THE PATH OF THE BLOCKCHAIN LEXICON (AND THE LAW)

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Abstract

The terminology around blockchain technology is notoriously confusing, with disputes over whether a blockchain is the same as a distributed ledger, or whether an appcoin is the same as a protocol token. In this article, I examine the difficulties the rapidly shifting, contested vocabulary poses for regulators seeking to understand, govern, and potentially use blockchain technology, and offer suggestions for how to fight through the haze of unclear language.

In Part II, I provide examples of the fluctuating, contested language in the blockchain technology space, and describe the forces at play in shaping the language. In Part III, I lay out the problems the language raises for regulators, including challenges in identifying the facts about the technology, distinguishing among the many variations of the technology, and communicating clearly about the technology, as well as increasing the chances of regulatory capture, inconsistent regulation across jurisdictions and subject domains, and "perverse innovation."

In Part IV, I closely analyze the use of the term "immutable" in blockchain discourse, to illuminate the confusion a single term can cause for regulators (and the public at large). I argue that the widespread use of the term "immutable" as a defining feature of blockchain technology is misleading, given that (1) real world events have demonstrated that the unchangeable nature of a blockchain record is always limited by the decisions of its human governors to change it, and (2) the source of a blockchain record's "immutability"

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is disputed, meaning that it is unclear whether any particular variation of the technology may be fairly described as creating an "immutable" record. This is problematic as regulators have already begun to craft legislation describing the records created by blockchain technology as immutable, and are making decisions to use the technology in large part because of its "immutability."

In Part V, I suggest ways regulators can become better educated about blockchain technology, as is essential to responsibly govern or use the technology. I also recommend that regulators take a highly critical approach that (1) seeks to separate hype from reality; (2) is sensitive to how incentives may shape the way blockchain technology is portrayed by industry and those sponsored by industry, and how misleading terminology appears in publications of the highest prestige levels; (3) includes diverse perspectives from proponents and critics of the technology, multiple disciplines, and across the gender, race, geographic, and economic development spectrums; (4) takes nothing, including descriptions of the technology itself, at face value, but deeply interrogates and scrutinizes the technology and its stated capabilities; and (5) asks regulators to think for themselves about the technology and its benefits rather than succumbing to herd behavior.

I am hopeful that these recommendations, coupled with awareness that blockchain vocabulary is treacherous, can help regulators to discover the facts about blockchain technology and respond to them appropriately

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I. Introduction

On January 8, 1897, "the most important event in American legal history to have taken place at Boston University School of Law" occurred.[1] Oliver Wendell Holmes, Jr., then an Associate Justice of the Massachusetts Supreme Judicial Court, delivered a speech entitled *The Path of the Law* to a group of law students, faculty, judges, and practicing attorneys.[2] Touching on many themes that foreshadowed the Legal Realism movement, the speech became a classic of legal

[1] David J. Seipp, *Holmes's Path*, 77 B.U. L. REV. 515 (1997). Note that when Professor Seipp made this claim in 1997, the *Review of Banking & Financial Law*'s 2017 Law of FinTech Symposium had not yet occurred.
[2] *Id.* at 546–48.

theory.[3] In the speech, Holmes explored the "unnecessary confusion" created by the use of legal terms that carry the baggage of "moral significance" and "ethical associations."[4] He noted that, "[t]he law is full of phraseology drawn from morals, and by the mere force of language continually invites us to pass from one domain to the other without perceiving it, as we are sure to do unless we have the boundary constantly before our minds."[5] Holmes speculated

> whether it would not be a gain if every word of moral significance could be banished from the law altogether, and other words adopted which should convey legal ideas uncolored by anything outside the law. We should lose the fossil records of a good deal of history and the majesty got from ethical associations, but by ridding ourselves of an unnecessary confusion we should gain very much in the clearness of our thought.[6]

One hundred twenty years later at a FinTech Symposium at Boston University School of Law, Holmes' insights into the problems indeterminate language creates for law remain relevant. This article picks up on the linguistic challenges identified by Holmes, and explores the confusion they can sow for regulators and policymakers grappling with blockchain technology.

As many have discussed, regulators face numerous challenges in approaching blockchain technology,[7] whether in the world of

[3] GERALD J. POSTEMA, 11 LEGAL PHILOSOPHY IN THE TWENTIETH CENTURY: THE COMMON LAW WORLD 43 (2011) ("This language would decisively shape and direct American legal theory in the twentieth century. "The Path of Law" quickly acquired the status of a classic, one of the most influential pieces of jurisprudential writing in English in the twentieth century . . . .").

[4] Oliver Wendell Holmes, Jr., *The Path of the Law,* 10 HARV. L. REV. 457, 464 (1897).

[5] *Id*. at 459–60.

[6] *Id.* at 464.

[7] In the remainder of this article, I use the term "regulators" as shorthand for lawmakers, regulators, and other policymakers. Commentators have offered a plethora of suggestions to regulators on when and how to regulate blockchain technology. *See, e.g.*, Carla L. Reyes, *Moving Beyond Bitcoin To An Endogenous Theory Of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 VILL. L. REV. 191, 193 (2016) (proposing an "endogenous theory of regulation," under which that regulators would pass laws and

finance or in the multiplicity of other social systems the technology is predicted to transform.[8] The regulatory dilemmas include the classic one when approaching innovative technologies or practices: finding *just the right moment* to regulate, such that regulation is available immediately when people need to be protected and to have guidance in how to structure their businesses, but not so early that regulation inappropriately inhibits innovation and the possibility of new jobs or industries.[9] Blockchain technology, along with most of the fintech practices considered in this Symposium, certainly has generated this struggle for regulators.[10]

In this article, however, I focus on a less-discussed dilemma: the fast-moving vocabulary around blockchain technology, and the challenges this unstable verbal terrain poses for regulators (not to mention those developing the technology and deciding whether it

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implement them directly in the software code of DLTs by working with the DLT's software developers and network); Kevin V. Tu & Michael W. Meredith, *Rethinking Virtual Currency Regulation in the Bitcoin Age,* 90 WASH. L. REV. 271 (2015) (suggesting that policymakers should think creatively about how to enact new or modified regulations for virtual currency that advance existing regulatory objectives in order to "foster the creation of a more effective legal framework").

[8] Proponents of blockchain technology as a record-keeping technology predict that it will disrupt property records, voting, government benefits administration, academic and identity records, supply chain management, and virtually every single system that keeps track of anything. For a rosy and wide-ranging overview of the possibilities of the technology, *see generally,* DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION (2016) (exploring the various potential uses and positive impact of blockchain technology).

[9] This dilemma is known as the "pacing problem" in regulating innovation. *See* Mark Fenwick et al., *Regulation Tomorrow: What Happens When Technology is Faster than the Law?* (Tilburg Univ., TILEC Discussion Paper No. 2016-024, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2834531 [https://perma.cc/8SGF-UBKU] (providing an overview of how innovative practices and technologies create regulatory challenges).

[10] *See, e.g.*, Oz Shy, Can eCash & Virtual Currency Compete with Other Electronic Payments: Presented at the Accredited Standards Committee X9 All Committees Meetings of the Federal Reserve Bank of Minneapolis (Oct. 22, 2014), https://drive.google.com/file/d/0Bw1E1lOCYALJY1NNR0RfTk9NQXhlYXJKV3pWaE5WNlo2RFVv/view [https://perma.cc/7EQJ-U4FX] (stating that the longstanding Federal Reserve position on virtual currency was that "regulators should be careful not to inhibit experimentation and growth of innovative payment technologies").

is appropriate for their needs).[11] This issue is significant for fintech law in that blockchain technology is being actively considered and experimented with for use in practically every financial practice and system, from central bank digital currencies, to clearing and settlement systems, to cross-border payments and beyond.[12] So, the unsettled vocabulary is relevant to how financial regulators understand, discuss, and ultimately regulate (or not) the technology or its uses, as well as how courts will interpret any regulation or regulatory guidance in the future. However, the vocabulary problems are also more broadly applicable to *any* regulators evaluating the technology, including those outside the financial sector, as well as to groups considering implementing the technology in whatever domain.[13]

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[11] In a separate project, I explore the systemic risks that may be created due to misunderstandings about blockchain technology that stem from communication and language problems. *See* Angela Walch, Communication Problems and Systemic Risk: How Imprecise Language Could Taint System-Wide Decisions on Blockchain Technology (Jan. 2017) (unpublished manuscript) (on file with author).

[12] For an optimistic vision of how blockchain technology will transform the financial system, see WORLD ECON. FORUM, THE FUTURE OF FINANCIAL INFRASTRUCTURE (2016), http://www3.weforum.org/docs/WEF_The_future_of_financial_infrastructure.pdf [https://perma.cc/JR5D-9PPT] (examining the ways in which distributed ledger technology could revolutionize financial services).

[13] The private sector is not alone in considering using blockchain technology. A number of governments have announced that they are trialing or implementing blockchain technology in various government systems. *See, e.g.*, Michael del Castillo, *Illinois Joins R3, Unveils Expansive Blockchain Support Plan*, COINDESK (Mar. 16, 2017), http://www.coindesk.com/illinois-government-unveils-expansive-blockchain-industry-support-plan/ [https://perma.cc/MV3W-NFKG] (describing a "sweeping plan" by Illinois to implement blockchain solutions in various government agencies); *Dubai Launches Blockchain Strategy to Become Paperless by 2020*, GULF NEWS (Oct. 5, 2016), http://gulfnews.com/news/uae/government/dubai-launches-blockchain-strategy-to-become-paperless-by-2020-1.1907790 [https://perma.cc/D8VZ-YNAW] (examining Dubai's efforts to shift all transactions to blockchain records and thereby become paperless); Jonathan Keane, *Sweden Moves to Next Stage With Blockchain Land Registry*, COINDESK (Mar. 31, 2017), http://www.coindesk.com/sweden-moves-next-stage-blockchain-land-registry/ [https://perma.cc/E5MT-89XD] (explaining Sweden's trial use of blockchain technology to record property transactions); Andrea Tinianow et al., Opinion, *Delaware's 2017 Resolution: Make Blockchain a Reality*, COINDESK (Jan. 3,

In Part II of this article, I provide a high-level overview of the contested lexicon of blockchain technology and the forces contributing to its state of flux. In Part III, I outline some of the problems this creates for regulators. To help crystallize the confusion potentially spawned by a fluctuating, contested vocabulary, in Part IV, I analyze the use of a key term from blockchain technology: "immutable." Finally, in Part V, I suggest ways regulators could mitigate the difficulties in understanding and assessing the risks and benefits of the technology.

II. Blockchain Technology's Unsettled Terminology

The vocabulary used in the blockchain technology—er, DLT—I mean SLT—space is notoriously confusing. A quick sampling of just some of the blockchain lingo makes the point:

- Blockchain technology, sometimes called "the blockchain" or just "blockchain," is alternatively referred to as "distributed ledger technology" (DLT),[14] "shared ledger technology" (SLT),[15] "consensus ledger" technology,[16] "mutual distributed

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2017), http://www.coindesk.com/what-expect-delaware-blockchain-initiative-2017/ [https://perma.cc/H5W5-D9TA] (detailing Delaware's efforts to implement blockchain technology).

[14] *See, e.g.*, Andrea Pinna & Wiebe Ruttenberg, *Distributed Ledger Technologies in Securities Post-Trading,* (European Cent. Bank, Occasional Paper No. 172, 2016), https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf [https://perma.cc/68U5-C93N] (discussing how DLTs could be used in securities post-trading).

[15] David Birch of Consult Hyperion has pushed for the "shared ledger technology" term. *See, e.g.*, David Birch, *Shared Ledger Technology and the Future of Banks (from 1956)*, DISRUPTIVE VIEWS (Feb. 11, 2016), https://disruptiveviews.com/shared-ledger-technology-future-banks-1956/ [https://perma.cc/9664-DAUF] ("[T]here is at least the possibility that SLT will indeed achieve impossible improvements in banking operations.").

[16] *See, e.g.*, Pinna & Ruttenberg, *supra* note 14, at 9 ("Other DLTs are referred to as consensus ledgers, as they do not keep track of the history of transactions but instead operate on the basis of consensus reached on a ledger of accounts, which are updated with new transactions at each validation round.").

ledger" technology,[17] or even a decentralized or "distributed database."[18]

- There are "public blockchains" (also called "permissionless blockchains" or "open blockchains") and "private blockchains" (also called "permissioned blockchains" or "closed blockchains").[19] Of course, one can substitute "DLTs" for "blockchains" throughout the preceding sentence. There are also "restricted" and "unrestricted" DLTs.[20]

- There are various parties involved in operating these databases or ledgers that are sometimes called "miners,"[21] and other times "nodes"[22] or "validators."[23] Of course, some of the

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[17] *See, e.g.*, Michael Mainelli & Alistair Milne, *The Impact and Potential of Blockchain on the Securities Transaction* Lifecycle (SWIFT Inst., Working Paper No. 2015-007, 2016), https://ssrn.com/abstract=2777404 [https://perma.cc/HG47-BGPL] (referring to blockchain technology as "mutual distributed ledger" technology).

[18] *See, e.g.*, Sebastien Meunier, *Blockchain Technology—a Very Special Kind of Distributed Database* (Dec. 29, 2016), https://medium.com/@sbmeunier/blockchain-technology-a-very-special-kind-of-distributed-database-e63d00781118#.oywrg7q0r [https://perma.cc/W62T-KEEX] (providing a taxonomy of distributed database technology, including blockchain technology).

[19] *See, e.g.*, BITFURY GRP. & JEFF GARZIK, PUBLIC VERSUS PRIVATE BLOCKCHAINS (2015), http://www.the-blockchain.com/docs/Jeff%20Garzik%20Public%20vs%20Private%20Blockchain%20pt1.pdf [https://perma.cc/F9YH-W4VD] (describing permissioned and permissionless blockchains, and pros and cons of each).

[20] *See, e.g.*, Pinna & Ruttenberg, *supra* note 14, at 11 (explaining the characteristics of restricted and unrestricted DLTs).

[21] *See, e.g.*, ANDREAS M. ANTONOPOULOS, MASTERING BITCOIN: UNLOCKING DIGITAL CRYPTOCURRENCIES 173–74 (2014).

[22] *See, e.g.*, *id.* at 179.

[23] *See, e.g.*, Antony Lewis, *A Gentle Introduction to Blockchain Technology*, BITS ON BLOCKS (Sept. 9, 2015), https://bitsonblocks.net/2015/09/09/a-gentle-introduction-to-blockchain-technology/ [https://perma.cc/UQ8F-6CZ5] ("Important members of the network are called validators or nodes which pass around transaction data (payments) and block data (additions to the ledger.").

nodes might be "partial" (as opposed to "full function"),[24] and some of the miners might be in a "mining pool."[25]

- There are "virtual currencies,"[26] "digital currencies,"[27] "central bank digital currencies" (which may or may not use blockchain technology at some point),[28] in addition to "cryptocurrencies,"[29] "tokens,"[30] "protocol tokens,"[31] "app coins,"[32] "alt-coins,"[33] and "meta-coins."[34]

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[24] *See, e.g.*, MARC SEL & MARLEEN MOUTON, PWC, BLOCKCHAIN & ITS APPLICATION IN FINANCIAL SERVICES (2016), https://www.pwc.be/en/documents/20161122-blockchain-and-applications-financial-services.pdf [https://perma.cc/5Q7R-CQ54] (distinguishing partial nodes from full function nodes).

[25] *See, e.g.*, ANTONOPOULOS, *supra* note 21, at 207–10.

[26] *See, e.g.*, Dong He et al., *Virtual Currencies and Beyond: Initial Considerations* 7 (Int'l Monetary Fund, Staff Discussion Note No. 16/03, 2016), https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf [https://perma.cc/4KZG-DKBS] (defining virtual currencies).

[27] *See, e.g.*, *id.* at 7–8 (describing the difference between virtual currencies and digital currencies).

[28] *See, e.g.*, Max Raskin & David Yermack, *Digital Currencies, Decentralized Ledgers, and The Future of Central Banking,* 10 (Nat'l Bureau of Econ. Research, Working Paper No. 22238, 2016) (discussing the possibility of central bank digital currencies) (forthcoming in RESEARCH HANDBOOK ON CENTRAL BANKING (Peter Conti-Brown & Rosa Lastra eds., 2017)).

[29] *See, e.g.*, He et al., *supra* note 26, at 9 (identifying and explaining cryptocurrencies).

[30] *See, e.g.*, Lewis, *supra* note 23 (explaining the basics of tokens).

[31] *See, e.g.*, Will Warren, *The Difference Between App Coins and Protocol Tokens,* MEDIUM (Feb. 2, 2017), https://medium.com/0x-project/the-difference-between-app-coins-and-protocol-tokens-7281a428348c#.gdpfgrh7y [https://perma.cc/E7LV-T73Y] (comparing and contrasting app coins and protocol tokens).

[32] *See, e.g.*, *id.* (comparing and contrasting app coins and protocol tokens).

[33] *See, e.g.*, Peter Van Valkenburgh, *What are Forks, Alt-coins, Meta-coins, and Sidechains?*, COIN CENTER (Dec. 8, 2015), https://coincenter.org/entry/what-are-forks-alt-coins-meta-coins-and-sidechains [https://perma.cc/JC33-KJ9K] (explaining certain terminology and "technical concepts from the ever-changing universe of Bitcoin-derived innovations").

[34] *See, e.g.*, *id.* (discussing the basics of meta-coins).

- And whatever the technology is called, people say it is "immutable,"[35] "trustless,"[36] and "secure."[37]

The terms listed above might refer to the same thing, or almost the same thing, or something closely related, or even something completely opposite. While there are language guides and explainers

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[35] *See, e.g.*, Andrea Tinianow & Caitlin Long, *Delaware Blockchain Initiative: Transforming the Foundational Infrastructure of Corporate Finance,* HARV. L. SCH. F. ON CORP. GOVERNANCE & FIN. REG. (Mar. 16, 2017), https://corpgov.law.harvard.edu/2017/03/16/delaware-blockchain-initiative-transforming-the-foundational-infrastructure-of-corporate-finance/ [https://perma.cc/3WX7-253P] ("Distributed ledgers . . . create a single record of transactions among multiple parties, providing one immutable, "golden copy" of data that all parties see at the same time and can trust as valid."); Marc Pilkington, *Blockchain Technology: Principles & Applications*, *in* RESEARCH HANDBOOK ON DIGITAL TRANSFORMATIONS 15 (F. Xavier Olleros & Majlinda Zhegu eds., 2016) ("Immutability is a characteristic of blockchain technology."); CHAMBER OF DIG. COMMERCE & CTR. FOR FIN. MKTS. & POLICY AT GEORGETOWN UNIV. MCDONOUGH SCH. OF BUS., BLOCKCHAIN AND FINANCIAL INCLUSION 8 (2017) [hereinafter BLOCKCHAIN AND FINANCIAL INCLUSION], http://finpolicy.georgetown.edu/sites/finpolicy.georgetown.edu/files/Blockchain%20and%20Financial%20Inclusion%20120417.pdf [https://perma.cc/9Q5B-35S9] ("The disruptive component of blockchain technology is that its core functionality depends on the creation of an immutable ledger…").

[36] *See, e.g.*, Sinclair Davidson et al., Economics of Blockchain (2016) (unpublished manuscript), https://ssrn.com/abstract=2744751 [https://perma.cc/P5CZ-K4TT] ("The blockchain technology is *trustless* . . . .") (emphasis in original); Trent J. MacDonald et al., Blockchains and the Boundaries of Self-Organized Economies 8 (2016) (unpublished manuscript), https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2749514 [https://perma.cc/8G-PV-BDP8] ("blockchain technology is trustless, meaning that it does not require third party verification (i.e., trust)").

[37] *See*, *e.g.*, Ahmed Banafa, *A Secure Model of IoT with Blockchain*, MIT TECH. REV. (Jan. 5, 2017), https://www.technologyreview.com/s/603298/a-secure-model-of-iot-with-blockchain/ [https://perma.cc/S7VD-7EVG] (stating in reference to "blockchain, "Most important of all, it's secure"); Stuart Levi, *Blockchains Offer Revolutionary Potential in Fintech and Beyond*, Skadden Arps (Jan. 30, 2017), https://www.skadden.com/insights/blockchains-offer-revolutionary-potential-fintech-and-beyond [https://perma.cc/7DCV-99QM] ("With blockchains, distributed ledgers provide the same benefits as a trusted third party, but in a far more efficient and secure manner.").

that have been produced by different parties within the space,[38] the reality is that the terminology is very much evolving.[39] At the moment, it would be difficult to provide a clear or uncontested definition of any of the terms above,[40] and recent conferences have included discussions of the unsettled terminology.[41]

This vocabulary free-for-all is due to a number of factors, some of which include:

- *Word Taint*. Certain terminology within the blockchain and cryptocurrency space has developed undesirable connotations, and people have introduced new terms to

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[38] *See, e.g.*, Van Valkenburgh, *supra* note 33 (explaining certain terminology and "technical concepts from the ever-changing universe of Bitcon-derived innovations"); Meunier, *supra* note 18 (providing a taxonomy of distributed database technology and noting the contested definition of a blockchain).

[39] As Juri Mattila recently described, "the terminology around the whole phenomenon is still heavily in flux. Caught in the middle of it all, it can be difficult to form a clear picture on blockchain technology and the phenomenon that surrounds it." Juri Mattila, *The Blockchain Phenomenon: The Disruptive Potential of Distributed Consensus Architectures* 3 (Berkeley Roundtable of the Int'l Econ., Working Paper 2016-1), http://www.brie.berkeley.edu/wp-content/uploads/2015/02/Juri-Mattila-.pdf [https://perma.cc/PWS9-GP8H].

[40] *See* Colin Platt, *Thoughts on the Taxonomy of Blockchains & Distributed Ledger Technologies*, MEDIUM (Feb. 27, 2017), https://medium.com/@colin_/thoughts-on-the-taxonomy-of-blockchains-distributed-ledger-technologies-ecad1c819e28#.6gktvnu8k [https://perma.cc/S3M5-KGNS] (proposing a taxonomy of the different flavors of blockchain technology and distributed ledger technology); Nelson M. Rosario, *What's in a Name? From Bitcoin to Blockchain to Distributed Ledgers*, COINDESK (Feb. 11, 2017), http://www.coindesk.com/whats-in-a-name-from-bitcoin-to-blockchain-to-distributed-ledgers/ [https://perma.cc/9H2V-VR3M]. *Cf.* Peter Van Valkenburgh, *Does it Matter that Different Government Agencies Define Bitcoin Differently?*, COIN CENTER (Jan. 11, 2017), https://coincenter.org/entry/does-it-matter-that-different-government-agencies-define-bitcoin-differently [https://perma.cc/475V-QTXB] (acknowledging that different government regulators have categorized Bitcoin differently based on the activity the particular regulator governs).

[41] *See Construct 2017 Agenda*, COIN DESK http://www.coindesk.com/events/construct-2017/agenda/ [https://perma.cc/F4KH-D2VQ] (acknowledging that blockchain technology's "universe of verbiage is only becoming more and more complex and intimidating for newcomers to the space").

avoid the negative associations.[42] For instance, references to "Bitcoin" or "cryptocurrency" were (and still are, in some cases) associated with crime due to Bitcoin's use in money laundering and in illicit marketplaces like Silk Road.[43] It was not socially acceptable for banks to use something associated with the underworld, so the term "blockchain technology" took hold, possibly in an attempt to sever the ties to "Bitcoin" and its criminal undertones. Over the past few years, we have seen an increase in the use of the term "DLT" in lieu of "blockchain technology," perhaps in response to the extreme hype around "blockchain technology," in an attempt to sound more restrained and controlled.

- *Technology Variations.* Blockchain technology emerged in 2008 with Bitcoin, and has been evolving ever since.[44] Many new blockchains, both public and private, have been created, with a variety of features and potential uses.[45] Indeed, once the financial sector discovered blockchain technology, one of the biggest transformations that occurred was that an open network of transaction processors was eschewed for a private, trusted group of parties to maintain the record, under defined sets of terms and conditions.[46] This was a

[42] The process of contamination and replacement of contaminated terms in common discourse is a familiar process for linguists. *See* Edna Andrews, *Cultural Sensitivity and Political Correctness: The Linguistic Problem of Naming*, 71 AM. SPEECH, no. 4, 1996, at 389.

[43] GOV'T. OFFICE FOR SCIENCE, DISTRIBUTED LEDGER TECHNOLOGY: BEYOND BLOCK CHAIN 7 (2015), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf [https://perma.cc/YD7Z-995Y].

[44] *See* ANTONOPOULOS, *supra* note 21, at 3.

[45] Ethereum and ZCash are examples of new public blockchains/cryptocurrencies. *See* ETHEREUM, https://www.ethereum.org/ [https://perma.cc/HK4A-TALB]; ZCASH, https://z.cash/ [https://perma.cc/MDP7-Y4E7]. Private blockchains (or distributed ledgers) are being created at Digital Asset Holdings, Monax, and in consortia like R3 and Hyperledger. *See* DIGITAL ASSET, https://digitalasset.com/ [https://perma.cc/YAQ9-PM5Z]; HYPERLEDGER, https://www.hyperledger.org/ [https://perma.cc/E6XU-3AY9]; MONAX, https://monax.io/ [https://perma.cc/5GU4-TM87]; R3, http://www.r3cev.com/ [https://perma.cc/5D5G-R5TW].

[46] *See* Anna Irrera, *The Public vs Private Debate on Blockchain*, FIN. NEWS (Sept. 28, 2015), https://www.fnlondon.com/articles/blockchain-fintech-the-

change to a fundamental feature of the technology, and there is still great debate among the technologists in the field over how the attributes of public and private blockchains differ.[47] As variations to the technology have been created, new terms have been introduced to distinguish new from existing forms.[48] This is seen clearly with the creation of the terms "private blockchain," "closed blockchain," and "permissioned blockchain" to distinguish blockchains with known transaction validators from those with no barriers to joining the transaction-validating network.[49]

- *Cross-Field Communications*. Blockchain technology is incredibly interdisciplinary, and brings together fields including software engineering, networks, distributed systems, cryptography, security, economics, finance, monetary theory, risk, law, philosophy, ethics, sociology, psychology, archival and record-keeping studies, and political science, among others.[50] Thus, people from disparate fields of expertise often must communicate with one another about the

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public-vs-private-debate-20151001 [https://perma.cc/V3GH-8FE6] (reporting that most experimentation with blockchain technology in the banking sector is of the permissioned variety).

[47] For example, there is not yet settled agreement on how the security profile or immutability (permanency) differs in a public versus a private blockchain. *See, e.g.*, Vitalik Buterin, *Vitalik Buterin: On Public and Private Blockchains*, CoinDesk (Aug. 7, 2015), http://www.coindesk.com/vitalik-buterin-on-public-and-private-blockchains/ [https://perma.cc/E5LG-KXTJ]; Peter Van Valkenburgh, Dir. of Research, Coin Ctr., Comments to the European Securities and Markets Authority on its Consultation on Distributed Ledger Technology Applied to Securities Markets 2 (Sept. 2, 2016), https://coincenter.org/files/2016-09/coin-center-letter-to-esma.pdf [https://perma.cc/6RV8-ZXRF].

[48] *See, e.g.*, Tim Swanson, *A Brief History of R3 – the Distributed Ledger Group*, Great Wall Numbers (Feb. 27, 2017), http://www.ofnumbers.com/2017/02/27/a-brief-history-of-r3-the-distributed-ledger-group/ [https://perma.cc/ZT3K-N5PT] (describing why R3 uses "distributed ledger" rather than "blockchain" to describe their technology).

[49] *See, e.g.*, BitFury Grp. & Garzik, *supra* note 19; Irrera, *supra* note 46.

[50] *See, e.g.*, Vincenzo Morabito, Business Innovation Through Blockchain: The B3 Perspective 118 (2017) ("The interdisciplinary nature of blockchain technology . . . lead[s] people to see the technology as primarily belonging to their own discipline.").

technology.[51] The translation required to speak across fields can yield flawed understandings, through attempts to use the vocabulary of one's own field to imperfectly express concepts from the original field.[52] For instance, though Bitcoin birthed the blockchain phenomenon, the word "ledger," now a common term to refer to the record created by a blockchain network, does not appear in the original whitepaper that introduces and explains Bitcoin.[53] Rather, the term likely appeared in explanations of the technology to non-technical people, analogizing the record created by the Bitcoin network to the more familiar concept of a ledger.[54]

- *Industry "Pivots."* Related to word contamination and technology experimentation, the language around blockchain technology has shifted as the associated startup industry has "pivoted" (in Silicon Valley parlance) to what is trendy and likely to attract investment.[55] For instance, as the terms "blockchain technology" and "DLT" increased in

[51] *See id.*

[52] Achieving clear cross-field communications is a key difficulty in conducting interdisciplinary research, given the jargon and differing knowledge paradigms of the fields involved. *See generally* L.J. Bracken & E.A. Oughton, *'What Do You Mean?' The Importance of Language in Developing Interdisciplinary Research,* 31 TRANSACTIONS INST. BRIT. GEOGRAPHERS 371 (2006).

[53] *See* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, BITCOIN (2008), https://bitcoin.org/bitcoin.pdf [https://perma.cc/YX4A-AFQZ].

[54] *See, e.g.*, JOSHUA ASHLEY KLAYMAN & F. DARIO DE MARTINO, MORRISON & FOERSTER, THE (HEART)BEAT HAS SOUNDED: THE WORLD ECONOMIC FORUM PLACES BLOCKCHAIN FRONT AND CENTER 2–3 (2016), https://media2.mofo.com/documents/160817-world-economic-forum-blockchain.pdf [https://perma.cc/4F5N-YAEX].

[55] *See* Tim Swanson, *The great pivot? Or just this years froth?,* GREAT WALL NUMBERS (Oct. 16, 2015), http://www.ofnumbers.com/2015/10/16/the-great-pivot-or-just-this-years-froth/ [https://perma.cc/27QW-5NM3]; Stan Higgins, *ItBit Rebrands as Paxos Amid Blockchain Pivot,* COINDESK (Sept. 14, 2016), http://www.coindesk.com/itbit-rebrands-paxos-amid-blockchain-pivot/ [https://perma.cc/7F6T-C58W]; Pete Rizzo, *Adam Draper; Investors Don't Want to Hear the Word Bitcoin*, COINDESK (Oct. 19, 2015), http://www.coindesk.com/adam-draper-investors-bitcoin-blockchain/ [https://perma.cc/9HGM-KX4T] (discussing the "vernacular change" from "Bitcoin" to "blockchain" in investor interest).

popularity over "Bitcoin" and "cryptocurrencies," a number of startup companies changed both their Bitcoin-based names and business models to move away from Bitcoin.[56] One commentator from the R3 consortium has referred to the tendency of startup companies to market themselves as "blockchain" companies to attract venture capital funding and buzz as "chainwashing," arguing that many companies that refer to themselves as "blockchain" or "distributed ledger" companies either don't actually *use* blockchain technology in their product/service offerings, or don't *need to use* blockchain technology to best achieve their customers' goals.[57]

- *Fine Tuning*. Terminology around blockchain technology has also changed through efforts to replace words that seemed misleading or imprecise. For example, there is now a debate about whether "DLT" or "SLT" more accurately describes the associated systems.[58] Further, some argue that "validators" or "transaction processors" are more descriptive of the role played by computers within a blockchain network, than "miners," as is commonly used with cryptocurrencies like Bitcoin.[59] I explore below how the term "immutable" may be

[56] Among the companies that have changed names from a "Bitcoin"-based name are Itbit (now Paxos), and BitReserve (now Uphold). *Id.* ("The move confirms past indications that its leadership was seeking to rebrand to better highlight its private blockchain and distributed ledger work."); Johnathan Schieber, *Rebranding As Uphold, Bitreserve Says Goodbye To Bitcoin*, TECHCRUNCH (Oct. 14, 2015), https://techcrunch.com/2015/10/14/rebranding-as-uphold-bitreserve-says-goodbye-to-bitcoin/ [https://perma.cc/ZZ5R-56JN] ("The company formerly known as Bitreserve is moving beyond its Bitcoin roots to become a full-service provider of financial transactions under the new moniker Uphold.").

[57] Tim Swanson, *Chainwashing*, GREAT WALL NUMBERS (Feb. 13, 2017), http://www.ofnumbers.com/2017/02/13/chainwashing/ [https://perma.cc/XQH6-J35A] (commenting on how the "hype cycle" has driven companies to use various blockchain-related phrases).

[58] *See, e.g.*, *How To Explain The Value Of Replicated, Shared Ledgers From First Principles*, RICHARD GENDAL BROWN (Apr. 27, 2015), https://gendal.me/2015/04/27/how-to-explain-the-value-of-replicated-shared-ledgers-from-first-principles/ [https://perma.cc/TUA5-N7K5] (explaining shared ledger technology); Swanson, *supra* note 48 (explaining distributed ledger technology).

[59] *See* Irrera, *supra* note 46 (defining the function of miners); George Sam-

misleading when used to describe all variations of blockchain technology,[60] and a debate over the meaning of "decentralized" is ongoing.[61]

In short, the language of blockchain technology is evolving quickly, and the language differences are occurring for reasons both substantive (i.e., to indicate actual differences) and non-substantive (e.g., to achieve marketing goals).

III. Terminology Headaches for Regulators

Unsurprisingly, the fluctuating terminology around blockchain technology can cause difficulties for global regulators seeking to understand and appropriately govern the technology.[62] This problem is not unique to blockchain technology, but occurs across fields and with any new technology or practice. It takes time for people to figure out how to talk consistently about a new topic, and many times, we never do.

In this Part III, I outline some of the particular challenges and risks the unsettled terminology of blockchain technology poses for regulators. These include challenges with (1) understanding the technology, (2) identifying and distinguishing the different variants of the technology, (3) crafting precise language to regulate the technology. The problematic vocabulary also increases the chances of (1) regulatory capture (and the risks that accompany it), (2) inconsistent

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man, *How Transactions Are Validated On A Distributed Ledger*, SAMMANTICS (Mar. 8, 2016), http://sammantics.com/blog/2016/3/6/how-transactions-are-validated-on-a-shared-ledger [https://perma.cc/9LBU-MD79] (defining the functionality of validators).

[60] *See* Part IV *infra*.

[61] *See* Vitalik Buterin, *The Meaning of Decentralization*, MEDIUM (Feb. 6, 2017), https://medium.com/@VitalikButerin/the-meaning-of-decentralization-a0c92b76a274#.oz2xb0yxx [https://perma.cc/N8PC-MX3F].

[62] In discussing the challenges blockchain technology's moving vocabulary poses for regulators, I do not mean to suggest that regulators should or will regulate the technology itself directly. Rather, because the technology is being described as a "platform" technology that could potentially be used for countless social practices, it is important for regulators to deeply understand the workings of the technology, in order to anticipate how its use might impact activities within their remit.

regulation across subject-matter domains and jurisdictions, and (3) "perverse innovation."[63] I describe each of these in more detail below.

First, a fluid, contested vocabulary makes it difficult to understand blockchain technology. It is extremely challenging, even several years after blockchain technology appeared on regulators' radar screens, to follow the discussion and practices around the technology when its vocabulary is so malleable and potentially misleading. How can regulators (or anyone else) even tell whether people are discussing the same topic or manifestation of technology when people explain the technology, its risks, and its potential benefits using divergent terminologies? (This is assuming that regulators have the subject-matter expertise necessary to deeply understand the complex nature of the technology, with its blend of cryptography, game theory, and multiple other domains.) The realization that vocabulary could be creating and masking misunderstandings about the technology has only just begun to dawn on the finance industry, with one influential fintech pundit recently acknowledging that inappropriate conflation of different forms of the technology was occurring due to imprecise use of language.[64]

This challenge is what scholars of the regulation of innovation call the difficulty of nailing down the "facts" about a technology so that it can be regulated appropriately.[65] If regulators can't figure out what the facts are, or misunderstand them, then they can't fully identify or quantify the risks posed by the technology, and are more likely to make bad decisions about whether and how to regulate. This means that regulators will have to do a lot more work to reveal the facts, and that it is essential for them to take a critical approach, as I explore in Part V.

Second, and related to difficulties in understanding the technology, are challenges with identifying each variant of the technology with precision. Regulators must be able to assess the risks and benefits of each form of the technology, to determine which forms

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[63] *See* Dan Burk, *Perverse Innovation,* 58 WM. & MARY L. REV. 1 (2016).

[64] *See* Penny Crosman, *Blockchain Misreads Could Set Banks Up for Mistakes*, AM. BANKER (Mar. 14, 2017), https://www.americanbanker.com/news/blockchain-misreads-could-set-banks-up-for-mistakes [https://perma.cc/5A3Y-49VW] (reporting that "vocabulary mix-ups are rampant").

[65] *See* Fenwick et al., *supra* note 9 (discussing the need for regulators to decide relevant facts before "deciding what, when and how they should make a regulatory intervention").

should be treated alike, and which should be treated differently. For example, are public and private blockchains different enough from one another that they should be managed differently by regulators? What about distributed ledgers that use varying "consensus mechanisms" to agree on the truth of the ledger? Making these types of determinations is much more difficult if vocabulary acts as a barrier to, rather than a facilitator of, understanding.

Third, rapidly shifting terminology makes it more difficult for regulators themselves to communicate about blockchain technology, whether through reports, white papers, speeches, or regulation. How does one craft the definitions section of a regulation seeking to address blockchain technology when both words and technology are still in flux? A meaning or terminology shift after a regulation is crafted could result in a poor fit between the regulation and the regulated practice, which could undermine the regulation and regulator itself.

We have seen this particular challenge play out in the difficulties regulators have had with the term "virtual currencies." Bitcoin and other cryptocurrencies were commonly referred to as "virtual currencies" during the first few years of Bitcoin's existence. For instance, in October 2012, the European Central Bank (ECB) defined virtual currency as "a type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community."[66] It also noted that "[t]his definition may need to be adapted in future if fundamental characteristics change."[67] Things did indeed change, and in February 2015, the ECB revised its definition of "virtual currency" to "a digital representation of value, not issued by a central bank, credit institution or e-money institution, which, in some circumstances, can be used as an alternative to money."[68] As a further example of regulators' difficulty keeping up with the language of blockchain technology, New York State referred to its 2015 tailored licensing scheme for virtual currency money transmission issues as the "Bit

[66] EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES 5 (2012), http://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf [https://perma.cc/DF76-FG6P].

[67] *Id.*

[68] EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES: A FURTHER ANALYSIS 25 (2015), http://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes-en.pdf [https://perma.cc/BMK2-3RGD].

License."[69] The name now seems quite dated as companies using variants of the technology have been busy deleting "bit" from their names and "pivoting" to something new.[70]

As lawyers know, the language problems I have just discussed may result in interpretive problems down the road, as regulators, companies, lawyers, and the courts decipher actions (e.g., regulation or guidance) taken by regulators in regards to blockchain technology. For example, if the technology is rapidly evolving as regulations are drafted, a blockchain technology company might argue that the regulation is inapplicable to its variant of the technology, even though its technology raises similar policy concerns.

For good reason, lawyers and the law are deeply concerned with achieving accuracy and precision in the use of language,[71] and although law comes equipped with tools to interpret problematic language (e.g., canons of statutory construction[72] and rules for contract interpretation),[73] good drafters strive for precision generally and ambiguity only by choice. A fluid terminology in the subject being regulated makes this even more difficult than usual.

In addition to making it hard for regulators to deeply understand the technology and craft regulation, an unstable vocabulary can increase the risk of undesirable regulatory outcomes.

First, the lack of a clear vocabulary around blockchain technology increases regulators' need (real or perceived) to rely on industry experts to explain the technology to them, as they may feel unable to make sense of it on their own. This dependence greatly increases the risk of regulatory capture, with all the consequences that may bring, such as errant risk analysis, and a tendency to under-

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[69] *See, e.g.*, *BitLicense Frequently Asked Questions*, N.Y. STATE DEP'T OF FIN. SERVS., http://www.dfs.ny.gov/legal/regulations/bitlicense_reg_framework_faq.htm [https://perma.cc/UM4S-6VJG].

[70] *See, e.g.*, *supra* note 56 (listing companies that have rebranded).

[71] Clarity in law allows those governed to understand the law, accurately predict how to comply with the law, and undertake useful cost-benefit analyses to determine whether or not to comply. Ambiguous laws have the opposite consequence, leading to uncertainty in those governed and difficulty in structuring behavior in relation to the law, potentially resulting in the loss of beneficial activity due to this uncertainty paralysis.

[72] *See generally* Cass Sunstein, *Interpreting Statutes in the Regulatory State*, 103 HARV. L. REV. 405 (1989) (discussing principles of statutory interpretation, including the canons of statutory construction).

[73] *See* 11 RICHARD A. LORD, WILLISTON ON CONTRACTS § 31:1 (4th ed.).

regulate.[74] "Regulatory capture occurs when bureaucrats, regulators and politicians cease to serve some notion of a wider collective public interest and begin to systematically favour specific vested interests, usually the very interests they were supposed to regulate and restrain for the wider public interest."[75] It is very easy for supporters of a complex new technology or practice to hype the perks of the technology while downplaying the risks or glossing over them entirely.[76] The complexity and highly technical nature of blockchain technology may make regulators more inclined to take industry claims at face value, particularly since they may be out of their depth given the technology's highly interdisciplinary, abstruse nature. The opacity of blockchain technology is similar to that of the complex financial products, algorithms, and risk models that helped to spawn the financial crisis, when people in the financial sector blithely assembled complexity without truly understanding what they were doing, and seemingly disregarded the potential implications of their actions.[77] Regarding the risk models and corresponding financial products that contributed to the financial crisis, Erik Gerding has argued that "[r]egulators were both daunted by the complexity posed by new financial

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[74] *See* Andrew Baker, *Restraining Regulatory Capture? Anglo-America, Crisis Politics and Trajectories of Change in Global Financial Governance*, 86 INTERNATIONAL AFFAIRS, No. 3, 2010, at 647, 647–63 (discussing the role that capture of financial regulators by the financial industry played in creating the Financial Crisis, and post-Crisis steps taken to mitigate the possibility of future capture).

[75] *Id.* at 648.

[76] For example, neither investors, board members, nor those contracting with the blood-testing company Theranos performed adequate due diligence on its technology to understand its true capabilities and risks. *See* Nick Bilton, *How Elizabeth Holmes' House of Cards Came Tumbling Down*, VANITY FAIR (Oct. 2016), http://www.vanityfair.com/news/2016/09/elizabeth-holmes-theranos-exclusive [https://perma.cc/CN6J-WRBJ].

[77] *See generally* SCOTT PATTERSON, THE QUANTS: HOW A NEW BREED OF MATH WHIZZES CONQUERED WALL STREET AND NEARLY DESTROYED IT (2010) (describing how the use of algorithms and complicated financial structures contributed to the 2008 financial crisis); Erik Gerding, *Code, Crash, and Open Source: The Outsourcing of Financial Regulation to Risk Models and the Global Financial Crisis,* 84 WASH. L. REV. 127 (2009) (describing how regulators bought into the belief that the financial sectors' complex risk models and financial products could adequately manage risk, and how problems with the models contributed to the financial crisis).

instruments and awed by the promise of new financial engineering to shift and spread risk efficiently."[78] There is similar potential for regulators to be daunted and awed by blockchain technology, as it is extraordinarily complex and purportedly will solve virtually every problem that regulators and the financial sector (and the world at large) have.[79]

Further, the potential for regulatory capture seems enhanced with blockchain technology, given the great number of prominent former regulators and financial industry players who have taken executive or advisory roles with blockchain technology companies or lobbying organizations,[80] and who are now explaining the technology to current regulators and advocating for its adoption in

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[78] Gerding, *supra* note 77, at 134.

[79] *See* Angela Walch, *Open Source Operational Risk: Should Public Blockchains Serve as Financial Market Infrastructures?*, *in* 2 HANDBOOK OF BLOCKCHAIN, DIGITAL FINANCE, AND INCLUSION (David Lee Kuo Chen & Robert Deng, eds.), (forthcoming 2017), https://ssrn.com/abstract=2879239 [https://perma.cc/LXP8-HAHD].

[80] *See, e.g.*, TAPSCOTT & TAPSCOTT, *supra* note 8, at 8 (stating that "Ben Lawsky quit his job as the superintendent of financial services for New York State to build an advisory company in [the blockchain technology] space"); *Arthur Levitt Advises Bitcoin Companies: BitPay and Vaurum*, BUSINESSWIRE (Oct. 28, 2014), http://www.businesswire.com/news/home/20141028005244/en/Arthur-Levitt-Advises-Bitcoin-Companies-BitPay-Vaurum#.Vgye8ctViko [https://perma.cc/9B66-J9DY] (reporting that Arthur Levitt, former chairman of the Securities and Exchange Commission, will serve as an advisor to BitPay (a Bitcoin payment processor) and Vaurum (a Bitcoin exchange)); Michael Casey, *Bitcoin Startup 21 Unveils Product Plan: Embeddable Mining Chips*, DOW JONES INST. NEWS (May 18, 2015) (reporting that Lawrence Summers, former Secretary of the Treasury, has joined the advisory board of 21 Inc., a Bitcoin company seeking to produce an "embedded mining chip"); Nathaniel Popper, *ItBit Bitcoin Exchange Gets Banking License in New York, A First in U.S.*, N.Y. TIMES (May 7, 2015), https://www.nytimes.com/2015/05/08/business/dealbook/bitcoin-exchange-receives-first-license-in-new-york-state.html?_r=0 [https://perma.cc/7KQN-6YGV] (reporting that Sheila Bair, former chairwoman of the Federal Deposit Insurance Corporation had been appointed a board member of ItBit, a Bitcoin exchange); *About Us*, DIG. CHAMBER OF COMMERCE, https://digitalchamber.org/about/ [https://perma.cc/U8E4-WC7D] (listing Mark Wetjen, former commissioner of the Commodity Futures Trading Commission, as a member of the Board of Advisors of the Digital Chamber of Commerce, "the world's leading trade organization representing the digital asset and blockchain industry").

various settings.[81] Regulators may have personal relationships with those advocating for blockchain technology, and may also be awed by the status and prestige of the people supporting the technology, increasing the potential for regulators to be influenced by industry without adequately interrogating the technology and its implications.[82] With the blockchain hype cycle in full force, it has become taboo to express skepticism about the technology's benefits or concern about its potential risks,[83] which is a clear recipe for groupthink.

Second, 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. Such a scenario could make it much more difficult for regulated parties to comply with disparate regulations, thereby undermining the policy objectives regulators hope to achieve. At the same time, having to navigate multiple inconsistent regulatory regimes greatly increases the costs of regulated parties, and could result in unintended stifling of innovation.[84] Finally, inconsistent regulation can

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[81] This is the "revolving door" problem that has been widely discussed, as people pass from working for the regulator to working for or on behalf of regulated parties, and potentially back to working for the regulator, *ad infinitum*. *See* ANAT ADMATI & MARTIN HELLWIG, THE BANKERS' NEW CLOTHES 204–05 (2013).

[82] Arthur E. Wilmarth, Jr., *Turning a Blind Eye: Why Washington Keeps Giving In to Wall Street*, 81 U. CIN. L. REV. 1283 1417–18 (2013) (citations omitted) ("[E]xtensive professional and social contacts encourage regulators to align themselves with the outlook of industry officials, a phenomenon that analysts have described as "cultural capture" and "cognitive capture." . . . The likelihood of cultural capture increases when (i) financial regulators feel part of an "in-group" with industry executives due to close professional contacts and shared "social networks," and (ii) regulators view industry insiders as occupying a "higher status" based on wealth, intellectual achievement and social prominence.").

[83] *See* VICTORIA L. LEMIEUX, SOC. SCI. & HUMANITIES RESEARCH COUNCIL OF CAN., BLOCKCHAIN TECHNOLOGY FOR RECORDKEEPING: HELP OR HYPE? (2016) (noting that "critical commentators online have received strong negative feedback from a blockchain technology 'fan base'").

[84] This issue is familiar to cryptocurrency actors in the blockchain space, as it has been raised by the panoply of U.S. state and federal laws governing money transmission. Cryptocurrency advocates have participated in the Uniform Law Commission's initiative to draft the Uniform Regulation of Virtual Currency Businesses Act and have proposed guidance for state money transmis-

spawn forum shopping and regulatory arbitrage, with regulated parties seeking to exploit differences in regulation across jurisdictions.

Third, regulating a technology with a rapidly shifting vocabulary can prompt regulated actors to tweak the technology to avoid regulatory burdens. Dan Burk recently termed this type of tinkering "perverse innovation," as the technological innovation stems from the attempt to avoid regulation (i.e., to fall into a loophole in the regulation).[85] This may be a desirable outcome of regulation, but it can be undesirable if regulation sends the technology down a less fruitful path than it would otherwise have taken. This issue relates to the classic regulatory dilemma of *when* it is best to regulate.

With all of these challenges, Holmes' idea of striking certain words from law's lexicon doesn't look so bad, as one is tempted to delete the existing vocabulary around blockchain technology and start over, unencumbered by its "unnecessary confusion."[86]

IV. The Mutable Meaning of "Immutable"

In this section, I focus on a single term associated with blockchain technology—immutable—to provide but one example of how differing understandings of what is said to be a key attribute of the technology could impact regulators' (and others') assessments of the risks posed by the technology. "Immutable" (and its variations, e.g., "immutability") is an omnipresent term in describing blockchain technology. The most downloaded paper on blockchain technology in the open-access repository SSRN (with more than 6,500 downloads), Marc Pilkington's *Blockchain Technology: Principles and Applications,* states, "Immutability is a characteristic of blockchain technology."[87] "Immutable" appears in various forms in the World Economic Forum's 2016 report on blockchain technology's role in

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sion regulators, as part of efforts to simplify the compliance burdens of virtual currency businesses that operate across the United States. *See* Jerry Brito & Peter Van Valkenburgh, *State Digital Currency Principles and Framework,* COIN CENTER (Mar. 8, 2017), https://coincenter.org/files/2017-03/statevirtualcurrencyprinciplesandframeworkv2.0.pdf [https://perma.cc/6DCB-549M].

[85] *See* Burk, *supra* note 63 (noting that perverse innovation can be beneficial in certain respects, as well).

[86] Holmes, *supra* note 4, at 497 (discussing how eliminating certain terms could lessen confusion in the legal lexicon).

[87] Pilkington, *supra* note 35, at 15.

future financial infrastructures;[88] Don and Alex Tapscotts' popular book on blockchain technology with glowing blurbs from a Nobel Prize winner, prominent Chief Executive Officers, and renowned academics;[89] and a 2016 Federal Reserve discussion paper,[90] among countless other sources. Synonyms of "immutable," such as "permanent," "indelible," or "unchangeable," similarly appear often.

As I have discussed elsewhere, the attribute of immutability is one of the primary selling features of blockchain technology.[91] Blockchain technology is at heart a record-keeping technology, and it purports to enable the creation of permanent, unchangeable records.[92]

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[88] *See e.g.*, WORLD ECON. FORUM, *supra* note 12, at 21 (discussing distributed ledger technology's ability to deliver "faster and more accurate reporting by automating compliance processes that draw on *immutable* data sources"); *id.* at 25 ("DLT provides transaction *immutability*, which is a key requirement for eliminating the need for an enforcer of trust in the ecosystem."); *id.* at 43 ("Storing financial information on the ledger provides *immutable*, real-time updates and facilitates automated review."); *id.* at 55 ("Reduced fraud: transparent and *immutable* data on DLT can reduce fraudulent transactions to a fraction of what they are today.") (emphasis added throughout).

[89] *See, e.g.*, TAPSCOTT & TAPSCOTT, *supra* note 9, at 66 ("*immutable* time stamps"), 78 ("is an *immutable* record of everything truly desirable?"); *id.* at 81 ("Because the blockchain records and stores all transactions in an *immutable* record.") (emphasis added throughout). BLOCKCHAIN REVOLUTION contains plaudits from Hernando de Soto, a Nobel Prize winner in Economics; the CEOs of Royal Bank of Canada, Digital Asset Holdings, Siemens USA, SAP SE, Breyer Capital, Seagate Technology, Tata Consultancy Services, Cognizant, OgilvyOne Worldwide, and Unilever; and academics from MIT and Harvard Law School. *Id.* at unnumbered pages prior to Table of Contents.

[90] *See* David Mills et al., Fed. Reserve Bd., Distributed ledger technology in payments, clearing, and settlements (Fin. & Econ. Discussion Paper 2016-095, 2016), https://www.federalreserve.gov/econresdata/feds/2016/files/2016095pap.pdf [https://perma.cc/CGB5-5PJR].

[91] Walch, *supra* note 79, at 2–5; *see also* BLOCKCHAIN AND FINANCIAL INCLUSION, *supra* note 35, at 8.

[92] *But see* Victoria L. Lemieux, *In Blockchain We Trust? Blockchain Technology for Identity Management and Privacy Protection, in* CEDEM17: PROCEEDINGS OF THE INTERNATIONAL CONFERENCE FOR E-DEMOCRACY AND OPEN GOVERNMENT 57, 60–61 (Peter Parycek & Noella Edelman eds. 2017), http://www.donau-uni.ac.at/imperia/md/content/department/gpa/zeg/bilder/cedem/cedem17/cedem17_proceedings_donau_universit__t_edition.pdf [https://perma.cc/46D3-WKKK] (noting that "the persistence of entire blockchain

This is said to be unlike anything seen before, and the power to create certainty and permanency in records theoretically enables changes to virtually every social system that we have, as all rely to some extent on keeping track of things in a reliable and trusted way.[93] This is why so many see potential for blockchain technology to change systems including voting, government benefits, health records, insurance, and property records, among countless others. With certainty and permanence in our records, no one can cheat anymore, because cheating can always be called out with reliable records, and risks can be assessed more accurately across the board. Certainty and permanence are indeed potent tools, and if we have finally found these with blockchain technology, then it is small wonder that so many are celebrating.

But, are we sure that we have found this certainty and permanency—this *immutability?* Or are we using, perhaps, the *wrong word* at times, and in doing so, potentially overstating what is said to be one of the technology's most prized and transformative capabilities?[94]

I raise the issue because there appears to be a haze of confusion around the term, which is troubling, given that immutability is perhaps the most fundamental attribute of blockchain technology that is said to make it revolutionary. There are two conceptual problems with

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networks is not guaranteed," and exploring issues this raises for record keeping done through blockchain technology).

[93] *Cf.* Christian Catalini & Joshua Gans, *Some Simple Economics of the Blockchain* (MIT Sloan Research Paper No. 5191-16, 2016), https://ssrn.com/abstract=2874598 [https://perma.cc/U9TD-Z3GB] (describing the benefits possible due to the Bitcoin blockchain's "distributed, costless verification" and categorizing blockchain technology as a "general purpose technology" due to its ability to reshape multiple industries).

[94] *See* Gideon Greenspan, *The Blockchain Immutability Myth*, COINDESK, (May 9, 2017), http://www.coindesk.com/blockchain-immutability-myth/ [https://perma.cc/8ZBM-PFXW] ("In blockchains, there is no such thing as perfect immutability"). *Cf.* Noah Smith, *Statistical Significance Is Overrated*, BLOOMBERG: VIEW, (Apr. 13, 2017), https://www.bloomberg.com/view/articles/2017-04-13/statistical-significance-is-overrated [https://perma.cc/RK7J-QQRW] (arguing that the term "statistically significant" is often misinterpreted as meaning 'important' rather than 'noticeable' and discussing problems caused by this misunderstanding); Campbell Harvey et al., *Separating investment facts from flukes*, OUPBLOG, (Jan. 8, 2016), https://blog.oup.com/2016/01/investment-facts-from-flukes/?src=homepage [https://perma.cc/9WPL-NP68].

the use of the term "immutable" around blockchain technology at the moment. First, if one uses "immutable" according to its basic dictionary definition—"not capable of or susceptible to change"[95]—then real world events involving the two most prominent blockchains have demonstrated the word "immutable" to be an inapt descriptor, as both Bitcoin and Ethereum have been rolled back and revised during their existence.[96] Second, the word "immutable" (or synonyms such as permanent, indelible, and unchangeable) is generally used to describe all variations of blockchain technology, yet there is debate over what creates a blockchain record's immutability, and it is therefore unclear whether all variations of the technology share this emergent property. I explore each of these problems in turn.

The first conceptual problem is that it is misleading to continue to state that "[i]mmutability is a characteristic of blockchain technology"[97] when the records created by both Bitcoin and Ethereum have each been changed at various times, and when they remain subject to 51 percent attacks. Bitcoin's blockchain forked into two separate ledgers in March 2013, requiring certain miners (i.e., transaction processors of the network) to agree to move from one ledger to the other to reunite in a single ledger.[98] These miners were creating legitimate records (according to the software protocol's rules) on the ledger they were working on, but agreed with the developers to abandon that record to allow Bitcoin to continue as a single record.[99] Thus, the abandoned ledger did not remain permanent or indelible, as those involved agreed to treat it as illegitimate. An even more dramatic demonstration that blockchain records can change occurred in July 2016 when the Ethereum blockchain rolled back its "immutable" ledger to erase a theft of Ether, the currency of that system.[100] The result

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[95] *Immutable*, MERRIAM-WEBSTER, https://www.merriam-webster.com/dictionary/immutable [https://perma.cc/9VKK-4BGA].

[96] *See infra* notes 98–101 and accompanying text (explaining the changes to Bitcoin and Ethereum).

[97] Pilkington, *supra* note 35, at 15.

[98] *See* Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 866, 873 (discussing Bitcoin's March 2013 hard fork and how developers and miners fixed it).

[99] *See id.*

[100] *See* Kevin D. Werbach, Trustless Trust 66–68, (Aug. 14, 2016) (unpublished manuscript), https://ssrn.com/abstract=2844409 [https://perma.cc/G8RC-9CM7] (providing a succinct overview of the events surrounding the

of Ethereum revising its ledger was that the network split in two, as one contingent used the revised record, while another continued using the original record.[101] These real world events in public blockchains demonstrate at a minimum that it is problematic to describe blockchain technology as a whole as immutable, when at least some (and perhaps all?) blockchain records may be changed if the people operating the blockchain so choose. To put it bluntly, people can always agree to override the technology.

This chance of changing Bitcoin's and Ethereum's records has always been acknowledged in theory, as the discussion around these systems conceded the possibility of a 51 percent attack on the networks.[102] A 51 percent attack could occur if a party or colluding group controlled at least 51 percent of the computing power of the network, allowing them to determine what is recorded to the network's records, and potentially to revise the existing record.[103] For a variety of reasons, many consider the risk of a successful 51 percent attack to be essentially zero, but others see it as more uncertain.[104] Describing the records of public blockchains as "immutable" embeds a single risk assessment (zero chance) into the adjective describing the blockchain, similar to how mortgage-backed securities carried the adjective of "AAA."[105] This (over)simplification in the general way of talking about blockchain technology means that people have to fight through the information barrier created by the use of the term "immutable" to get to the truth, when there is little reason for them to understand "immutable" as having any meaning other than its standard one as "unchangeable."

Even prominent Bitcoin advocate Andreas Antonopoulos has described Bitcoin as hard to change, rather than absolutely unchangeable.[106] He still refers to Bitcoin's blockchain as immutable,

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July 2016 Ethereum hard fork).

[101] *See id.*

[102] *See generally* Walch, *supra* note 98.

[103] *See* Walch, *supra* note 98, at 861–63 (describing Bitcoin's 51 percent attack risk and exploring reasons the risk is often dismissed).

[104] *See id.*

[105] *See generally* Brent J. Horton, *Toward a More Perfect Substitute: How Pressure on the Issuers of Private-Label Mortgage-Backed Securities Can Improve the Accuracy of Ratings*, 93 B.U. L. REV. 1905 (2013) (discussing how the AAA ratings attached to mortgage-backed securities shaped investors' perceptions of risk in the run-up to the 2008 Financial Crisis).

[106] *See* Andreas Antonopolous, *The Monument of Immutability, at the Silicon*

however, because he says it represents the closest humanity has come to creating something truly immutable, and anything easier to change than Bitcoin has no claim to the word immutable.[107] This convoluted justification for continuing to use the word "immutable" to describe Bitcoin's blockchain from a prominent figure in the blockchain community creates confusion because the hidden meaning for immutable ("hard to change") does not match the general understanding of the word immutable ("unchangeable"). The secret meaning of "hard to change" does not seem to have reached the academics, consultants, thought leaders,[108] and regulators who continue to state without qualification that blockchain technology creates immutable, permanent, unchangeable, indelible records.[109] This communication

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Valley Bitcoin Meetup, YOUTUBE (Sept. 13, 2016), https://www.youtube.com/watch?v=h1SHF3YPrjM [https://perma.cc/KP6Z-XD28] (commenting that immutability is a "tricky concept because it doesn't really exist").

[107] *See id.*

[108] I use Daniel Drezner's definition of "thought leader" in this article. *See* Daniel W. Drezner, *Triumph of the Thought Leader…and the Eclipse of the Public Intellectual*, CHRONICLE OF HIGHER EDUC. (Apr. 6, 2017), http://www.chronicle.com/article/Triumph-of-the-Thought-Leader/239691 [https://perma.cc/97LQ-V2EW] ("A Thought Leader is an intellectual evangelist. They develop their own singular lens to explain the world, and then proselytize to anyone within earshot."). Drezner contrasts thought leaders with public intellectuals, which he defines as "experts, often academics, who are well versed and well trained enough to comment on a wide range of issues." Drezner categorizes public intellectuals as "skeptics" and thought leaders as "true believers." *Id.* Drezner's newly-released book explores this phenomenon, its causes and implications in more depth. DANIEL W. DREZNER, THE IDEAS INDUSTRY (2017).

[109] This is not a universal problem, as some commentators are careful to note that the immutability of blockchains is not absolute. *See, e.g.*, Greenspan, *supra* note 94 ("In blockchains, there is no such thing as perfect immutability"); Werbach, *supra* note 100, at 41 ("On the blockchain . . . it is impossible to alter a recorded value *if the system is functioning as intended*.") (emphasis added); *id.* at 42 ("Blockchain trust is immutable in a probabilistic sense"); Dave Birch, *Mutable & Immutable Blockchains*, CONSULT HYPERION (Sept. 26, 2016), http://www.chyp.com/mutable-and-immutable-blockchains/ [https://perma.cc/P7J8-UL9C] (describing "immutable" in the context of the Bitcoin blockchain as "theoretically mutable but not mutable under any practical circumstances that we can envisage"); Jameson Lopp, *Bitcoin: The Trust Anchor in a Sea of Blockchains*, COINDESK (July 23, 2016), http://www.coindesk.com/bitcoin-the-trust-anchor-in-a-sea-of-blockchains/ [https://per-

failure creates an asymmetry of information between those who know the actual capabilities of the technology and those who don't, enabling the possibility of a "market for lemons"[110] as well as the risk that blockchain technology will be used in areas for which it is ill-suited.

The second conceptual problem with the use of "immutable" is that it is generally used to describe "blockchain technology" or "DLT" as a whole, when there are numerous variations in the technologies and practices that arguably fall into these buckets, and it is currently unclear which, if any, of the variations may be fairly described as immutable. At base, this is a problem of describing an emergent property of a complex system[111] as if it exists regardless of what changes one makes to the underlying system. This is problematic with blockchain technology because, as I discuss below, there is disagreement about what gives rise to immutability. If we don't know what creates the immutability, then it is hard to predict how tweaking different features of the system will affect immutability, and whether it would be accurate to describe a given variety of blockchain technology as creating an immutable record.

An analogy may help to clarify what I mean. A cake that is moist is highly prized, but baking a cake that actually turns out moist is not a simple task. Quite a few factors affect whether a cake turns out moist, including "the ingredients used, the method of preparation, and the baking time and temperature."[112] If you leave oil or butter out of your recipe, for example, or if you bake a cake at too high a temperature, or for too long, the result is not a moist cake. The moistness of a cake is a property that is created by a combination of

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ma.cc/9PHF-2H2D] ("When we describe a blockchain as 'immutable', we are broadly claiming that there is a guarantee that the contents will never be changed. However, from a machine consensus standpoint this is a probabilistic guarantee that can never reach 100%. From a social standpoint, we can only gauge a blockchain's immutability by its history and make an educated guess about its future based upon the values held by its community.").

[110] *See generally* George Akerlof, *The Market for Lemons: Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970).

[111] *See* Christopher W. Johnson, *What are Emergent Properties and How do They Affect the Engineering of Complex Systems?*, 91 RELIABILITY ENG'G & SYS. SAFETY 1475, 1475–81 (2006) (providing a history of theories of emergent properties of complex systems).

[112] *How to Make a Moist Cake*, BETTER HOMES & GARDENS, http://www.bhg.com/recipes/how-to/bake/how-to-make-a-moist-cake/ [https://perma.cc/SK4C-FWC8].

ingredients and actions—it is an *emergent property* of the complex system that is the baking process.

Similarly, immutability, or at least being "hard to change," is a much-desired emergent property of certain blockchain systems. But the active debate on what creates immutability in blockchain systems shows that there is not yet consensus on this point. For instance, some argue that immutability comes from the proof of work consensus mechanism that is used in the Bitcoin network to maintain the record.[113] Others say that immutability comes from the cryptography (i.e., the hashing process).[114] Still others say it comes from chaining "blocks" of transactions together so that any changes will be evident.[115] The one certain thing here is that immutability's source remains in dispute.

This is important, given that there are so many variations to the features of systems that are being created under the heading of blockchain technology or DLT.[116] Some systems allow anyone to be part of the transaction validation network, while others limit the group to certain trusted parties.[117] Some systems use proof of work, while others use proof of stake, or a variety of other consensus mechanisms.[118] Further, a variety of cryptographic techniques are used,[119] and systems vary on whether they make the entire ledger

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[113] *See* Antonopoulos, *supra* note 106; Felipe de Oliveira Simoyama et al., *Triple entry ledgers with blockchain for auditing*, INT. J. AUDITING TECH. (forthcoming 2017) (manuscript at 11) (on file with author) ("The proof of work concept is an important feature of bitcoin, since it is what provides for immutability of records and timestamps.").

[114] *See* Lewis, *supra* note 23 ("With respect to immutability, there are two key ideas that help to make tampering easy to detect: hashes and blocks . . . A *hash function* is a type of mathematical function which turns *data* into a fingerprint of that data called a *hash*").

[115] *See id.*

[116] *See generally* GEORGE SAMMAN & SIGRID SEIBOLD, KPMG CONSENSUS: IMMUTABLE AGREEMENT FOR THE INTERNET OF VALUE (2016), https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/kpmg-blockchain-consensus-mechanism.pdf [https://perma.cc/w9bs-235j] (providing a survey of the variety of consensus mechanisms used by different forms of blockchain technology).

[117] *See id.* at 15.

[118] *See generally id.*

[119] *See* Joseph Chow, *Blockchain Underpinnings: Hashing*, MEDIUM: CONSENSYS (Jan. 13, 2016), https://medium.com/@ConsenSys/blockchain-underpinnings-hashing-7f4746cbd66b [https://perma.cc/9hs3-3mkb], (describing the role cryptographic hashing plays in blockchain technology, and the hashing

publicly viewable (e.g., Bitcoin) or limit visibility of the relevant entries to the parties involved (e.g., R3's Corda).[120] All of these are potentially significant changes that could affect the immutability of the resulting record, much like substituting artificial butter spray could affect the moistness of a cake whose recipe called for pure butter. Indeed, "when blockchain technology is adapted from permissionless environments to permissioned environments the immutability of blockchain becomes questionable."[121] Despite this complexity and uncertainty, the bulk of the discourse around blockchain technology states simply that "immutability is a characteristic of blockchain technology."[122] While it is possible that any variety of the technology could yield the emergent property of immutability, this seems highly unlikely, and is definitely not yet firmly established.

Why is it important for regulators to be aware of this confusion? Because in the current overheated atmosphere of blockchain euphoria, some are already taking regulatory actions related to blockchain technology (perhaps to protect it or promote its use) and are potentially acting based on poor understanding, baking confusion into the law they are creating. For instance, in February 2017, the Arizona state legislature passed a statute defining signatures "secured through a blockchain" as "electronic signatures,"[123] and providing that "smart contracts may exist in commerce."[124] The statute defines "blockchain

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functions used by different systems).

[120] *See* Richard Gendal Brown et al., R3, Corda: An Introduction 8 (Aug. 2016), https://static1.squarespace.com/static/55f73743e4b051cfcc0b02cf/t/57bda2fdebbd1acc9c0309b2/1472045822585/corda-introductory-whitepaper-final.pdf [https://perma.cc/buq5-ssg2] ("[I]n our model, it is not the case that transactions and ledger entries are globally visible. In cases where transactions only involve a small subgroup of parties we strive to keep the relevant data purely within that subgroup.").

[121] Nitesh Emmadi & Harika Narumanchi, *Reinforcing Immutability of Permissioned Blockchains with Keyless Signatures' Infrastructure*, *in* INTERNATIONAL CONFERENCE ON DISTRIBUTED COMPUTING AND NETWORKING (2017) 1–2 (describing how immutability of the ledger cannot be guaranteed in permissioned blockchains and proposing remedies to guarantee immutability in permissioned settings).

[122] Pilkington, *supra* note 35, at 15.

[123] Act of Sept. 21, 2006, ch. 26, ARIZ. REV. STAT. ANN. § 44-7003 (2006) (amended by 2017 Ariz. Sess. Laws 2417), https://legiscan.com/AZ/text/HB2417/id/1528949 [https://perma.cc/RB8T-4EZP].

[124] *Id.*

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." It further states that "[t]he data on the ledger is protected with cryptography, is *immutable* and auditable and provides an uncensored truth."[125]

Although there are numerous problems with this definition,[126] I will limit my critique here to the use of "immutable." First, stating that "the data on the ledger is . . . immutable" in a statute does not mean that the data is immutable (i.e., unchangeable) in reality. Does the statute mean that courts should treat data on a blockchain, public or private, *as if* it is immutable, even if it is empirically demonstrated that it is not? As discussed, it is clear from events like the July 2016 Ethereum hard fork that blockchain records are vulnerable to changes through social consensus (i.e., the people who are part of the relevant blockchain system can *choose* to alter the record).[127] Using the word "immutable" in the definition of "blockchain technology" ends up being nonsensical and confusing, particularly since the legislation was both proposed and enacted after the July 2016 Ethereum hard fork. If the legislators intended "immutable" to mean something other than "unchanging" or "unchangeable," then they needed to define it that way (though it is poor drafting as a rule to assign non-intuitive meanings to defined terms in statutes and contracts).

Second, the definition states that data on both private and public, permissioned and permissionless, ledgers is immutable.[128] Despite the fact that it is unresolved whether different variations of blockchain technology give rise to immutable records, the statute explicitly treats public and private ledgers as if they have identical capabilities. Does the statute suggest that data on private blockchains should be treated as immutable, even if these ledgers have a much weaker claim to this property? Again, the definition of blockchain

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[125] H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017) (emphasis added) (explaining the Arizona legislature's definition of the blockchain).

[126] For instance, stating "the data on the ledger . . . provides an uncensored truth" is hugely problematic. The data on a blockchain ledger is not necessarily true, as there can be errors or fraud involved in its entry. The truth of the data appearing on a blockchain is dependent on processes *outside* the technology itself.

[127] *See* Werbach, *supra* note 100, at 67.

[128] H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017).

technology here may not comport with reality, which is generally understood to be a bad idea for a law.

The problems with the Arizona statute suggest that the lawmakers involved were legislating without an understanding of blockchain technology, and that they failed to critically analyze the subject they were dealing with. Embedding confusion and misunderstandings in law is a serious problem, and demonstrates just how vital it is that regulators fight through the terminology issues and hype around blockchain technology as they evaluate how to treat it. Moreover, as regulators are evaluating the technology for *use* in the burgeoning "regtech" space[129] and in government record-keeping of all kinds, it is critical that regulators understand the *actual* capabilities of the technology. The problematic usage of the term "immutable" makes it difficult to determine and evaluate the capabilities of blockchain technology, and is just one example of how terminology problems can prevent regulators from making the best decisions.

The term "immutable," with its varying and sometimes non-intuitive meanings in describing blockchain technology, is one that I very much wish we could strike from the blockchain lexicon, as "by ridding ourselves of an unnecessary confusion we should gain very much in the clearness of our thought."[130]

V. Mitigation Strategies

Given the fluctuating and contested vocabulary of the blockchain technology space, what can regulators do to minimize the problematic terminology's impact on their actions? In this Part V, I offer some suggestions, tempered by the understanding that the problems of unsettled terminology cannot be completely resolved. These suggestions deal with regulators' approach to ensuring they

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[129] RegTech envisions using blockchain technology or DLT as a way to facilitate regulatory compliance by regulated parties, and potentially to allow the regulator a real-time view of the relevant activities of regulated parties. *See generally* Veele Colaert, RegTech as a Response to Regulatory Expansion in the Financial Sector (Mar. 17, 2017) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2677116 [https://perma.cc/7RQH-KZK9] (providing an overview of the risks and benefits of RegTech, which Colaert defines as ""the use of technological solutions to facilitate compliance with and monitoring of regulatory requirements.").

[130] Holmes, *supra* note 4, at 464.

understand the facts about the technology, as well as its risks and benefits; I do not propose particular regulatory actions or strategies.

These mitigation suggestions include various ways regulators can educate themselves about the technology, and crucially, the mindset and critical perspective they should assume in the education process. Over the past several years, regulators and international organizations have been actively working to learn about blockchain technology, so I do not mean to suggest that the education process has not begun.[131] I do argue, however, that it remains incomplete.

A. Learn Everything About Blockchain Technology

Regulators must work to educate themselves about blockchain technology, so that their understanding of the technology is less affected by vocabulary problems. If regulators are well educated, they will be alert to sometimes over-inclusive or under-inclusive terminology and subtle but consequential distinctions between variants of the technology, and able to respond to these nuances in their analyses.[132] Below, I suggest actions regulators can take to learn the facts about blockchain technology, many of which are already being taken. These actions, however, should go hand-in-hand with the mindset described in Part V.B. to help fight through the terminology problems that permeate the blockchain discourse.

1. Cultivate Expertise

To become better educated, regulators can seek advice from outside experts, including consulting firms, academics, or companies operating in the industry. Regulators and legislative bodies such as Congressional committees and the European Parliament have done

[131] *See infra* Part V.A. for examples of education efforts regulators have already undertaken or are currently involved in.

[132] *See* Crosman, *supra* note 64; Fenwick et al., *supra* note 9 (arguing that regulation functions best when regulators develop a holistic understanding of the subject they seek to regulate).

this by holding hearings,[133] convening conferences or workshops,[134] seeking public comment,[135] creating advisory boards,[136] and inviting speakers to address their members.[137] Regulators have also been experimenting with blockchain technology to better understand it, often partnering with industry in these endeavors.[138]

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[133] *See, e.g.*, *Beyond Silk Road: Potential Risks, Threats, and Promises of Virtual Currency: Hearing Before the S. Comm. on Homeland Sec. & Governmental Affairs*, 113th Cong. 5 (2013); *Hearing at the Economic Committee of the European Parliament on Virtual Currencies* (Jan. 25, 2016), http://www.europarl.europa.eu/committees/en/econ/events-hearings.html?id=20160125CHE00081 [https://perma.cc/4GBH-PJE8].

[134] *See, e.g.*, *SEC Fintech Forum*, U.S. SEC. & EXCHANGE COMMISSION, https://www.sec.gov/spotlight/fintech [https://perma.cc/L8U4-DWU9].

[135] *See, e.g.*, *Discussion paper on distributed ledger technology* (Fin. Conduct Auth., Discussion Paper DP17/3, 2017), https://www.fca.org.uk/publication/discussion/dp17-03.pdf [https://perma.cc/47KH-J579] (seeking input from the public on DLT risks, opportunities, and regulatory challenges).

[136] *See, e.g.*, Press Release, Int'l Monetary Fund, IMF Managing Director Welcomes Establishment of High Level Advisory Group on FinTech (Mar. 15, 2017), http://www.imf.org/en/News/Articles/2017/03/15/pr1784-imf-managing-director-welcomes-establishment-of-high-level-advisory-group-on-fintech [https://perma.cc/YCN5-U27A] (reporting the creation of an advisory group to advise the International Monetary Fund on fintech issues).

[137] *See, e.g.*, *Chamber of Digital Commerce Gathers at Federal Reserve Annual Meeting to Discuss Blockchain Technology*, YAHOO! FIN. (June 6, 2016), http://finance.yahoo.com/news/chamber-digital-commerce-gathers-federal-211345230.html [https://perma.cc/GX5Q-HT6F] (reporting on presentations on blockchain technology by representatives of blockchain companies and the Chamber of Digital Commerce to governors of ninety central banks at the U.S. Federal Reserve); Don Tapscott, CEO, Tapscott Grp. Inc., Address at IMF Annual Meeting (Oct. 6, 2016), http://www.imf.org/external/mmedia/view.aspx?vid=5160059156001 [https://perma.cc/7DSP-GMVV].

[138] *See, e.g.*, Ian Allison, *Bank of England & China Merchants Bank Join Hyperledger Project*, INT'L BUS. TIMES (Feb. 28, 2017), http://www.ibtimes.co.uk/bank-england-china-merchants-bank-join-hyperledger-project-1609011 [https://perma.cc/ZA7T-JC8P] (reporting that the Bank of England and the Federal Reserve Bank of Boston joined the Hyperledger project, a consortium developing open source blockchain technology software); Rod Garratt, *CAD-Coin versus Fedcoin*, R3 (Apr. 5, 2017), https://www.finextra.com/finextra-downloads/newsdocs/cad-coin-versus.pdf [https://perma.cc/V67X-Y8SC] (discussing Project Jasper, the Bank of Canada's distributed ledger technology experimental payments collaboration with R3 and other

Self-education is also a possibility. In this scenario, teams within different regulators can work to become internal experts on the technology. Indeed, this has been the case with many regulators, with many creating a "blockchain" or "DLT" internal team to steer knowledge and experimentation.[139] However, the multidisciplinary nature of the technology makes its mastery challenging, as deeply understanding the technology requires knowledge of fields including, among many others, economics, computer science, law, finance, and cryptography.

To help remedy the expertise problem, regulators can also hire internal experts, bringing expertise in-house. This could be difficult with blockchain technology, however, as developers with experience in the area are in great demand, and regulators may be unable to compete with high private sector compensation.[140] Further, there are frequent reports that the number of people with true expertise in the topic is extremely limited.[141]

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partners); *Fintech Accelerator Proof of Concept: PwC- Distributed Ledger Technology,* BANK OF ENG. (June 17, 2016), http://www.bankofengland.co.uk/Documents/fintech/pwcpoc.pdf [https://perma.cc/8HFY-UGLV] (reporting on the Bank of England's proof of concept work with consulting /accounting firm PwC on distributed ledger technology).

[139] *See, e.g.*, Stan Higgins, *EU Parliament Rep Seeks €1 million for Blockchain Research*, COINDESK (Aug. 30, 2016), http://www.coindesk.com/eu-parliament-member-seeks-e1-million-blockchain-research/ [https://perma.cc/GK35-VTH7] (reporting on funding request for distributed ledger technology task force previously approved by European Parliament); EUROPEAN CENT. BANK & TARGET 2 SEC., TERMS OF REFERENCE: TASK FORCE ON DISTRIBUTED LEDGER TECHNOLOGIES (Aug. 16, 2016), https://www.ecb.europa.eu/paym/initiatives/shared/docs/dlt_task_force_mandate.pdf [https://perma.cc/M2F7-YB8Z] (discussing a task force created by the European Central Bank to explore the implications of distributed ledger technologies).

[140] *See* Kim S. Nash, *Blockchain Experts, a Rare Breed, May Demand Big Bucks*, WALL ST. J.: CIO J. (May 12, 2016), https://blogs.wsj.com/cio/2016/05/12/blockchain-experts-a-rare-breed-may-demand-big-bucks/ [https://perma.cc/92KS-DFGN] (reporting that different Wall Street firms are paying $250,000 annual salaries for blockchain engineers).

[141] *See* Michael del Castillo, *The Lack of Blockchain Talent is Becoming an Industry Concern*, COINDESK (Mar. 2, 2017), http://www.coindesk.com/blockchain-hiring-difficulties-becoming-industry-concern/ [https://perma.cc/Y3SA-KMFG] ("The alleged lack of available talent for blockchain industry jobs was high on the agenda at the DTCC's Fintech Symposium, held . . . in New York City yesterday."); Michael Scott, *The Blockchain Devel-*

2. Consult with Other Regulators across Jurisdictions and Subject Domains

Given the potential for regulators to understand blockchain technology differently because of the divergent language around it, regulators from different jurisdictions and subject matters should communicate with one another about their understandings. Communication can help to flush out misunderstandings, and there are many examples of these collaborations occurring already.[142] However, discussions and collaborations can also spread misinformation and misunderstandings, and generate herding behavior as regulators compete to appear as innovation-friendly as others to avoid stifling job creation in their jurisdictions.

3. Follow Activity by Standards Organizations and Academia

Standards bodies such as the International Organization for Standardization (ISO) and the United Nations' International Telecommunications Union (ITU) play an important role in streamlining terminology and other common practices across a field or technology. These bodies, along with the Internet-focused W3C, have begun to look at blockchain technology, and have formed working groups to determine where and when standards may be appropriate.[143]

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oper Shortage: Emerging Trends & Perspectives, BITCOIN MAGAZINE (Oct. 31, 2016), https://bitcoinmagazine.com/articles/the-blockchain-developer-shortage-emerging-trends-and-perspectives-1477930838/ [https://perma.cc/HJ5W-F8MD] ("Amid the steady rise of blockchain innovation, there are growing concerns about a looming shortage of qualified developers.") .

[142] *See, e.g.*, *Discussion paper on distributed ledger technology*, *supra* note 135, at 8 (referring to collaboration to learn about distributed ledger technology between the U.K.'s Financial Conduct Authority and the European Securities & Markets Authority, as well as in IOSCO and the Financial Stability Board); *ECB, Bank of Japan Partner for Distributed Ledger Technology Research,* BBR INTERMEDIARIES ECN & EXCHANGE (Dec. 7, 2016), http://ecnandexchanges.banking-business-review.com/news/ecb-bank-of-japan-partner-for-distributed-ledger-technology-research-071216-5689953 [https://perma.cc/4BKY-ZE3E].

[143] *See Blockchain Community Group*, W3C COMMUNITY & BUS. GROUPS, https://www.w3.org/community/blockchain/ [https://perma.cc/4A4M-J8ZK] (listing blog posts from the online W3C Blockchain Community Group, the Internet's informal blockchain governing body); Stan Higgins, *Australia to*

These initiatives stimulate potentially affected parties to join the conversation, with the goal of shaping useful standards.[144] Regulators should closely follow the work of standards bodies, but should also keep in mind that the organizations themselves are not immune to politics among groups with diverging interests.[145]

Additionally, there is an initiative at the University of British Columbia's blockchain technology research center (Blockchain@UBC) to create a glossary of terminology around blockchain

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Lead International Blockchain Standards Effort, COINDESK (Sept. 15, 2016), http://www.coindesk.com/australia-lead-international-blockchain-standards-effort/http://www.coindesk.com/australia-lead-international-blockchain-standards-effort/http://www.coindesk.com/australia-lead-international-blockchain-standards-effort/ [https://perma.cc/H6WT-6HP6] (reporting that Australia will manage the international technical committee for the development of blockchain standards for the International Organization for Standardization (ISO), including standards for terminology); Media Release, Standards Austl., Austl. to Lead Int'l Blockchain Standards Comm. (Sept. 15, 2016), http://www.standards.org.au/OurOrganisation/News/Documents/Australia%20to%20lead%20international%20blockchain%20standards%20committee.pdf) [https://perma.cc/4LAV-NTLU] ("Joining Australia on the technical committee are 35 ISO member bodies including Germany, USA, Canada, Estonia, France, Japan, UK, and Korea."); Bailey Reutzel, *At W3C Event, Industry Seeks to Weave Blockchains into New Web*, COINDESK (July 15, 2016), http://www.coindesk.com/w3c-events-industry-begins-long-road-blockchain-standards/ [https://perma.cc/N7M2-2X8Y] (discussing W3C's role in developing international blockchain standards); *Workshop on Security Aspects of Blockchain*, INT'L TELECOMM. UNION (Mar. 21, 2017), http://www.itu.int/en/ITU-T/Workshops-and-Seminars/201703/Pages/default.aspx [https://perma.cc/P7KP-GGTY] (providing coverage of the ITU workshop on blockchains and security).

[144] *See Blockchain Community Group*, *supra* note 143 (including online posts from blockchain users about developing appropriate international standards).

[145] *See* CRAIG N. MURPHY & JOANNE YATES, THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION: GLOBAL GOVERNANCE THROUGH VOLUNTARY CONSENSUS 26–45 (2009) (explaining the difficulties involved in achieving consensus when disagreements exist both within and across groups); J.M. Porup, *A battle rages for the future of the Web*, ARS TECHNICA UK (Feb. 13, 2017), https://arstechnica.co.uk/information-technology/2017/02/future-of-the-www-tim-bl-drm/ [https://perma.cc/P8GF-RBEP] (describing the heated battle over Digital Rights Management (DRM) standards in W3C, the Internet's informal governing body).

technology,[146] and regulators may want to build from projects like these.

4. Watch and Learn: Buy Time Until the Language and Technology Stabilize

Time and continued experimentation with blockchain technology will hopefully lead to a more unified and stable terminology, which will make the technology easier to understand, and therefore regulate. A strategy of waiting for a stable terminology is in tension with consumer protection and financial and social stability regulatory goals, so regulators should look for creative ways to achieve their core missions while giving the technology a chance to evolve and stabilize.

This will be difficult due to the rush to incorporate blockchain technology into numerous critical social practices and key parts of the financial system.[147] Notably, the Depository Trust and Clearing Company (DTCC) announced in January 2017 that it was putting derivatives on a blockchain (or distributed ledger, or who knows).[148] Industry may not wait until a stable technology or terminology emerges before using the technology in important ways,[149] so consumers and financial stability may be put at risk before the technology or its vocabulary gets nailed down.[150]

Regulators around the globe have been looking for creative ways to enable safe technological experimentation in "fintech"

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[146] *See* VICTORIA L. LEMIEUX, SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL OF CANADA, BLOCKCHAIN TECHNOLOGY FOR RECORD KEEPING: HELP OR HYPE? app. B (2016), https://www.researchgate.net/profile/Victoria_Lemieux/publication/309414363_Blockchain_for_Recordkeeping_Help_or_Hype/links/580f539408ae009606bb62f6.pdf [https://perma.cc/7PJC-LA8W] (providing definitions of key terms associated with blockchain technology proposed to be incorporated into existing archival InterPARES Trust Terminology Database).

[147] *See generally* WORLD ECON. FORUM, *supra* note 12.

[148] Nathaniel Popper, *Wall Street Clearinghouse to Adopt Bitcoin Technology*, N.Y. TIMES: DEALBOOK (Jan. 9, 2017), https://www.nytimes.com/2017/01/09/business/dealbook/wall-street-clearing-house-to-adopt-bitcoin-technology.html [https://perma.cc/6YUA-BAHP] (reporting that the DTCC would be developing a permissioned distributed ledger to manage derivatives trading).

[149] *See* Fenwick et al., *supra* note 9, at 5.

[150] *Id.* at 9–10 (describing the impossibility of protecting consumers from 'unknown unknowns'—negative externalities associated with new technology that have not yet been discovered).

(including blockchain technology), and the latest trend is to create "regulatory sandboxes."[151] These safe harbors, which have been adopted or proposed in a growing number of countries around the world, allow certain fintech companies to escape regulatory sanction in their startup phase, while protecting consumers in specified ways.[152] Each sandbox is slightly different, and each is in a different phase of rollout or discussion,[153] but the idea seeks to emulate the clinical trials held for pharmaceuticals in allowing limited "trying out" of financial technology before making it available to the masses. U.S. Commodity Futures Trading Commission Acting Chair Christopher Giancarlo has advocated the creation of a regulatory sandbox in the United States so that it does not lose ground to countries more willing to allow experimentation with the technology.[154] And a recent G20 Insights Paper called for the creation of a global regulatory sandbox to "support beneficial private sector blockchain development," including for use in providing financial services to the unbanked and underbanked.[155]

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[151] *See Regulatory Sandbox*, FIN. CONDUCT AUTHORITY (May 11, 2015), https://www.fca.org.uk/firms/project-innovate-innovation-hub/regulatory-sandbox [https://perma.cc/9ELB-ZJ2B] (compiling relevant information about the U.K.'s "regulatory sandbox" concept and status launched in 2015 by the Financial Conduct Authority); Will Hallatt et al., *Hong Kong Launches Regulatory Sandbox in Wake of Developments in Australia, Malaysia, Singapore, and the UK*, HERBERT SMITH FREEHILLS (Sept. 30, 2016), http://sites.herbertsmithfreehills.vuturevx.com/103/12430/landing-pages/2016.09.30-apac-fintech-briefing.pdf [https://perma.cc/4B4U-MZS4] (providing an overview of regulatory sandbox initiatives around the world).

[152] *See* Hallatt et al., *supra* note 151.

[153] *See id*. (describing Singapore's regulatory sandbox); Corey McHattan, *Australia - ASIC Issues "Sandbox" Framework, Including "Fintech Licencing Exemption"*, CONVENTUS LAW (Jan. 13, 2017), http://www.conventuslaw.com/report/australia-asic-issues-sandbox-framework-including/ [https://perma.cc/FF9D-EA8S] (describing Australia's regulatory sandbox); *Regulatory Sandbox*, *supra* note 151.

[154] *See* J. Christopher Giancarlo, *CFTC's Giancarlo: How US Regulators Can Boost Blockchain in 2017*, COINDESK (Dec. 16, 2016), http://www.coindesk.com/cftcs-giancarlo-how-regulators-can-boost-blockchain-2017/ [https://perma.cc/HQ7K-9HZG].

[155] *See* Julie Maupin, *The G20 Countries Should Engage with Blockchain Technologies to Build an Inclusive, Transparent, and Accountable Digital Economy for All*, G20 INSIGHTS (Mar. 16, 2017), http://www.g20-insights.org/wp-content/uploads/2017/03/g20-countries-engage-blockchain-technologies-build-inclusive-transparent-accountable-digital-economy.pdf/ [https://

While the sandbox approach may be helpful in evaluating new business models or technologies in a controlled setting, regulators should be mindful of the limitations of the conclusions they can draw from the experiments conducted in the sandboxes. While the sandbox activities may reveal consequences to consumers from a micro-prudential perspective, they can't reveal the macro-prudential (systemic) consequences of the activities, because they have not been tested on a broad scale that would give meaningful indications of how they would interact with the larger financial system. So, just because a fintech (or blockchain) company appears to work fine in trial run with a limited set of consumers does not mean that it has been vetted from a systemic risk or contagion perspective.

B. Adopt a Critical Mindset in the Education Process

In Part V.A, I suggested ways that regulators could learn about blockchain technology, with the goal of overcoming the vocabulary problems around it. However, education without the appropriate mindset is still likely to lead to misunderstandings about the technology, poor risk assessments of it, and harmful regulatory actions or omissions. It is essential that regulators do not simply accept what they read or hear at face value; rather, they must adopt a critical point of view and act strategically to uncover the facts beneath the muddle of inconsistent terminology, misinformation, and hype. I offer the following suggestions to facilitate this critical approach.

1. Seek to Separate Hype from Reality

First, throughout the education process, regulators must seek to filter out hype surrounding the technology. Hype can be insidious and unintentional, based on genuine misunderstandings by those spreading it, or by a lack of attention to detail. It can also be motivated by incentives, such as the desire to profit by selling the technology or oneself as a thought leader.

A contested vocabulary can mask hype, acting almost like a sleight of hand in a magic trick. As with the use of "immutable," imprecise vocabulary usage can suggest that each variation of the technology has the same fundamental characteristics, when the characteristics of a given variant may be vastly different from the

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perma.cc/RDF6-ESBC].

characteristics of other forms of the technology that are also labeled "blockchain." We see this in references to "the blockchain" in describing the technology, as if all forms of blockchain technology were essentially like Bitcoin or Ethereum, when there are extremely consequential differences amongst the features, which affect the emergent properties of the varying systems.

Hype and terminology errors can end up in work by legitimate academics and organizations, and then ripple through the field, making an imprecise or inaccurate statement hard to remove from discourse, as other work builds on it and cites it as fact.[156] One example of this phenomenon is the widely stated "fact" in blockchain discussions that Estonia is using blockchain technology as part of its national digital identity system,[157] when, according to Estonian officials and historic records, that is untrue.[158] Taking another example, if every early work states that blockchain technology is "immutable," then works that are written now will likely also state that it is immutable, relying on the earlier works, and the overstatement about the technology itself may become immutable. Thus, regulators should be alert to the potential for terminology confusion to disguise hype in their quest for the facts about blockchain technology.

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[156] The struggle to root out falsehoods ("fake news") in social media is very much part of the current zeitgeist in 2017, and the blockchain space is wrestling with this issue as well.

[157] *See, e.g.*, Dave Birch, *House of Blockchain*, CONSULT HYPERION (Dec. 7, 2016), http://www.chyp.com/house-of-blockchain/ [https://perma.cc/FY42-3ZYQ] (stating that discussion of blockchain technology in United Kingdom's House of Lords included incorrect statements that the Estonian digital identity system used blockchain technology); Michael Mainelli, *Blockchain Will Help Us Prove Our Identities in a Digital World*, HARV. BUS. REV. (Mar. 16, 2017), https://hbr.org/2017/03/blockchain-will-help-us-prove-our-identities-in-a-digital-world [https://perma.cc/VPL5-QKET] (stating that "since 2007 Estonia has been operating a universal national digital identity scheme using blockchain); Don Tapscott, *New Economy Talks with Don Tapscott*, INT'L MONETARY FUND (Oct. 6, 2016), http://www.imf.org/external/mmedia/view.aspx?vid=5160059156001 [https://perma.cc/KW2M-9V8Y] (quoting Don Tapscott at the 42 minute mark, "Estonia showing the way forward with the blockchain-based identity").

[158] *See* Dave Birch, *Estonia, fake news and digital identity,* CONSULT HYPERION (Mar. 20, 2017), http://www.chyp.com/estonia-fake-news-and-digital-identity/ [https://perma.cc/46YA-3YNP] (debunking the "urban legend" that Estonia's digital identity system uses a blockchain).

2. Consider the Source (and the Source's Incentives)

In any research project, one must consider the legitimacy of the source of information, asking, essentially, is this source reliable? Regulators, in their research on blockchain technology, must do the same. This evaluation includes ferreting out the incentives that may shape a source's perspective and advice, and determining how those incentives affect the source's credibility. As with all industries, blockchain technology has advocates that lobby for it to be treated favorably by regulators and widely adopted by parties that include governments. Over the past several years, lobbying groups (i.e., the Chamber of Digital Commerce and the Global Blockchain Business Council),[159] a think tank and advocacy organization with blockchain industry funding (i.e., Coin Center),[160] and a Congressional Blockchain

[159] *About Us*, CHAMBER OF DIG. COM., http://www.digitalchamber.org/about.html [https://perma.cc/QKU7-9QDE] ("The Chamber of Digital Commerce is the world's leading trade association representing the digital asset and blockchain industry. Our mission is to promote the acceptance and use of digital assets and blockchain-based technologies. Through education, advocacy, and working closely with policymakers, regulatory agencies and industry, our goal is to develop a pro-growth legal environment that fosters innovation, jobs and investment."); *About*, GLOBAL BLOCKCHAIN BUS. COUNCIL, http://gbbcouncil.org/ [https://perma.cc/S2LJ-U385] ("The GBBC educates business leaders on Blockchain technology, provides a forum for businesses and technology experts to collaborate on Blockchain-based business solutions, supports businesses interested in implementing Blockchain technology in their operations and advocates for the global adoption of this transformative technology.")

[160] The donors to Coin Center listed on Coin Center's website include venture capital firms with investments in the blockchain technology space (e.g., Andreessen Horowitz and Union Square Ventures) and companies in the blockchain technology space (e.g., Chain, Blockstream, and BitFury). *About Us*, COIN CTR., https://coincenter.org/about#supporters [https://perma.cc/NE2Y-BLN8]; Jerry Brito, *Coin Center Raises $1 Million for 2017 Operations, Announces New Supporters*, COIN CTR. (Feb. 21, 2017), https://coincenter.org/entry/coin-center-raises-1-million-for-2017-operations-announces-new-supporters [https://perma.cc/PYB8-JEG2] ("Coin Center is 'the leading non-profit research and advocacy center focused on the public policy issues facing cryptocurrency and decentralized computing technologies like Bitcoin and Ethereum.'").

Caucus focused on pushing the technology forward, have formed.[161] Regulators must be sensitive to how the goals and incentives of these parties may shape the information and recommendations they provide.[162] The Chamber of Digital Commerce and Coin Center have been active in educating regulators and policymakers through mediums such as conferences, meetings, reports and white papers, op-eds, and proposed legislation.[163] This is to be expected, but regulators need to be sure that they factor the interests of these parties into the weight they give their analyses and advice.[164]

Regulators are also learning about the technology from the industry itself—from owners of companies in the blockchain ecosystem; the software developers and cryptographers building the systems; consulting firms that have developed blockchain technology advising practices; and many, many thought leaders—through an extremely active conference scene[165] and direct consultation.[166] This is appropriate and essential, but again, conflicts of interest must be kept in mind in evaluating the information provided by these parties. (And yes, even academics can be conflicted by relationships with industry

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[161] Olga Kharif, *New Congressional Caucus Seeks Favorable Laws for Blockchain*, BLOOMBERG (Sept. 26, 2016), https://www.bloomberg.com/news/articles/2016-09-26/new-congressional-caucus-seeks-favorable-laws-for-blockchain [https://perma.cc/K7UL-4GT9] (reporting on the formation of a congressional caucus by Representatives Mick Mulvaney and Jared Polis "to advocate for cryptocurrencies and blockchain-based technologies"). Since Mick Mulvaney became the Director of the Office of Management & Budget in early 2017 (resigning his Congressional seat), David Schweikert has joined the Blockchain Caucus. *See* Neeraj Agrawal, *Congressional Blockchain Caucus Kicks Off*, COIN CTR. (Feb. 1, 2017), https://coincenter.org/entry/congressional-blockchain-caucus-kicks-off [https://perma.cc/X8G6-X9BY].

[162] *See supra* notes 74–83 and accompanying text.

[163] *See, e.g.*, COIN CTR., www.coincenter.org [https://perma.cc/NE2Y-BLN8]; DIG. CHAMBER COM., https://digitalchamber.org [https://perma.cc/PPJ3-NJ9Z].

[164] *See supra* notes 74–83 and accompanying text.

[165] It is common knowledge in the blockchain community that there are a prodigious number of conferences, summits, and workshops on blockchain technology and fintech. CoinDesk maintains a partial list of upcoming events at *Bitcoin Events*, COINDESK, http://www.coindesk.com/bitcoin-events/ [https://perma.cc/EA7W-MV9W] (showing nine Bitcoin or blockchain events scheduled for May 2017 alone).

[166] *See generally* Part V.A.

or others, a desire for the spotlight, or the source of their research funding.)

In evaluating a source, one also generally looks for signals of legitimacy and authority, such as an association with a known and respected institution.[167] This is complicated in the blockchain space, however, in part because terminology problems, the complexity of the technology, and extreme hype have resulted in inaccurate or imprecise and therefore misleading information appearing in works from legitimate, authoritative sources.[168] So while this is generally a sound tactic, in blockchain world, the imprimatur of a trusted institution is not necessarily sufficient to ensure reliable information, making the other suggestions in this Section V.B more important.

3. Seek Diverse Perspectives

To uncover the facts about blockchain technology that are now drowned out by a cacophony of confusing terminology, regulators should ensure that they seek out and consider a diversity of perspectives on the technology. By this I mean that they should seek and consider input from those who view the technology as having limitless potential, as well as those who are more skeptical; and those who see few risks to the technology, as well as those who see great risks; and of course, those who fall somewhere in the middle of these spectrums. Considering a multiplicity of perspectives can reveal vocabulary inconsistencies and hype, allowing a more nuanced truth to emerge and enabling regulators to make better decisions about the technology. The benefits of including diverse perspectives in decision-making are well established.[169]

Additional types of diversity can also be helpful. I have previously called for multiple disciplines to be involved in the evaluation and development of blockchain technology, given its foundational and interdisciplinary nature.[170] Insights about the technology's risks and

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[167] *See generally*, *Evaluating Sources of Information*, PURDUE OWL, https://owl.english.purdue.edu/owl/resource/553/01/ [https://perma.cc/K5KB-TFX5].

[168] *See, e.g., supra* text accompanying note 35 (describing blockchain technology as immutable); Mainelli, *supra* note 157 (stating that Estonia's digital identity system uses a blockchain).

[169] *See generally* SCOTT E. PAGE, THE DIFFERENCE (2008) (exploring how different types of diversity improve problem solving in groups).

[170] *See* Angela Walch, *Blockchain Workshop Position Statement*, W3 (June

benefits can come from any relevant discipline, so regulators cannot just focus on learning from technical experts. Rather, they must be alert to and seek input from those in fields such as record keeping, law, economics, finance, risk and numerous others. This inclusion of multiple fields is necessary, but poses risks of its own, given the difficulties of communicating across disciplines mentioned earlier.[171]

Gender, ethnic, economic, geographic, and other forms of diversity are also relevant to this issue. The technology and finance worlds are known to be dominated by men and to be predominantly white.[172] This is often the case in the blockchain space as well, as a look

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30, 2016), https://www.w3.org/2016/04/blockchain-workshop/interest/walch.html [https://perma.cc/2DLB-6CA7].

[171] *See supra* notes 50–54 and accompanying text (discussing "Cross-Field Communications").

[172] *See, e.g.,* DAVID BEEDE ET AL., U.S. DEP'T OF COMMERCE, ECON. & STATISTICS ADMIN., ESA ISSUE BRIEF 04-11, WOMEN IN STEM: A GENDER GAP TO INNOVATION 1 (2011), http://www.esa.doc.gov/sites/default/files/womeninstemagaptoinnovation8311.pdf [https://perma.cc/S9JG-HJ98] ("[W]omen are vastly underrepresented in STEM jobs and among STEM degree holders despite making up nearly half of the U.S. workforce and half of the college-educated workforce."); LIANA CHRISTIN LANDIVAR, U.S. DEP'T OF COMMERCE, ECON. & STATISTICS ADMIN., U.S. CENSUS BUREAU, ACS-24, DISPARITIES IN STEM EMPLOYMENT BY SEX, RACE & HISPANIC ORIGIN 19 (2013), https://www.census.gov/prod/2013pubs/acs-24.pdf [https://perma.cc/3QUG-B5TX] ("Black and Hispanic workers are underrepresented in STEM occupations."); SILICON VALLEY BANK, U.S. STARTUP OUTLOOK 2017 12 (2017), https://www.svb.com/uploadedFiles/Content/Trends_and_Insights/Reports/Startup_Outlook_Report/US%20Startup%20Outlook%20Report%202017.pdf [https://perma.cc/C2XK-BXJU] ("Women in tech leadership has been a topic of conversation in Silicon Valley and globally for several years. It is well-known that women are underrepresented on startup boards and in the executive suite. For all the work being done to change this ratio in the U.S., this year's survey respondents report there is no progress in the aggregate. Leading into 2017, 70% of startups report having no women on their boards, and more than half (54%) have no women in executive positions."); OLIVER WYMAN, WOMEN IN FINANCIAL SERVICES 2016 6 (2016), http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2016/june/WiFS/WomenInFinancialServices_2016.pdf [https://perma.cc/FR4M-32WK] ("Female representation is growing on financial services Boards (20 percent in 2016) and Executive Committees (16 percent in 2016), but progress is slow."). *See generally,* U.S. GOV'T ACCOUNTABILITY OFF., GAO-13-238, DIVERSITY MANAGEMENT: TRENDS AND PRACTICES IN THE FINANCIAL SERVICES INDUSTRY AND AGENCIES AFTER THE RECENT FINANCIAL

at most conference panels and advisory boards reveals.[173] Including people from different backgrounds in the discussion can help to bring different points of view and experiences to the conversation, which should lead to more fulsome analyses by regulators.

This means that regulators should seek input from experts other than just those recommended or provided by blockchain industry groups. Regulators can of course critique and assess the credibility of industry-provided information, but they should not do so on their own. What if they miss something? What if they are overpowered by industry influence? Including parties known for expressing a critical perspective as advisors can help ensure that regulators are able to consider a more complete picture.[174]

4. Doubt Everything and Trust No One: Timeo Thought Leaders Et Dona Ferentes[175]

Regulators should approach their education on blockchain technology from a skeptical perspective, accepting no claims on faith. Ideally, they should take this approach to everything they do, but it is particularly important to do so with emerging technologies or practices. As discussed in Part III, language problems coupled with complexity can contribute to regulatory capture and a tendency among regulators to go along with what industry says because they are inadequately equipped to question it.[176] With blockchain technology,

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CRISIS (2013), http://www.gao.gov/assets/660/653814.pdf [https://perma.cc/GC8E-DYYJ] (reporting on the underrepresentation of women and minorities in the financial services industry).

[173] *See, e.g.,* Press Release, *supra* note 136 (listing the fourteen members of the IMF's High Level Advisory Group on Fintech, two of whom are women); *Consensus 2017 Speakers*, COINDESK, http://www.coindesk.com/events/consensus-2017/speakers/ [https://perma.cc/ZRU6-7P5T] (reflecting that fewer than 20 percent of the speakers at the premier industry blockchain technology conference are women).

[174] *See* Brett McDonnell & Daniel Schwarcz, *Regulatory Contrarians*, 89 N.C. L. REV. 1629 (2011) (proposing the creation of formal "regulatory contrarians" tasked to monitor and critique financial regulators to improve systemic risk oversight by ensuring that contrarian viewpoints are aired).

[175] VIRGIL, THE AENEID. Translated loosely as "Beware of Thought Leaders bearing gifts"—an allusion to the famous saying, "Beware of Greeks bearing gifts," which refers to the gift of the Trojan Horse that proved so dangerous.

[176] *See supra* notes 74–83 and accompanying text.

it is not okay for regulators to accept that they can't fully understand what is going on, nor is it okay to simply parrot the claims of the technology's loudest proponents, cowed by the threat of derision for holding back innovation.[177]

Further, regulators should be vigilant in searching for errors and oversimplified language in even academic works that they read about blockchain technology.[178]

Thus, in their education process on blockchain technology, regulators cannot skip steps, analyzing only the *implications* of the technology and treating the *capabilities* of the technology as proven. Regulators and policymakers seem to be jumping ahead to questions like "What are the implications for property records if we have a secure, immutable, reliable record keeping system?" rather than fully interrogating whether all (or *any*) variations of blockchain technology have these features.[179] Again, this is analogous to the steps that were skipped in the analysis of mortgage-backed securities and credit default swaps, when people jumped ahead to ask "What are the wonderful things that can be facilitated if we have managed to do away with risk by dividing it up in complicated, opaque structures?"[180]

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[177] *See supra id*. Gerding makes a similar argument regarding complex risk models and financial products, stating that "Regulators cannot outsource oversight . . . to risk models and other codes without thoroughly and continuously auditing [them]. . . . [T]his auditing requires both technical expertise and a constant critical examination of technical assumptions. Regulators cannot abdicate responsibility to examine codes because they are embedded in a complex technology or involve elegant economic models." Gerding, *supra* note 77, at 186.

[178] *See supra* Part V.B.2 (discussing how misleading "facts" become immutable).

[179] I made an analogous argument in an earlier paper, arguing that regulators and commentators had largely focused their analysis of Bitcoin and cryptocurrencies on how they could be categorized in the existing regulatory structure, rather than focusing on the fundamental characteristics of the technology and its risks and capabilities. *See* Walch, *supra* note 98, at 883–85.

[180] *See, e.g.,* Alan Greenspan, Chairman Fed. Reserve, Remarks to the Federal Reserve Bank of Chicago's Forty-first Annual Conference on Bank Structure: Risk Transfer and Financial Stability (May 5, 2005), http://www.federalreserve.gov/Boarddocs/Speeches/2005/20050505/default.htm [https://perma.cc/9BBT-ADY7] ("The use of a growing array of derivatives and the related application of more-sophisticated approaches to measuring and managing risk are key factors underpinning the greater resilience of our largest financial institutions, which was so evident during the credit cycle of 2001–02 and

The fun part of the analysis of any new practice or technology is thinking about the positive "what ifs," assuming that the features of the new practice or technology are as described. That is the role that "thought leaders" play, pushing society to imagine a brighter future. While the expression of these ideas is important to help us move forward with hope for the future, acute critique alongside claims of transformation is essential.[181] With blockchain technology, the thought leaders' visions are that many human problems can be solved, including those of regulators. With a real-time view of the actions of the parties they regulate, regulators will have solid knowledge with which to make decisions, enabling sounder decisions and preventing events like Lehman Brothers' collapse.[182] The gifts offered by the thought leaders are enticing indeed, but regulators' jobs are to scrutinize these gifts to see if they are everything they appear to be, and, as with the Trojan Horse, what other surprises may lurk inside the packages.

Regulators must therefore be hyper-critical and skeptical about blockchain technology itself. They must insist upon precision in understanding precisely *how* the technology achieves what it achieves, how its capabilities *change* as different features are tweaked, which unstated assumptions are made in describing the technology's benefits and risks, what those assumptions are based on, what each word of jargon means in the relevant fields involved, and so much more. It is not enough for decisions to be made with a high-level understanding that any and all forms of blockchain technology create a golden record "by collaboration, by cryptography and by some clever code."[183]

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which seems to have persisted.").

[181] *See* Drezner, *supra* note 108 (noting the differing roles that thought leaders and public intellectuals play in the distribution of ideas in society, and the need for public intellectuals to provide critique to balance thought leaders' less-nuanced and sometimes-overstated claims).

[182] J. Christopher Giancarlo, Comm'r, U.S. Commodities Future Trading Comm'n, Special Address at the Depository Trust & Clearing Corporation 2016 Blockchain Symposium: Regulators and the Blockchain: First, Do No Harm (Mar. 29, 2016), http://www.cftc.gov/PressRoom/SpeechesTestimony/opagiancarlo-13 [https://perma.cc/CBF7-2975].

[183] Don Tapscott, *How the blockchain is changing money and business*, TED (June 2016), https://www.ted.com/talks/don_tapscott_how_the_blockchain_is_changing_money_and_business/transcript?language=en [https://perma.cc/EJ7Y-4XEZ] (received over 1.6 million views from August 2016 through April 21, 2017).

5. Don't Just Follow the Herd: Resist Peer Pressure

Regulators are not immune to peer pressure, more scientifically referred to as "herd behavior."[184] In the current climate, regulators and others may feel compelled to praise or use blockchain technology simply because others are doing it. If regulators or policymakers see others considering the use of blockchain technology for central bank digital currencies, or for property records, they may feel pressured to do the same, possibly to appear open to innovation or to draw jobs to their locale, or because they want to ensure they are not missing out on a legitimately useful technology. Given that the adoption of new technologies is also subject to herd behavior,[185] the problematic language of blockchain technology means that there is potential for misunderstandings about the technology to drive adoption, rather than actual capabilities.

As regulators observe what their counterparts are doing, and consult with them as I suggested in Part V.A, they do risk triggering "thoughtless herd behavior."[186] The use of problematic blockchain terminology in the conversations among different regulators means that any errors in understanding can be passed like a virus among them, potentially resulting in the entire herd sharing that misunderstanding. Again, this is important because of the high number of critical systems that blockchain technology seeks to disrupt.

As countless wall posters in classrooms around the world proclaim, "What is popular is not always right, and what is right is not

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[184] *See* Heshan Sun, *A Longitudinal Study of Herd Behavior in the Adoption and Continued Use of Technology*, 37 MGMT. INFO. SYS. Q. 1013, 1014 (2013) ("Herd behavior refers to the phenomenon that everyone does what everyone else is doing, even when their private information suggests doing something quite different.") (citations omitted).

[185] *See id.* at 1014 (noting that herd behavior "may explain why people quickly converge on the same form of technology by imitating each other's choices. . . . [W]hen herding, people may later reexamine and reverse their initial decisions, somewhat accounting for the en masse abandonment of a particular technology").

[186] *See* Tom C.W. Lin, *The New Financial Industry*, 65 ALA. L. REV. 567, 608 (2014) ("Too much coordination could lead to "destructive coordination," which could result in thoughtless herd behavior by regulators and participants. Too much coordination can also erode competition among regulators with different areas of focus and expertise.") (citations omitted).

always popular."[187] Regulators need to have the courage to think for themselves, even as they consult with and learn from others.

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Following the suggestions in this Part V undoubtedly slows things down, as regulators have to build their understanding of the technology and its implications from the ground up. Indeed, through their education and critical approach, regulators may end up helping to *create* the set of facts about the technology. It is much more efficient to listen to a single perspective and assume everything one hears is true, than to spend time collecting diverse opinions and interrogating every bit of information one receives. It is also exciting to believe that a new technology will solve countless intractable human problems. Taking a slow, inquisitive, and deliberative approach is in tension with the need to quickly get up to speed on the technology to ensure that imminent risks are identified and addressed efficiently. And there are pressures analogous to those in the pharmaceutical industry, where there are tradeoffs between making a helpful treatment available quickly to those who could benefit from it, and fully understanding the risks posed by the treatment. If blockchain technology offers all the benefits it is said to, then it is unsurprising that there is a rush to adopt it in many sectors, and regulators do not want to be seen as holding back beneficial societal progress.

Scholars of the regulation of innovation have offered various ways to approach regulating under uncertainty,[188] but a detailed discussion of these approaches and their merits is outside the scope of this paper.

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[187] This saying is variously attributed to Albert Einstein or Howard Cosell.

[188] *See, e.g.,* Lin, *supra* note 186, at 619–20 (proposing the use of sunset provisions and mandated reviews in the regulation of "cyborg finance"); Vincent R. Johnson, *Nanotechnology, Environmental Risks, and Regulatory Options*, 121 PENN ST. L. REV. 471 (2016) (proposing the use of "soft law" for the initial governance of nanotechnology); Wulf A. Kaal, *Dynamic Regulation for Innovation*, *in* PERSPECTIVES IN LAW, BUSINESS AND INNOVATION (Mark Fenwick et al. eds., 2016) (surveying the proposals made of how to regulate fast-moving innovations and proposing dynamic regulation for innovation).

VI. Conclusion

In this article, I have sought to illuminate one of the myriad challenges facing regulators as they grapple with how to treat blockchain technology—the technology's fluid, contested vocabulary. Such a shifting terminology can cause a variety of problems for regulators, and I offer suggestions to minimize its negative effects, through extensive education that incorporates a critical mindset. I am hopeful that awareness of language difficulties, and consideration of how they can result in misunderstandings, will improve the situation, much as awareness of cognitive biases may reduce their impact on decision making.[189]

The struggles regulators (and the rest of us) face in uncovering the "facts" about blockchain technology mirror those in the current public discussion of "fake news." When different interest groups have reasons (e.g., money, fame, power) to tell a certain story to the rest of the world, it is difficult to find the kernels of truth in diverging accounts. Language choices undoubtedly help to shade facts in various ways, just as they do in the discourse around blockchain technology. The irony, of course, is that blockchain technology purports to offer us the solution to our perennial struggles in identifying and preserving truth. A blockchain record is said to show us the truth, the "golden copy."[190] As the Arizona statute claims, the data on it "provides an uncensored truth."[191] Yet the truths about the technology and its capabilities remain unclear and contested because they are still in flux and shrouded in a fog of confusing terminology.

As the law evolves around blockchain technology, or whatever we end up calling it, my suggestions in fighting through problematic vocabulary may prove useful in approaching fintech more broadly, and I am hopeful that language problems will not stop us from making full and relatively safe use of this technology. In the end, contested language around the technology reflects the underlying uncertainties about the forms the technology will ultimately take, so until these

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[189] *See, e.g.,* L. Song Richardson, *Systemic Triage: Implicit Racial Bias in the Criminal Courtroom*, 126 YALE L.J. 862 (2017) (reviewing NICOLE VAN CLEVE, CROOK COUNTY: RACISM AND INJUSTICE IN AMERICA'S LARGEST CRIMINAL COURT (2016)) (discussing how awareness of implicit biases through education may help to reduce their influence on decisions).

[190] Tinianow & Long, *supra* note 35.

[191] H.B. 2417, 53rd Leg., 1st Reg. Sess. (Ariz. 2017).

more fundamental issues are resolved, the language around blockchain technology will continue to evolve. Thus, for the moment, the path of the blockchain lexicon is a winding and undefined one, and law must do its best to follow it.