Written Testimony of

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Energy & Commerce Committee Chairwoman Rodgers, Subcommittee on Innovation, Data, and Commerce Chairman Bilirakis, Ranking Member Schakowsky, and members of the Committee, thank you for inviting me to testify regarding blockchain technology and its non-financial use cases, including a review of some of the existing innovative uses of smart contracts and decentralized autonomous organizations.

My name is Carla Reyes and I am an Associate Professor of Law at SMU Dedman School of Law. I am not testifying on behalf of SMU Dedman School of Law, Southern Methodist University, or any other institution. Rather, I am testifying in my personal capacity, and the views I express here are entirely my own.

Legislative and regulatory discussion related to blockchain technology generally centers on financial use cases, including various forms of digital assets and decentralized financial projects. This hyper-focus on one segment of blockchain technology-related use cases risks the creation of legal regimes that are neither clear nor—more basically—fit for purpose, and heightens the risk of discouraging useful innovation in areas unrelated to finance and financial services.[1] To avoid such pitfalls, the technical attributes, functions, and limitations of blockchain protocols and related software applications should feature prominently in policy discussions. Unfortunately, those technical attributes, functions, and limitations are complex and not easily distilled.

I am grateful for this Committee's efforts to demystify the technology, educate constituents, and explore the full range of productive activity to which innovative creators, communities, and businesses are putting blockchain technology, and I submit this statement to aid your efforts. In

[1] Carla L. Reyes, *Moving Beyond Bitcoin to an Endogenous Theory of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 VILL. L. REV. 191, 194, 201-202, 211-13 (2016) [hereinafter Reyes, *Moving Beyond Bitcoin*]; Joshua A.T. Fairfield, *BitProperty*, 88 S. CAL. L. REV. 805, 830 (2015).

Section I, I offer a very brief introduction to blockchain technology and highlight the important role that discussing technical issues with precision (or failing to do so) plays in the development of policy, law, and regulation in this arena.[2] In Section II, I discuss smart contracts and examine uses of smart contracts in regulatory compliance, supply chain management, art production, improving the U.C.C. financing statement filing system, and decentralized autonomous organizations (DAOs). My hope is that this testimony assists the Committee in its efforts to distill the technology to its basics because my long-held view is that a balanced approach to policy-making in this arena requires understanding how the technology and its applications work.

I. Developing clear and effective policy, law, and regulation for products and services that incorporate blockchain technology requires understanding the technology, its functions, and it limitations.

Over a decade of interaction between law and blockchain technology reveals a persistent misunderstanding of the technology.[3] Take, for example, the 2013 virtual currency guidance issued by FinCEN in March 2013.[4] That guidance used terminology such as "administrator" and "centralized repository" to offer regulatory guidance to an emerging industry focused on increasing decentralization.[5] Neither industry members, nor their lawyers or advisors understood the terms or how they applied to decentralized blockchain protocols, and many spent significant time and money trying to understand the guidance.[6] Nearly ten years later, despite recent claims that

[2] The testimony provided in Section I draws from published law review articles Carla L. Reyes, *Autonomous Business Reality*, 21 NEV. L.J. 437 (2021) [hereafter Reyes, *Autonomous Business Reality*]; and Carla L. Reyes, *Emerging Technology's Language Wars: Cryptocurrency*, 64 WM & MARY L. REV. 1193 (2023) [hereafter Reyes, *Language Wars: Cryptocurrency*].

[3] *See generally*, Reyes, *Moving Beyond Bitcoin, supra* note 1 (arguing that to preserve the innovative potential of a wide variety of blockchain technology-related use cases, U.S. law and regulation needs to expand its view beyond payments applications of the technology).

[4] FIN. CRIMES ENF'T NETWORK, U.S. DEP'T OF THE TREASURY, GUIDANCE FIN-2013- G001: APPLICATION OF FINCEN'S REGULATIONS TO PERSONS ADMINISTERING, EXCHANGING, OR USING VIRTUAL CURRENCIES (2013).

[5] *Id*. at 2, 4.

[6] Reyes, *Language Wars: Cryptocurrency*, *supra* note 2, at 1197.

"crypto-markets suffer from a lack of regulatory compliance[,] not a lack of regulatory clarity,"[7] and, alternatively, that cryptocurrency transactions are "completely unregulated,"[8] the public discourse continues to evidence deep misunderstandings of blockchain technology, its functions, and its limits. I am honored to have the opportunity to serve as a resource to this Committee as it seeks to deepen its knowledge of the technical aspects of blockchain technology.

At the highest level of generality, blockchain technology is one type of distributed database known broadly as distributed ledger technology (DLT).[9] A distributed ledger, for its part, is a "type of distributed database that assumes the possible presence of malicious users (nodes)."[10] Although the terms DLT and blockchain are frequently used interchangeably, a blockchain protocol is a specific kind of distributed ledger that structures its data in a literal "chain of blocks" by linking blocks of validated transactions together using one-way cryptographic hashes.[11] Ultimately, blockchain protocols use this specific data structure to track transitions in state in order to allow participants in the network to reach agreement about the existence and evolution of shared facts between them.[12]

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[7] *Office Hours with Gary Gensler: The Laws that Govern the Securities Industry* (Apr. 27, 2023), https://twitter.com/GaryGensler/status/1651624244445421591?s=20

[8] Press Release, Senator Elizabeth Warren, *At Hearing, Senator Warren Says Crypto Takes the Sting out of Sanctions and Calls for Cracking Down on Crypto to Hold Russia Accountable for its Aggression* (Mar. 3, 2022), https://www.warren.senate.gov/newsroom/press-releases/at-hearing-senator-warren-says-crypto-takes-the-sting-out-of-sanctions-and-calls-for-cracking-down-on-crypto-to-hold-russia-accountable-for-its-aggression. Note that, in my view, both positions cannot be simultaneously accurate. If the law is clear and it applies, then the industry and cryptocurrency transactions are not unregulated. Indeed, that both claims can be made simultaneously is itself evidence that application of law and regulation to the blockchain industry is not clear.

[9] GARRICK HILEMAN & MICHEL RAUCHS, GLOBAL BLOCKCHAIN BENCHMARKING STUDY 11 (2017).

[10] *Id*.

[11] *Id*.

[12] Reyes, *Autonomous Business Reality*, *supra* note 2, at 445 (citing Peter Van Valkenburgh, *What's a "Blockchain," Anyway?*, COINCENTER (April 25, 2017), https://www.coincenter.org/education/blockchain-101/whats-a-blockchain/; Richard Gendal Brown, *Introducing R3 Corda™: A Distributed Ledger Designed for Financial Services*, RICHARD GENDAL BROWN (Apr. 5, 2016), https://gendal.me/2016/04/05/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services/).

In that regard, it is worth noting that at various times this testimony refers to blockchain technology as a blockchain protocol. Indeed, blockchain technology is a protocol technology.[13] A protocol, for its part, is "a set of instructions for the compilation and interaction of objects."[14] In the context of a computer network, a protocol may set out the rules that allow networked computers to communicate with each other.[15] Although many view blockchain protocols as shrouded in mystery, protocol technologies are used every day without much thought by nearly everyone. For example, "the Internet Protocol is a network protocol that defines the digital message formats and rules for communication among connected computers."[16] Indeed, every email sent requires use of a protocol that allows individuals to communicate with one another.[17] When we act via the Internet, we do so by interacting with a stack of technologies that includes a physical layer, a logical layer, an application layer, and a content layer.[18]

Similarly, when users interact with blockchain-based products and services, they interact with a set of layered technologies. What people colloquially refer to as blockchain, or blockchain technology, is a protocol—a set of rules—that allows networked computers (nodes) to track transitions in the global state of recorded data in the network without a centralized third-party intermediary.[19] For example, the Bitcoin blockchain tracks the uses of unspent transaction outputs, or UTXOs.[20] UTXOs remain locked by a small computer program (a script) that says "this can be redeemed by a public key that hashes to X, along with a signature from the owner of that public

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[13] Carla L. Reyes, *(Un)Corporate Crypto-Governance*, 88 FORDHAM L. REV. 1875, 1897 (2020).
[14] ALEXANDER R. GALLOWAY, PROTOCOL: HOW CONTROL EXISTS AFTER DECENTRALIZATION 76 (2004).
[15] Reyes, *Autonomous Business Reality*, *supra* note 2, at 445.
[16] *Id*. at 445 & n. 39.
[17] *Id*.
[18] Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. ON TELECOMM. & HIGH TECH. L. 37, 59 (2002). The OSI Model uses a seven-layer stack to describe the Internet's technology stack. *Id*.
[19] Carla L Reyes, *Creating Cryptolaw for the Uniform Commercial Code*, 78 WASH. & LEE L. REV. 1521, 1538 (2021) [hereafter Reyes, *Creating Cryptolaw*].
[20] *Id*. at 1539.

key."[21] To build more complex computer programs on top of the Bitcoin blockchain, however, often requires implementing them separately from the blockchain protocol, interacting with it, rather than being part of it.[22]

Meanwhile, other blockchain protocols enable additional computer programs to be layered on top of, or incorporated into, the blockchain technology stack.[23] The Ethereum protocol, for example, was designed as a global decentralized computer—the Ethereum Virtual Machine—to enable developers to build a variety of on-chain applications with a greater range of complexity.[24] Importantly, blockchain protocols vary in the combination and implementation of specific technological elements,[25] and, as a result, not every blockchain protocol emphasizes the same technology stack. Some blockchain protocols optimize privacy,[26] some blockchain protocols seek to better support a decentralized gaming experience,[27] while still others aim to provide a powerful platform for developers to use in building new and innovative projects.[28]

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[21] ARVIND NARAYANAN, JOSEPH BONNEAU, EDWARD FELTEN, ANDREW MILLER & STEVEN GOLDFEDER, BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION 52 ((2016) "Bitcoin doesn't use an account-based model. Instead, Bitcoin uses a ledger that just keeps track of transactions . . . .Transactions specify a number of inputs and a number of outputs . . . . You can think of the inputs as coins being consumed (created in a pervious transaction) and the outputs as coins being created.").

[22] *Id*. at 55.

[23] Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 333 (2017).

[24] ANDREAS M. ANTONOPOULOS & GAVIN WOOD, MASTERING ETHEREUM: BUILDING SMART CONTRACTS AND DAPPS 2, 4 (Rachel Roumeliotis et al. eds, 2018) ("Unlike Bitcoin, which has a very limited scripting language, Ethereum is designed to be a general-purpose programmable blockchain that runs a virtual machine capable of executing code of arbitrary and unbounded complexity.").

[25] Reyes, *Autonomous Business Reality*, *supra* note 2, at 444-445 (noting, for example, the various technical methods that blockchain protocols use to achieve consensus).

[26] For example, Monero, Zcash, and Dash.

[27] For example, WAX and Flow.

[28] For example, Ethereum, Aeternity, and EOS.

The Bitcoin blockchain[29] and the Ethereum protocol[30] are arguably the two most well-known blockchain protocols,[31] and both rely on intrinsic tokens (bitcoin the case of the Bitcoin blockchain, and ether in the case of the Ethereum protocol) to incentivize honest behavior in the development of consensus and to serve as a security tool.[32] In Ethereum for example, developers use ether to limit the computing power to execute a smart contract by the cost required to operate the computer program.[33] Imposing this limit prevents the launch, accidental or otherwise, of a smart contract that consumes all of the Ethereum protocol's computing power, which would have the effect on the protocol of a denial of service attack.[34] Ultimately then, cryptocurrency such as bitcoin and ether serve a function beyond acting as a medium of exchange—namely, such cryptocurrency serves an important role in ensuring the proper function of the underlying protocol.[35] Certain protocols allow users to build other non-intrinsic tokens on top of the protocol. Such tokens do not serve the same function in the protocol. The underlying blockchain protocol and its related intrinsic cryptocurrency will continue to operate whether any specific non-intrinsic token ceases to exist, or not.[36] Although the technical differences between intrinsic cryptocurrency and non-intrinsic tokens are more complicated than that, even this brief comparison of two types

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[29] NARAYANAN, ET AL, *supra* note 21, at xxii (2016). A note on terminology. It has become customary to refer to the Bitcoin software, protocol, and network using the uppercase Bitcoin while the lowercase bitcoin refers to individual units of cryptocurrency. Reyes, *Language Wars: Cryptocurrency*, *supra* note _, at 1212 & n. 85.

[30] "Ethereum is a platform for decentralized applications, smart contracts and decentralized, autonomous organizations." HENNING DIEDRICH, ETHEREUM: BLOCKCHAIN, DIGITAL ASSETS, SMART CONTRACTS, DECENTRALIZED AUTONOMOUS ORGANIZATIONS 30 (2016). In other words, "Ethereum is designed to be a general-purpose programmable blockchain." ANTONOPOULOS & WOOD, *supra* note 24, at 1.

[31] Reyes, *Language Wars: Cryptocurrency*, *supra* note 2, at 1212.

[32] *Id*.

[33] *Id*.; NARAYANAN ET AL, *supra* note 21, at 266.

[34] ANTONOPOULOS & WOOD, *supra* note 24, at 207.

[35] NARAYANAN ET AL., *supra* note 21, at 65-66; *see also* ANTONOPOULOS & WOOD, *supra* note 24, at 2.

[36] Reyes, *Language Wars: Cryptocurrency*, *supra* note 2, at 1215. To further emphasize how different intrinsic cryptocurrencies and non-intrinsic tokens are, note that because they exist at two different layers of the blockchain technology stack, different groups of software developers are usually responsible for the creation and maintenance of each. *See* Raina S. Haque, Rodrigo Seira Silva-Herzog, Brent A. Plummer & Nelson M. Rosario, *Blockchain Development and Fiduciary Duty*, 2 STAN. J. BLOCKCHAIN L. & POL'Y 139, 152 (2019) (naming the developers that create non-intrinsic tokens "smart contract developers" and distinguishing them from those who contribute to the layer 1 blockchain protocol, referred to as "protocol developers").

of what are often jointly and broadly referred to as digital assets demonstrates that the technical attributes may have policy implications.

In recent research, I considered linguistic evidence of misunderstandings about the differences among types of cryptocurrencies and its impact on the law and policy-making sphere, which I would be happy to provide to the Committee.[37] That research revealed that stakeholders in the legal field—legal academics, lawmakers, judges, and lawyers—tend to use cryptocurrency related terms[38] interchangeably, and often hold a specific example out for use in building the applicable legal framework.[39] In so doing, law and policy risk ignoring the important variations in cryptocurrencies and their technical attributes.[40] That failure, in turn, can lead to one-size-fits all policy and legal frameworks that leave industry confused and clamoring for deeper clarity.[41] In other words, good policy for blockchain technology requires understanding the technology, its uses, and its limitations.

II. Smart contracts are simple, rather passive, computer programs that can be layered into the blockchain technology stack as a powerful transactional tool.[42]

Smart contracts represent another frequently misunderstood feature of blockchain protocols.[43] A smart contract is one type of computer program commonly deployed in connection with a blockchain protocol.[44] Like the variation in technical features and intended uses of blockchain

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[37] Reyes, *Language Wars: Cryptocurrency*, *supra* note 2.
[38] The cryptocurrency-related terms investigated were: cryptocurrency, cryptoassets, digital assets, virtual currency, tokens, NFTs and stablecoins. *Id*. at 1220.
[39] *Id*. at 1248.
[40] *Id*.
[41] *Id*.
[42] The testimony provided in Section II is largely drawn from my published article *Creating Cryptolaw for the Uniform Commercial Code*, *supra* note 19.
[43] For a deeper discussion of how such misunderstandings has impacted law and policy around smart contracts up to this point, see Carla L. Reyes, *Emerging Technology's Language Wars: Smart Contracts*, 2022 WIS. L. FORWARD 85 (2023).
[44] Reyes, *Creating Cryptolaw*, *supra* note 19, at 1541.

protocols, the precise implementation of a smart contract can vary significantly.[45] At the core, however, a smart contract is very similar to a persistent script—a standing computer program—that says "if event x happens, then execute result y."[46] Despite common discussions about the self-executing or self-enforcing nature of smart contracts, smart contracts are really quite passive.[47] Smart contracts do not, on their own, mine datasets, or even the blockchain protocol upon which the smart contract is built, to find data evidencing that an event, "x," has occurred.[48] Instead, someone or something must trigger a smart contract, i.e., send a signal that an event "x," has occurred.[49] That signal might come from a source participating in the blockchain protocol, or an outside source might trigger the smart contract.[50] In either case, the parties using a smart contract as a tool in their broader software application can mitigate the risk of unintentionally or improperly triggering the smart contract through a variety of on-chain and off-chain mechanisms, including additional technical measures to secure the application and traditional contracts that allocate the risk of loss in the event that something goes wrong.

Smart contracts are frequently employed as tools to perform obligations.[51] Occasionally, those obligations are contractual obligations, and smart contracts help incentivize performance by both

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[45] *Id*.
[46] *Id*.; *see also* Carla L. Reyes, *A Unified Theory of Code Connected Contracts*, 46 J. CORP. L. 981, 987 (2021) ("[A] smart contract is computer software that causes something to happen upon the fulfillment of pre-determined conditions.") [hereafter Reyes, *Unified Theory*]; VITALIK BUTERIN, ETHEREUM WHITE PAPER: A NEXT GENERATION SMART CONTRACT & DECENTRALIZED APPLICATION PLATFORM 1 (2013) (defining smart contracts as "systems which automatically move digital assets according to arbitrary pre-specified rules.").
[47] ANTONOPOULOS & WOOD, *supra* note 24, at 128-29 ("All smart contracts in Ethereum are executed, ultimately, because a transaction initiated from and EOA. A contract can call another contract that can call another contract and so on, but the first contract in such a chain of execution will always have been called by a transaction for an EOA.").
[48] *Id*. at 129 ("Contracts never run on their own or in the background.").
[49] *Id*. ("Contracts effectively lie dormant until a transaction triggers execution, either directly or indirectly as part of a chain of contract calls.").
[50] Reyes, *Unified Theory*, *supra* note 46, at 987 (citing DIEDRICH, ETHEREUM, *supra* note 30, at 167-70.
[51] HENNING DIEDRICH, LEXON DIGITAL CONTRACTS 6 (2020) ("Digital contracts, in so far as they are blockchain smart contracts, cannot coerce any action. They can send money and log statements. They cannot otherwise force anyone to do anything. They typically operate on incentives instead and utilize staking to broaden the applicability of this principle: you pay something in that you will lose if you don't perform your role.").

parties in order to avoid later disputes.[52] Some projects use smart contracts to build RegTech—software tools for more efficiently and accurately performing legal obligations imposed by statute and regulation.[53] For example, R3 CEV undertook a trial with the United Kingdom's banking regulator, the Financial Conduct Authority.[54] The R3 software allowed banks to automatically notify the FCA each time the banks issue a mortgage.[55] The software aims to reduce error and cost in complying with the FCAs mortgage regulatory requirements.[56]

Smart contracts also serve as the foundation of a variety of efforts to modernize the global supply chain. The term supply chain refers to the links between companies that result in "inputs arriv[ing] at a business to create value, including the means by which products arrive to consumers."[57] Many businesses believe that blockchain technology can be leveraged to eliminate waste and inefficiency in supply chains.[58] Others hope to use blockchain technology to trace the origins of their products and services.[59] Particular interest in this kind of provenance tracing stems from businesses required to comply with food safety laws.[60] Although many hope blockchain technology will revolutionize supply chain management, a significant limitation remains. In particular, while blockchain technology can confirm that blockchain-based records have not been

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[52] Reyes, *Unified Theory*, *supra* note 46, at 988.
[53] *See, e.g.*, Reyes, *Autonomous Business Reality*, *supra* note 2, at 488-489 (offering the example of Securitize, a company that uses smart contracts to automate corporate regulatory compliance); see also Joan MacLeod Heminway & Adam J. Sulkowski, Blockchains, Corporate Governance, and the Lawyer's Role, 65 Wayne L. Rev. 17 (2019) (discussing the potential of using blockchain technology to streamline certain aspects of corporate governance).
[54] Anna Irrera, *R3, UK Regulator and Banks Team Up on Blockchain-Based Mortgage Reporting*, REUTERS (Sept. 12, 2017, 1:05 AM), https://www.reuters.com/article/us-r3-fca/r3-uk-regulator-and-banks-team-up-on-blockchain-based-mortgage-reporting-idUSKCN1BN0QX.
[55] *Id*.
[56] *Id*.
[57] Adam J. Sulkowski, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future Governance, Legal Frameworks, and Lawyers?*, 43 DELAWARE J. CORP. L. 303, 305 (2019); *see also* Kishanthi Parella, *Improving Human Rights Compliance in Supply Chains*, 95 NOTRE DAME L. REV. 727, 736 (2019) ("The tool that corporations use to connect their various functions around the world is the global supply chain.").
[58] Sulkowski, *supra* note 57, at 311.
[59] *Id*.
[60] HENRY KIM & MAREK LASKOWSKI, AGRICULTURE ON THE BLOCKCHAIN: SUSTAINABLE SOLUTIONS FOR FOOD, FARMERS, AND FINANCING 6 (Blockchain Research Institute, 2018).

tampered with after the record's inclusion in the protocol, blockchain technology cannot itself ensure that the data is accurate or reliable.[61] The inputs into a blockchain-based supply chain management system still originate from data providers, and some of those data providers may provide unreliable data.[62] Even still, significant interest in blockchain-based supply chain management tools exist because of the likelihood for significant cost savings, reduced inefficiency, and increased (if not perfect) reliability of record-keeping.[63]

Some projects use smart contracts to explore alternative methods of incentivizing art production and compensating artists. For example, the Plantoid project relies upon donations, pre-paid commissioned work, and a unique royalty structure to incentivize the production of metal sculptures depicting flowers or other plants.[64] While each individual artwork is financially autonomous,[65] the smart contracts powering the Plantoid enables new forms of collective economic and artistic methods of production.[66]

In my own research on modernizing the state filing systems related to Article 9 of the Uniform Commercial Code (U.C.C.), I used smart contracts to build what commercial lawyers and State Secretary of States offices refer to as the U.C.C.-1 filing form, or a Financing Statement.[67] By way of summary explanation, a contract generally only binds its parties, however security agreements—agreements to create a security interest in specific personal property[68]—represent an

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[61] *Id*. at 7.
[62] *Id*.
[63] *Id*. at 8.
[64] Primavera de Filipi, *Plantoids: A Blockchain-Based Lifeform*, planetoid.org.
[65] For an explanation of how this is true, see Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 385-86 (2017), and Reyes, *supra* note 2, *Autonomous Business Reality*, at 468-69.
[66] Carla L. Reyes, *Autonomous Corporate Personhood*, 96 WASH. L. REV. 1453, 1496 (2021).
[67] This portion of the testimony only offers a summary of the Article. For a full explanation of the smart contract-based prototype of the UCC-1 form and the computer code needed to operate it, see *Creating Cryptolaw for the Uniform Commercial Code*, 78, WASH. & LEE L. REV. 1521 (2021). The rest of this paragraph is drawn from the abstract summary of that Article.
[68] *Id*. at 1532-33.

exception to this rule. Under certain conditions, security agreements not only bind the parties—often a creditor and debtor—but also bind third-party creditors that want to lend against, or collect on debt from, the same personal property.[69] To receive this extraordinary benefit, creditors must put the world on notice, usually by filing a financing statement in the filing system operated in the state where the debtor is located.[70] Unfortunately, it is well documented that in practice, the filing system provides constructive, but not necessarily actual, notice to interested parties, and thereby can increase risk of financial loss.[71] To solve this problem, I built a smart-contract-based U.C.C.-1 form that both replicates the function of the financing statement and automates the performance of several U.C.C. Article 9 rules so that the filing system actually works as intended.

Entrepreneurs also leverage smart contracts to power a new wave of business ventures. A decentralized autonomous organization (DAO) is computer software that leverages smart contracts to enable dispersed individuals to engage in productive cooperative activities.[72] Many DAOs form legally-recognizable entities. Some prominent examples include the formation of a New Zealand-based irrevocable trust,[73] a software collective organized as a Vermont Blockchain-Based Limited Liability Company,[74] an investment firm organized as a Delaware Limited Liability Company,[75]

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[69] *Id*. at 1533-34.
[70] *Id*. at 1534-35.
[71] John J. Eikenburg, Jr., Comment, Filing *Provisions of Revised Article 9*, 53 SMU L. REV. 1627, 1631 (2000) (When first drafted, the filing system may have been adequate, but currently many problems exist with the system.); Brian G. Bosta, Comment, *Bringing Article 9 Up to Speed: The Need for a National Filing System*, 31 U. DAYTON L. REV. 25 (2005) (Companies in the business of lending must be able to find existing transactions between a potential debtor and its creditors efficiently, accurately, and as cost-effectively as possible to protect their legal rights. The current filing system under Revised Article 9 of the [U.C.C.] does not facilitate these goals.); Lynn M. LoPucki, *Computerization of the Article 9 Filing System: Thoughts on Building the Electronic Highway*, 55 L. CONTEMP. PROBS. 5,6 (1992) (As the article 9 filing system is currently conceived and implemented, (1) it is impractical for a secured creditor to do everything necessary to make and maintain an effective filing, (2) many kinds of filings are effective even though they are, as a practical matter, impossible for searchers to discover, and (3) the processes for both filing and searching are unreasonably complex and error-prone.).
[72] Carla L. Reyes, *If Rockefeller Were a Coder*, 87 GEO. WASH. L. REV. 373, 387 (2019).
[73] Reyes, *Autonomous Business Reality*, *supra* note 2, at 442 (discussing the Dash Trust).
[74] *Id*. (discussing dOrg LLC).
[75] MetaCartel Ventures (Venture DAO), metacartel.xyz/about (Meta Cartel Ventures DAO is organized as a Delaware LLC)

and an organization dedicated to Web3 education, organized as a Texas Limited Liability Company[76] among many others. These ventures tend to feature flatter governance structures and innovative economic models.[77] These innovations in governance and business structures force "us to ask not only how does business law apply when businesses use autonomous technology, but also, what do autonomous businesses require us to reassess in business law?"[78]

Indeed, in the wake of corporate scandals, including recent scandals in the cryptocurrency industry such as those involved in the failure of FTX, the need for corporate governance reform is clear. Many legal scholars have proposed such reforms over many years, and yet corporations have been slow to adopt such governance reforms.[79] Such reforms as diversification of board members,[80] greater governance transparency,[81] and increased shareholder power,[82] all have functional equivalents in the governance structures used by a variety of DAOs.[83] As DAOs become increasingly feasible mechanisms for organizational governance, we might observe lessons that can be applied in more traditional corporate governance settings, whether by using blockchain technology or through more low-technology means.[84] To reap such benefits, however, it is important that policy recognize the wide variety of DAOs in existence, their varying levels of

[76] ATX DAO, atxdao.com (ATX DAO is organized as a Texas LLC).
[77] Reyes, *Autonomous Business Reality*, *supra* note 2, at 487.
[78] Reyes, *Autonomous Business Reality*, *supra* note 2, at 487.
[79] *Id*. at 482-86.
[80] *See generally*, Yaron Nili*, Beyond the Numbers: Substantive Gender Diversity in Boardrooms*, 94 IND. L.J. 145 (2019).
[81] *See generally*, Yaron Nili, *The "New Insiders": Rethinking Independent Directors' Tenure*, 68 HAST. L.J. 97 (2016); Kobi Kastiel & Yaron Nili, *"Captured Boards": The Rise of "Super Directors" and the Case for a Board Suite*, 2017 WIS. L. REV. 19 (2017); Usha Rodrigues, *Let the Money Do the Governing: The Case for reuniting Ownership and Control*, 2 STAN. J.L. BUS. & FIN. 254, 255-56 (2004).
[82] *See generally* Lucian Arye Bebchuk, *The Case for Increasing Shareholder Power*, 118 HARV. L. REV. 833, 835 (2005); Lisa M. Fairfax, *Shareholder Democracy on Trial: International Perspective on the Effectiveness of Increased Shareholder Power*, 3 VA. L. & BUS. REV. 1, 2 (2008).
[83] Reyes, *Autonomous Business Reality*, *supra* note 2, at 482.
[84] *Id*.

autonomy (many DAOs involve many people directly, and some do not),[85] and prevent the flight of such businesses and their innovative, democratizing potential to other, offshore jurisdictions.

Ultimately, like any technology, what a smart contract is, for legal and policy analysis purposes, depends on how it is used, and how a smart contact is used depends upon both the social context in which it is put to work and the technical architecture through which it functions.[86] Recognizing the role of both the social context and the technical architecture in determining the nature of any particular smart contract or smart contract-based application or organization is key to enabling efficient and effective policy-making that enables innovation and preserves the transactional power of smart contracts without facilitating bad actors. In other words, considering the varied socio-technical contexts in which smart contracts are used can help avoid the creation of confusing, overbroad rules that are technically impossible to comply with and push innovation offshore.

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Ultimately, making clear law and effective policy for the many variations of blockchain protocols and its wide-ranging applications does not require coding or computer engineering knowledge. However, a balanced approach to policy-making in this arena that encourages innovation and preserves the democratizing and transparency-enhancing potential of applications built on blockchain protocols while preventing harmful activity requires understanding how the technology works, right down to the very important but highly technical details. Otherwise, not only will new legal frameworks be likely to underperform their intended function, but we may also miss key opportunities to improve our existing legal rules and systems. Indeed, without deeper investigation into the socio-technical context of blockchain protocols and their use cases, policy

[85] *Id*. at 470-71.
[86] Reyes, *A Unified Theory*, *supra* note 46, at 1001.

approaches and legal frameworks risk continuing generalizations and perpetuating myths that exacerbate the extent to which law lags behind or, worse, compounds the risks related to technology.