” *supra* note 195, at 7.

¹⁹⁵ *Id.* at 12.

¹⁹⁶ *Id.* at 13.

¹⁹⁷ Issac John, *Dubai picks IBM, Consensys to kick off blockchain project*, KHALEEJ TIMES (Mar. 14, 2017), <http://www.khaleejtimes.com/dubai-picks-ibm-consensys-to-kick-off-blockchain-project>.

¹⁹⁸ Nikhil Lohade, *Dubai Aims to Be a City Built on Blockchain*, WALL ST. J. (Apr. 24, 2017), <https://www.wsj.com/articles/dubai-aims-to-be-a-city-built-on-blockchain-1493086080>.

¹⁹⁹ *Id.*

²⁰⁰ *Id.*

²⁰¹ Shahjahan Chaudhary, *Dubai Launches Digital Currency: Emcash*, MEDIUM (Oct. 1, 2017), https://medium.com/@shahjahan_ch/dubai-launches-digital-currency-emcash-a5e8dde78e45.

²⁰² *Id.*

²⁰³ *Id.*

²⁰⁴ Carpenter & Hughes, *supra* note 181.

More Legal Aspects of Smart Contract Applications



Legal Aspects of Using Smart Contracts for Smart Records and Smart Cities

Using smart contracts and DLT protocols in the context of government recordkeeping may raise important questions of administrative law.²⁰⁵ Given the inherent difficulties of correctly programming smart contracts applications, “[w]hat remedies will belong to the governed when the computer code makes an unexpected or undesirable decision, or both? Who will be at fault if the code executes prematurely because it misread the circumstances?”²⁰⁶ Although the administrative law burdens will fall to the state agencies embarking on a smart records project, those developing DLT-based programs that incorporate smart contract features for government use must carefully negotiate their contracts with the hiring agency and pay particular attention to questions of liability for product malfunction and unexpected consequences. Furthermore, the more complicated the software programming required, the more likely the philosophies (and, at times, biases) of the software developer are to infuse the code. “[E]xtensive research evidences the extent to which developers frequently write implicit biases into the code and algorithms they create.”²⁰⁷ As a result, those businesses offering software-as-a-service solutions to governments seeking to implement a smart records regime must remain vigilant and cognizant of laws relating to anti-discriminatory practices conducted by the government.

SMART CONTRACTS FOR REAL ESTATE REGISTRIES

Why Are DLT-Based Real Estate Registries Needed?

Around the world, governments manage real property ownership rights through public land registries. Such registries, effectively operated as a centralized ledger, suffer from significant flaws, even in industrial countries, where a complicated system of real estate law has developed.

In many developing countries, land registry systems remain inefficient, inaccurate, and bloated with inequities and corruption, and in some cases, they do not functionally exist at all. In his groundbreaking book *The Mystery of Capital*, economist Hernando de Soto argued “that the major stumbling block that keeps the rest of the world from benefiting from capitalism is its inability to produce capital.”²⁰⁸ De Soto posited that although the world’s poor “already possess the assets they need to make a success of capitalism . . . they hold these resources in defective forms,” such as real property without proper title.²⁰⁹ The idea is that because the assets are not held by title, they “cannot readily be turned into capital, cannot be traded outside of narrow local circles where people know and trust each other, cannot be used as collateral for a loan, and cannot be used as a share against investment.”²¹⁰ Without proper title, an enabling mechanism for leveraging assets, the assets held by the poor members of developing nations are “dead capital,”²¹¹ useless for wealth generation and a stumbling block to economic development. Many believe that DLT offers an alternative method for registering and tracing real estate ownership interests more accurately and efficiently. Another claim is that blockchain-based land registries offer the opportunity to democratize real estate ownership interests by putting control over the record into the hands of the owners and thereby limiting the effect of corruption and politics that otherwise jeopardize land registries in many developing countries.²¹²

²⁰⁵ Reyes, *supra* note 3, at 423.

²⁰⁶ *Id.* at 425.

²⁰⁷ *Id.* at 426 (citing FRANK PASQUALE, *THE BLACK BOX SOCIETY* 110-13 (2015)).

²⁰⁸ HERNANDO DE SOTO, *MYSTERY OF CAPITAL: WHY CAPITALISM TRIUMPHS IN THE WEST AND FAILS EVERYWHERE ELSE* 20 (2000).

²⁰⁹ *Id.* at 5-6.

²¹⁰ *Id.* at 6.

²¹¹ *Id.*

²¹² *Id.* at 11, 16 (“The institutions that give life to capital—that allow one to secure the interests of third parties with work and assets—do not exist here.”). Earlier in his career, De Soto explained the idea in terms of his native Peru as follows: “So far, we have seen that Peruvians are forced to assume excessively high costs in order to operate legally or, if they are unable to do so, that they have been left out of the system. This means that they cannot take advantage of the country’s good laws, namely the facilitating instruments provided by the law to make economic and social activities more efficient: property rights, contracts, and extracontractual law.” HERNANDO DE SOTO, *THE OTHER PATH: THE INVISIBLE REVOLUTION IN THE THIRD WORLD* 177 (June Abbott trans., 1990).

More Legal Aspects of Smart Contract Applications



Where Are DLT-Based Land Registries Being Developed?

Examples of blockchain-based land registry proposals abound. *The Economist* reported that Factom partnered with the government of Honduras in 2015 to build a more effective land registry there, where “land registries are badly kept, mismanaged and/or corrupt,” as they are “across much of the world.”²¹³ The Republic of Georgia engaged the Bitfury Group “to advance transparency by developing a system for registering land titles using the Blockchain for the National Agency of Public Registry.”²¹⁴ The chairman of Georgia’s National Agency of Public Registry reportedly described Georgia’s interest in building a blockchain-based land registry as follows:

By building a Blockchain-based property registry and taking full advantage of the security provided by the Blockchain technology, the Republic of Georgia can show the world that we are a modern, transparent and corruption-free country that can lead the world in changing the way land titling is done and pave the way to additional prosperity for all.²¹⁵

Greece has also expressed interest in developing a blockchain-based land registry; in Greece “only 7% of the territory is adequately mapped.”²¹⁶ The Swedish National Land Survey unveiled its own plans to partner with ChromaWay to test a system for registering and recording land titles in an effort to digitize its real estate process.²¹⁷ In West Africa, Bitland Global (“Bitland”) is developing a land registry system designed to “provide immutable records of ownership to those who normally would have difficulty” obtaining such records.²¹⁸ Located in Kumasi, Ghana, Bitland is a nonprofit organization “working to keep the land registration process accessible, transparent, and free from government corruption” by updating “paper data storage houses into digital format,” consolidating “new land registry requests against the old registries,” and integrating systems that local communities have developed for keeping track of titles.²¹⁹ And lest the United States feel left out of the movement, The Office of the Cook County Recorder of Deeds in Cook County, Illinois participated in a pilot program during the last several months of 2016 through May 2017.²²⁰ Although the Cook County Recorder of Deeds ultimately determined that a DLT-based land registry and mortgage recording system could provide certain efficiencies and decrease the potential for fraudulent transfers, the resource-intensive nature of a DLT-based system and the reality of local politics led the office to conclude that it should not further pursue a DLT-based system until around 2020.²²¹

These DLT-based land registries rely upon the smart contract capabilities of DLT protocols. The general idea is that DLT-based land registries can leverage the capacity of smart contracts to record state changes in real estate ownership and then immutably record those changes on the chosen DLT protocol. Some of the land registry projects under development rely on public DLT protocols, while others are designed for private DLT protocols, and still others, like that of ChromaWay, are protocol and consensus-neutral such that they can be deployed on any underlying DLT protocol. By recording the changes in land ownership on a DLT protocol, these land registry projects also offer an accountability mechanism—namely, “every user of [the] service can reliably verify that the service operates in the intended way (e.g., information provided by the service agrees with the information it provided to other users).”²²² Although the possibility of an immutable audit trail offers an attractive reason for moving land registries to DLT, DLT does not automatically solve the problem of ensuring that the data originally entered into the ledger is accurate and reliable—it merely ensures that once the data is entered, state changes to that data can be traced going forward.²²³

²¹³ *Blockchains: The great chain of being sure about things*, THE ECONOMIST (Oct. 31, 2015), <https://www.economist.com/news/briefing/21677228-technology-behind-bitcoin-lets-people-who-do-not-know-or-trust-each-other-build-dependable>.

²¹⁴ BitFury, About, <http://bitfury.com/> (last visited Apr. 2, 2018).

²¹⁵ Stan Higgins, *Republic of Georgia to Develop Blockchain Land Registry*, COINDESK (Apr. 22, 2016), <http://www.coindesk.com/bitfury-working-with-georgian-government-on-blockchain-land-registry/>.

²¹⁶ *Blockchains*, *supra* note 215.

²¹⁷ Pete Rizzo, *Sweden Tests Blockchain Smart Contracts for Land Registry*, COINDESK (June 16, 2016), <http://www.coindesk.com/sweden-blockchain-smart-contracts-land-registry/>.

²¹⁸ Jamie Redman, *Bitland: Blockchain Land Registry Against ‘Corrupt Government’*, BITCOIN.COM (May 26, 2016), <https://news.bitcoin.com/bitland-blockchain-land-registry/>.

²¹⁹ L. Chris Bates, *Bitland Global White Paper 2* (Jan. 11, 2016), <https://bravenewcoin.com/assets/Whitepapers/Bitland-Whitepaper.pdf>.

²²⁰ John Mirkovic, *Blockchain Cook County—Distributed Ledgers for Land Records: Cook County Recorder of Deeds Blockchain Pilot Program—Final Report* (May 30, 2017), <https://illinoisblockchain.tech/blockchain-cook-county-final-report-1f56ab3bf89>.

²²¹ *Id.* at 3-4.

²²² BitFury, *On Blockchain Auditability 2* (Nov. 14, 2016), http://bitfury.com/content/5-white-papers-research/bitfury_white_paper_on_blockchain_auditability.pdf.

²²³ Victoria L. Lemieux, *Blockchain Technology for Recordkeeping: Help or Hype?*, Vol. 2, at 40 (Oct. 25, 2016),

https://www.researchgate.net/profile/Victoria_Lemieux/publication/309414363_Blockchain_for_Recordkeeping_Help_or_Hype/links/580f539408ae009606bb2f6.pdf.



Legal Aspects of DLT-Based Land Registries

The most critical and obvious legal aspect of DLT-based land registries centers on the fact that most public land registries are controlled by government actors. Thus, to be legally effective, land registry processes must be developed in connection with or on behalf of the relevant government actor. Alternatively, the company might develop a platform and allow governments to adopt it as they please.²²⁴ Regardless of how the DLT-based land registry is adopted by the appropriate government actor, both the government and the application developer should remain cognizant of the implications that doing so will have for real estate law more broadly. Developers should be prepared to explain to their government clients how the DLT-based system interacts with, and in some respects, might replace, the existing real estate laws.²²⁵ Further, where the DLT-based land registry is offered on a software-as-a-service (“SaaS”) basis, the company should consider traditional legal issues applicable in the SaaS context, including licensing, software code escrow, privacy and security, redundancy systems, and system-level agreements, among others. A detailed description of the issues involved in each of these areas is beyond the scope of this white paper; however, companies offering DLT-applications in this area would be well served by consulting experienced technology transactions counsel before launch.

SMART CONTRACTS FOR ENABLING SELF-SOVEREIGN IDENTITY

How Can Smart Contracts Enable Self-Sovereign Identity?

Many observers think that DLT offers an opportunity to create and validate digital identities that could replace current physical forms of identification such as a passport or driver’s license. In the digital economy, a person’s identity is often fragmented across government agencies, service providers, and business entities. Often people jeopardize the security of their own identities by using the same user name and password across platforms for ease of memory. Furthermore, the person does not retain full control of all of the pieces of their own digital identity. Instead, the person gives up control of certain identity data to the service provider, ultimately meaning that the service provider can revoke the person’s access to such data. Such revocation could, in turn, impact access to other services that is predicated upon the digital identity that has been revoked.

For example, major social networks allow a person to build a trusted digital identity by allowing that person to use his or her login credentials for their services as a proxy to log in to other services. But if a major social media platform deactivates a person’s account, that person loses the identity he or she created on that social media platform, which could put at risk the trusted nature of his or her online identity with a host of other providers.²²⁶

In this context, an ideal form of digital identity has been described as a self-sovereign identity. A self-sovereign identity would offer a person control over his or her identity (including who has access to what aspects of his or her identity), would be protected from unauthorized use or disclosure, and would be portable—namely, capable of use by the person to identify himself or herself without seeking permission from or being tied to a service provider, and capable of being transferred freely without being at risk of loss.²²⁷ Holistically, a self-sovereign identity can be thought of as a repository of identity data about a person where data that supports proof of that person’s unique identity can be added by the identity owner or by others at the identity owner’s request.²²⁸

DLT is thought to enable self-sovereign identity in ways that were previously not feasible. DLT allows the creation of a digital fingerprint by linking “attributes” to a self-sovereign identity. “Attributes” (which are also sometimes called “claims”) are descriptors of a person, such as the person’s name or birthdate. DLT also allows other entities to verify a person’s attributes (also sometimes referred to as an “attestation”), which, in turn, allows that person to use the verified attribute in other circumstances.

²²⁴ For a more thorough review of how a government might, in line with administrative law constraints, adopt a DLT-based application that takes a traditional government process and moves it to a DLT-based process, see Reyes, *supra* note 3.

²²⁵ For an in-depth consideration of how to undertake such considerations, see *id.*

²²⁶ Andrew Tobin & Drummond Reed, Sovrin Foundation, *The Inevitable Rise of Self-Sovereign Identity 4* (last updated Mar. 28, 2017), <https://sovrin.org/wp-content/uploads/2017/06/The-Inevitable-Rise-of-Self-Sovereign-Identity.pdf>.

²²⁷ Christopher Allen, *The Path to Self-Sovereign Identity*, COINDESK (Apr. 27, 2016), <http://www.coindesk.com/path-self-sovereign-identity/>; Tobin & Reed, *supra* note 228, at 6.

²²⁸ Tobin & Reed, *supra* note 228, at 9.



For example, if a person's name and social security number are attested to by a bank, then a subsequent bank can rely on that attestation without having to independently conduct the same verification. The DLT protocol provides a security level for self-sovereign identity. DLT protocols make it exceedingly difficult for a single entity to make changes to recorded transactions without the nodes on the network becoming aware of the change and rejecting it. Perhaps recognizing the potential benefits of using a DLT-based system to provide digital identity service, the United Nations High Commissioner for Refugees ("UNHCR") teamed up with Accenture and Microsoft, as part of ID2020,²²⁹ to create a digital ID network powered by DLT.²³⁰ The system "connects existing public and commercial records so people can access their personal details from any location."²³¹

Legal Aspects of Using Smart Contracts for Self-Sovereign Identity

Using a system of self-sovereign identity built on DLT protocols will allow individuals to benefit from the security and privacy built into DLT's cryptographic nature, and it may also limit a business's risk of liability for data breach or mishandling of personal data by enabling it to rely solely on attestations that have been signed to the ledger, and not collect any data itself. However, certain data privacy laws may be incompatible with the immutable nature of the digital identities anchored in a DLT protocol. For example, European citizens have a "right to be forgotten," and the U.S. Fair Credit Reporting Act, the Gramm-Leach Bliley Act, and the SEC's Regulation S-P mandate that personal financial data be easily redacted.²³² Further, to the extent that any self-sovereign identity solution links biometric data to the system, there are a number of privacy laws in the United States that either specifically govern biometric data or are broad privacy laws under which biometric data may fall. Generally speaking, such laws regulate third parties' use and collection of biometric data. Some states even regulate how digital accounts are handled after the owner dies, and others are actively attempting to pass such legislation. Such laws raise the question of how to treat a self-sovereign identity repository or account after the person to whom the identity belongs is deceased.²³³

Moreover, there is some concern that, depending upon the design of the DLT-based digital identity system, a more centralized identity repository may emerge, rather than the intended self-sovereign identity paradigm. In particular, Brandie Nonnecke, of the Center for Information Technology Research in the Interest of Society, argues that as biometric data is tokenized, a token service provider could amass a significant amount of biometric data that may pose a greater cybersecurity risk than intended.²³⁴ In the UNHCR digital identity program, for example, the UNHCR and Accenture built a Biometric Identity Management System ("BIMS")²³⁵ to enable relief agencies to more easily share information. Even though the BIMS is a DLT-based system, "[a]s biometric and personal data are collected by UNHCR and shared with third parties, there's the possibility that this data could be transferred to privately controlled databases, raising the risk of data being compromised or stolen."²³⁶ The risk of liability from such data centralization and related potential data breaches must be considered before moving forward with an identity product launch.

Further, to the extent that financial institutions rely on attestations or other elements of a self-sovereign identity to meet compliance obligations under the anti-money laundering provisions of the Bank Secrecy Act, what happens if the self-sovereign identity service provider makes an error or the code suffers from a flaw that compromises the integrity of the attestations? In light of the complexity of coding smart contracts to accurately execute according to the designers' intended purpose, complex issues of fault, liability, and remedies may arise. Any company beginning the planning phase of a product launch in this area would do well to carefully consider each of these issues throughout the product life cycle.

²²⁹ ID2020, <http://id2020.org/> (last visited Apr. 2, 2018).

²³⁰ *Accenture and Microsoft plan digital IDs for millions of refugees*, BBC NEWS (June 20, 2017), <http://www.bbc.com/news/technology-40341511>.

²³¹ *Id.* For another example of a self-sovereign identity system, see Sovrin, <https://sovrin.org/> (last visited Apr. 2, 2018).

²³² 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.

²³³ For a discussion of how privacy interests are traditionally terminated at death and an exploration of how they should be revived and reshaped in a digital future, see Natalie M. Banta, *Death and Privacy in the Digital Age*, 94 N.C. L. REV. 927 (2016).

²³⁴ Brandie M. Nonnecke, *Risks of Recognition*, CONTEXT: BY NEW AMERICA (Sept. 5, 2017), <https://www.newamerica.org/cybersecurity-initiative/humans-of-cybersecurity/blog/risks-of-recognition/>.

²³⁵ Accenture, *UNCHR: Identity Management System Uses Biometrics to Better Serve Refugees*, <https://www.accenture.com/us-en/success-unhcr-innovative-identity-management-system> (last visited Apr. 2, 2018).

²³⁶ Nonnecke, *supra* note 236.



IV. AN INITIAL RISK MITIGATION CHECKLIST FOR BUSINESSES DEVELOPING SMART CONTRACTS APPLICATIONS

Although smart contract-based applications vary greatly, sufficient common elements exist to enable the companies developing them to be proactive in reducing their risk of liability exposure. We offer a preliminary, non-exhaustive checklist of such issues here, and we recommend that companies in this area reach out to experienced legal counsel at each stage of application development: when contracting with customers, when building and testing the application, and before moving the application to public deployment.

Practical issues to consider with legal counsel when developing smart contracts applications include, but are not limited to:

- What is the legal context in which the smart contract application will operate?
- Will the smart contract replace any function previously performed by government actors? If so, what features of the law need to be replicated in the application to protect the validity of the transaction, and how should the user (a state actor) expect the law to change in response to use of the smart contract application?
- What laws otherwise apply to the transactions taking place within the application? Does the application allow parties to comply with their obligations under those laws?
- What hazards are posed by use of the smart contract application alone (e.g. can you be held liable for a (i) a loss of data; (ii) business interruption; (iii) privacy breach; and/or (iv) a failure to perform)?
- What hazards are posed by using the smart contract application with other software (e.g., can a party be held liable for a flaw in the software that causes the smart contract to fail)?
- Are there hazards that should be designed or guarded against?
- Do you owe any duties to any other parties involved in the smart contract application?
- If you have a duty to warn, what warnings or instructions are necessary and/or advisable?
- How should a warning be communicated in order to limit liability exposure if the application malfunctions?
- Do you have a protocol or system of monitoring in place to assist your software developers in guarding against coding implicit biases into the smart contract application?
- Do you have an incident response plan to control and mitigate any failure in the application or breach?
- Do you have a protocol in place to capture the data that you will need to quantify any loss or liability?
- What contractual provisions do you need to limit liability and maximize the availability of indemnification?
- Have you considered and properly contracted around issues unique in the software-as-a-service context?
- Have you considered and properly contracted for software code audit services?
- What privacy and security law considerations do you need to bake into the smart contract application?
- Have you considered what insurance you need to protect your business from loss and liability exposure associated with smart contract applications, and whether your application would benefit from specially crafted (or "manuscripted") coverage (e.g., errors and omissions insurance) that is tailored to your business model?

V. CONCLUSION

In sum, smart contracts will continue to evolve as a technology, and the legal issues surrounding the technology will likewise continue to evolve and involve novel questions beyond simply contract law. We predict that smart contracts will continue to disrupt, from both a technological and legal perspective, digital asset sales, venture capital and capital markets, supply chain management, government and smart cities, real estate registries, and self-sovereign identity, as well as other use cases not yet imagined. Although legal risk remains inherent in any technology platform, we conclude that companies who engage in careful planning can and will effectively mitigate these legal risks while offering products and services that utilize smart contracts.