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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 I, 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 II, 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 III, 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 (i) 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 (ii) the source of a blockchain record's "immutability" 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 IV, I suggest ways regulators can become better educated about blockchain technology, as is essential for them to responsibly govern or use the technology. I also recommend that regulators take a highly critical approach that (i) seeks to separate hype from reality; (ii) 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; (iii) includes diverse perspectives from proponents and critics of the technology, multiple disciplines, and from across the gender, race, geographic, and economic development spectrums; (iv) takes nothing, including descriptions of the technology itself, at face value, but deeply interrogates and scrutinizes the technology and its stated capabilities; and (v) 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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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 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 eyes."[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 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 policy makers[7] grappling with blockchain technology.

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[1] David J. Seipp, *Holmes' Path*, 77 B.U. L. REV. 515 (1997) at 515. Note that when Seipp made this claim in 1997, the *Boston University Review of Banking& Financial Law's* 2017 Fintech Symposium, held on February 27, 2017, had not yet occurred.

[2] *Id.* at 546-548.

[3] Gerald J. Postema, LEGAL PHILOSOPHY IN THE TWENTIETH CENTURY: THE COMMON LAW (2011). [Page 1 of Chapter 2, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1874112].

[4] Oliver Wendell Holmes, Jr., *The Path of the Law,* 10 HARV. L. REV. 457 (1897) at 997.

[5] *Id*. at 993.

[6] *Id.* at 997.

[7] In the remainder of this article, I use the term "regulators" as a shorthand for law makers, regulators, and other policy makers.

As many have discussed, regulators face numerous challenges in approaching blockchain technology,[8] whether in the world of finance or in the multiplicity of other social systems the technology is predicted to transform.[9] 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.[10] Blockchain technology, along with most of the fintech practices considered in this Symposium, certainly has generated this struggle for regulators.[11]

In this piece, 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 and deciding whether this technology is appropriate for their needs).[12] This 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.[13] 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 any regulation or regulatory guidance will be interpreted by courts in the future. However, it is also more broadly applicable to *any* regulators evaluating the technology (including those outside

[8] Commentators have offered a plethora of advice to regulators on when and how to regulate blockchain technology. *See, e.g.,* Kevin V. Tu & Michael Meredith, *Rethinking Virtual Currency Regulation in the Bitcoin Age,* 90 WASH. L. REV. 271 (2015); Carla L. Reyes, *Moving Beyond Bitcoin To An Endogenous Theory Of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 VILL. L. REV. 191 (2016).

[9] Blockchain technology, as a record-keeping technology, is predicted by its proponents to 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).

[10] 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?,* 2016, available at https://ssrn.com/abstract=2834531 (providing an overview of how innovative practices and technologies create regulatory challenges).

[11] *See, e.g.,* Oz Shy et al., Fed. Reserve Bank Bos., CAN ECASH & VIRTUAL CURRENCY COMPETE WITH OTHER ELECTRONIC PAYMENTS? 12 (2014) (stating that "[the l]ongstanding Federal Reserve position on virtual currency [was that] . . . regulators should be careful not to inhibit experimentation and growth of innovative payment technologies.").

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

[13] For an optimistic vision of how blockchain technology will transform the financial system, *see, e.g.,* WORLD ECONOMIC FORUM, THE FUTURE OF FINANCIAL INFRASTRUCTURE: AN AMBITIOUS LOOK AT HOW BLOCKCHAIN CAN RESHAPE FINANCIAL SERVICES (2016), http://www3.weforum.org/docs/WEF_The_future_of_financial_infrastructure.pdf.

the financial sector), as well as to groups considering implementing the technology in whatever domain.[14]

In Part I 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 II, I outline some of the problems this creates for regulators. To help crystallize the confusion potentially spawned by a fluctuating, contested vocabulary, in Part III, I analyze the use of a key term from blockchain technology ("immutable"). And in Part IV, I offer suggestions of ways regulators could mitigate the difficulties in understanding and assessing the risk and benefits of the technology.

I. 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 the lingo makes the point:

- Blockchain technology, sometimes called "the blockchain" or just "blockchain," is alternatively referred to as "distributed ledger technology" (DLT),[15] "shared ledger technology" (SLT),[16] "consensus ledger" technology,[17] or "mutual distributed ledger" technology,[18] or even a decentralized or "distributed database."[19]

- There are "public blockchains" (also called "permissionless blockchains" or "open blockchains") and "private blockchains" (also called "permissioned blockchains" or

[14] 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 some government systems. *See., e.g.,* Andrea Tinianow *et al*, *Delaware's 2017 Resolution: Make Blockchain a Reality* (Opinion), COINDESK, (January 3, 2017), available at http://www.coindesk.com/what-expect-delaware-blockchain-initiative-2017/ (visited April 12, 2017); Jonathan Keane, *Sweden Moves to Next Stage with Blockchain Land Registry*, COINDESK, (March 31, 2017), available at http://www.coindesk.com/sweden-moves-next-stage-blockchain-land-registry/ (visited April 12, 2017); Michael del Castillo, *Illinois Joins R3, Unveils Expansive Blockchain Support Plan*, CoinDesk, (March 16, 2017), available at http://www.coindesk.com/illinois-government-unveils-expansive-blockchain-industry-support-plan/ (visited April 11, 2017); *Dubai Launches Blockchain Strategy to Become Paperless by 2020*, GULF NEWS, (October 5, 2016), available at http://gulfnews.com/news/uae/government/dubai-launches-blockchain-strategy-to-become-paperless-by-2020-1.1907790 (visited April 12, 2017);

[15] *See, e.g.,* Andrea Pinna & Wiebe Ruttenberg, *Distributed ledger technologies in securities post-trading,* EUROPEAN CENTRAL BANK (April 2016) available at https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf.

[16] 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, (February 11, 2016), available at https://disruptiveviews.com/shared-ledger-technology-future-banks-1956/ (visited March 18, 2017).

[17] *See, e.g.,* Pinna & Ruttenberg, *supra* note 13, at 9.

[18] *See, e.g.,* Michael Mainelli & Alistair Milne, *The Impact and Potential of Blockchain on the Securities Transaction Lifecycle*, SWIFT INSTITUTE WORKING PAPER (May 9, 2016), available at https://ssrn.com/abstract=2777404 (referring to blockchain technology as "mutual distributed ledger" technology).

[19] *See, e.g.,* Sebastien Meunier, *Blockchain technology — a very special kind of Distributed Database* (Dec. 29, 2016), available at https://medium.com/@sbmeunier/blockchain-technology-a-very-special-kind-of-distributed-database-e63d00781118#.oywrg7q0r (visited Jan. 21, 2017) (providing a taxonomy of distributed database technology, including blockchain technology).

"closed blockchains").[20] (And, of course, one can substitute "DLTs" for "blockchains" throughout the preceding sentence.) There are also "restricted" and "unrestricted" DLTs.[21]

- There are various parties involved in operating these databases or ledgers, who are sometimes called "miners,"[22] and other times "nodes"[23] or "validators."[24] Of course, some of the nodes might be "partial" (as opposed to "full function"),[25] and some of the miners might be in a "mining pool."[26]

- There are "virtual currencies,"[27] "digital currencies,"[28] "central bank digital currencies"[29] (which may or may not use blockchain technology at some point), "cryptocurrencies,"[30] "tokens,"[31] "protocol tokens,"[32] "app tokens,"[33] "app coins,"[34] "alt coins,"[35], and "meta coins."[36]

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[20] *See, e.g.,* BITFURY GROUP & JEFF GARZIK, PUBLIC VERSUS PRIVATE BLOCKCHAINS: PART I: PERMISSIONED BLOCKCHAINS (2015), http://bitfury.com/content/4-white-papers-research/public-vs-private-pt1-1.pdf) (explaining permissioned and permissionless blockchains, and pros and cons of each); BITFURY GROUP & JEFF GARZIK, PUBLIC VERSUS PRIVATE BLOCKCHAINS: PART II: PERMISSIONLESS BLOCKCHAINS (2015), (same).

[21] *See, e.g.,* Pinna & Ruttenberg, *supra* note 13, at 11.

[22] *See, e.g.,* ANDREAS M. ANTONOPOULOS, MASTERING BITCOIN: UNLOCKING DIGITAL CRYPTOCURRENCIES 173-174 (2014).

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

[24] *See, e.g.,* Antony Lewis, *A gentle introduction to blockchain technology*, BITS ON BLOCKS (September 9, 2015), available at https://bitsonblocks.net/2015/09/09/a-gentle-introduction-to-blockchain-technology/ (visited March 20, 2017).

[25] *See, e.g.,* Marc Sel & Marleen Mouton, *Blockchain & its application in Financial Services*, PWC 2 (Nov. 2016), available at https://www.pwc.be/en/documents/20161122-blockchain-and-applications-financial-services.pdf (distinguishing partial nodes from full function nodes).

[26] *See, e.g.,* Antonopoulos, *supra* note 20, at 207-210.

[27] *See, e.g.,* Dong He *et al.*, *Virtual Currencies & Beyond: Initial Considerations*, IMF STAFF DISCUSSION NOTE, January 2016, available at https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf at 7.

[28] *See, e.g., id.* at 7-8.

[29] *See, e.g.,* Max Raskin & David Yermack, *Digital currencies, decentralized ledgers, and the future of central banking,* in Peter Conti-Brown & Rosa Lastra (eds.), Research Handbook on Central Banking, Edward Elgar Publishing, forthcoming 2017 (discussing the possibility of central bank digital currencies). (available on SSRN)

[30] *See, e.g.,* He, *supra* note 26, at 9.

[31] *See, e.g.,* Antony Lewis, *A gentle introduction to tokens*, BITS ON BLOCKS (September 28, 2015), available at https://bitsonblocks.net/2015/09/28/a-gentle-introduction-to-digital-tokens/ (visited March 22, 2017).

[32] *See, e.g.,* Will Warren, *The difference between App Coins and Protocol Tokens,* MEDIUM (February 2, 2017), available at https://medium.com/0x-project/the-difference-between-app-coins-and-protocol-tokens-7281a428348c#.gdpfgrh7y (visited March 19, 2017).

[33] *See, e.g., id.*

[34] *See, e.g., id.*

[35] *See, e.g.,* Peter Van Valkenburgh, *What are Forks, Alt-coins, Meta-coins, and Sidechains?,* COIN CENTER (Dec. 8, 2015), available at https://coincenter.org/entry/what-are-forks-alt-coins-meta-coins-and-sidechains) (visited Jan. 21, 2017) (explaining certain terminology and "technical concepts from the ever-changing universe of Bitcoin-derived innovations");

[36] *See, e.g., Id.*

- Whatever the technology is called, people say it is "immutable,"[37] "trustless"[38] and "secure."[39]

- And that's not even the half of it, as I'm leaving out reams of other problematic terms because I've made my point.

Many of the terms listed above refer to the same thing, or almost the same thing, or something closely related, or even something completely opposite. There are various language guides and explainers that have been produced by different parties within the space,[40] but the reality is that the terminology is very much evolving in the area.[41] At the moment, it would be

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[37] *See, e.g.,* Andrea Tinianow & Caitlyn Long, *Delaware Blockchain Initiative: Transforming the Foundational Infrastructure of Corporate Finance,* HARVARD LAW SCHOOL FORUM ON CORPORATE GOVERNANCE & FINANCIAL REGULATION, (March 16, 2017) ("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….Distributed ledgers are append-only databases that maintain a perfect, immutable audit trail of who did what and when they did it."); Marc Pilkington, *Blockchain Technology: Principles & Applications*, *Research Handbook on Digital Transformations,* eds. F. Xavier Olleros and Majlinda Zhegu *(*2016) (p. 15 of SSRN version) ("Immutability is a characteristic of blockchain technology."); *Blockchain and Financial Inclusion: the role blockchain technology can play in accelerating financial inclusion,* White Paper produced by the Chamber of Digital Commerce and the Center for Financial Markets & Policy at Georgetown University McDonough School of Business, p. 8 (March 2017), available at http://finpolicy.georgetown.edu/sites/finpolicy.georgetown.edu/files/Blockchain_and_Financial_Inclusion.pdf (visited April 1, 2017) ("The disruptive component of blockchain technology is that its core functionality depends on the creation of an immutable ledger…").

[38] *See, e.g.,* Sinclair Davidson *et al*, *Economics of Blockchain*, available at https://ssrn.com/abstract=2744751. ("blockchain technology is *trustless*") (original emphasis); Trent J. MacDonald *et al*, *Blockchains & the Boundaries of Self-Organized Economies*, Chapter in BANKING BEYOND BANKS & MONEY, Pablo Tasca, Tomaso Aste et al, eds. (p. 8 of SSRN version) (2016) ("blockchain technology is trustless, meaning that it does not require third party verification (i.e., trust)").

[39] *See, e.g.,* Ahmed Banafa, *A Secure Model of IOT with Blockchain*, MIT TECHNOLOGY REVIEW (Jan. 5, 2017), available at https://www.technologyreview.com/s/603298/a-secure-model-of-iot-with-blockchain/ (visited Mar. 31, 2017) ("Most important of all, it's secure. (referring to "blockchain")); Stuart Levi of Skadden Arps, *Blockchains Offer Revolutionary Potential in Fintech and Beyond*, Practitioner Insights Commentaries, 2017 WL 954702 (March 13, 2017) ("With blockchains, distributed ledgers provide the same benefits as a trusted third party, but in a far more efficient and secure manner.")

[40] *See, e.g.,* Peter Van Valkenburgh, *What are Forks, Alt-coins, Meta-coins, and Sidechains?,* COIN CENTER (Dec. 8, 2015), available at https://coincenter.org/entry/what-are-forks-alt-coins-meta-coins-and-sidechains) (visited Jan. 21, 2017) (explaining certain terminology and "technical concepts from the ever-changing universe of Bitcon-derived innovations"); Meunier, *supra* note 17 (providing a taxonomy of distributed database technology, including blockchain technology, and noting the contested definition of a blockchain).

[41] As Juri Mattila recently described it:

> [O]ne thing is quite clear: the terminology around the whole phenomenon [of blockchain technology] 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. As a result of all the hype and excitement, the development of the blockchain ecosystem is often perceived to progress so rapidly that in order to keep up, there is often a tendency to try to dive in too deep too quickly. Understandably, the big picture can remain blurry as a result.

difficult to provide a clear or uncontested definition of any of the terms above,[42] and recent conferences have included discussions of the unsettled terminology.[43]

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

- *Word Taint*. Certain terminology within the blockchain and cryptocurrency space has developed undesirable connotations, and people have introduced new terms to avoid the negative associations.[44] 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.[45] It was not socially acceptable for banks to use something associated with the underworld, so the term "blockchain technology" took hold, in some ways as a deliberate 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 "distributed ledger technology" (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 2009 with Bitcoin, and has been evolving ever since. Many new public blockchains have been created, as have

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Mattila, *The Blockchain Phenomenon: The Disruptive Potential of Distributed Consensus Architectures*, BERKELEY ROUNDTABLE OF THE INTERNATIONAL ECONOMY WORKING PAPER 2016-1 (undated), available at http://www.brie.berkeley.edu/wp-content/uploads/2015/02/Juri-Mattila-.pdf (visited March 22, 2017) at 3.

[42] *See* Colin Platt, *Thoughts on the taxonomy of blockchains & distributed ledger technologies*, MEDIUM (February 27, 2017), available at https://medium.com/@colin_/thoughts-on-the-taxonomy-of-blockchains-distributed-ledger-technologies-ecad1c819e28#.6gktvnu8k (visited March 10, 2017) (proposing a taxonomy of the different flavors of blockchain technology and distribute ledger technology); Nelson M. Rosario, *What's in a Name? From Bitcoin to Blockchain to Distributed Ledgers*, COINDESK (February 11, 2017), available at http://www.coindesk.com/whats-in-a-name-from-bitcoin-to-blockchain-to-distributed-ledgers/ (discussing the evolution of terminology in the world of blockchain technology). *Cf.* Peter Van Valkenburgh, *Does it matter that different government agencies define Bitcoin differently?,* COIN CENTER (Jan. 11, 2017), available at https://coincenter.org/entry/does-it-matter-that-different-government-agencies-define-bitcoin-differently (visited Jan. 21, 2017) (acknowledging that different government regulators have categorized Bitcoin differently (e.g., "virtual currency," "property," "commodity"), based on the activity the particular regulator governs).

[43] *CoinDesk*'s "Construct 2017" conference for blockchain software developers included a panel discussion on "Taxonomy & Lexicon Standards in Blockchain Tech." http://www.coindesk.com/events/construct-2017/agenda/ (visited Feb. 1, 2017) (noting that blockchain's "universe of verbiage is only becoming more and more complex and intimidating for newcomers to the space").

[44] The process of contamination and replacement of contaminated terms in common discourse is a familiar process for linguists, and is explored in Edna Andrews, *Cultural Sensitivity and Political Correctness: The Linguistic Problem of Naming*, AMERICAN SPEECH, Vol. 71, No. 4 (Winter 1996), pp. 389-404.

[45] Mark Walport, DISTRIBUTED LEDGER TECHNOLOGY: BEYOND BLOCK CHAIN (A REPORT BY THE UK GOVERNMENT CHIEF SCIENTIFIC ADVISOR), December 2015, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf, at 7 (stating that "[t]he first difficulty in communication [of blockchain technology's significance to policy makers and the public] is the strong association of block chain technology with Bitcoin…[, which] creates suspicion amongst citizens and government policymakers because of its association with criminal transactions and 'dark web' trading sites, such as the now defunct Silk Road") [hereinafter the "Walport Report").

many "private" ones.[46] Indeed, one of the biggest transformations that happened with blockchain technology once it was discovered by the financial sector was that the open network of transaction processors was eschewed for a private, trusted group of parties to maintain the list, under defined sets of terms and conditions.[47] This was a 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.[48] As variations to the technology have been created, new terms have been introduced to distinguish new from existing forms.[49] This is seen clearly with the creation of the terms "private blockchain," "closed blockchain" or "permissioned blockchain" to distinguish blockchains with known transaction validators from those with no restraints on joining the transaction validating network.

- *Cross-Field Communications*. Blockchain technology is incredibly interdisciplinary, and brings together fields such as software engineering, networks, distributed systems, cryptography, security, economics, finance, monetary theory, risk, law, philosophy, ethics, sociology, psychology, political science, archival and record-keeping studies, and no doubt others. Thus, people from disparate fields of expertise are often called to communicate with one another about the technology. The translation required to speak across fields can yield flawed understandings, and an attempt to use the vocabulary of one's own field to imperfectly express concepts from the original field.[50] For instance, though Bitcoin birthed the blockchain phenomenon, the word "ledger," now a common term to refer to the record created by blockchain software, does not appear in the original

[46] Ethereum and ZCash are examples of new public blockchains/cryptocurrencies. Private blockchains (or distributed ledgers) are being created at Digital Asset Holdings, Monax, and in consortia like R3 and Hyperledger.
[47] *See* Anna Irrera, *The public versus private debate on blockchain*, FN (Sept. 28, 2015), available at https://www.fnlondon.com/articles/blockchain-fintech-the-public-vs-private-debate-20151001, (visited Mar. 16, 2017) (noting that most experimentation with blockchain technology in the banking sector is of the permissioned variety).
[48] 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., id.*; Peter Van Valkenburgh, *Comments to the European Securities and Markets Authority on its Consultation on Distributed Ledger Technology Applied to Securities Markets* (Sept. 2, 2016) p. 2, available at https://coincenter.org/files/2016-09/coin-center-letter-to-esma.pdf (describing the differences in security and immutability provided by public and private blockchains); Vitalik Buterin, *Vitalik Buterin: On Public and Private Blockchains*, COINDESK (August 7, 2015), available at http://www.coindesk.com/vitalik-buterin-on-public-and-private-blockchains/ (describing the differences between public and private blockchains).
[49] *See, e.g.*, Tim Swanson, *A Brief History of R3: the Distributed Ledger Group*, GREAT WALL OF NUMBERS, February 27, 2017, available at http://www.ofnumbers.com/2017/02/27/a-brief-history-of-r3-the-distributed-ledger-group/ (visited March 10, 2017) (describing why R3 uses "distributed ledger" rather than "blockchain" to describe their technology).
[50] 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* L.J. Bracken & E.A. Oughton, *'What do you mean?' The importance of language in developing interdisciplinary research,* 31 TRANSACTIONS OF THE INSTITUTE OF BRITISH GEOGRAPHERS 371 (2006).

whitepaper that introduces and explains Bitcoin.[51] Rather, the term likely appeared as part of explaining the technology to non-technical people, analogizing the record created by the Bitcoin software to the more familiar concept of a ledger.

- *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. For instance, as "blockchain technology" and "DLT" increased in popularity over Bitcoin and cryptocurrencies, a number of startup companies changed both their names and their business models to move away from Bitcoin-based ones.[52] 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.[53]

- *Fixing Inaccuracies*. 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 "distributed ledger technology" or "shared ledger technology" more accurately describes these systems. Further, some argue that "validators" or "transaction processors" are more descriptive of the role played by computers within a blockchain network, rather than referring to them as "miners" as is common with cryptocurrencies like Bitcoin. I explore below how the term "immutable" may be misleading when used to describe all variations of blockchain technology.[54] And a debate over the meaning of "decentralized" is ongoing.[55]

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[51] *See* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, 2008, available at https://bitcoin.org/bitcoin.pdf (visited February 13, 2017).

[52] Among the companies that have changed names from a "Bitcoin" based name are Itbit (now Paxos), and BitReserve (now Uphold). Stan Higgins, *ItBit Rebrands as Paxos Amid Blockchain Pivot,* COINDESK, Sept. 14, 2016, available at http://www.coindesk.com/itbit-rebrands-paxos-amid-blockchain-pivot/ (visited Jan. 22, 2017); Johnathan Schieber, *Rebranding As Uphold, Bitreserve Says Goodbye To Bitcoin*, TECH CRUNCH, Oct. 14, 2015, available at https://techcrunch.com/2015/10/14/rebranding-as-uphold-bitreserve-says-goodbye-to-bitcoin/ (visited Feb. 1, 2017).

[53] Tim Swanson, *Chainwashing*, GREAT WALL OF NUMBERS (February 13, 2017), available at http://www.ofnumbers.com/2017/02/13/chainwashing/ (visited March 23, 2017).

[54] *See* Part III *infra.*

[55] Vitalik Buterin, *The Meaning of Decentralization*, MEDIUM (February 6, 2017), available at https://medium.com/@VitalikButerin/the-meaning-of-decentralization-a0c92b76a274#.oz2xb0yxx (visited February 6, 2017) (exploring the different meanings of "decentralization" with regard to blockchain technologies).

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

II. 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.[56] 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 II, I outline some of the particular challenges the unsettled terminology of blockchain technology poses for regulators. These include challenges in understanding the technology, identifying and distinguishing the different variants of the technology, and crafting precise language to regulate the technology, as well as the potential to create regulatory capture (and the risks that accompany it), inconsistent regulation across subject-matter domains and jurisdictions, and "perverse innovation."[57] 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 into blockchain technology appearing on regulators' radar screens, to follow the discussion and practices around the technology when its vocabulary is so malleable and potentially misleading. How would regulators (or anyone else) even know whether people are discussing the same topic or manifestation of technology, when people explain the technology, its risks, and potential benefits to one another in diverging terminologies? (This is assuming that regulators have the subject-matter expertise to deeply understand the complex nature of 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 inappropriate conflation of different forms of the technology through imprecise language.[58]

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[56] 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.

[57] *See* Dan Burk, *Perverse Innovation,* 58 WM. & MARY L. REV. 1 (2016) (describing innovative activities spawned by seeking loopholes in regulation as "perverse innovation").

[58] *See* Penny Crosman, *Blockchain misreads could set banks up for mistakes*, AMERICAN BANKER, March 14, 2017 (reporting that "vocabulary mix-ups are rampant," quoting security software executive Jay Wack as saying "Part of the market problem today is everyone does not have the same understanding of words;" and quoting Chris Skinner, chair of the Financial Services Club and well-known fintech influencer, as acknowledging that he had until

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.[59] If a regulator can't figure out what the facts are (or misunderstands them), it can't fully identify or quantify the risks posed by the technology, and is more likely to make a bad decision about whether and how to regulate. This means that regulators 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 IV.

Second, and related to difficulties in understanding the technology, are challenges in 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 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, a rapidly shifting terminology makes it more difficult for regulators themselves to communicate about blockchain technology, whether through reports, white papers, speeches, or regulation itself. How does one craft the definitions section of a regulation seeking to address blockchain technology when both words and the technology are still actively in flux? A meaning or terminology shift that occurs after regulation is crafted can result in a poor fit between the regulation and the practice it is regulating, which can end up undermining 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."[60] It also noted that "[t]his definition may need to be adapted in future if fundamental characteristics change."[61] 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

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recently conflated "distributed ledger technology" and "blockchain" until technology experts pointed out his error).

[59] *See* Mark Fenwick, Wulf A. Kaal & Erik P. Vermeulen, *Regulation Tomorrow: What Happens When Technology is Faster than the Law?* (September 4, 2016), U. of St. Thomas (Minnesota) Legal Studies Research Paper No. 16-23, available at https://ssrn.com/abstract=2834531.

[60] EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES 5 (2012) [hereinafter 2012 ECB PAPER], http://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf.

[61] *Id.*

institution, which, in some circumstances, can be used as an alternative to money."[62] 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 License,"[63] which now seems quite dated as companies using variants of the technology have been busy deleting "bit" from their names and "pivoting" to something new.[64]

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 regulation is written, perhaps a blockchain technology company could argue that the regulation is inapplicable to its variant of the technology, even though its technology flavor raises similar policy concerns.

For good reason, law and lawyers are deeply concerned with achieving accuracy and precision in the use of language,[65] and although law comes equipped with tools to interpret problematic language (think of the canons of statutory construction,[66] and rules for contract interpretation[67]), 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 lead to 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-regulate.[68] According to Andrew Baker, "[r]egulatory capture occurs when bureaucrats, regulators and politicians cease to serve some notion of a wider collective public

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[62] EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES: A FURTHER ANALYSIS 25 (2015) [hereinafter 2015 ECB PAPER], http://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemesen.pdf.

[63] *See, e.g.,* NEW YORK STATE DEPT. OF FINANCIAL SERVICES, *BitLicense Frequently Asked Questions*, available at http://www.dfs.ny.gov/legal/regulations/bitlicense_reg_framework_faq.htm (visited March 22, 2017).

[64] *See supra* note 51.

[65] Clarity in law allows those governed to understand the law, to accurately predict how to comply with the law, and to undertake useful cost-benefit analysis in determining 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.

[66] *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).

[67] *See* 11 Williston on Contracts § 31:1 (4th ed.).

[68] *See* Andrew Baker, *Restraining regulatory capture? Anglo-America, crisis politics and trajectories of change in global financial governance,* International Affairs 86: 3 (2010) 647–663 (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).

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."[69] 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.[70] 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 the financial sector blithely assembled complexity without truly understanding (or perhaps completely disregarding) what they were doing (or the potential implications of it).[71] 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 the new financial instruments and awed by the promise of new financial engineering to shift and spread risk efficiently."[72] 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 really, the rest of the world) have.[73]

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,[74] and who are now explaining the technology to current regulators and advocating

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[69] *Id.* at 648.

[70] 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 (October 2016), available at http://www.vanityfair.com/news/2016/09/elizabeth-holmes-theranos-exclusive (visited March 24, 2017).

[71] *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).

[72] *Id.* at 134.

[73] *See* Angela Walch, *Open Source Operational Risk: Should Public Blockchains Serve as Financial Market Infrastructures?,* Chapter in *HANDBOOK OF BLOCKCHAIN, DIGITAL FINANCE, AND INCLUSION, VOLUME 2: CHINATECH, MOBILE SECURITY, AND DISTRIBUTED LEDGER* (David Lee Kuo Chen & Robert Deng, Eds.), forthcoming 2017, available at https://ssrn.com/abstract=2879239, pp. 2-5 of SSRN version (discussing how blockchain technology is said to create reliability for regulators & the financial system).

[74] A few examples of this phenomenon include: a former chairman of the Securities & Exchange Commission (Arthur Levitt), a former Treasury Secretary (Lawrence Summers), a former Chair of the Federal Deposit Insurance Corporation (Sheila Bair), the former head of the New York Department of Financial Services and originator of the Bit License (Benjamin Lawsky), and a former commissioner of the Commodity Futures & Trading Commission (Mark Wetjen) are among the former regulators who have been involved with the blockchain technology industry. *See 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 (reporting that Arthur Levitt, former chairman of the Securities and Exchange Commission,

for its adoption in various settings.[75] 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, which increases the potential for them to be influenced by industry without adequately interrogating the technology and its implications.[76] 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,[77] all of which is a 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

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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 8, 2015, at B5 (reporting that Sheila Bair, former chairwoman of the Federal Deposit Insurance Corporation had been appointed a board member of ItBit, a Bitcoin exchange); Don Tapscott & Alex 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"); Digital Chamber of Commerce, About Us, https://digitalchamber.org/about/ (visited March 31, 2017) (listing Mark Wetjen, former commissioner of the CFTC 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").

[75] 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, e.g.,* ANAT ADMATI & MARTIN HELLWIG, THE BANKERS' NEW CLOTHES (2013) 204-205.

[76] Arthur Wilmarth has described the potential for cognitive capture of financial regulators by the financial sector:

> extensive 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." As James Kwak has explained, "'cultural capture' . . . operates through a set of shared but not explicitly stated understandings" leading to "regulatory actions that serve the ends of industry." Similarly, Willem Buiter has argued that "cognitive regulatory capture" occurs when regulators "internalis[e], as if by osmosis, the objectives, interests and perception of reality of the vested interest they are meant to regulate and supervise in the public interest." 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.

Arthur E. Wilmarth, Jr., *Turning a Blind Eye: Why Washington Keeps Giving In to Wall Street*, 81 U. CIN. L. REV. 1283 (2013) at 1417-1418 (citations omitted).

[77] *See* Victoria L. Lemieux, *Blockchain Technology for Recordkeeping: Help or Hype?*, (2016) Vol. 1, p. 7 (noting that "critical commentators online have received strong negative feedback from a blockchain technology "fan base"").

regulated parties, and could result in unintended stifling of innovation.[78] Finally, inconsistent regulation can spawn forum shopping and regulatory arbitrage, with regulated parties seeking to exploit differences in regulation across jurisdictions. With a technology that spans borders seamlessly (much like the Internet), actors in the blockchain space are likely to fall into many regulators' jurisdictions, making this problem more acute.

Third, regulating a technology with a rapidly shifting vocabulary can prompt regulated actors to tweak the technology to avoid regulatory burdens. Dan Burk has 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).[79] This may be a desirable outcome of regulation, but it can be undesirable as well if regulation sends the technology down a less fruitful path than it would otherwise have taken. (This is related 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 just delete the existing vocabulary around blockchain technology and start over, unencumbered by its "unnecessary confusion."[80]

III. THE MUTABLE MEANING OF "IMMUTABLE"

Thus far, I have pointed out the inconsistent terminology surrounding blockchain technology, and discussed, somewhat abstractly, how amorphous terminology can impact regulation of the technology. In this section, I focus on a single term associated with blockchain technology, 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. That term is *immutable.*

"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."[81] "Immutable" appears in various forms in the World Economic Forum's 2016

[78] This issue is familiar to cryptocurrency actors in the blockchain space, as it has arisen in the panoply of US 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 transmission regulators, as part of efforts to simplify the compliance burdens of virtual currency businesses that operate across the US. *See* Jerry Brito & Peter Van Valkenburgh, *State Digital Currency Principles and Framework,* COIN CENTER (March 8, 2017), available at https://coincenter.org/files/2017-03/statevirtualcurrencyprinciplesandframeworkv2.0.pdf.

[79] *See* Burk, *supra* note 55, at [ ]. Burk notes that this type of innovation can be beneficial at times, as well.

[80] *Supra* note 4, at 997.

[81] Pilkington, *supra*, note 36, at p. 15 of SSRN version. *See* Social Science Research Network, www.ssrn.com, (visited April 7, 2017).

report on blockchain's technology's role in future financial infrastructures,[82] Don and Alex Tapscotts' popular book on blockchain technology with glowing blurbs from Nobel Prize winners, prominent CEOs and renowned academics,[83] and the Federal Reserve's 2016 discussion paper on *Distributed ledger technology in payments, clearing, and settlement*,[84] among countless other places. Synonyms of "immutable," such as "permanent," "indelible," or "unchangeable," similarly appear everywhere.

As I have discussed elsewhere, the attribute of immutability is one of the primary selling features of blockchain technology.[85] Blockchain technology is at heart a record-keeping technology,[86] and it purports to enable the creation of permanent, unchangeable records.[87] This is said to be unlike anything humans have 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.[88] This is why so many see potential for blockchain technology to change systems from voting, to government benefits, health records, insurance, property records, and countless other systems. If

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[82] *See* WORLD ECONOMIC FORUM, *supra* note 12, at, *e.g.,* 21 (listing distributed ledger technology's potential use in "automated compliance" with benefits of "faster and more accurate reporting by automating compliance processes that draw on *immutable* data sources"), 25 (entitled "Distributed ledger technology will question the need for individual books of record through *immutable* and distributed record-keeping" and stating that "DLT provides transaction *immutability*, which is a key requirement for eliminating the need for an enforcer of trust in the ecosystem."), 43 (stating that automated compliance for financial institutions could be a DLT use case because "Storing financial information on the ledger provides *immutable*, real-time updates and facilitates automated review."), 55 (stating that "Reduced fraud: transparent and *immutable* data on DLT can reduce fraudulent transactions to a fraction of what they are today") (emphasis added throughout).

[83] *See* DON TAPSCOTT & ALEX TAPSCOTT, *supra* note 8, at, *e.g.,* 66 ("*immutable* time stamps"), 78 ("is an *immutable* record of everything truly desirable?"), 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. (Blurbs found before Table of Contents – unpaginated).

[84] https://www.federalreserve.gov/econresdata/feds/2016/files/2016095pap.pdf.

[85] *See supra* note 72, at 2-5. *See also Blockchain and Financial Inclusion: the role blockchain technology can play in accelerating financial inclusion, supra* note 36, at 8 ("The disruptive component of blockchain technology is that its core functionality depends on the creation of an immutable ledger…").

[86] Although blockchain technology has its roots in Bitcoin, a digital currency, it is the creation of the reliable record by the network that solves the "double spend" problem that had plagued prior forms of digital money. The reliable memorialization of who has which bitcoins enables the system of exchange to function, thus the record-keeping nature of the technology defines it.

[87] *But see*, Victoria L. Lemieux, *In Blockchain We Trust?: Blockchain Technology for Identity Management & Privacy Protection*, (2017) p. 4-5 (noting that "the persistence of entire blockchain networks is not guaranteed," and exploring issues this raises for record keeping done through blockchain technology) (working paper on file with author).

[88] *See, e.g.,* Christian Catalini & Joshua Gans, *Some Simple Economics of the Blockchain*, Working Paper available at [SSRN] (2016) (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).

we finally have certainty and permanency in our records, then 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 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?[89]

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

1) if one uses "immutable" according to its basic dictionary definition ("not capable of or susceptible to change"),[90] then real world events with 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;[91] and

2) the word "immutable" (or synonyms such as permanent, indelible, unchangeable) is generally used to describe all variations of blockchain technology (permissioned and permissionless, with various consensus mechanisms), 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" when the records created by both Bitcoin and Ethereum have each been changed at various times, and when they remain subject to 51% attacks. Bitcoin's blockchain forked into two separate ledgers in March 2013, requiring certain miners (the transaction processors of the network) to agree to move from one ledger to

[89] *Cf.* Noah Smith, *Statistical Significance Is Overrated*, BLOOMBERG VIEW, (April 13, 2017), available at https://www.bloomberg.com/view/articles/2017-04-13/statistical-significance-is-overrated (visited April 14, 2017) (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, (January 8, 2016), available at https://blog.oup.com/2016/01/investment-facts-from-flukes/?src=homepage (visited April 17, 2017).
[90] Merriam-Webster, April 11, 2017, https://www.merriam-webster.com/dictionary/immutable.
[91] *See infra* notes 91-92 and accompanying text.

the other to reunite in a single ledger.[92] 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. Thus, the abandoned ledger did not remain permanent or indelible as the people 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.[93] The result of the Ethereum revising its ledger was that the network split in two, as one contingent continued using the revised record, while another contingent continued using the original record. These real world events in public blockchains demonstrate at a minimum that it is problematic to describe "blockchain technology" as a whole as having the property of immutability, when at least some (and perhaps all?) blockchain records may be changed *if the people operating the blockchain decide to* (i.e., people can always override the technology, which is a strange fact to have to insist upon).

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% attack on the networks. A 51% attack could occur if a party or colluding group controlled at least 51% 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.[94] Because the cost of conducting such an attack would likely be very high, this risk is generally considered to be so low that it is virtually impossible. Describing the records of public blockchains as immutable embeds this risk analysis into the adjective describing the blockchain, similar to how mortgage-backed securities carried the adjective of "AAA."[95] 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 at 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 how Bitcoin is hard to change rather than absolutely unchangeable.[96] He still refers to Bitcoin's blockchain as immutable, however, because he says it represents the closest humanity has come to creating

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[92] *See* Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. Legis. & Pub. Pol'y 837, at 866, 873 (discussing Bitcoin's March 2013 hard fork and how developers and miners fixed it).

[93] For a succinct overview of the events surrounding the July 2016 Ethereum hard fork, see Kevin D. Werbach, *Trustless Trust*, 66-68, (2016), available at https://ssrn.com/abstract=2844409.

[94] *See* Walch, *supra* note 92, at 861-863 (describing Bitcoin's 51% attack risk and exploring reasons the risk is often dismissed).

[95] *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).

[96] *See* Andreas Antonopolous, *The Monument of Immutability*, Silicon Valley Bitcoin Meetup (Sept. 13, 2016) https://www.youtube.com/watch?v=h1SHF3YPrjM.

something truly immutable, and anything easier to change than Bitcoin has no claim to the word immutable.[97] 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 "secret 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,[98] and regulators who continue to state without qualification that blockchain technology creates immutable, permanent, unchangeable, indelible records.[99] This communication 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."[100]

The second conceptual problem with the use of "immutable" is that it is generally used to describe "blockchain technology" or "distributed ledger technology" 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[101] (immutability being the emergent property) 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

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[97] *See id.*

[98] I use Daniel Drezner's definition of "thought leader" in this article. "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." *See* Daniel W. Drezner, *Triumph of the Thought Leader…and the Eclipse of the Public Intellectual*, THE CHRONICLE OF HIGHER EDUCATION, (April 6, 2017) (describing how thought leaders are displacing public intellectuals in public discourse). Drezner's just-released book, THE IDEAS INDUSTRY, explores this phenomenon, its causes and implications in more depth.

[99] This is not a universal problem, as some commentators are careful to note that the immutability of blockchains is not absolute. *See e.g.*, Dave Birch, *Mutable & Immutable Blockchains*, Consult Hyperion's Tomorrow's Transactions, (September 26, 2016), available at http://www.chyp.com/mutable-and-immutable-blockchains/ (visited April 11, 2017) (describing "immutable" in the context of the Bitcoin blockchain as "theoretically mutable but not mutable under any practical circumstances that we can envisage"); Werbach, *supra* note 89, at 41 ("On the blockchain…it is impossible to alter a recorded value *if the system is functioning as intended*" (emphasis added)), 42 ("Blockchain trust is immutable in a probabilistic sense"); Jameson Lopp, *Bitcoin: The Trust Anchor in a Sea of Blockchains*, COINDESK (July 23, 2016), available at http://www.coindesk.com/bitcoin-the-trust-anchor-in-a-sea-of-blockchains/ (visited April 11, 2017) ("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.").

[100] *See generally* George Akerlof, *The Market for Lemons: Quality Uncertainty and the Market Mechanism*, 84 The Quarterly Journal of Economics 488 (1970).

[101] *See* Christopher W. Johnson, *What are Emergent Properties and How do They Affect the Engineering of Complex Systems?*, Reliability Engineering and System Safety, vol. 91, no. 12, pp. 1475–1481, 2005 (providing a history of theories of emergent properties of complex systems).

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. Many people love cake that is moist. If you bake cakes regularly, you know that many factors affect whether a cake turns out moist. The "ingredients used, the method of preparation, and the baking time and temperature" all impact whether a cake turns out to be moist.[102] 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 ingredients and actions – it is an *emergent property* of the complex system that is the baking process.

Similarly, immutability is a much desired emergent property of certain blockchain systems (or at least being "hard to change" is, per my earlier discussion). But the active debate on what creates immutability in blockchain systems shows that consensus has not yet been reached on this point. For instance, some argue that immutability comes from the use of the proof of work consensus mechanism that is used in the Bitcoin network to maintain the record.[103] Others say that immutability comes from the cryptography that is used (the hashing process).[104] Still others say it comes from chaining "blocks" of transactions together so that any changes will be evident.[105] 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 distributed ledger technology. Some systems allow anyone to be part of the transaction validation network, while others limit the group to certain trusted parties. Some systems use proof-of-work, while others use proof of

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[102] Better Homes & Gardens offers the following recommendations for making a cake turn out moist:

> - Make sure to follow the recipe, using the ingredients called for. Some cakes use milk, buttermilk, or sour cream for liquid. They all are appropriate for different types of cakes. Some cakes use vegetable oil, butter, or shortening for the fat. Make sure to use real butter and not a substitute when butter is called for, as substitutes contain water, which will not give the same tender crumb as the fat from the butter.
>
> - Make sure to follow the exact preparation steps in the recipe, following all beating times given. Some cakes are beaten with a mixer and some are stirred together. These will produce different cake textures.
>
> - Bake according to the time and temperature given in the recipe. Overbaking will cause a dry cake.
>
> http://www.bhg.com/recipes/how-to/bake/how-to-make-a-moist-cake/ (visited April 9, 2017).

[103] See Antonopoulos, *supra* note 92; Felipe de Oliveira Simoyama et al, *Triple entry ledgers with blockchain for auditing*, INT. J. AUDITING TECHNOLOGY (forthcoming 2017) p. 11 of draft ("The proof of work concept is an important feature of bitcoin, since it is what provides for immutability of records and timestamps.") (draft on file with author).

[104] *See* Antony Lewis, *A Gentle Introduction to Immutability of Blockchains*, BITS ON BLOCKS (February 29, 2016), available at https://bitsonblocks.net/2016/02/29/a-gentle-introduction-to-immutability-of-blockchains/ (visited March 20, 2017).

[105] *See id.*

stake, or a variety of other consensus mechanisms.[106] Further, a variety of cryptographic techniques are used,[107] and systems vary on whether they make the entire ledger publicly viewable (like Bitcoin), or limit visibility of the relevant entries to the parties involved (like R3's Corda).[108] 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, a recent computer science paper noted that "when blockchain technology is adapted from permissionless environments to permissioned environments the immutability of blockchain becomes questionable."[109] Despite this complexity and uncertainty, the bulk of the discourse around blockchain technology states simply, like the Pilkington piece, that "immutability is a characteristic of blockchain technology."[110] I suppose it is possible that any variety of the technology could yield the emergent property of immutability, but it seems highly unlikely, and is definitely not something that has been 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 actions related to blockchain technology (perhaps to protect its development or promote its use), and are potentially acting based on poor understanding and baking confusion into the law they are creating. For instance, in March 2017, the Arizona state legislature passed a statute defining signatures "secured through a blockchain" as electronic signatures,[111] and providing that "smart contracts may exist in commerce."[112] The statute's definition of "blockchain technology" is:

> "BLOCKCHAIN TECHNOLOGY" MEANS 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

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[106] *See generally* George Samman & Sigrid Seibold, *Consensus: Immutable agreement for the Internet of value*, KPMG White Paper (June 2016), available at https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/kpmg-blockchain-consensus-mechanism.pdf (visited April 8, 2017) (providing a survey of the variety of consensus mechanisms used by different forms of blockchain technology).

[107] *See* Joseph Chow, *Blockchain Underpinnings: Hashing*, CONSENSYS MEDIUM, (January 8, 2016), available at https://medium.com/@ConsenSys/blockchain-underpinnings-hashing-7f4746cbd66b, (visited April 11, 2017) (describing the role cryptographic hashing plays in blockchain technology, and the hashing functions used by different systems).

[108] *See* Richard Gendal Brown *et al, Corda: An Introduction*, R3 White Paper, (August 2016), 8, available at https://static1.squarespace.com/static/55f73743e4b051cfcc0b02cf/t/57bda2fdebbd1acc9c0309b2/1472045822585/corda-introductory-whitepaper-final.pdf ("[[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.")

[109] Nitesh Emmadi & Harika Narumanchi, *Reinforcing Immutability of Permissioned Blockchains with Keyless Signatures' Infrastructure*, ICDCN '17 Proceedings of the 18th International Conference on Distributed Computing and Networking (January 2017), p. 1-2 (describing how immutability of the ledger cannot be guaranteed in permissioned blockchains and proposing remedies to guarantee immutability in permissioned settings).

[110] Pilkington, *supra* note 36, at 15.

[111] https://legiscan.com/AZ/text/HB2417/id/1528949.

[112] https://legiscan.com/AZ/text/HB2417/id/1528949. (I confess that I am not sure what this means.)

> ECONOMICS OR TOKENLESS. THE DATA ON THE LEDGER IS PROTECTED WITH CRYPTOGRAPHY, IS *IMMUTABLE* AND AUDITABLE AND PROVIDES AN UNCENSORED TRUTH.[113]

Although there are numerous problems with this definition,[114] 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 (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 earlier, it is clear from events like the post-DAO 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. 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 legislature 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. As described earlier in this section, it is unresolved whether different variations of blockchain technology give rise to immutable records, and 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 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 law-makers involved were legislating without an understanding of the facts around 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, which 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[115] and in government record-keeping of all kinds, it is critical that regulators understand

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[113] https://legiscan.com/AZ/text/HB2417/id/1528949 (emphasis added).

[114] For instance, stating that "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.

[115] 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. For an overview, see Veele Colaert, *RegTech as a response to regulatory expansion in the financial sector*, (providing an

actual capabilities of the technology. The problematic usage of the term immutable makes it difficult to determine and evaluate the capabilities, and is just one example of how terminology problems around blockchain technology can prevent regulators from making the best decisions.

The term "immutable," with its varying and often 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."[116]

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

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. 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. Below, I suggest actions regulators can take to learn the facts about blockchain technology, many of which they are already doing. These actions, however, should go hand-in-hand with the mindset described in Part IV.B. below 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, such as consulting firms, academics, or companies operating in the industry. Regulators and legislative

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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." (March 2017), available at https://ssrn.com/abstract=2677116.

[116] Holmes, *supra* note 4, at 997.

bodies such as Congressional committees and the European Parliament have done this by holding hearings,[117] convening conferences or workshops,[118] seeking public comment,[119] creating advisory boards,[120] and inviting speakers to address their members.[121] Regulators have also been experimenting with blockchain technology to better understand it, often partnering with industry in these endeavors.[122]

Self-education is also a possibility, meaning that 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 "distributed ledger technology" internal team to

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[117] *See, e.g., Beyond Silk Road: Potential Risks, Threats, and Promises of Virtual Currency: Hearing Before the S. Comm. on Homeland Sec. and Governmental Affairs*, 113th Cong. 5 (available at www.hsgac.senate.gov/download/?id=4cd1ff12-312d-429f-aa41-1d77034ec5a8) (2013); Hearing on Virtual Currencies at the ECON Committee of the European Parliament, January 25, 2016, http://www.europarl.europa.eu/committees/en/econ/events-hearings.html?id=20160125CHE00081.

[118] *See, e.g.,* SEC Fintech Forum, November 14, 2016, https://www.sec.gov/spotlight/fintech (including discussions on blockchain technology); P2P Financial Systems Workshop at UCL, September 8-9, 2016, https://www.p2pfisy.com/about/ (including presentations on blockchain technology and sponsored by central banks from Germany, the United States, Canada, and the United Kingdom).

[119] *See, e.g.,* Financial Conduct Authority, *Discussion paper on distributed ledger technology*, (April 2017), available at https://www.fca.org.uk/publication/discussion/dp17-03.pdf (seeking input from the public on the following questions:

> • What new risks and opportunities does DLT present to our statutory objectives of market integrity, consumer protection and competition? Can DLT support more effective competition, financial system integrity and deliver better consumer outcomes? How can regulated firms mitigate any risks?
>
> • Do any of DLT's characteristics make it challenging to fit DLT solutions into the regulatory framework, despite our approach of 'technology neutrality'?).

[120] *See, e.g., IMF Managing Director Welcomes Establishment of High Level Advisory Group on FinTech*, IMF Press Release, (March 15, 2017), available at http://www.imf.org/en/News/Articles/2017/03/15/pr1784-imf-managing-director-welcomes-establishment-of-high-level-advisory-group-on-fintech (visited April 11, 2017) (reporting the creation of an advisory group to advise the International Monetary Fund on fintech issues, and including multiple members from the blockchain community, including, among others, Blythe Masters (CEO of Digital Asset Holdings), Alex Tapscott (co-author of BLOCKCHAIN REVOLUTION), and Marco Santori and Patrick Murck (both lawyers in the Fintech practice group at Cooley LLP).

[121] *See, e.g.,* http://www.imf.org/external/mmedia/view.aspx?vid=5160059156001 (Don Tapscott's speech on the blockchain at the IMF Annual Meeting, October 6, 2016); *Chamber of Digital Commerce Gathers at Federal Reserve Annual Meeting to Discuss Blockchain Technology*, (June 6, 2016), http://finance.yahoo.com/news/chamber-digital-commerce-gathers-federal-211345230.html (visited April 11, 2017) (reporting on presentations on blockchain technology by representatives of blockchain companies and the Chamber of Digital Commerce to governors of 90 central banks at the US Federal Reserve).

[122] *See, e.g.,* Rod Garratt, *CAD-Coin versus Fedcoin*, R3 REPORT, (April 5, 2017), available at https://www.r3cev.com/blog/2017/4/4/r3-report-cad-coin-versus-fedcoin , (reporting on Project Jasper, the Bank of Canada's distributed ledger technology experimental payments collaboration with R3 and other partners); Bank of England, *Fintech Accelerator Proof of Concept: PwC- Distributed Ledger Technology,* (June 17, 2016), available at http://www.bankofengland.co.uk/Documents/fintech/pwcpoc.pdf (reporting on the Bank of England's proof of concept work with consulting /accounting firm PwC on distributed ledger technology); Ian Allison, *Bank of England & China Merchants Bank Join Hyperledger Project*, INTERNATIONAL BUSINESS TIMES, (February 28, 2017), available at http://www.ibtimes.co.uk/bank-england-china-merchants-bank-join-hyperledger-project-1609011 (visited April 12, 2017) (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).

steer knowledge and experimentation.[123] However, the multidisciplinary nature of the technology makes its mastery challenging, as deeply understanding the technology requires knowledge of fields such as economics, computer science, law, finance, cryptography, and many more.

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.[124] Further, there are frequent reports that the number of people with true expertise in the topic is extremely limited.[125]

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. This can help to flush out misunderstandings, and there are many examples of this occurring already.[126]

However, discussions and collaborations can also spread misinformation and misunderstandings, and as well as generate herding behavior as regulators compete to appear as innovation-friendly as others to avoid stifling job creation in their jurisdictions.

3. Watch 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

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[123] *See, e.g.,* Terms of Reference: Task Force on Distributed Ledger Technologies, European Central Bank, (August 16, 2016), available at https://www.ecb.europa.eu/paym/initiatives/shared/docs/dlt_task_force_mandate.pdf (reporting on creation of task force by the European Central Bank to explore the implications of distributed ledger technologies); Stan Higgins, *EU Parliament Rep Seeks €1 million for Blockchain Research*, CoinDesk, (August 30, 2016), available at http://www.coindesk.com/eu-parliament-member-seeks-e1-million-blockchain-research/ (reporting on funding request for distributed ledger technology task force previously approved by European Parliament).

[124] *See* Kim S. Nash, *Blockchain Experts, a Rare Breed, May Demand Big Bucks*, WALL ST. J., May 12, 2016.

[125] *See* Michael del Castillo, *The Lack of Blockchain Talent is Becoming an Industry Concern*, COINDESK, (March 2, 2017), available at http://www.coindesk.com/blockchain-hiring-difficulties-becoming-industry-concern/ (visited April 12, 2017); Michael Scott, *The Blockchain Developer Shortage: Emerging Trends & Perspectives*, BITCOIN MAGAZINE, (October 31, 2016), available at https://bitcoinmagazine.com/articles/the-blockchain-developer-shortage-emerging-trends-and-perspectives-1477930838/ (visited April 12, 2017).

[126] *See, e.g.,* Financial Conduct Authority, *supra* note 109, at 8 (referring to collaboration to learn about distributed ledger technology between the UK'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 & EXCHANGES, (December 7, 2016), available at http://ecnandexchanges.banking-business-review.com/news/ecb-bank-of-japan-partner-for-distributed-ledger-technology-research-071216-5689953 (visited April 12, 2017) (reporting that the Bank of Japan and the European Central Bank have partnered to conduct distributed ledger technology research).

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.[127] These initiatives stimulate potentially affected parties to join the conversation, with the goal of shaping useful standards. Regulators should closely follow the work of standards bodies, but should also keep in mind that standards organizations themselves are not immune to politics among groups with diverging interests.[128]

There is also an initiative at the University of British Columbia's blockchain technology research center (Blockchain@UBC) to create a glossary of terminology around blockchain technology,[129] 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/social stability regulatory goals, so regulators can 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 in key parts of the financial system. Notably, the Depository Trust and Clearing Company (the DTCC) announced in January 2017 that it was putting derivatives on a blockchain (or distributed ledger, or who knows).[130] Industry may not wait until a stable

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[127] *See* Stan Higgins, *Australia to Lead International Blockchain Standards Effort,* COINDESK, September 15, 2016, available at http://www.coindesk.com/australia-lead-international-blockchain-standards-effort/ (visited February 6, 2017) (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).
http://www.standards.org.au/OurOrganisation/News/Documents/Australia%20to%20lead%20international%20blockchain%20standards%20committee.pdf. *See* https://www.w3.org/community/blockchain/ (W3C Blockchain Community Group); http://www.coindesk.com/w3c-events-industry-begins-long-road-blockchain-standards/; http://www.itu.int/en/ITU-T/Workshops-and-Seminars/201703/Pages/default.aspx (coverage of ITU workshop on blockchains and security in March 2017).

[128] *See* Craig N. Murphy & JoAnne Yates*,* THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION: GLOBAL GOVERNANCE THROUGH VOLUNTARY CONSENSUS (2009) (Chapter 2: Standards wars and the future of ISO); J.M. Porup, *A battle rages for the future of the Web*, ARS TECHNICA UK, Feb. 13, 2017, available at https://arstechnica.co.uk/information-technology/2017/02/future-of-the-www-timbl-drm/ (describing heated battle over DRM standards in W3C, the Internet's informal governing body).

[129] *See* Victoria Lemieux, *Blockchain Technology for Record Keeping: Help or Hype?*, October 2016, Appendix B: Blockchain Terminology (providing definitions of key terms associated with blockchain technology proposed to be incorporated into existing archival InterPARES Trust Terminology Database). ("InterPARES Trust Terminology Project: Key Blockchain Terms and Definitions" (InterPARES Trust, 2017).]

[130] Nathaniel Popper, *Wall Street Clearinghouse to Adopt Bitcoin Technology*, N.Y. TIMES, Jan. 9, 2017 (reporting that the D.T.C.C., America's primary clearinghouse, would be developing a permissioned distributed ledger to manage derivatives trading).

technology or terminology emerges before using the technology in important ways. So, consumers and financial stability may be put at risk before the technology or its vocabulary gets nailed down.

Regulators around the globe have been looking for creative ways to enable safe technological experimentation in "fintech" (including blockchain technology), and the latest trend is to create "regulatory sandboxes."[131] 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 still protecting consumers in certain specified ways.[132] Each sandbox is slightly different, and each are in different phases of rollout or discussion,[133] 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. CFTC Acting Chair Christopher Giancarlo has advocated the creation of a regulatory sandbox in the US so that the US does not lose ground to countries more willing to allow experimentation with the technology.[134] 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, among others.[135]

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

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[131] *See* Herbert Smith Freehills, *Hong Kong Launches Regulatory Sandbox in Wake of Developments in Australia, Malaysia, Singapore, and the UK*, Sept. 30, 2016, available at http://sites.herbertsmithfreehills.vuturevx.com/103/12430/landing-pages/2016.09.30-apac-fintech-briefing.pdf (visited February 13, 2017) (providing overview of regulatory sandbox initiatives around the world). The Financial Conduct Authority (FCA) of the United Kingdom pioneered the "regulatory sandbox" concept in 2015, and launched its first cohort of companies into the sandbox in 2016. The FCA has compiled relevant information about the sandbox concept and status at https://www.fca.org.uk/firms/project-innovate-innovation-hub/regulatory-sandbox (visited February 13, 2017).

[132] *See Herbert Smith Freehills, supra* note 56.

[133] *See id*.; https://www.fca.org.uk/firms/project-innovate-innovation-hub/regulatory-sandbox (describing Singapore's regulatory sandbox for fintech companies); http://www.conventuslaw.com/report/australia-asic-issues-sandbox-framework-including/ (describing Australia's regulatory sandbox for fintech companies).

[134] *See* J. Christopher Giancarlo, *CFTC's Giancarlo: How US Regulators Can Boost Blockchain in 2017*, Opinion, CoinDesk, December 16, 2016, available at http://www.coindesk.com/cftcs-giancarlo-how-regulators-can-boost-blockchain-2017/.

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

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 IV.A above, 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. In this section, I offer 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 about 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, as my discussion of "immutable" suggests, 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 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 can ripple through the field, making an imprecise or inaccurate statement extremely hard to remove from discourse, as other work builds on it and cites it as if true.[136] 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,[137] when, according to Estonian officials and historic records, that is untrue.[138]

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[136] The struggle to ferret 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.

[137] *See, e.g.,* Don Tapscott's speech to the IMF (at the 42 minute mark, "Estonia showing the way forward with the blockchain-based identity"); Michael Mainelli, *Blockchain Will Help Us Prove Our Identities in a Digital World*, HARVARD BUSINESS REVIEW, (March 16, 2017), available at https://hbr.org/2017/03/blockchain-will-help-us-prove-our-identities-in-a-digital-world (visited April 10, 2017) (stating that "since 2007 Estonia has been operating a universal national digital identity scheme using blockchain); Dave Birch, *House of Blockchain*, CONSULT HYPERION'S

Thus, regulators should be alert to the potential for terminology confusion to disguise hype in their quest for the facts about blockchain technology.

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 for it to be widely adopted, including by governments. Over the past several years, lobbying groups (the Chamber of Digital Commerce and the Global Blockchain Business Council),[139] a think tank / advocacy organization with blockchain industry funding (Coin Center),[140] and a Congressional Blockchain Caucus focused on pushing the technology forward,

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TOMORROW'S TRANSACTIONS, (December 7, 2016), available at http://www.chyp.com/house-of-blockchain/ (visited April 10, 2017) (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).

[138] *See* Dave Birch, *Estonia, fake news and digital identity,* CONSULT HYPERION'S TOMORROW'S TRANSACTIONS, (March 20, 2017), available at http://www.chyp.com/estonia-fake-news-and-digital-identity/ (visited April 10, 2017) (debunking the "urban legend" that Estonia's digital identity system uses a blockchain).

[139] The Chamber of Digital Commerce's "About Us" section states:

> 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.

http://www.digitalchamber.org/about.html (visited Feb. 1, 2017).

The Global Blockchain Business Council's "About" section states:

> "The Global Blockchain Business Council (GBBC) brings together the world's leading businesses and business leaders to highlight the latest innovations and advances in Blockchain technology. 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."

http://gbbcouncil.org/ (visited April 12, 2017).

[140] 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." 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). *See* Jerry Brito, *Coin Center raises $1 million for 2017 operations, announces new*

have formed,[141] and regulators need to be sensitive to how the goals and incentives of these parties may shape the information and recommendations they provide. The Chamber of Digital Commerce and Coin Center have been active in educating regulators and policy makers through mediums such as conferences, meetings, reports and white papers, op-eds, and proposed legislation.[142] 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.

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 who have developed blockchain technology advising practices, and many, many thought leaders through an extremely active conference scene[143] as well as direct consultation. 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 (gasp) academics can be conflicted by relationships with industry or others, a desire for the spotlight, or the source of their research funding.)

In evaluating a source, one also looks for signals of legitimacy and authority, such as an association with a known and respected institution. This is complicated in the blockchain space, however, in part because a combination of 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.[144] 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. This makes the other suggestions I provide in this Section IV.B more important.

3. Seek Diverse Perspectives

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supporters, COIN CENTER, (February 21, 2017), available at https://coincenter.org/entry/coin-center-raises-1-million-for-2017-operations-announces-new-supporters (visited April 12, 2017).

[141] Olga Kharif, *New Congressional Caucus Seeks Favorable Laws for Blockchain*, BLOOMBERG, September 26, 2016, available at https://www.bloomberg.com/news/articles/2016-09-26/new-congressional-caucus-seeks-favorable-laws-for-blockchain (visited February 6, 2017) (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), Rep. David Schweikert has joined the Blockchain Caucus. *See* Neeraj Agrawal, *Congressional Blockchain Caucus kicks off*, COIN CENTER, (February 1, 2017) (stating that Coin Center hosted a reception for the Congressional Blockchain Caucus).

[142] For examples, see the websites of the Digital Chamber of Commerce (https://digitalchamber.org) and Coin Center (www.coincenter.org).

[143] 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 http://www.coindesk.com/bitcoin-events/, which shows 9 Bitcoin or blockchain events scheduled for May 2017 alone (visited April 12, 2017).

[144] *See, e.g., supra* note 37; Mainelli, *supra* note 133 (stating in the HARVARD BUSINESS REVIEW that Estonia's digital identity system uses a blockchain).

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 diversity, 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 between on 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.[145]

Additional types of diversity can also be helpful. I have called before for the inclusion of multiple disciplines to be involved in the evaluation and development of blockchain technology, given its foundational and interdisciplinary nature.[146] Insights about the technology's risks and benefits can come from any of these disciplines, so regulators cannot just focus on learning from technical experts on the technology. 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.[147]

Diversity here can also mean gender, ethnic, economic, geographic, and other forms of diversity. The technology and finance worlds are known to be dominated by men and to be predominantly white.[148] This is often the case in the blockchain space as well, as a look at most

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

[146] *See* Angela Walch, *Position Statement*, W3C Blockchain and the Web Workshop, (June 30, 2016), available at https://www.w3.org/2016/04/blockchain-workshop/interest/walch.html (visited April 14, 2017).

[147] *See supra* discussion of "Cross-Field Communications" in Part I.

[148] *See, e.g.,* David Beede et al, *Women in STEM: A Gender Gap to Innovation*, U.S. Dept. of Commerce Economics & Statistics Administration, at 1 (August 2011), available at http://www.esa.doc.gov/sites/default/files/womeninstemagaptoinnovation8311.pdf ("women 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"); Silicon Valley Bank, *US Startup Outlook 2017*, at 12, undated, early 2017, available at https://www.svb.com/uploadedFiles/Content/Trends_and_Insights/Reports/Startup_Outlook_Report/US%20Startup%20Outlook%20Report%202017.pdf ("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."); *Women in Financial Services 2016*, OLIVER WYMAN at 6 (2016), available at file:///C:/Users/Angela/Downloads/WomenInFinancialServices_2016.pdf ("Female representation is growing on financial services Boards (20 percent in 2016) and Executive Committees (16 percent in 2016), but progress is slow. At current rates of growth, financial services globally will not reach even 30 percent female Executive Committee representation until 2048."); Liana Christin Landivar, *Disparities in STEM Employment by Sex, Race & Hispanic Origin*, U.S. CENSUS BUREAU AMERICAN COMMUNITY SURVEY REPORTS, at 19 (September 2013), available at https://www.census.gov/prod/2013pubs/acs-24.pdf ("Black and Hispanic workers are underrepresented in STEM occupations."; *Diversity Management: Trends and Practices in the Financial Services*

conference panels and advisory boards reveals.[149] 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 on their own, but they should not carry all the water on providing critique. 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.[150]

4. *Doubt Everything and Trust No One (Timeo Thought Leaders et dona ferentes[151])*

Regulators should approach all of their education 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 we have with blockchain technology. As discussed in Part II above, 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.[152] With blockchain technology, 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.[153]

Industry and Agencies after the Recent Financial Crisis, GAO Report, (April 2013), available at http://www.gao.gov/assets/660/653814.pdf (reporting on the underrepresentation of women and minorities in the financial services industry).

[149] *See, e.g., IMF Managing Director Welcomes Establishment of High Level Advisory Group on FinTech*, *supra* note 120 (listing the 14 members of the IMF's High Level Advisory Group on Fintech, of who 2 are women); *Consensus 2017 Speakers*, CoinDesk, available at http://www.coindesk.com/events/consensus-2017/speakers/ (visited April 20, 2017) (listing 99 speakers for the premier industry blockchain technology conference, of whom 12 are women).

[150] *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).

[151] 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.

[152] *See supra* notes 68-77 and accompanying text.

[153] Gerding makes a similar argument regarding complex risk models and financial products:

> [L]aw must not defer to [complex risk models and financial products]…uncritically. Regulators cannot outsource oversight--whether over consumer lending or over risks posed to financial institutions and global capital markets--to risk models and other codes without thoroughly and continuously auditing… [them]. Second, this 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 67, at 186.

Further, regulators should be vigilant for errors and oversimplified language in even academic works that they read about blockchain technology. Many academic and industry works contain terminology conflating different variations of the technology or misstating its features. As people read and cite these earlier works, the errors are compounded and misstatements become embedded as facts. Taking the single example of "immutable," 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 (sorry).

Thus, in their education process on blockchain technology, regulators cannot skip steps. By this I mean that they cannot skip ahead to analyzing only the *implications* of the technology, treating the capabilities of the technology as proven. Regulators and policy makers 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.[154] Again, this is analogous to the steps that were skipped in the analysis of mortgage-backed securities and credit default swaps – 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?[155]

The fun part of the analysis of any new practice or technology is thinking about the "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.[156] 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 on which to make decisions, enabling sounder decisions and preventing things

[154] 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 92, at 883-885.

[155] *See, e.g.,* Alan Greenspan, Chairman Fed. Reserve, Risk Transfer and Financial Stability: Remarks by Chairman Alan Greenspan to the Federal Reserve Bank of Chicago's Forty-first Annual Conference on Bank Structure (May 5, 2005), available at http:// www.federalreserve.gov/Boarddocs/Speeches/2005/20050505/default.htm. ("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 which seems to have persisted. Derivatives have permitted the unbundling of financial risks. Because risks can be unbundled, individual financial instruments now can be analyzed in terms of their common underlying risk factors, and risks can be managed on a portfolio basis. Partly because of the proposed Basel II capital requirements, the sophisticated risk-management approaches that derivatives have facilitated are being employed more widely and systematically in the banking and financial services industries.") Greenspan also described some of the risks of credit derivatives in this speech.

[156] *See* Drezner, *supra* note 98 (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.)

like Lehman Brothers' collapse from happening. 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 just 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 the understanding that (any form) of blockchain technology creates a golden record "by collaboration, by cryptography and by some clever code."[157]

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

Regulators are not immune to peer pressure, more scientifically referred to as "herd behavior."[158] In the current climate, many (regulators and others) may feel compelled to praise or use blockchain technology simply because others are doing it. If regulators or policy makers 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 look 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 herding behavior,[159] 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 IV.A, they do risk triggering "thoughtless herd behavior."[160] 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

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[157] Don Tapscott, TED Talk, *How the blockchain is changing money and business*, (at 4:56) available at https://www.ted.com/talks/don_tapscott_how_the_blockchain_is_changing_money_and_business?language=en (received over 1.6 million views from August 2016 through April 21, 2017).

[158] *See* Heshan Sun, *A Longitudinal Study of Herd Behavior in the Adoption and Continued Use of Technology*, MIS Quarterly Vol. 37 No. 4, pp. 1013-1041/December 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" p. 1014) (citations omitted).

[159] *See* Sun, *supra* note 158, 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.")

[160] *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).

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 always popular."[161] 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 IV undoubtedly slows things down, as regulators have to build their understanding of the technology and its implications from the ground up, as it were. Through their learnings 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, as opposed to spending time to collect diverse opinions and interrogate 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,[162] but a detailed discussion of these approaches and their merits is outside the scope of this paper.

V. CONCLUDING THOUGHTS

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

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

[162] *See, e.g.,* Lin, *supra* note 160, at 619-620 (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*, chapter in Perspectives in Law, Business & Innovation, Mark Fenwick, Wulf A. Kaal, Toshiyuki Kono & Erik P.M. Vermeulen eds., Springer (2016) (surveying the proposals made of how to regulate fast-moving innovations and proposing dynamic regulation for innovation).

how they can result in misunderstandings, will improve the situation, much as awareness of cognitive biases may reduce their impact on decision-making.[163]

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 (money, fame, power, etc.) 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."[164] As the Arizona statute claims, the data on it "provides an uncensored truth."[165] Yet the truths about the technology and its capabilities remain unclear and contested because they are still in flux and hidden 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 more fundamental issues are resolved, the language around blockchain technology will continue to move. 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.

[163] *See, e.g.,* L. Song Richardson, *Systemic Triage: Implicit Racial Bias in the Criminal Courtroom*, 126 YALE L.J. 862 (2017) (review of 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).
[164] Tinianow & Long, *supra* note 37.
[165] Arizona statute, *supra* note 113.