

AUTONOMOUS BUSINESS REALITY

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Society tends to expect technology to do more than it can actually achieve, at a faster pace than it can actually move. The resulting hype cycle infects all forms of discourse around technology. Unfortunately, the discourse on law and technology is no exception to this rule. The resulting discussion is often characterized by two or more positions at opposite ends of the spectrum, such that participants in the discussion speak past each other, rather than to each other. The rich context that sits in the middle ground goes disregarded altogether. This dynamic most recently surfaced in the legal literature regarding autonomous businesses. This Article seeks to fill the gap in the current discussion by creating a taxonomy of autonomous businesses and using that taxonomy to demonstrate that automation, standing alone, is not what makes autonomous businesses exceptional. Rather, the capacity of autonomous businesses to make radical governance changes more prevalent in the market pushes the boundaries of current choice of entity and governance paradigms while also illuminating low-technology functional equivalents that may offer more traditional businesses a path to governance reform.

To make these claims, this Article begins in Part I by briefly introducing the two emerging technologies that enable business automation. Part II reviews the existing literature and argues that by focusing on only one specific segment of the current autonomous business landscape, the literature misses key opportunities to evolve business law. Part III builds a map of existing autonomous businesses, demonstrating the differences among them and explaining them as a function of design trade-offs. Part III then uses that map to build a taxonomy of autonomous businesses and offers a framework for considering the broader impacts of

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autonomous businesses on law. Part IV examines ways that autonomous business reality may incentivize reforms in traditional corporations while simultaneously emphasizing the need for continued research and innovation in choice of business entity, organizational governance, and regulatory compliance.

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INTRODUCTION

U.S. public companies frequently ask shareholders to make certain decisions via vote.¹ To facilitate the voting process and accurately tabulate the votes cast, U.S. corporate governance embraced a complex system known as the “proxy

¹ Anne Sheehan & John C. Coates, *Proxy Plumbing Recommendation*, HARV. L. SCH. F. ON CORP. GOVERNANCE (Sept. 10, 2019), <https://corpgov.law.harvard.edu/2019/09/10/proxy-plumbing-recommendation/> [perma.cc/8BTH-XHWG] (“Over 600 billion shares are voted every year at more than 13,000 shareholder meetings, including more than 3,000 at SEC-registered operating companies.”).

system.”² The primary goal of the proxy system lies in providing “accurate, timely and cost-effective vote counts” in a transparent and accessible manner that reduces fraud and increases informed voting.³ Unfortunately, many agree that systemic problems in the proxy system prevent it from achieving this goal.⁴ Specifically, shareholders,⁵ c-suite executives,⁶ regulators,⁷ judges,⁸ and academics all lament the various ways the proxy system lacks accuracy and transparency.⁹ Although the technology exists (and has existed for quite some time) to make the proxy system more efficient, no system-wide upgrades have been undertaken.¹⁰ Some view the failure to technologically upgrade the proxy system as a misalignment of incentives, and argue that absent some form of legislative or regulatory intervention, the difficulties now inherent in the proxy system will continue unabated.¹¹

Meanwhile, companies willing to experiment with emerging technologies are quietly testing systems built on blockchain technology and artificial intelligence that promise to radically improve the proxy system.¹² Although some quickly dismiss the notion that applications of blockchain technology can

² *Id.* (“Shareholders typically vote via agents known as proxies, subject to oversight and regulation by the Securities and Exchange Commission (SEC). As described in the overview in Annex A, shares are commonly owned in ‘stacks’ or chains of contracts through intermediaries or agents such as custodians, broker-dealers, banks, and transfer agents, many of which are regulated by the SEC. Many participants outsource some or all aspects of voting to third parties. The overall system of voting, proxies, intermediation, and third-party services will be referred to in this recommendation as the ‘proxy system.’”).

³ *Id.*

⁴ *See, e.g., id.*; Henry T. C. Hu & Bernard Black, *Empty Voting and Hidden (Morphable) Ownership: Taxonomy, Implications, and Reforms*, 61 BUS. LAW. (ABA) 1011, 1014 (2006); Lucian A. Bebchuk, *The Myth of the Shareholder Franchise*, 93 VA. L. REV. 675, 682 (2007); Paul Rose, *The Corporate Governance Industry*, 32 J. CORP. L. 887, 906 (2007).

⁵ Sheehan & Coates, *supra* note 1, at n.6 (relating testimony from Ken Bertsch of the Council of Institutional Investors that “[t]he current system of proxy voting is fraught with inefficiencies and a too-large margin for error.”).

⁶ U.S. SEC. & EXCH. COMM’N, *ROUNDTABLE ON THE PROXY PROCESS* 43–46 (2018) (relating testimony from Bob Schiffelite, CEO of Broadridge and Paul Conn, CEO of Computershare testifying about the need for stronger vote confirmation requirements).

⁷ *Id.* at 20, 22, 32–37.

⁸ *See, e.g., In re Dole Food Co., Stockholder Litig.*, C.A. No. 8703-VCL, 2017 WL 624843, at *4 n.1 (Del. Ch. Feb. 15, 2017).

⁹ *See* Hu & Black, *supra* note 4; Bebchuk, *supra* note 4; Rose, *supra* note 4.

¹⁰ Sheehan & Coates, *supra* note 1 (“Many observers of the proxy system see a potential path toward comprehensive reform in the form of improved technologies. . . . It should be noted, however, that the basic technologies necessary for tracking shares and votes—essentially a spreadsheet plus electronic communication—have been available for decades.”).

¹¹ *Id.* (“Rather than technological impediments, it is incentives and private interests (as affected by existing regulation), coupled with the externalities of networks, which have prevented moving the U.S. proxy system onto a single, reformed technological platform.”).

¹² *See Preferred Blockchain*, SECURITIZE, <https://www.securitize.io/product/blockchain> [https://perma.cc/66S6-RDJ9].

improve the regulation and functioning of capital markets,¹³ most such commentators focus their attention on either the problematic aspects of public blockchain protocols¹⁴ or the weakness of certain permissioned systems.¹⁵ This singular focus on a binary divide between public blockchain protocols and permissioned systems ignores industry reality, where some of the leading solutions operate as protocol-agnostic middleware.¹⁶ Indeed, the discussion about technologically remodeling the proxy system represents just one area in which literature at the intersection of business law and technology ignores industry's current state of the art. For example, in the broader discussion of corporate governance reforms, scholars generally consider either low-technology governance reforms, or technology's ability to disrupt traditional business structures and governance mechanisms,¹⁷ and only rarely do scholars consider both.¹⁸ In other words, the existing academic discourse fails to adequately consider the ways in which technology and law might work together to innovate in the realms of business entity structure and corporate governance.

Part of this failure to consider the full, rich tapestry of technological innovation stems from the age-old difficulty of separating hype from fiction before investigating the intersection of law and technology. For example, literature at the intersection of law and technology often forecasts the trajectory of technology in order to consider whether existing law can deal with coming societal changes.¹⁹

¹³ See, e.g., Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 837, 842, 848–55 (2015).

¹⁴ *Id.* at 844, 869–874.

¹⁵ See, e.g., Jeff John Roberts, *JP Morgan Alums Launch 'Blockchain as a Service' on AWS*, FORTUNE (Jan. 23, 2019, 6:00 AM), <https://fortune.com/2019/01/23/blockchain-aws-kadena/> [<https://perma.cc/Q7YR-P6PG>]; Park Bramhall, *Blockchain Isn't Always the Solution (or Why Tokenizing Equity Securities Is Not the Answer to the Proxy Voting Problem)* 1, 3–4 (June 19, 2019) (unpublished manuscript), <https://papers.ssrn.com/abstract=3393774> [perma.cc/cBB2W-72UZ].

¹⁶ See, e.g., *Preferred Blockchain*, *supra* note 12.

¹⁷ See, e.g., Wulf A. Kaal & Samuel Evans, *Blockchain-Based Securities Offerings*, 20 U.C. DAVIS BUS. L.J. 89, 89, 92, 96–98 (2019); Wulf A. Kaal, *Blockchain-Based Corporate Governance*, 4 STAN. J. BLOCKCHAIN L. & POL'Y 3, 5–7 (2020) [hereinafter Kaal, *Blockchain-Based Corporate Governance*]; Wulf A. Kaal, *Blockchain Solutions for Agency Problems in Corporate Governance*, in ECONOMIC INFORMATION TO FACILITATE DECISION MAKING (Kashi R. Balachandran ed., 2019); Alexandra Andhov, *Corporations on Blockchain: Opportunities & Challenges*, 53 CORNELL INT'L L.J. (forthcoming 2021) (manuscript at 1, 29, 31–32) (on file with author).

¹⁸ For exceptions that do consider how law and technology can work together for positive reform, see George S. Geis, *Traceable Shares and Corporate Law*, 113 NW. U. L. REV. 227, 227–31, 267–76 (2018); Federico Panisi et al., *Blockchain and Public Companies: A Revolution in Share Ownership Transparency, Proxy Voting and Corporate Governance?*, 2 STAN. J. BLOCKCHAIN L. & POL'Y 189, 202–03, 216–18 (2019).

¹⁹ See, e.g., Anthony J. Casey & Anthony Niblett, *The Death of Rules and Standards*, 92 IND. L.J. 1401, 1403–05, 1407, 1410–17 (2017); Frank Pasquale, *A Rule of Persons, Not Machines: The Limits of Legal Automation*, 87 GEO. WASH. L. REV. 1, 17–18, 22–25, 29–31, 44, 49–51, 54–55 (2019).

Of course, it is also common for entrepreneurs building the technology to tout their advances in bold terms for marketing purposes.²⁰ Sensationalism related to the capacity of emerging technology runs wide and deep. Reality lies somewhere in the gap between entrepreneurial visions of tech-utopia and legal visions of powerful data-overlords wreaking havoc on democratic society. For so long as reality lives in this gap, it remains hidden from systematic investigation by legal academics. Why does the gap persist? It is, quite simply, difficult to map out the current landscape of emerging technology usage, and even harder to do so before the landscape changes.²¹

By allowing the lacuna in the literature to persist, legal scholarship foregoes key discussions and misses pivotal opportunities to shape the interplay between law and technology. In the literature on business law and autonomous technologies (including blockchain technology and artificial intelligence), for example, U.S. legal scholars inquired for several years whether and how fully autonomous businesses could become formally recognized legal entities.²² Meanwhile, one

²⁰ For an infamous example, consider the story told by Slock.it, the software development team behind the decentralized venture capital firm known as “The DAO,” see *infra* notes 197–208 and accompanying text, which boldly proclaimed (roughly paraphrasing) that “The DAO is code, and the code is the contract.” See also Will Dunn, *The Rise and Fall of The DAO, the First Code-Based Company*, NEW STATESMAN TECH (July 22, 2016), <https://tech.newstatesman.com/feature/dao-code-based-company> [perma.cc/GK5K-T3AG].

²¹ Indeed, the rich complexity of reality holds lessons for legal scholars in a variety of fields, even though reality in those fields often goes unexplored. See, e.g., Elizabeth Pollman, *Corporate Disobedience*, 68 DUKE L.J. 709, 716 (2019) (“This Article aims to shed light on the broad spectrum of corporate disobedience to show the true complexity of this activity and to suggest that, to the extent that innovation or legal change can benefit society, some corporate disobedience could at least have the potential to provide value.”); Harry Surden, *Artificial Intelligence and Law: An Overview*, 35 GA. ST. U. L. REV. 1305, 1306 (2019) (“A key motivation in writing this article is to provide a realistic, demystified view of AI that is rooted in the actual capabilities of the technology. This is meant to contrast with discussions about AI and law that are decidedly futurist in nature. That body of work speculates about the effects of AI developments that do not currently exist and which may, or may not, ever come about. Although those futurist conversations have their place, it is important to acknowledge that they involve significant, sometimes unsupported, assumptions about where the technology is headed. That speculative discussion often distracts from the important, but perhaps less exotic, law and policy issues actually raised by AI technology today.” (footnote omitted)); Andrew D. Selbst, *A Mild Defense of Our New Machine Overlords*, 70 VAND. L. REV. EN BANC 87, 93 (2017) [hereinafter Selbst, *Machine Overlords*] (“Ultimately, the difficulties with the argument Brennan-Marquez presents stem from the limitations of this hypothetical technology. Had he instead considered a more realistic technology, his arguments would have had to change considerably.”); Carliss N. Chatman, *Myth of the Attorney Whistleblower*, 72 SMU L. REV. 669, 675, 693–94, 703–10 (2019) (arguing that only by looking at the realities of corporate legal practice can the failure of the SEC whistleblower regime to check corporate fraud be fully explained).

²² See, e.g., Shawn Bayern, *The Implications of Modern Business-Entity Law for the Regulation of Autonomous Systems*, 19 STAN. TECH. L. REV. 93, 94–96 (2015) [hereinafter Bayern, *Autonomous Systems*] (describing several mechanisms for organizing an autonomous business entity and arguing that an LLC may offer the best fit); Shawn Bayern, *Of Bitcoins, Independently Wealthy Software, and the Zero-Member LLC*, 108 NW. U. L. REV. 1485, 1485, 1495–98 (2014) [hereinafter Bayern, *Of Bitcoins*] (describing how an LLC might become a

decentralized autonomous organization (DAO) looked to law outside of the United States for an answer. The Dash DAO organized a New Zealand-based irrevocable trust—the Dash DAO Irrevocable Trust, or the Dash Trust—to create a formally recognizable governance structure, enable Dash the capacity to own property, and facilitate contracting.²³ A different kind of DAO, dOrg LLC, used a specifically tailored business formation statute to gain formal legal recognition, becoming the first Vermont Blockchain-Based Limited Liability Company (BLLC) in June 2019.²⁴

Both of these businesses are pioneering new ways of thinking about autonomous technology and business organizations. Nevertheless, they do not fit neatly within earlier scholarly discussions of autonomous businesses, which seemed to assume that businesses built on emerging technology would automate people out of the business altogether.²⁵ Instead, both the Dash Trust and dOrg LLC rely on people to a significant extent, using technology to automate many, but not all processes necessary to operate the business.²⁶ For example, dOrg LLC describes itself as a cooperative of freelance software engineers.²⁷ As a worker cooperative, the software engineering business operated by dOrg LLC is owned and controlled by the freelancers who contribute to the business, with profits distributed to members based on how much they work for dOrg LLC.²⁸ In other words, the early literature on autonomous businesses and entity formation speculated on the trajectory of the technology, foreseeing a rate of development that even the most cutting-edge companies currently in the industry have not

vehicle for granting autonomous software private legal personhood); Lynn M. LoPucki, *Algorithmic Entities*, 95 WASH. U. L. REV. 887, 906–24 (2018) [hereinafter LoPucki, *Algorithmic Entities*] (describing several ways for “algorithmic entities” to organize as formal business entities).

²³ Ryan Taylor, *Dash Core Group Legal Structure Details*, DASH F. (Aug. 1, 2018), <https://www.dash.org/forum/threads/dash-core-group-legal-structure-details.39848/#post-193885> [perma.cc/7TY-3ALP]. The Dash Trust chose New Zealand “for its strong reputation and well-defined trust laws.” *Id.*

²⁴ John Biggs, *dOrg Founders Have Created the First Limited Liability DAO*, COINDESK (June 11, 2019, 10:00 PM), <https://www.coindesk.com/dorg-founders-have-created-the-first-limited-liability-dao> [perma.cc/86FW-WUMJ].

²⁵ See, e.g., Bayern, *Of Bitcoins*, *supra* note 22; LoPucki, *Algorithmic Entities*, *supra* note 22.

²⁶ Notably, I have argued elsewhere that blockchain-based businesses such as the Dash Trust and dOrg LLC could also organize as a business trust under U.S. law in order to gain formal legal entity recognition. Carla L. Reyes, *If Rockefeller Were a Coder*, 87 GEO. WASH. L. REV. 373, 410, 412 (2019). My approach there was not to make any predictions about the trajectory of the technology, but rather to demonstrate a pathway to legal entity status that might accommodate blockchain-based businesses, whether they involved humans or not—an approach as equally applicable to current industry efforts as to future possibilities. *Id.* at 428.

²⁷ *dOrg*, GITHUB, <https://github.com/dOrgTech> [perma.cc/S9G8-JXFM].

²⁸ JIM JOHNSON & BRENT EMERSON, A TECHNOLOGY FREELANCER’S GUIDE TO STARTING A WORKER COOPERATIVE 5 (2009), <https://www.techworker.coop/sites/default/files/TechCoopHOWTO.pdf> [perma.cc/C6CT-W35D].

developed or adopted.²⁹ And so, the gap between the reality of the people-driven work of the Dash Trust and dOrg LLC and the visions of a human-less future business world persists.³⁰

This Article investigates the full panoply of autonomous technology implemented by existing businesses to uncover the full spectrum of autonomous business reality. To that end, the Article maps out the current landscape of autonomous businesses and uses the map to build a taxonomy that opens up further analysis. In doing so, this Article reveals that the meaningful impact of autonomous businesses for business law lies in the new economically productive organizational models enabled by the technology, rather than the mere use of technology to automate some specific business function. Specifically, this Article argues that only by considering the full spectrum of automation in business does the true import of autonomous technologies for business law emerge. In particular, the capacity of autonomous businesses to make radical governance changes more prevalent in the market pushes the boundaries of current choice of entity and governance paradigms while also challenging traditional theories of corporate governance. Indeed, the autonomous business taxonomy may serve as a vehicle for incentivizing traditionally centralized and hierarchical businesses to adopt many of the low-technology corporate governance reforms suggested in existing literature.

To make these claims, this Article begins in Part I by briefly introducing the two emerging technologies that enable business automation on an unprecedented scale: blockchain technology and artificial intelligence. Part II argues that by focusing on only one specific segment of the current autonomous business landscape, the existing literature misses key opportunities to evolve business law in the areas of entity structure and corporate governance. Part III builds a map of existing autonomous businesses, demonstrating the differences among them and explaining them as a function of design trade-offs made by founders, owners, and managers. Part III then uses that map to build a taxonomy of autonomous businesses and offers a framework for considering broader impacts of autonomous businesses on law. Part IV uses that framework to examine the ways that autonomous business reality may incentivize reforms in traditional corporations while simultaneously emphasizing the inverse need for continued research, regulation, and innovation at the intersection of autonomous technology and business law.

I. A (VERY) BRIEF INTRODUCTION TO BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE

This Part offers a very brief introduction to two of the key emerging technologies enabling increased corporate automation: blockchain technology and

²⁹ See Bayern, *Autonomous Systems*, *supra* note 22, at 96–97, 108; LoPucki, *Algorithmic Entities*, *supra* note 22, at 897–98.

³⁰ For further discussion of the Dash Trust and dOrg, see *infra* Section II.A.

artificial intelligence. Blockchain technology, in connection with smart contracts, enables new levels of automation in scenarios that previously required a trusted third-party intermediary. Further, corporations frequently incorporate artificial intelligence into products and services in order to leverage efficiency, accuracy, and cross-selling opportunities. Increasingly, artificial intelligence is making its way from the product-side of corporations to the management-side.³¹ Understanding these technological building blocks of the new corporate infrastructure is imperative for analyzing whether and to what extent autonomous businesses can shed new light on the decades old debates regarding the role of business organizations in structuring commercially productive enterprise and the appropriate mechanics of corporate governance.

A. *Blockchain Technology*

Blockchain technology is one type of distributed database known broadly as distributed ledger technology (DLT).³² Researchers describe a distributed ledger as a “type of distributed database that assumes the possible presence of malicious users (nodes).”³³ Although commonly used interchangeably with DLT, the term blockchain more precisely refers to a sub-set of DLT protocols that structure their data in a literal “chain of blocks” by linking blocks of validated transactions together using one-way cryptographic hashes.³⁴ The combination and implementation of specific technological elements, such as the type of consensus

³¹ Michael R. Siebecker, *Making Corporations More Humane Through Artificial Intelligence*, 45 J. CORP. L. 95, 96–97 (2019).

³² GARRICK HILEMAN & MICHEL RAUCHS, GLOBAL BLOCKCHAIN BENCHMARKING STUDY 11 (2017).

³³ *Id.* As I have explained before, I am aware of the ongoing debate as to appropriate terminology, and, in particular, the discussion around the terms blockchain technology versus distributed ledger technology. Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 391–92 (2017). Without intending to weigh in on the substance of that debate, I use the term distributed ledger technology as the broader umbrella term to encompass both permissioned and permissionless blockchains, as well as protocols such as R3’s Corda that do not strictly fit the definition of a “chain of blocks.” HILEMAN & RAUCHS, *supra* note 32, at 11, 22, 24, 26, 93. Meanwhile, I use the term “blockchain technology” to refer specifically to those distributed ledgers that use data structures composed of a cryptographically linked chain of blocked data. *Id.* at 11. Adopting these terms is not a statement about the technical accuracy of this or any other terminology. I use these terms, consistently with other researchers such as Hileman and Rauchs, as a legal academic, grounded in the premise that all of these protocols exist and are in use, and that any legal and policy discussion of such systems should account for the full range of implementations, or explain why the analysis only matters for a specific implementation. For further insight into my position, see *id.*; see also Tim Swanson, *A Brief History of R3—The Distributed Ledger Group*, GREAT WALL OF NUMBERS (Feb. 27, 2017), <http://www.ofnumbers.com/2017/02/27/a-brief-history-of-r3-the-distributed-ledger-group/> [perma.cc/TT59-XNWS]; WILLIAM MOUGAYAR, THE BUSINESS BLOCKCHAIN: PROMISE, PRACTICE, AND APPLICATION OF THE NEXT INTERNET TECHNOLOGY 4–7 (2016) (“Since the Internet is comprised of a public version and several private variations, blockchains will also follow that path. Therefore, we will have public and private blockchains.”).

³⁴ HILEMAN & RAUCHS, *supra* note 32, at 11.

mechanism used to verify transactions, vary by implementation among various DLT and blockchain protocols.³⁵ Generally speaking, however, blockchain protocols, and most DLT protocols, track transitions in state in order to allow participants in the network to reach agreement about the existence and evolution of shared facts.³⁶

Blockchain technology is a protocol technology.³⁷ A protocol is “a set of instructions for the compilation and interaction of objects.”³⁸ Generally, a “network protocol” simply sets the rules that allow networked computers (nodes) to communicate with each other.³⁹ As a protocol technology, computer programs can be built on top of, or incorporated into, blockchain technology.⁴⁰ A smart contract is one type of computer program frequently used in connection with blockchain technology, and which receives significant attention from lawyers,

³⁵ There are, for example, any number of different ways to achieve consensus. Ethereum traditionally uses proof-of-work, but Ethereum is moving to proof-of-stake consensus. Alyssa Hertig, *Ethereum's Big Switch: The New Roadmap to Proof-of-Stake*, COINDESK (May 16, 2017, 3:27 PM), <https://www.coindesk.com/ethereums-big-switch-the-new-roadmap-to-proof-of-stake/> [perma.cc/R7ZF-LWXZ]. Ripple and Stellar use “a unique node list of at least one hundred nodes they can trust in voting on the state of affairs.” DON TAPSCOTT & ALEX TAPSCOTT, *BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN AND OTHER CRYPTOCURRENCIES IS CHANGING THE WORLD* 32 (2016) (emphasis omitted). There are other mechanisms as well, including proof of activity, proof of capacity, and proof of storage. *Id.* DLT protocols may also vary in what activity must be cryptographically signed. *Id.* at 30. As alluded to above, the Bitcoin blockchain requires transactions to be cryptographically signed, while in the Ethereum protocol, computations and programs are also cryptographically signed. *Id.* at 30–32. Other variations abound. *See, e.g.*, Richard Gendal Brown, *Introducing R3 Corda™: A Distributed Ledger Designed for Financial Services*, RICHARD GENDAL BROWN (Apr. 5, 2016), <https://gendal.me/2016/04/05/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services/> [perma.cc/5W5B-R9N8].

³⁶ Peter Van Valkenburgh, *What's a "Blockchain," Anyway?*, COIN CENTER (Apr. 25, 2017), www.coincenter.org/entry/what-is-blockchain-anyway [perma.cc/8R4T-QSUM]; *see also* Brown, *supra* note 35 (“[DLT are] platforms, shared across the Internet between mutually distrusting actors, that allow them to reach consensus about the existence and evolution of facts shared between them.”).

³⁷ Carla L. Reyes, *(Un)Corporate Crypto-Governance*, 88 *FORDHAM L. REV.* 1875, 1897 (2020).

³⁸ ALEXANDER R. GALLOWAY, *PROTOCOL: HOW CONTROL EXISTS AFTER DECENTRALIZATION* 76 (2004).

³⁹ Will Warren, *The Difference Between App Coins and Protocol Tokens*, MEDIUM: 0X BLOG (Feb. 1, 2017), <https://blog.0xproject.com/the-difference-between-app-coins-and-protocol-tokens-7281a428348c> [perma.cc/3MX5-42DE]. For example, the Internet Protocol is a network protocol that defines the digital message formats and rules for communication among connected computers. *Internet Protocol (IP)*, TECHNOPEdia (Aug. 30, 2019), <https://www.techopedia.com/definition/5366/internet-protocol-ip> [perma.cc/KV5J-KB2D]. Email is also built on a protocol that allows users to communicate with one another; “[i]t’s just a way for two computers to talk to one another.” Ryan Shea, *When to Use Protocol Tokens*, MEDIUM (Nov. 13, 2017), <https://medium.com/@ryanshea/protocol-tokens-1ed44fa89453> [perma.cc/4ZBQ-EXZ2].

⁴⁰ Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 *DUKE L.J.* 313, 333 (2017).

legislators, and code developers alike.⁴¹ Like DLT and blockchain protocols, the precise implementation of a smart contract can vary significantly.⁴² At base, however, a smart contract is merely a “stored procedure” or “persistent script”—a standing computer program—that says “if event x happens, then execute result y.”⁴³ Generally speaking, however, smart contracts manifest some combination of the following characteristics:⁴⁴ (1) exert some control over assets digitally recorded on a DLT or blockchain protocol,⁴⁵ (2) take some action upon receipt of

⁴¹ Amy Davine Kim & Perianne Boring, *State-by-State Smart Contract Laws? If It Ain't Broke, Don't Fix It*, COINDESK (Feb. 26, 2018, 2:07 PM), <https://www.coindesk.com/state-smart-contract-laws-aint-broke-dont-fix> [perma.cc/XU7Q-QTHB]; Andrea Tinianow, *A Split Emerges in Blockchain Law: Wyoming's Approach Versus the Supplemental Act*, FORBES (Mar. 7, 2019, 12:41 PM), <https://www.forbes.com/sites/andreatinianow/2019/03/07/a-split-emerges-in-blockchain-law-wyomings-approach-versus-the-supplemental-act/> [perma.cc/ZJC8-R6XT]; Andrea Tinianow, *Part Two: A Split Emerges in Blockchain Law: Wyoming Approach Versus Supplemental Act. A Postscript*, FORBES (Mar. 24, 2019, 2:09 PM), <https://www.forbes.com/sites/andreatinianow/2019/03/24/part-two-a-split-emerges-in-blockchain-law-wyoming-approach-versus-supplemental-act-a-postscript/> [perma.cc/4FHK-TYKT]; Guidance Note Regarding the Relation Between the Uniform Electronic Transactions Act and Federal Esign Act, Blockchain Technology and “Smart Contracts” (Unif. L. Comm’n 2019), <https://www.uniformlaws.org/viewdocument/guidance-note-regarding-the-relatio?CommunityKey=2c04b76c-2b7d-4399-977e-d5876ba7e034&tab=librarydocuments> [https://perma.cc/JG4J-25X4].

⁴² ARVIND NARAYANAN ET AL., BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION 60–64 (2016) (discussing the various uses of smart contracts, called scripts in the Bitcoin network).

⁴³ Carla L. Reyes, *A Unified Theory of Code Connected Contracts*, 46 J. CORP. L. (forthcoming 2021). Vitalik Buterin defines smart contracts as “systems which automatically move digital assets according to arbitrary pre-specified rules.” VITALIK BUTERIN, ETHEREUM WHITE PAPER: A NEXT GENERATION SMART CONTRACT & DECENTRALIZED APPLICATION PLATFORM 1 (2014), https://blockchainlab.com/pdf/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf [perma.cc/4Y9D-FA4X]. Others define smart contract as “a computerized transaction protocol to execute contract terms.” Alex Norta, *Setup of Cross-Organizational Collaborations for Decentralized Autonomous Organizations* 1 (2015), https://www.researchgate.net/publication/277014751_Creation_of_Cross-Organizational_Collaborations_for_Decentralized_Autonomous_Organizations [perma.cc/J23L-9X2D]; Richard Gendal Brown, *A Simple Model for Smart Contracts*, RICHARD GENDAL BROWN (Feb. 10, 2015), <https://gendal.me/2015/02/10/a-simple-model-for-smart-contracts/> [perma.cc/Q5KB-BXYX] (“A smart-contract is an event-driven program, with state, which runs on a replicated, shared ledger and which can take custody over assets on that ledger.”).

⁴⁴ The longer definition I have included here is intended to reflect, for the non-technical reader, that a smart contract is not just of a singular shape and size, but rather, can be put to many uses, and, as a result, some smart contracts will emphasize certain characteristics over others. For more detail on smart contracts, see for example, Reyes, *supra* note 43; Werbach & Cornell, *supra* note 40, at 313.

⁴⁵ HENNING DIEDRICH, ETHEREUM: BLOCKCHAINS, DIGITAL ASSETS, SMART CONTRACTS, DECENTRALIZED AUTONOMOUS ORGANIZATIONS 167 (2016) (“A smart contract is decentralized code that moves money based on a condition. Any decentralized code can move money, i.e. cryptocurrency, or effect some other type of exchange, e.g. of digital assets.”); MOUGAYAR, *supra* note 33 at 42 (explaining that smart contracts “control a real-world valuable property via ‘digital means’”).

specified data,⁴⁶ (3) may be used to build a dApp or DAO,⁴⁷ (4) guarantee execution,⁴⁸ and (5) write the resulting state change from the operation of the smart contract into the blockchain protocol or DLT ledger.⁴⁹

Developers can use smart contracts or systems of smart contracts to create DAOs.⁵⁰ A DAO is computer software, distributed across a “peer-to-peer network, incorporating governance and decision-making rules.”⁵¹ Although tempting to assume, given the name, that DAOs always run entirely autonomously,⁵² actual instantiations of DAOs are far more varied.⁵³ In fact, like the smart contracts that enable their creation,⁵⁴ simple DAOs are best suited for full automation while conducting more complex activity through a DAO may require additional touch points with either people or other technology, like artificial intelligence.⁵⁵ For example, a hypothetical DAO launched on the Ethereum protocol might simply engage in the sale and exchange of tokens.⁵⁶ A DAO can be, and has

⁴⁶ DIEDRICH, *supra* note 45, at 167 (explaining that smart contracts are decentralized computer code that executes after a condition is fulfilled); MOUGAYAR, *supra* note 33, at 42–43 (“Smart contracts are software code representing business logic that runs a blockchain, and they are triggered by some external data that lets them modify some other data. They are closer to an event-driven construct, more than artificial intelligence.”).

⁴⁷ William Mougayar, *9 Myths Surrounding Blockchain Smart Contracts*, COINDESK (Apr. 18, 2016, 4:44 PM), <http://www.coindesk.com/smart-contract-myths-blockchain/> [perma.cc/G4BW-4NAD] (“Smart contracts are usually part of a decentralized (blockchain) application. There could be several contracts to a specific application. For example, if certain conditions in a smart contract are met, then the program is allowed to update a database.”).

⁴⁸ DIEDRICH, *supra* note 45, at 168 (“A smart contract is guaranteed to execute. . . . Once things are set in motion, the blockchain underneath serves as an independent third party and makes sure that what was agreed upon in the code will be executed.”); *see also* Werbach & Cornell, *supra* note 40, at 333 (“With smart contracts, the transaction is irreversibly encoded on a distributed blockchain.”).

⁴⁹ Gideon Greenspan, *Why Many Smart Contract Use Cases Are Simply Impossible*, COINDESK (Apr. 18, 2016, 3:41 PM), <http://www.coindesk.com/three-smart-contract-misconceptions/> [perma.cc/SN67-HLRP] (“A smart contract is a piece of code that is stored on an [sic] blockchain, triggered by blockchain transactions and which reads and writes data in that blockchain’s database. . . . A smart contract is just a fancy name for code that runs on a blockchain, and interacts with that blockchain’s state.”).

⁵⁰ ALLEN & OVERY LLP, *DECENTRALIZED AUTONOMOUS ORGANIZATIONS 2* (2016).

⁵¹ *Id.* at 2.

⁵² “In the technological context, engineers apply the term ‘autonomous’ to computer controlled systems that make important choices about *their own actions* with little or no human intervention.” Harry Surden & Mary-Anne Williams, *Technological Opacity, Predictability, and Self-Driving Cars*, 38 *CARDOZO. L. REV.* 121, 131 (2016).

⁵³ *See infra* Section II.A. Note that this is true of discussions of other autonomous systems which also consider levels of automation on a spectrum. For example, those researching autonomous vehicles consider a spectrum from partially autonomous to fully autonomous. *See* Surden & Williams, *supra* note 52, at 132–35.

⁵⁴ *See* Reyes, *supra* note 43.

⁵⁵ *See infra* Section II.A.

⁵⁶ Christoph Jentzsch, *Decentralized Autonomous Organization to Automate Governance 1–2* (2016) (unpublished manuscript), <https://lawofthelevel.lexblogplatformthree.com/wp-content/uploads/sites/187/2017/07/WhitePaper-1.pdf> [perma.cc/J4ZW-P6AP].

been,⁵⁷ coded using smart contracts to autonomously set the token price, sell the tokens, purchase tokens, and otherwise handle the tokens.⁵⁸ In order for a DAO to build and sell a real-world product, however, it may need to hire a “Contractor.”⁵⁹ Depending upon the purpose of the DAO, it may also need people to make management decisions.⁶⁰ For a DAO to fully, or at least more fully, automate in such circumstances, a DAO may need to rely on a form of artificial intelligence to act in the stead of, or to assist, its human managers.

B. Artificial Intelligence

Like blockchain technology and DLT, many misunderstand artificial intelligence (AI), at least in part, because of the lack of a generally agreed upon definition.⁶¹ When speaking in the most general terms, experts explain AI as “a set of techniques aimed at approximating some aspect of human or animal cognition using machines.”⁶² Indeed, many consider AI to be a broad term used to refer to a large set of information or computer sciences.⁶³ Some of the sub-disciplines of AI include, among others,⁶⁴ data mining,⁶⁵ expert systems,⁶⁶ robotics,⁶⁷ machine learning,⁶⁸ natural language processing,⁶⁹ and neural networks.⁷⁰ Data mining is

⁵⁷ See, e.g., METRONOME, OWNER’S MANUAL (2018), https://metronome.io/download/owners_manual.pdf [perma.cc/3YN2-QK7T].

⁵⁸ Jentsch, *supra* note 56, at 2.

⁵⁹ *Id.*

⁶⁰ See, e.g., Carla L. Reyes et al., *Distributed Governance*, 59 WM. & MARY L. REV. ONLINE 1, 4–6 (2017) (detailing the epic rise and fall of The DAO).

⁶¹ Ryan Calo, *Artificial Intelligence Policy: A Primer and Roadmap*, 51 U.C. DAVIS L. REV. 399, 403–04 (2017); Matthew U. Scherer, *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies*, 29 HARV. J.L. & TECH. 353, 359 (2016) (“Unfortunately, there does not yet appear to be any widely accepted definition of artificial intelligence even among experts in the field, much less a useful working definition for the purposes of regulation.”).

⁶² Calo, *supra* note 61, at 404. Harry Surden uses nearly the inverse definition: “we might describe AI as using technology to automate tasks that ‘normally require human intelligence.’ This description of AI emphasizes that the technology is often focused upon automating specific types of tasks: those that are thought to involve intelligence when people perform them.” Surden, *supra* note 21, at 1307 (footnote omitted).

⁶³ M. TIM JONES, *ARTIFICIAL INTELLIGENCE: A SYSTEMS APPROACH* 5 (2008); Surden, *supra* note 21, at 1310.

⁶⁴ Some of these other disciplines include, natural language understanding, planning, and evolutionary computation. JONES, *supra* note 63, at 15–17; see also Michael Simon et al., *Lola v. Skadden and the Automation of the Legal Profession*, 20 YALE J.L. & TECH. 234, 253–54 (2018).

⁶⁵ JIAWEI HAN ET AL., *DATA MINING: CONCEPTS AND TECHNIQUES* xxiii (3d ed. 2012).

⁶⁶ C.S. KRISHNAMOORTHY & S. RAJEEV, *ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS FOR ENGINEERS* 5–6 (1996).

⁶⁷ Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513, 529 (2015) [hereinafter Calo, *Robotics*].

⁶⁸ Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 87, 89 (2014).

⁶⁹ Simon et al., *supra* note 64, at 253.

⁷⁰ JONES, *supra* note 63, at 250–52.

the computational process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems.⁷¹ Expert systems are computer systems that emulate the decision-making ability of a human expert.⁷² These systems are designed to solve complex problems by reasoning about knowledge, which is often represented as if-then rules.⁷³ In robotics, engineers power mechanical objects with one or more of the other areas of AI so that the mechanical object can take information in, process it, and then act accordingly.⁷⁴ “Machine learning . . . refers to the capacity of a system to improve its performance at a task over time.”⁷⁵ Natural language processing “algorithms rely on tremendous amounts of human-generated data to ‘learn’ how humans use the written word” in order to “streamline and improve language-centered AI systems, from translation and text prediction to search results and conversational chatbots.”⁷⁶ Neural networks are processing devices modeled after biological neural networks used to estimate or approximate functions that can depend on a large number of inputs and are generally unknown.⁷⁷

Of these various sub-disciplines of AI, advances in computer processing speed and the rise of big data sparked increased interest in, and heightened the hype surrounding, machine learning.⁷⁸ In fact, people commonly refer to AI more broadly when what they really have in mind is machine learning.⁷⁹ Some scholars believe that trying to untangle the distinction between machine learning and AI

⁷¹ Andrew D. Selbst, *Disparate Impact in Big Data Policing*, 52 GA. L. REV. 109, 123–24 (2017) (“Data mining is the process of finding patterns among different people or outcomes to determine what aspects make them similar or different.”); *see also* Simon et al., *supra* note 64, at 253 (“Data mining is a process that ‘extract[s] interesting—nontrivial, implicit, previously unknown and potentially useful—information from data in large datasets’ and focuses on the properties of datasets.” (citing JOHANNES FÜRNKRANZ ET AL., FOUNDATIONS OF RULE LEARNING 4 (2012))).

⁷² KRISHNAMOORTHY & RAJEEV, *supra* note 66, at 6.

⁷³ *Id.*

⁷⁴ Calo, *Robotics*, *supra* note 67, at 529 (“There is some measure of consensus, however, around the idea that robots are mechanical objects that take the world in, process what they sense, and in turn act upon the world.”).

⁷⁵ Calo, *supra* note 61, at 405; *see also* Surden, *supra* note 68, at 88 (“Broadly speaking, machine learning involves computer algorithms that have the ability to ‘learn’ or improve in performance over time on some task.” (citing PETER FLACH, MACHINE LEARNING: THE ART AND SCIENCE OF ALGORITHMS THAT MAKE SENSE OF DATA 3 (2012))).

⁷⁶ Amanda Levendowski, *How Copyright Law Can Fix Artificial Intelligence’s Implicit Bias Problem*, 93 WASH. L. REV. 579, 607 (2018).

⁷⁷ JONES, *supra* note 63, at 250–52.

⁷⁸ Calo, *supra* note 61, at 405; *see also* Levendowski, *supra* note 76, at 590–91 (“Most AI systems are trained using vast amounts of data and over time, hone the ability to suss out patterns that can help humans identify anomalies or make predictions.”). Most AI needs lots of data exposure to automatically perform a task. *Id.*

⁷⁹ Levendowski, *supra* note 76, at 590 (“When journalists, researchers, and even engineers say ‘AI,’ they tend to be talking about machine learning, a field that blends mathematics, statistics, and computer science to create computer programs with the ability to improve through experience automatically.”).

is impossible at this point.⁸⁰ The goal of this brief introduction to the various disciplines of AI is not to try and revive this terminology war, but rather, merely to point out that what is often popularly mistaken as a monolithic technology is actually quite diverse in terms of its underlying techniques, goals, and uses. Even if popular use of the terminology remains forever tangled, understanding the differences is imperative for legal professionals because those differences often hold legal and policy implications.⁸¹ Indeed, confusing machine learning with AI more broadly represents only one area of popular confusion about autonomous technologies that legal professionals must strive to overcome.

For example, the term machine learning often evokes images of walking and talking robots acquiring higher order cognitive functions of the type involved in human intellectual functions.⁸² However, the “machine” in machine learning most often refers to a computer crunching data using an algorithm.⁸³ And an algorithm tends to learn “in a functional sense: [it is] capable of changing [its] behavior to enhance [its] performance on some task through experience.”⁸⁴ Frequently used to make predictions, machine learning algorithms can automate tasks almost completely once they have learned to perform their objective function⁸⁵ well.⁸⁶ However, even when machine learning algorithms achieve some level of automation, some measure of human involvement remains. For example, depending upon the type of machine learning at issue,⁸⁷ a human may be kept “in the loop” for training and auditing purposes.⁸⁸ And even without a human in the loop, machine learning algorithms, like all technology, remain a social

⁸⁰ See *id.* at 590 n.38.

⁸¹ For insightful research demonstrating the link between the nuances of AI and corresponding legal and policy responses, see Andrew D. Selbst & Solon Barocas, *The Intuitive Appeal of Explainable Machines*, 87 *FORDHAM L. REV.* 1085, 1099–109 (2018); Surden, *supra* note 21, at 1311.

⁸² These images are encouraged by popular media—from movies like *The Terminator* and *I, Robot*. *THE TERMINATOR* (Cinema ‘84 1984); *I, ROBOT* (Twentieth Century Fox 2004).

⁸³ Surden, *supra* note 68, at 89.

⁸⁴ *Id.* (emphasis omitted); see also Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 *GEO. L.J.* 1147, 1157 (2017) (explaining that machine learning algorithms “‘optimize a performance criterion using example data or past experience.’ In other words, these algorithms make repeated passes through data sets, progressively modifying or averaging their predictions to optimize specified criteria.” (footnote omitted)).

⁸⁵ An objective function is an algorithm’s performance criterion. Coglianese & Lehr, *supra* note 84.

⁸⁶ Surden, *supra* note 68, at 90.

⁸⁷ Simon et al., *supra* note 64, at 254 (“Machine learning can take place in a number of ways. These include ‘supervised learning,’ where the learning algorithm is given inputs and desired outputs with the goal of learning which rules lead to the desired outputs; ‘unsupervised learning,’ where the learning algorithm is left on its own to determine the relationships within a dataset; and ‘reinforcement learning,’ where the algorithm is provided feedback on its performance as it navigates a data set.”).

⁸⁸ Levendowski, *supra* note 76, at 591 (noting that supervised learning is “overwhelmingly used to train commercial AI systems”).

technology—that is, machine learning algorithms are used within, and put to use for, a social context.⁸⁹

Business management represents one social context in which machine learning algorithms are used.⁹⁰ At least one corporate board, that of Deep Knowledge Ventures, appointed an algorithm to its board of directors in an observer capacity to provide predictions and other data to other board members.⁹¹ And while putting an algorithm on the board of directors may be an outlier, some business models regularly rely on AI to take important action on an automated, high-speed basis. For example, broker-dealers regularly use algorithms for advice and execution of stock market trades.⁹² In fact, “[a]lgorithmic trading programs influence the trading decisions of as many as seventy percent of the securities transactions executed in the United States.”⁹³ A picture of a wide range of autonomous business enterprises emerges when we consider the range of AI techniques, such as machine learning, and the increasing capacity to automate business coordination via blockchain technology and blockchain-based smart contracts.

II. AUTONOMOUS BUSINESSES OF THE FUTURE: EXPECTATIONS FOR BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE TO TRANSFORM BUSINESS

The complexity of, and extreme optimism about, blockchain technology and AI make it easy to get lost in the possibilities of fully autonomous businesses operated solely by machines without any human interaction or oversight. Indeed, this is true of any assessment of the implications of technology in a new field; the tendency to believe that computers can do more than they can, faster than

⁸⁹ Carla L. Reyes & Jeff Ward, *Digging into Algorithms: Legal Ethics and Legal Access*, 21 NEV. L.J. 325, 325, 342–43 (2020) (examining the reality of algorithms as a social technology in the context of legal technology); see also Selbst, *Machine Overlords*, *supra* note 21, at 88–89 (“In making his argument, Brennan-Marquez inadvertently sets up a false dichotomy between human reason and machines as quasi-magical objects. But machines are designed and can be deconstructed. Even if humans cannot understand machines in the same way we understand each other, that is not to say we cannot understand them at all.”).

⁹⁰ There are any number of other examples of how using machine learning in a specific social context can raise legal issues unique to that context, many of which have been discussed in the literature. See, e.g., Selbst, *supra* note 71, at 115–16; Kristin N. Johnson, *Regulating Innovation: High Frequency Trading in Dark Pools*, 42 J. CORP. L. 833, 855 (2017); Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 3–4 (2014); Joshua A. Kroll et al., *Accountable Algorithms*, 165 U. PA. L. REV. 633, 650–51 (2017); Margaret Hu, *Algorithmic Jim Crow*, 86 FORDHAM L. REV. 633, 663 (2017); Jason R. Bent, *Is Algorithmic Affirmative Action Legal?*, 108 GEO. L.J. 803, 806–07 (2020).

⁹¹ Florian Möslein, *Robots in the Boardroom: Artificial Intelligence and Corporate Law*, in RESEARCH HANDBOOK ON THE LAW OF ARTIFICIAL INTELLIGENCE 649 (Woodrow Barfield & Ugo Pagallo eds., 2018). Many perceive this move as more of a publicity stunt on the part of Deep Knowledge Ventures, however, the fact that it happened at all is sufficient to make the point here.

⁹² Johnson, *supra* note 90, at 855.

⁹³ *Id.*

they can, drives thinking to extremes.⁹⁴ In the context of autonomous businesses, considering only fully automated businesses risks missing the legal issues that are important to the many businesses that occupy the full spectrum of automation in-between.⁹⁵ Specifically, the literature on autonomous and algorithmic entities, like much of the broader legal and policy literature regarding emerging technology, often deals with hypothetical technology expected to exist but not yet on the market.⁹⁶ Technology forecasting can enable legal future-casting to prepare legal systems for new scenarios. However, many businesses already automate to some extent using AI, blockchain technology, or both, and they do so in a variety of ways.⁹⁷ This landscape of industry reality offers rich context for exploring necessary legal change. To begin exploring these issues, this Part reviews the literature on autonomous businesses, business organizational law, and corporate governance, exploring the variety of starkly different positions taken by scholars in the field. In doing so, this Part reveals that the gap in existing literature results from underappreciation of current business uses of autonomous technology and sets the stage for developing a new framework for understanding autonomous businesses—one rooted in industry reality.

A. *Autonomous Businesses and Business Organizational Law*

One strand of literature considers the capacity of existing business organizational law to accommodate and control autonomous businesses.⁹⁸ Several

⁹⁴ See Brian Fung, *Everything You Think You Know About AI Is Wrong*, WASH POST (June 2, 2016, 3:30 AM), <https://www.washingtonpost.com/news/the-switch/wp/2016/06/02/everything-you-think-you-know-about-ai-is-wrong/> [perma.cc/5ZBT-VETH]. This is a particular problem in the realm of AI. *Id.* Daniel Marlin, *What Is Blockchain and How Will It Change the World?*, FORBES (Dec. 22, 2017, 8:52 AM), <https://www.forbes.com/sites/danielmarlin/2017/12/22/what-is-blockchain-and-how-will-it-change-the-world/> [perma.cc/6KKW-7QEB] (explaining how the blockchain technology cycle appears to rival that of AI).

⁹⁵ The inverse is also true. Traditional business law scholarship focuses on fully hierarchical corporations, which entirely lack automation. See, e.g., Lawrence E. Mitchell, *Structural Holes, CEO, and Informational Monopolies: The Missing Link in Corporate Governance*, 70 BROOK. L. REV. 1313 (2005). This focus runs the risk of missing important lessons for the law on the books when the law in action must account for automation in business in a variety of contexts.

⁹⁶ For a discussion of this issue in the context of AI more broadly, see Surden, *supra* note 21, at 1322.

⁹⁷ See *infra* Part III.

⁹⁸ The work I undertake in this Article to create the autonomous business reality taxonomy in Part III can be viewed as an abstracted application of the Algorithmic Systems Query (ASQ) analytical tool Jeff Ward and I offer to lawyers trying to evaluate legal technology for use in law practice. See Reyes & Ward, *supra* note 89, at 353. This literature often explores what Professor Ward and I refer to as the “context ideal,” which “begins by identifying the desired or required state,” and “asking questions like ‘What results should be accomplished at the societal, organizational, and individual levels?’” *Id.* at 355. For example, some of this literature explores the ideal type of business organization for autonomous entities, while other literature explores the ideal role of such entities in society. See *id.* at 353. As we warn in the article outlining the ASQ analytical tool, and as demonstrated in the discussion of the literature

scholars have debated whether and how a fully autonomous business could form a legal entity under existing laws.⁹⁹ Professor Shawn Bayern was the first to offer a systematic investigation into the possibility of autonomous business enterprises through “independently wealthy software.”¹⁰⁰ Bayern observed that autonomous computer software, from computer viruses to machine learning algorithms, already permeate society.¹⁰¹ The introduction of bitcoin and blockchain technology meant that software could more easily retain and manage wealth independently from human interfaces.¹⁰² From Bayern’s perspective, the Uniform Limited Liability Company Act (ULLCA) already explicitly provides for the possibility that an LLC may operate without any members.¹⁰³ Bayern explains that this reality naturally flows from the law’s long history of creating fictional entities and treating them like people for certain purposes.¹⁰⁴ Although Matthew Scherer criticizes Professor Bayern’s reading of the LLC statutes,¹⁰⁵ Professor Bayern maintains

on business law and autonomous entities below, “[t]he danger in exploring the context ideal lies in jumping to the identification of potential solutions, rather than needs.” *Id.* at 356.

⁹⁹ See, e.g., Bayern, *Of Bitcoins*, *supra* note 22, at 1497; LoPucki, *Algorithmic Entities*, *supra* note 22, at 893–95; Matthew U. Scherer, *Of Wild Beasts and Digital Analogues: The Legal Status of Autonomous Systems*, 19 NEV. L.J. 259, 262 (2018); Shawn Bayern, *Are Autonomous Entities Possible?*, 114 NW. U. L. REV. ONLINE 23, 24 (2019) [hereinafter Bayern, *Are Autonomous Entities Possible?*]. These questions quickly turned to, and are intertwined with, questions of legal personhood for autonomous systems. I take up this question in a separate paper, Carla Reyes, *Autonomous Corporate Personhood*, 96 WASH. L. REV. (forthcoming 2021). I took up a related, but slightly different question regarding whether and how blockchain-based businesses at various levels of the technology stack could form a legally recognizable business entity in Reyes, *supra* note 26. The issue there is slightly different from that addressed by Bayern, Scherer, and LoPucki because most of the businesses considered in that article, as further demonstrated below, continue to involve humans at some level of the business, despite significant reliance on autonomous technology.

¹⁰⁰ Bayern, *Of Bitcoins*, *supra* note 22, at 1487.

¹⁰¹ *Id.* at 1492.

¹⁰² *Id.* at 1493 (noting that a system like Bitcoin is not functionally necessary for this possibility; more precisely, then, what Bitcoin enables for autonomous software is the convenient, “legal access to a functionally independent financial life. It practically enables what in the past was just a theoretical possibility.”).

¹⁰³ *Id.* at 1496–97 (explaining that the RULLCA includes “in a list of events that cause the dissolution of an LLC, ‘the passage of 90 consecutive days during which the company has no members.’” And that “this provision, perhaps surprisingly, appears not to be a mandatory rule imposed by the uniform statute.”); Bayern, *Autonomous Systems*, *supra* note 22, at 101–02 (explaining how to create an autonomous and member-less LLC).

¹⁰⁴ Bayern, *Of Bitcoins*, *supra* note 22, at 1495.

¹⁰⁵ Scherer, *supra* note 99, 264–65 (arguing that even if, strictly speaking, the letter of the statute supports Bayern’s interpretation, allowing fully autonomous entities to form legal entities would violate the spirit and intent of the statute, such that courts would not tolerate their existence); see also Matt Scherer, *Is AI Personhood Already Possible Under U.S. LLC Laws? (Part One: New York)*, LAW & AI (May 14, 2017), <http://www.lawandai.com/2017/05/14/is-ai-personhood-already-possible-under-current-u-s-laws-dont-count-on-it-part-one/> [perma.cc/RSM5-6TZ5]; Matt Scherer, *Is AI Personhood Already Possible Under U.S. LLC Laws? (Part Two: Uniform LLC Act)*, LAW & AI (May 21, 2017), <http://www.lawandai.com/2017/05/21/is-ai-personhood-already-possible-under-current-u-s-laws-part-two-uniform-llc-act/> [perma.cc/

that “simply as a matter of positive law, that [his] reading of the LLC statutes is correct.”¹⁰⁶ Indeed, Bayern outlines at least three ways to create an LLC that operates “without ongoing human internal governance,”¹⁰⁷ and notes that if “even one state permits [one of these techniques], other states are unlikely to interfere with their operation” in light of the internal affairs doctrine.¹⁰⁸ Ultimately, Bayern has always argued, and continues to argue, that the ability of the LLC statutes to create a legal entity “container” for autonomous software naturally flows from the long history of flexibility and creativity enabled and expected by modern business organization law.¹⁰⁹

Indeed, Bayern opines that an autonomous fictional entity with “private-law personhood”¹¹⁰ really does not pose that different of a scenario than what can be accomplished by private parties using technology creatively now.¹¹¹ Further, Bayern contends that if an autonomous system did organize as an LLC and conduct ordinary business operations, the public, including customers, suppliers, and regulators, would be unlikely to discern its status as a business operated by artificial intelligence, absent extraordinary circumstances.¹¹² Ultimately, Bayern concludes that “there appear to be many organizational advantages, and few systematic downsides, in permitting memberless entities that a nonhuman system might ‘inhabit’ and use as an interface to the rest of private law.”¹¹³

Notably, Vermont legislators appear to agree with Professor Bayern that the benefits outweigh the potential costs, as the state specifically created a pathway to formally create a blockchain-based LLC (BLLC).¹¹⁴ The statute, however,

619Z-CLKY]; Matt. Scherer, *Is AI Personhood Already Possible Under U.S. LLC Laws? (Part Three)*, LAW & AI (June 18, 2017), <http://www.lawandai.com/2017/06/18/is-ai-personhood-already-possible-under-u-s-llc-laws-part-three/> [perma.cc/VB5G-ARPZ].

¹⁰⁶ Bayern, *Are Autonomous Entities Possible?*, *supra* note 99, at 25, 29 (“[I]nternal governance is a matter of the law of the state in which an entity is organized.”).

¹⁰⁷ *Id.* at 26–33.

¹⁰⁸ *Id.* at 29; Lauren Henry Scholz, *Algorithmic Contracts*, 20 STAN. TECH. L. REV. 128, 142, 166, 168 (2017) (arguing that contracts that defer to algorithms may be too indefinite to enforce). However, Bayern responds that modern contract law appears uncontroversial to enforce agreements far more indefinite than the operating agreements that would be required to carry out Bayern’s LLC approach to autonomous business entities. See Shawn Bayern, *Artificial Intelligence and Private Law*, in RESEARCH HANDBOOK ON THE LAW OF ARTIFICIAL INTELLIGENCE, *supra* note 91, at 144, 148.

¹⁰⁹ Bayern, *Are Autonomous Entities Possible?*, *supra* note 99, at 47 (“My transactional technique to create algorithmic entities under American LLC laws . . . is consistent . . . with strong historical trends toward flexibility in entity structure and governance.”); see also SHAWN J. BAYERN, *CLOSELY HELD ORGANIZATIONS* 243–45 (2013).

¹¹⁰ Bayern, *Autonomous Systems*, *supra* note 22, at 94 (“For the purposes of this [paper], legal personhood is simply the capacity of a person, system, or legal entity to be recognized by law sufficiently to perform basic legal functions.”).

¹¹¹ *Id.* at 107.

¹¹² *Id.* at 108.

¹¹³ *Id.* at 109.

¹¹⁴ See VT. STAT. ANN. tit. 11, § 4173 (West, Westlaw through Acts 1-130, 132-148, 150, M-1-M-11 of the Adjourned Sess. of the 2019-2020 Vt. Gen. Assemb.) (creating blockchain-

appears to expect some human involvement in the organization.¹¹⁵ Indeed, the first Vermont BBLIC, dOrg LLC, is owned and operated by people who merely coordinate their economic activity through blockchain-based code.¹¹⁶ Requiring humans to remain involved may reflect a subtle nod to the concerns of another prominent scholar in the field, Professor Lynn LoPucki. Professor LoPucki argues that several qualities of what he terms “algorithmic entities”¹¹⁷ make their potential existence a “risk of existential catastrophe” at the hands of artificial intelligence.¹¹⁸ LoPucki argues that algorithmic control of a legal entity presents significant danger because algorithms could “accumulate wealth, leverage it in capital markets, and participate in the political process—without being subject to the constraints under which humans operate.”¹¹⁹ LoPucki sees an algorithmic entity’s capacity to participate effectively in legitimate economic and political activity particularly concerning because he views corporate charter competition as reducing the capacity of state governments to effectively regulate traditional business entities, let alone algorithmic ones.¹²⁰

In particular, Professor LoPucki predicts that three qualities of artificial entities make them exceptional,¹²¹ and thus a greater threat to society than algorithms acting with human collaborators. First, LoPucki believes that because algorithmic entities will lack sympathy or empathy that they will exhibit ruthlessness to a degree not present in humans.¹²² Second, society will experience

based LLCs which “may provide for its governance, in whole or in part, through blockchain technology”).

¹¹⁵ *See id.*

¹¹⁶ *LL-DAO*, GITHUB, <https://github.com/dOrgTech/LL-DAO> [perma.cc/K7FS-XCV8].

¹¹⁷ LoPucki, *Algorithmic Entities*, *supra* note 22, at 897. LoPucki defines algorithmic entities to mean those entities controlled by an algorithm, where “[a]n algorithm is a set of decision-making rules” operating on a computer as a program that executes decisions in response to external circumstances, and where an algorithm controls an entity when it makes the entity’s decisions without human participation. *Id.* Notably, to qualify as algorithmically controlled, a human could create the algorithm and then relinquish control, but a human cannot modify the algorithm. *Id.* I note some skepticism at the proliferation of such algorithms. As computer software, algorithms require regular updates, patches and other “modifications” that may require human activity. For example, in the taxonomy of autonomous *businesses infra* Part III, LoPucki’s definition of algorithmic entities would exist beyond Metronome, the most autonomous example included in the taxonomy.

¹¹⁸ *Id.* at 897.

¹¹⁹ *Id.* at 901–02.

¹²⁰ *Id.* at 889. LoPucki’s chief concern ties into his other work regarding corporate charter competition. *See* Lynn M. LoPucki, *Corporate Charter Competition*, 102 MINN. L. REV. 2101, 2103–04 (2018) [hereinafter LoPucki, *Corporate Charter*].

¹²¹ Calo, *Robotics*, *supra* note 67, at 550, 551 (referring to “exceptionalism” as the idea “that a person, place, object, or concept is qualitatively different from others in the same basic category”). In the context of AI and other emerging technologies, Ryan Calo encourages us to only consider a technology exceptional, such that it requires new, specific laws “when its introduction into the mainstream requires a systematic change to the law or legal institutions in order to reproduce, or if necessary displace, an existing balance of values.” *Id.* at 552; *see also* LoPucki, *Algorithmic Entities*, *supra* note 22, at 952.

¹²² LoPucki, *Algorithmic Entities*, *supra* note 22, at 904.

more difficulty in deterring bad activity by algorithmic entities because they cannot be incarcerated the same way a human controller can, and algorithmic entities will be immune to social pressures to which human controllers would otherwise respond.¹²³ Finally, LoPucki sees algorithmic entities as more easily replicated, making algorithmic entities better able to flee jurisdictions, more difficult to destroy, better at hedging against regulatory changes, and better able to collude together for the economic detriment of others.¹²⁴

When Professor LoPucki combines these three characteristics of algorithmic entities with his view that such entities can be created under not only the ULLCA, but also the Delaware General Corporate Law,¹²⁵ the Model Business Corporation Act,¹²⁶ the Uniform Limited Partnership Act,¹²⁷ and the Revised Uniform Partnership Act,¹²⁸ he finds that algorithmic entities become even more difficult to control because they will be hard to detect in their various forms and can migrate across state and national borders to avoid detection and regulation.¹²⁹ Professor LoPucki identifies corporate charter competition as the root of the problem.¹³⁰ From his perspective,

the natural culmination of charter competition is a system that does not restrict at all. . . . By embracing the charter competition, the United States has become the world's largest supplier of anonymous entities and enabled its corporate service providers to achieve the world's lowest rate of compliance with the international standards designed to prevent terrorist financing and money-laundering.¹³¹

When the charter competition problem LoPucki identifies collides with the reality of algorithmic entities, LoPucki anticipates the emergence of a new and dangerous threat to society.¹³²

Despite the starkly different positions taken by each of these scholars, they appear to rely on a common underlying assumption about the nature of businesses powered by autonomous technology: the businesses are all powered entirely by artificial intelligence, algorithms, blockchain technology, or some

¹²³ *Id.* at 904.

¹²⁴ *Id.* at 904–05.

¹²⁵ *Id.* at 907–10 (demonstrating that under the Delaware General Corporation Law, corporations can eliminate the board of directors in their organizing documents and be operated directly by shareholders; for an autonomous corporation to do this, a “corporate dyad” could be formed, whereby two autonomous corporations are formed, without board of directors, and are each managed by a sole shareholder—each other).

¹²⁶ *Id.* at 911.

¹²⁷ *Id.* at 911–12.

¹²⁸ *Id.* at 912.

¹²⁹ *Id.* at 924–25.

¹³⁰ *Id.* at 952–53.

¹³¹ *Id.* at 952.

¹³² As Bayern puts it, LoPucki’s reaction to Bayern’s argument that autonomous entities can exist under current law is one of “honest horror: ‘[t]he survival of the human race may depend’ [according to LoPucki] on rejecting the premises of [Bayern’s] argument.” Bayern, *Are Autonomous Entities Possible?*, *supra* note 99, at 24.

combination of those technologies; no humans remain involved in the enterprise.¹³³ For example, LoPucki defines the term algorithmic entity to mean an entity controlled by an algorithm, where “an algorithm controls an entity only if the algorithm makes the entity’s decisions without human participation.”¹³⁴ Notably, “[t]hat a human created the algorithm does not disqualify the algorithm from status as a controller, provided that the human no longer has the ability to modify the algorithm.”¹³⁵ Yet, for all of the theoretical discussion about whether an algorithmic or autonomous entity can exist, none of the authors offer a real-life example of entrepreneurs attempting to create such an entity.¹³⁶ The discussion regarding whether and how to form a legally recognized autonomous businesses is not the only line of literature that underestimates the extent to which autonomous technology already permeates business enterprise.

B. *Autonomous Businesses and Corporate Governance*

A second strand of literature explores the impact of autonomous technologies on traditional corporate governance mechanisms.¹³⁷ Authors in this area explore a wide variety of issues, and, as a result, sometimes speak past each other.¹³⁸ Although an examination of each article touching on autonomous technologies and corporate governance lies beyond the scope of this Article, this Section provides an overview of the two most prominent lines of investigation that occupy the attention of scholars in this area, noting the gaps between the literature and industry reality caused by focusing on a small subsection of businesses using technology, rather than considering the bigger picture.

The first line of investigation focuses on “platform” companies and argues that platform governance represents the new, improved corporate governance model of the future.¹³⁹ In a series of related articles, Professors Mark Fenwick,

¹³³ See LoPucki, *Algorithmic Entities*, supra note 22, at 897–98, 952; Bayern, *Autonomous Systems*, supra note 22, at 95–96; Scherer, supra note 99, at 262.

¹³⁴ LoPucki, *Algorithmic Entities*, supra note 22, at 897.

¹³⁵ *Id.* at 897.

¹³⁶ Indeed, for all the examples used in building the autonomous business map in Figure 1 below, the closest examples of an algorithmic entity are the Plantoid and Metronome. See *infra* Section III.A and Figure 1. The operations and decision making of both businesses are, however, guided by humans at some point in the process. See *infra* text accompanying notes 228–243. Thus, even these very highly automated endeavors do not fit squarely within the depiction of algorithmic entities so hotly debated in the literature.

¹³⁷ Again, this literature might be thought of, in an abstracted sense, as an exploration of the context ideal of corporate governance. Taken together, then, the existing literature provides an exhaustive exploration of the context ideal for autonomous entities. See generally, Reyes & Ward, supra note 89.

¹³⁸ See, e.g., *infra* notes 139–165 and accompanying text.

¹³⁹ See generally Mark Fenwick et al., *The End of “Corporate” Governance: Hello “Platform” Governance*, 20 EUR. BUS. ORG. L. REV. 171 (2019) [hereinafter Fenwick et al., “Corporate” Governance]; Wulf Kaal et al., *Why Blockchain Will Disrupt Corporate Organizations: What Can Be Learned from the “Digital Transformation,”* 1 JBBA 91 (2018); Mark

Joseph A. McCahery, Erik P.M. Vermeulen, and Wulf Kaal argue that autonomous technologies like artificial intelligence and blockchain push all companies from a hierarchical and formalized governance structure to a flatter and more open governance structure based on a platform model.¹⁴⁰ While much has been written about platforms and the platform economy (or, relatedly, the sharing economy),¹⁴¹ definitional clarity remains elusive.¹⁴² Fenwick, McCahery, Vermeulen, and Kaal define platforms in broad strokes, by describing the technologies that underpin platform companies and offering examples.¹⁴³ In their view, platforms, driven by the proliferation of emerging technologies, “create[] value by facilitating exchanges between two different but interdependent groups . . . leverag[ing] networked digital technologies to promote economic exchange, the transfer of information or to connect people.”¹⁴⁴ Much as Marc Andreessen once

Fenwick & Erik P.M. Vermeulen, *Technology and Corporate Governance: Blockchain, Crypto, and Artificial Intelligence*, 48 TEX. J. BUS. L. 1 (2019).

¹⁴⁰ See Fenwick et al., “Corporate” Governance, *supra* note 139, at 177 (“Businesses will either operate ‘as’ a platform or be ‘integrated’ within a platform. The future of the digital age will be platform-driven ecosystems in which multiple players participate. . . . Given the proliferation of platforms, we seem to be living through a shift from a world of firms to a new world of platforms.”); Fenwick & Vermeulen, *supra* note 139, at 24 (“We currently live in a fast-moving ‘space’ between two co-existing realities: a centralized ‘old world’ and an emerging (but nascent and uncertain) ‘decentralized reality.’”); Kaal et al., *supra* note 139, at 92 (“The central claims of the paper are (i) digital technologies have already disrupted centralized, hierarchical corporate organizations by facilitating ‘platforms;’ (ii) this process of disruption will only continue as new blockchain-based technologies proliferate; and (iii) regulators need to be more attentive to these changes and their economic and social effects.”).

¹⁴¹ See generally Orly Lobel, *The Law of the Platform*, 101 MINN. L. REV. 87 (2016); Benjamin Means & Joseph A. Seiner, *Navigating the Uber Economy*, 49 U.C. DAVIS L. REV. 1511 (2016); Lina M. Khan, *Amazon’s Antitrust Paradox*, 126 YALE L.J. 710 (2017); Ryan Calo & Alex Rosenblat, *The Taking Economy: Uber, Information, and Power*, 117 COLUM. L. REV. 1623 (2017); Michèle Finck, *Digital Regulation: Designing a Supranational Legal Framework for the Platform Economy* (Law, Soc’y & Econ., Working Paper No. 15/2017, 2017), http://eprints.lse.ac.uk/87568/1/Finck_Digital%20Co-Regulation_Author.pdf [<https://perma.cc/HT8G-WUWL>]. While these articles deal with the business and regulatory issues raised by platforms, a whole other body of literature investigates first amendment in the context of platforms. See generally James Grimmelmann, *The Platform Is the Message*, 2 GEO. L. TECH. REV. 217 (2018); Thomas E. Kadri & Kate Klonick, *Facebook v. Sullivan: Public Figures and Newsworthiness in Online Speech*, 93 S. CAL. L. REV. 37 (2019); Kate Klonick, *The New Governors: The People, Rules, and Processes Governing Online Speech*, 131 HARV. L. REV. 1598 (2018); Kyle Langvardt, *Regulating Online Content Moderation*, 106 GEO. L.J. 1353 (2018).

¹⁴² Lobel, *supra* note 141, at 100–02 (“The common pattern that emerges is a definitional one. Platform companies adamantly endeavor to be defined first and foremost by what they are not. These companies are not selling the thing itself: the service, the product, the content. Rather, they are selling access to the software, the matching algorithms, and a digital system of reputation and trust between their users. . . . [T]he platform economy defies simple definitions. The platform economy is a system characterized primarily by what it’s not: conventional and static.” (footnote omitted)).

¹⁴³ See, e.g., Kaal et al., *supra* note 139, at 92–93.

¹⁴⁴ *Id.* at 92.

quipped that software would “eat[] the world,”¹⁴⁵ these authors view the economy of the future as one in which platforms dominate—you either operate a platform or are “eaten” by one.¹⁴⁶

This view of technological advancement sets up a stark dichotomy. As Fenwick et al. explain, “[w]e currently live in a fast-developing ‘space’ between two co-existing and competing ‘realities’: a centralized ‘old world’ and an emerging but, as yet, incomplete new ‘decentralized reality.’”¹⁴⁷ The difficulty with this pronouncement is that, as Fenwick, McCahery, Kaal, and Vermeulen themselves point out, many of the key platforms of today’s economy are owned and operated by the most hierarchical and centralized companies, including Amazon, Apple, Facebook, and Alphabet (Google).¹⁴⁸ Despite the claims that this emerging and inevitable “platform age” will lead to new methods of collaboration and governance involving a broader set of stakeholders in corporate decision-making,¹⁴⁹ signs of the surveillance economy point to the exact opposite scenario.¹⁵⁰ Indeed, research suggests that even the platform companies that make up the “sharing economy” replicate the centralized power structures they allegedly displace¹⁵¹—platform technology simply becomes the new medium through which to concentrate power, centralize resources, and more efficiently serve market demands.¹⁵²

In other words, Uber and Airbnb remain traditional corporations with traditional agency cost concerns born of traditional centralized management

¹⁴⁵ Marc Andreessen, *Why Software Is Eating the World*, WALL ST. J. (Aug. 20, 2011), <https://www.wsj.com/articles/SB10001424053111903480904576512250915629460> [perma.cc/E8G2-7V2K].

¹⁴⁶ Fenwick et al., “*Corporate*” *Governance*, *supra* note 139, at 196 (“As we have seen, there is no doubt that the platform model is replacing traditional economic theories based on organizations, firms, and markets.”).

¹⁴⁷ Kaal et al., *supra* note 139, at 97.

¹⁴⁸ Fenwick et al., “*Corporate*” *Governance*, *supra* note 139, at 172 (citing Andrei Hagiu, *Strategic Decisions for Multisided Platforms*, MIT SLOAN MGMT. REV. (Dec. 19, 2013), <https://sloanreview.mit.edu/article/strategic-decisions-for-multisided-platforms/> [https://perma.cc/T3YN-5ZU3]). Other examples offered by Fenwick et al. suffer the same flaws: Instagram, Airbnb, Uber, YouTube, Netflix. *Id.* at 175. Each of these examples are of platforms owned and operated by a corporation sporting a traditional centralized hierarchy at the highest levels: a board of directors and suite of corporate officers.

¹⁴⁹ *Id.* at 176–86.

¹⁵⁰ See generally SHOSHANA ZUBOFF, *THE AGE OF SURVEILLANCE CAPITALISM: THE FIGHT FOR A HUMAN FUTURE AT THE NEW FRONTIER OF POWER* (2019).

¹⁵¹ *Id.*

¹⁵² *Id.* For additional literature exploring the ways that platform companies, including those in the sharing economy, actually use autonomous technologies to centralize and amass power, see for example Abbey Stemler, *Platform Advocacy and the Threat to Deliberative Democracy*, 78 MD. L. REV. 105 (2018); Orly Lobel, *The Gig Economy & the Future of Employment and Labor Law*, 51 U. S.F. L. REV. 51 (2017); JEREMIAS PRASSL, *HUMANS AS A SERVICE: THE PROMISE AND PERILS OF WORK IN THE GIG ECONOMY* (2018); Keith Cunningham-Parmeter, *From Amazon to Uber: Defining Employment in the Modern Economy*, 96 B.U. L. REV. 1673 (2016).

hierarchies at the director and c-suite level.¹⁵³ The difficulty in viewing the world as a dichotomy between centralized traditional corporations and decentralized platforms¹⁵⁴ lies in assuming that using platform technology will always decentralize corporate power.¹⁵⁵ Technology will only decentralize power inside a business organization if such decentralization is a goal of those organizing the business. If not, the same technology can be used to reinforce power structures just as easily as it can be used to subvert them.¹⁵⁶ Further, platform technology does not stand alone as the sole type of automation used in business endeavors.¹⁵⁷ One can only view the market as a straight line of progressively more decentralized platforms¹⁵⁸ by focusing solely on one use of autonomous technologies in business.¹⁵⁹ Thus, while Fenwick, McCahery, Kaal, and Vermeulen are correct in observing that “technologies are well-placed to facilitate more ‘inclusive’ and ‘communal’ models of organization that empower more stakeholders,”¹⁶⁰ it is not inevitable that they will do so. Rather, business founders, owners, investors, and managers must actively architect a business to use technology to fundamentally disrupt management structures.

Picking up on the potential diversity in technological improvements to business organizations, a second line of investigation considers the ways in which autonomous technologies may disrupt, alter, improve upon, replace, or eliminate a specific mechanism of corporate governance.¹⁶¹ For example, when Delaware revised its General Corporation Law to allow corporate shares to be issued and tracked via blockchain technology,¹⁶² Professor George Geis considered the potential ripple effects of transplanting that corporate law requirement into blockchain technology.¹⁶³ Professor Geis argues that if blockchain-based corporate

¹⁵³ Julia Tomassetti, *Does Uber Redefine the Firm? The Postindustrial Corporation and Advanced Information Technology*, 34 HOFSTRA LAB. & EMP. L.J. 1, 38–42, 55 (2016).

¹⁵⁴ Kaal et al., *supra* note 139, at 97.

¹⁵⁵ *Id.*

¹⁵⁶ See generally ZUBOFF, *supra* note 150.

¹⁵⁷ For examples, see *infra* Section III.A.

¹⁵⁸ Fenwick et al., “Corporate” Governance, *supra* note 139, at 189.

¹⁵⁹ Platform technologies, in the sense of using platforms to flatten middle management, only occur among the “Managerial Automation Light” businesses in the taxonomy. See *infra* Figure 2.

¹⁶⁰ Fenwick & Vermeulen, *supra* note 139, at 12.

¹⁶¹ See, e.g., Kaal, *Blockchain-Based Corporate Governance*, *supra*, note 17; Cristoph Van der Elst & Anne LaFarre, *Bringing the AGM to the 21st Century: Blockchain and Smart Contracting Tech for Shareholder Involvement* 15–16 (Eur. Corp. Governance Inst., Working Paper No. 358/2017, 2017), http://ssrn.com/abstract_id=2992804 [perma.cc/QMT8-7CAG]; Geis, *supra*, note 18, at 230–31; Anne LaFarre & Christoph Van der Elst, *Blockchain Technology for Corporate Governance and Shareholder Activism 2* (Eur. Corp. Governance Inst., Working Paper No. 390/2018, Tilburg L. Sch. Legal Stud. Rsch. Paper Series, Paper No. 07/2018, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3135209 [perma.cc/9LUC-XGHK].

¹⁶² S.B. 69, 149th Gen. Assemb. (Del. 2017) (explicitly allowing for the use of the blockchain to maintain corporate share registries).

¹⁶³ Geis, *supra* note 18, at 273.

share registries enable fully traceable shares, using blockchain-based share registries may enable more responsive shareholder governance models, impact the nature of shareholder lawsuits, and offer the opportunity to rethink the separation of corporate and shareholder liability.¹⁶⁴ Others argue that blockchain technology and other digital communications technologies can improve the shareholder voting process, and potentially open greater avenues for shareholder participation.¹⁶⁵ Notably, the current literature on autonomous technologies and corporate governance, regardless of the line of investigation pursued, appears to assume that the aims of automation are the same for all businesses: to enable greater economic returns while also eliminating or otherwise putting new checks on traditional corporate managers. Yet, to date, the literature has not undertaken an assessment of whether industry participants are actually moving in that direction. The next Part begins filling in that gap by constructing a taxonomy of autonomous businesses as they actually exist.

III. AUTONOMOUS BUSINESS REALITY: A TAXONOMY TO HELP LAW ACCOUNT FOR THE FULL SPECTRUM OF AUTONOMOUS BUSINESSES

The competing visions of autonomous businesses, both in the literature discussed above and among technological futurists, often discuss such businesses as though they are monolithic.¹⁶⁶ This Part challenges that narrative by exploring business automation as a function of design trade-offs required of founders, owners, investors, managers, and other stakeholders¹⁶⁷ when deciding whether, when, and how to automate a business. In doing so, this Part discusses thirteen examples of business automation at varying levels of complexity, and maps them by degree of operational and managerial automation.¹⁶⁸ The autonomous business

¹⁶⁴ *Id.* at 274–76. For a framework to use in assessing the broader legal implications (the ripple effects) of moving certain legal rules to functionally reside in and be autonomously executed via blockchain technology (a legal transplant of sorts), see Reyes, *supra* note 33.

¹⁶⁵ See, e.g., Van der Elst & Lafarre, *supra* note 161, at 5; Christoph Van der Elst & Anne Lafarre, *Blockchain and Smart Contracting for the Shareholder Community*, 20 EUR. BUS. L. REV. 111, 125 (2019); Michael D. Goldman & Eileen M. Filliben, *Corporate Governance: Current Trends and Likely Developments for the Twenty-First Century*, 25 DEL. J. CORP. L. 683, 689, 695 (2000); Dirk Zetzsche, *Shareholder Passivity, Cross-Border Voting and the Shareholder Rights Directive*, 8 J. CORP. L. STUD. 289, 323 (2008).

¹⁶⁶ See generally Fenwick et al., “Corporate” Governance, *supra* note 139 (lumping all “platform” technologies into one group); LoPucki, *Algorithmic Entities*, *supra* note 22 (dealing with one specific type of algorithmic entity).

¹⁶⁷ Arguably, including the lawyers advising founders, owners, and investors.

¹⁶⁸ This work of mapping autonomous business reality represents a gap analysis, the second step in ASQ—namely, in building the map and the autonomous business reality taxonomy that flows from it, I focused “on the current state of the social context, asking: What are the current realities of the extent to which the identified values and demands are achieved in the social context. What are the gaps between the ideal of the values and the reality?” Reyes & Ward, *supra* note 89. This gap analysis, and the tool that results from engaging in it—the autonomous business reality taxonomy, represent the first such analysis undertaken in the autonomous business literature, and is undertaken in the hope of furthering the discussion toward more nuanced discussion of the functional system goals of business law, broadly speaking, and

map demonstrates the potential for wide variance in the level of autonomous technology used by a business. This Part then evaluates similarities across the operational-managerial automation tradeoffs made by each autonomous business enterprise in the map. The result is the creation of the first taxonomy of autonomous business reality, which, although built from a snapshot of a moment in time, provides a framework for evaluating developments in autonomous businesses moving forward. Finally, this Part uses the taxonomy to demonstrate that the aspect of autonomous businesses that makes them truly exceptional is not the mere use of automation, but rather the new business goals and economic models that autonomous technology can help businesses achieve.

A. *Understanding Differences Between Autonomous Businesses as Design Tradeoffs*

Although an autonomous business may sound futuristic, the reality is that businesses already automate their affairs in a variety of ways.¹⁶⁹ This variance among autonomous entities can be understood as a function of the design tradeoffs made by the founders when creating the entity. Although different disciplines consider design tradeoffs more explicitly and systematically than others, stakeholders in many fields must make design tradeoffs when undertaking activity to achieve one goal inhibits their ability to achieve another goal.¹⁷⁰ Software engineers make design tradeoffs when they write code.¹⁷¹ Policy makers must make tradeoffs when designing laws and regulations that impact competing policy goals.¹⁷² Business founders make tradeoffs when they choose which type of business organization to form.¹⁷³ Businesses also make tradeoffs throughout the business life-cycle:¹⁷⁴ when designing contracts and policies,¹⁷⁵ when designing

workable processes for experimenting with more diverse corporate governance structures specifically.

¹⁶⁹ See *infra* notes 179–83 and 184–227 and accompanying text.

¹⁷⁰ Alan Z. Rozenshtein, *Surveillance Intermediaries*, 70 STAN. L. REV. 99, 164 (2018) (“The tradeoff thesis . . . applies more generally to any situation in which we’re trying to maximize a set of values, . . . at least some of the time.”).

¹⁷¹ See, e.g., Tomáš Krabec & Percy Venegas, *Trust Design: Balancing Smart Contracts Utility and Decentralisation Risk*, 23 INT’L ADVANCES ECON. RSCH. 433, 434 (2017).

¹⁷² See, e.g., David E. Pozen, *Privacy-Privacy Tradeoffs*, 83 U. CHI. L. REV. 221, 243 (2016); Stephen Holmes, *In Case of Emergency: Misunderstanding Tradeoffs in the War on Terror*, 97 CALIF. L. REV. 301, 324 (2009); Adrian Vermeule, *A New Deal for Civil Liberties: An Essay in Honor of Cass R. Sunstein*, 43 TULSA L. REV. 921, 923 (2008); Cass R. Sunstein, *Health-Health Tradeoffs*, 63 U. CHI. L. REV. 1533, 1541–42 (1996); Kal Raustiala, *Form and Substance in International Agreements*, 99 AM. J. INT’L L. 581, 581–82 (2005); Samuel L. Bray, *Power Rules*, 110 COLUM. L. REV. 1172, 1184 (2010).

¹⁷³ Henry Hansmann, *Ownership and Organizational Form*, in THE HANDBOOK OF ORGANIZATIONAL ECONOMICS 891 (Robert Gibbons & John Roberts eds., 2012).

¹⁷⁴ Michael C. Jensen, *Value Maximization, Stakeholder Theory, and the Corporate Objective Function*, 14 J. APPLIED CORP. FIN. 8, 9–10, 13, 17, 21 (2001).

¹⁷⁵ Pozen, *supra* note 172, at 229, 233; Rozenshtein, *supra* note 170, at 163–64, 181; Eric Rasmusen, *Agency Law and Contract Formation*, 6 AM. L. & ECON. REV. 369, 376 (2004).

products,¹⁷⁶ when hiring employees,¹⁷⁷ when raising capital¹⁷⁸—the list could cover nearly every aspect of a business enterprise. When it comes to decisions of whether, to what extent, and in what capacity to automate a business enterprise, the founders generally have two types of automation to consider: operational and managerial.

By operational automation, this Article refers to the use of technology to automate routine operations within a business in order to capitalize on efficiency gains and grow economies of scale.¹⁷⁹ Incorporating technology-assisted or robot-assisted manufacturing equipment into an automobile factory represents a form of low-level operational automation.¹⁸⁰ When Amazon uses robots to optimize warehouse efficiency, Amazon engages in a slightly more complex level of operational automation.¹⁸¹ When traditional financial institutions offer robo-advisor services,¹⁸² or companies use chatbots in lieu of human-provided customer service,¹⁸³ they fully automate a specific operational process while maintaining a very traditional managerial structure. Up to this point, however, these are examples of traditionally organized and incorporated companies using technology to make operations more efficient. Other companies not only engage in some form of operational automation, but also implement some level of managerial automation.

This Article uses the term managerial automation to refer to the use of technology by a business enterprise to automate some level of its internal

¹⁷⁶ Rozenshtein, *supra* note 170, at 99, 128; Geoffrey G. Parker & Marshall W. Van Alstyne, *Two-Sided Network Effects: A Theory of Information Product Design*, 51 MGMT. SCI. 1494, 1494 (2005); Geoffrey Parker & Marshall Van Alstyne, *Six Challenges in Platform Licensing and Open Innovation*, 74 COMM'NS & STRATEGIES 17, 25 (2009).

¹⁷⁷ Darren Bernard et al., *Implied Tradeoffs of CFO Accounting Expertise: Evidence from Firm-Manager Matching 2–4* (Apr. 2020), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2858681 [perma.cc/ZYU2-MN5J].

¹⁷⁸ See, e.g., Renee M. Jones, *The Unicorn Governance Trap*, 166 U. PA. L. REV. ONLINE 165, 184–85 (2017); Jennifer S. Fan, *Regulating Unicorns: Disclosure and the New Private Economy*, 57 B.C. L. REV. 583, 606 (2016).

¹⁷⁹ Pratik Dholakiya, *4 Ways to Cut Costs Using Technology*, ENTREPRENEUR (June 23, 2015), <https://www.entrepreneur.com/article/247577> [perma.cc/H8DC-TYE4].

¹⁸⁰ Paul Davidson, *More Robots Coming to U.S. Factories*, USA TODAY (Feb. 10, 2015, 12:39 PM), <https://www.usatoday.com/story/money/2015/02/09/bcg-report-on-factory-robots/23143259/> [perma.cc/G7EM-XSF9].

¹⁸¹ Will Knight, *Inside Amazon's Warehouse, Human-Robot Symbiosis*, MIT TECH. REV. (July 7, 2015), <https://www.technologyreview.com/s/538601/inside-amazons-warehouse-human-robot-symbiosis/> [perma.cc/AC3J-P4MZ].

¹⁸² See, e.g., Tom Baker & Benedict Dellaert, *Regulating Robo Advice Across the Financial Services Industry*, 103 IOWA L. REV. 713, 739, 741 (2018); Nicole G. Iannarone, *Computer as Confidant: Digital Investment Advice and the Fiduciary Standard*, 93 CHI.-KENT L. REV. 141, 142–43 (2018).

¹⁸³ See A. Narasima Venkatesh, *Industry 4.0: Reimagining the Future of Workplace (Five Business Case Applications of Artificial Intelligence, Machine Learning, Robots, Virtual Reality in Five Different Industries)*, 26 INT'L J. ENG'G. BUS. & ENTER. APPLICATIONS 5, 5–6 (2018).

management functions.¹⁸⁴ A company need not install a robot on the board of directors to engage in managerial automation.¹⁸⁵ For example, using algorithms to automatically match drivers with people that need a ride allows Uber to eliminate several layers of management that typically characterize traditional taxi companies.¹⁸⁶ Uber’s user-side app replaces the dispatcher while the driver-side app monitors the location and activity of the drivers, confirming that they are only paid for work completed.¹⁸⁷ Similarly, in the distributed ledger technology industry, the financial institution consortium known as R3 created a permissioned distributed ledger called Corda™ to enable parties who interact with each other on a regular basis to “automate one or more common business processes.”¹⁸⁸ Sharing economy,¹⁸⁹ or platform technology,¹⁹⁰ companies like Uber, and businesses built upon permissioned distributed ledger technologies like Corda partially automate both operational and managerial functions, but do so at a relatively low level.¹⁹¹ Uber remains a traditional corporation with managerial power centered in the board of directors.¹⁹² The financial institutions using Corda™ similarly retain the full range of their traditional corporate governance structures.¹⁹³ Such companies automate operations to a slightly higher degree than Amazon does in its warehouses, while also flattening managerial operations at

¹⁸⁴ Abbey Stemler, *Betwixt and Between: Regulating the Shared Economy*, 43 FORDHAM URB. L.J. 31, 52–53 (2016) [hereinafter Stemler, *Betwixt and Between*] (describing how Uber uses technology to flatten managerial patterns). Note that in this paper, I invoke the meaning of the word “manager” in the sense that it is used by workers—to refer to a structure of supervisors that report up a chain to the ultimate seat of management, the board of directors, and c-suite officers.

¹⁸⁵ *See id.* at 53.

¹⁸⁶ *Id.*

¹⁸⁷ *Id.*

¹⁸⁸ RICHARD GENDAL BROWN, THE CORDA PLATFORM: AN INTRODUCTION 3, 7, 13 (2018), <https://www.corda.net/content/corda-platform-whitepaper.pdf> [perma.cc/9WFR-XZ9M].

¹⁸⁹ “[T]he term ‘Sharing Economy’ . . . refer[s] to all businesses that utilize platforms to connect people who have goods and services to offer with those who are willing to purchase them.” Abbey Stemler, *The Myth of the Sharing Economy and Its Implications for Regulating Innovation*, 67 EMORY L.J. 197, 199 n.12 (2017) [hereinafter Stemler, *Myth of the Sharing Economy*].

¹⁹⁰ Stemler, *Betwixt and Between*, *supra* note 184, at 57 (“Platforms . . . link[] sellers of products or services with buyers of those products or services. These platforms . . . are decentralized on both sides of the platform, in contrast to single-sided platforms, which follow Coasian norms and offer their own products or services to potential buyers (for example, Amazon.com).” (footnote omitted)).

¹⁹¹ *See* Tomassetti, *supra* note 153, at 54–56 (describing Uber’s use of technology to manage operations).

¹⁹² *See* Stemler, *Myth of the Sharing Economy*, *supra* note 189, at 205, 207.

¹⁹³ *See Delivering Blockchain Technology to Transform the Way the World Does Business*, R3, https://www.r3.com/wp-content/uploads/2018/09/US_18_R3_FS_v7.pdf [perma.cc/MG M3-6GAU] (“The R3 ecosystem includes some of the world’s largest technology firms, solution providers, central banks, regulators, financial services firms, and trade associations overseeing the development of the Corda platform, blockchain for every business in every industry.”).

the lower levels, or across enterprises. This marginally increased managerial automation reduces transaction costs and enables a comparative advantage over competitors.

Another category of existing automated businesses increases automation still further by automating *most* management and operational functions. Many businesses in this category use blockchain technology in an attempt to disrupt the business structures prevalent in competitor businesses.¹⁹⁴ For example, in 2016, a group of would-be venture capitalists formed a decentralized autonomous organization on the Ethereum¹⁹⁵ protocol.¹⁹⁶ The participants sought to use their venture, named “The DAO,” to democratize venture capital.¹⁹⁷ The participants invested ether¹⁹⁸ into The DAO and received DAO tokens in exchange.¹⁹⁹ The DAO used the tokens to eliminate the need for fund managers.²⁰⁰ Instead, The DAO token holders—the investors—would make investment decisions directly via vote.²⁰¹ Famously, The DAO did not live long enough to let the management experiment fully unfold.²⁰² Nevertheless, The DAO’s attempt to “democratize” venture capital represents an example of entrepreneurs combining a high level of operational automation with a relatively high level of managerial automation.²⁰³ The DAO automated its entire operation—from holding funds for investment, to receiving proposals, to distributing invested funds—except for the decision of whether to invest in a given proposal.²⁰⁴ That decision rested with the sole level

¹⁹⁴ Although these examples both use decentralized ledger technology, it may be possible to build similar businesses using machine learning algorithms or some other emerging technology. I do not intend to narrow this category of businesses to only blockchain-based businesses. I simply find these examples fascinating in a number of respects, and very useful for exploring autonomous businesses.

¹⁹⁵ The Ethereum protocol is one of the leading public blockchains. Anneken Tappe, *Bitcoin? Ethereum? Dogecoin? Your Guide to the Biggest Names in Crypto*, CNN (Apr. 22, 2021, 11:36 AM), <https://www.cnn.com/2021/04/22/investing/cryptocurrency-guide-top-five-bitcoin-ethereum/index.html> [<https://perma.cc/M8Q3-3477>]. A detailed introduction to Ethereum is beyond the scope of this Article. For more information on Ethereum, see generally ANDREAS M. ANTONOPOULOS & GAVIN WOOD, *MASTERING ETHEREUM: BUILDING SMART CONTRACTS AND DAPPS* (2019).

¹⁹⁶ Nathaniel Popper, *A Venture Fund with Plenty of Virtual Capital, but No Capitalist*, N.Y. TIMES (May 21, 2016), <https://www.nytimes.com/2016/05/22/business/dealbook/crypto-ether-bitcoin-currency.html> [perma.cc/34ZL-9CL2]. I note that this description of “The DAO” will be very short. For a more detailed review of The DAO’s history, see Reyes et al., *supra* note 60, at 4–5; see also Mark Fenwick et al., *Legal Education in the Blockchain Revolution*, 20 VAND. J. ENT. & TECH. L. 351, 376–77 (2017).

¹⁹⁷ Popper, *supra* note 196.

¹⁹⁸ Ether is the native-cryptocurrency of the Ethereum protocol. For more information on ether, see ANTONOPOULOS & WOOD, *supra* note 195, at 13–14.

¹⁹⁹ Popper, *supra* note 196.

²⁰⁰ See *Id.*

²⁰¹ *Id.*

²⁰² Reyes et al., *supra* note 60, at 6.

²⁰³ See *id.* at 5; see also, Reyes, *supra* note 26, at 388–89.

²⁰⁴ Reyes et al., *supra* note 60, at 4–5.

of management—the investors themselves.²⁰⁵ The DAO automated middle management functions to such an extent that the investors themselves remained in control of the business.²⁰⁶ In the last quarter of 2019, two other entities with business goals similar to those of The DAO emerged as Delaware LLCs: the LAO and MetaCartel Ventures.²⁰⁷

Another decentralized autonomous organization, Dash, operates via a masternode protocol in which participants stake 1000 DASH, the Dash native cryptocurrency, to become a masternode.²⁰⁸ Masternodes operate as full nodes that validate transactions occurring on the protocol.²⁰⁹ In return for providing these validation services, masternodes receive 45 percent of each block reward.²¹⁰ Another 45 percent of the block reward goes to the miner of the block, and the last 10 percent remains with Dash for use in funding the development of the network.²¹¹ Anyone can submit a proposal for funding from the Dash development funds.²¹² Masternode owners vote on those proposals, and when approved, the projects are automatically funded via smart contracts.²¹³ Here, Dash automated most of its operational functions but appears to recognize that it needs humans to continue to update and improve its code. Thus, Dash uses blockchain technology to allow the actual owners of the enterprise, the masternode owners, to retain management control of the enterprise, despite its extremely distributed nature and regardless of the number of participants.²¹⁴

²⁰⁵ *Id.* at 5.

²⁰⁶ *Id.* at 4–5. As a result, of course, the DAO looked a lot like a general partnership. In fact, in its ruling on The DAO token sale, the Securities Exchange Commission referred to The DAO as “an unincorporated organization,” which might be read as recognition of The DAO’s general partnership status. SEC, REPORT OF INVESTIGATION PURSUANT TO SECTION 21(A) OF THE SECURITIES EXCHANGE ACT OF 1934: THE DAO, RELEASE NO. 81207 (2017).

²⁰⁷ See THE LAO: A DAO SUPPORTING THE BLOCKCHAIN ECOSYSTEM, [thelao.io \[perma.cc/73SW-4DRH\]](https://perma.cc/73SW-4DRH); Liam Kelly, *Investment Sorcery: MetaCartel Launches DAO Venture Fund*, CRYPTO BRIEFING (Dec. 17, 2019), <https://cryptobriefing.com/metacartel-launches-dao-based-venture-fund/> [perma.cc/Y49B-C52G]. I note that neither of these entities appear on the Autonomous Business Reality Map in large part because they would occupy the exact same position as The DAO.

²⁰⁸ Evan Duffield & Daniel Diaz, *Dash: A Payments-Focused Cryptocurrency* (Aug. 22, 2018), <https://github.com/dashpay/dash/wiki/Whitepaper> [https://perma.cc/W7TS-572R]. Notably, unlike the other blockchain-based businesses introduced as examples in this Article, Dash is a base-layer protocol, not a DAO built on top of the Ethereum protocol or some other protocol. See *Which Blockchain to Fork to Start Your Own Cryptocurrency*, BLAIZE (Apr. 1, 2021), <https://blaize.tech/article-type/which-blockchain-to-fork-to-start-your-own-cryptocurrency/> [https://perma.cc/62RQ-3AW2]; *Dash: The Original DAO*, BITCOINIST (2016), <https://bitcoinist.com/dash-original-dao/> [https://perma.cc/P753-GP6N].

²⁰⁹ *Id.*

²¹⁰ *Id.*

²¹¹ NATHANIEL LUZ, DIGITAL IS THE CASH: UNDERSTANDING THE PAST, PRESENT & FUTURE OF FINANCE IN ONE READ 41–42 (2019).

²¹² *Id.* at 42.

²¹³ *Id.*

²¹⁴ Leah Stella Stephens, *How to Get Funded by a Decentralized Autonomous Organization*, BITCOIN INSIDER (Aug. 22, 2018, 10:51 PM), <https://www.bitcoininsider.org/article/36200/ho>

Indeed, Dash legally structured its business creatively to reinforce the automation created by the protocol while also recognizing the managerial role of the masternode operators. First, Dash's core developers work for Dash Core Group, Inc., a Delaware C-Corporation.²¹⁵ Second, the Dash DAO Irrevocable Trust (The Dash Trust), a New Zealand-based entity, owns the Dash Core Group for the benefit of the masternode operators.²¹⁶ The masternode operators continue to vote on whether to approve any particular proposal, including whether to elect specific individuals to serve as "Trust Protectors."²¹⁷ The Trust Protectors appoint the Trustee to act on behalf of The Dash Trust, and also elect the board of directors of the Dash Core Group.²¹⁸ Ultimately then, the masternode operators, through the Trust Protectors that they elect, largely control the fate of enterprise, just as they would if operating solely via the Dash protocol, without any legal entity structure built on top. The Dash Trust acts as a legally recognizable governance framework that respects the ethos of the Dash network, while also enabling the network to own property and hold assets,²¹⁹ such as trademarks²²⁰ and patents.²²¹ As a result, Dash represents a uniquely automated business—one with high levels of operational and managerial automation—with managerial automation based on the technology that powers the organization and reinforced by a creative legal structure.

A worker's collective of freelance software developers, dOrg, LLC,²²² represents a business with the same level of operational automation as Dash, but

w-get-funded-decentralized-autonomous-organization [perma.cc/T6J8-HK98] ("Humans are still making the decisions within DAOs, so you need to focus on the social aspects of communities and figure out how you can become useful to a particular human community.").

²¹⁵ Ryan Taylor, *Dash Core Group Legal Structure Details*, DASH FS. (Aug. 1, 2018), <https://www.dash.org/forum/threads/dash-core-group-legal-structure-details.39848/> [perma.cc/3WH9-JFW6]. Notably, the Dash Core team previously had organized as an Arizona non-profit trade association, but ran into several difficulties that required a re-organization. For further information, see *id.*

²¹⁶ *Id.*

²¹⁷ *Id.* The first slate of Trust Protectors was elected in the Spring of 2019. Joël Valenzuela, *Dash DAO Irrevocable Trust Completes Trust Protector Election in Historic Governance Moment*, DASH NEWS (Apr. 3, 2019), <https://dashnews.org/dash-dao-irrevocable-trust-completes-trust-protector-election-in-historic-governance-moment/> [perma.cc/WB4M-UA88].

²¹⁸ Taylor, *supra* note 215.

²¹⁹ As a legal person, The Dash Trust can own property, contract with others, and has standing to sue to enforce its rights. For more on autonomous entities and legal personhood, see a separate paper on that topic: Reyes, *Autonomous Corporate Personhood*, *supra* note 99.

²²⁰ For more on the very interesting questions surrounding trademarks and blockchain protocols, such as the Bitcoin Blockchain, Ethereum, and Dash, see a separate paper on that topic: Sean Pager & Carla Reyes, *Trademarking Blockchain Enterprises* (unpublished manuscript) (on file with author). With respect to Dash, the Dash Core Group owns the Dash mark, and the Dash Core Group is owned by The Dash Trust, meaning that The Dash Trust ultimately remains in control of the mark.

²²¹ Taylor, *supra* note 215.

²²² dOrgTech, *Ecosystem*, GITHUB, <https://github.com/dOrgTech/Ecosystem> [perma.cc/HWA4-YVGJ].

with a slightly greater level of managerial automation. As a worker's cooperative, dOrg LLC employees own the business, distributing profits in proportion to the work performed for the business.²²³ Regardless of contributions to the cooperative's work or the proportion of profits received, members of a worker's cooperative each receive one vote for use in making business and governance decisions.²²⁴ dOrg LLC reflects these rules and the ethos supporting them through the computer code that facilitates its existence.²²⁵ To formalize those rules while also obtaining a legally recognizable entity status, dOrg LLC became the first Blockchain-Based Limited Liability Organization organized under a 2018 Vermont statute.²²⁶ This structure allows many operational aspects of operating a software development business to be automated: sharing client requests, tracking work completion, accounting for owner profit allocations and distributions, etc.²²⁷ As such, dOrg LLC's use of blockchain technology also allows for a completely flat management structure without increased overhead costs: the employees own and manage the business such that no middle management or professional management classes exist in the business hierarchy. Nevertheless, the employee-owners, who are actual people and not autonomous technology, continue to develop software and perform the services that generate business revenue, such that dOrg LLC cannot be considered a fully automated business.

The Plantoid represents a business that automates managerial decisions to an even higher degree than The DAO, the LAO, MetaCartelVentures, Dash, or dOrg LLC because ownership itself is automated. Specifically, no human owns a Plantoid.²²⁸ "A Plantoid is the plant equivalent of an android; it is a robot or synthetic organism designed to look, act and grow like a plant."²²⁹ Each Plantoid exists in two parts: the metallic sculpture the public sees and appreciates, and the smart contract code that exists on the Ethereum protocol and powers the Plantoid.²³⁰ Essentially, each Plantoid is a metallic sculpture displayed in a public

²²³ JOHNSON & EMERSON, *supra* note 28, at 5 ("A cooperative is a business owned and controlled by the people who use its services. . . . But this guide is about worker cooperatives: businesses owned and controlled by the people who work in them. The worker-members own the business and return its profits to themselves based on how much they work for the cop.")

²²⁴ *Id.* ("[A] cooperative is governed on a democratic basis, with one vote per person regardless of investment.")

²²⁵ dOrgTech, *LL-DAO*, GITHUB, <https://github.com/dOrgTech/LL-DAO> [perma.cc/A4XH-45CF].

²²⁶ Biggs, *supra* note 24; *dOrg Launches First Limited Liability DAO*, GRAVEL & SHEA (June 2019), <https://www.gravelshea.com/2019/06/dorg-launches-first-limited-liability-dao/> [perma.cc/7DR3-ZYGA].

²²⁷ Biggs, *supra* note 24.

²²⁸ Kat Mustatea, *Meet Plantoid: Blockchain Art with a Life of Its Own*, FORBES (Jan. 31, 2018, 12:50 PM), <https://www.forbes.com/sites/katmustatea/2018/01/31/meet-plantoid-blockchain-art-with-a-life-of-its-own/> [perma.cc/MT3K-MCTP].

²²⁹ *I'm a Plantoid: A Blockchain-Based Life Form*, OKHAOS, <http://okhaos.com/plantoids/#love> [https://perma.cc/XX7R-FKZQ].

²³⁰ *Id.*

place.²³¹ This metallic sculpture is powered by a set of smart contracts, a DAO, that resides on the Ethereum protocol and manages the Plantoid's life-cycle and affairs.²³² When a passer-by appreciates the Plantoid's beauty, he or she can send a token of appreciation to the Plantoid by sending cryptocurrency to the Plantoid's wallet.²³³ The funds received then belong to the DAO powering the Plantoid.²³⁴ The smart contracts running the DAO require that when the Plantoid accumulates sufficient funds, the Plantoid will request proposals from artists to create a new Plantoid.²³⁵ Other than the selection of the winning artist proposal and the actual creation of new Plantoids, the Plantoid DAO automates the entire art production enterprise.²³⁶

Metronome, a platform-agnostic virtual currency and exchange service, exhibits an extremely high combined level of operational and management automation.²³⁷ Metronome uses an algorithm to automatically set the price of its product, a token referred to as "MET."²³⁸ Metronome automatically produces, stores, and sells MET via smart contracts.²³⁹ As protocol agnostic technology, Metronome can run on top of any blockchain protocol.²⁴⁰ The proceeds Metronome creates are not distributed to human shareholders or human managers—there are no humans involved beyond Metronome's launch.²⁴¹ Instead, Metronome holds the proceeds from sale of MET in a smart contract to be used by Metronome according to the requirements of its code.²⁴² Even still, Metronome, as computer software, must be updated and maintained by humans, meaning that non-autonomous touch points remain.²⁴³

²³¹ *Id.*

²³² Giulio Prisco, *Plantoids: The First Blockchain-Based Artificial Life Forms*, BITCOIN MAG. (Dec. 26, 2016), <https://bitcoinmagazine.com/business/plantoids-the-first-blockchain-based-artificial-life-forms-1482768916> [<https://perma.cc/S4GB-E69B>].

²³³ *Id.*

²³⁴ Grace Caffyn, *This Robot Plant Needs You and Bitcoin to Reproduce*, COINDESK (Nov. 1, 2015, 9:51 AM), <http://www.coindesk.com/this-robot-plant-needs-you-and-bitcoin-to-reproduce/> [perma.cc/G66R-MNE5].

²³⁵ *Id.*

²³⁶ Mustatea, *supra* note 228.

²³⁷ *Owners Manual*, GITHUB (Aug. 15, 2019), https://github.com/autonomousoftware/documentation/blob/master/owners_manual/owners_manual.md [perma.cc/ALY7-EJLH]; *see also* Jeff John Roberts, *Bitcoin Alums Announce New Digital Currency Metronome*, FORTUNE (Oct. 24, 2017), <http://fortune.com/2017/10/24/bitcoin-metronome/> [<https://perma.cc/EPY9-QEFV>]; METRONOME, <https://metronome.io/about/> [perma.cc/5Y8K-UAWE].

²³⁸ *Owner's Manual*, *supra* note 237.

²³⁹ *Id.*

²⁴⁰ *Id.*

²⁴¹ *Id.*

²⁴² *Id.*

²⁴³ Matthew Roszak, *From Metronome, a Milestone*, BLOQ: THE SYNC BLOG (June 27, 2019), <https://sync.bloq.com/from-metronome-a-milestone/> [perma.cc/A7NQ-MWUR] (describing genesis of Metronome, and that the "Metronome Team" works to deliver new software milestones).

This discussion of autonomous businesses reveals the varied approaches that businesses can take when addressing the design trade-offs of operational and managerial automation. As depicted in Figure 1 below, mapping these examples of autonomous businesses by their automation levels along axes of operational and managerial automation reveals the complex landscape of autonomous business entities.

FIGURE 1:²⁴⁴ AUTONOMOUS BUSINESS MAP

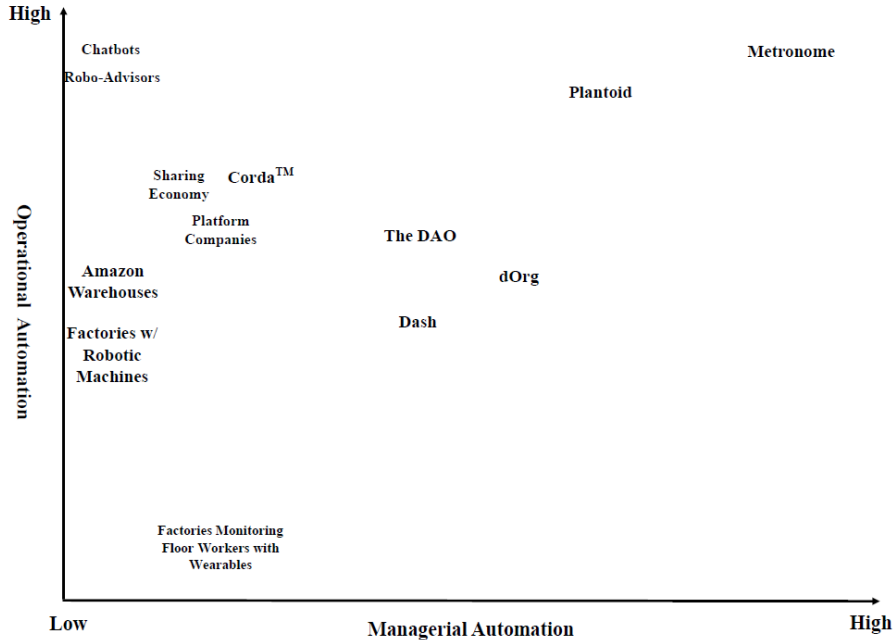


Figure 1 reveals a layer of complexity not yet captured by the existing literature on autonomous or algorithmic entities. Despite the diversity of automation in the market, most existing literature focuses on one cluster of autonomous businesses or another.²⁴⁵ The literature at the intersection of corporate law and autonomous businesses, for its part, mainly investigates businesses in the sharing economy on the one hand, or fully automated businesses, on the other.²⁴⁶ The autonomous business reality map (Figure 1), however, reveals that in seeking to reach unique end goals, each business adopts a distinct combination of technologies to facilitate different structural and governance ends. This gap between an expected future state of autonomous businesses and the current landscape results from an underappreciation of the entrepreneurial design tradeoffs undertaken in

²⁴⁴ Neither Figure 1 nor any of the other Figures contained in the following pages were built to scale, nor are they based on any mathematical formula. Rather, these figures are for visual aid purposes only. Specifically, these figures are intended only for use in symbolically representing industry automation efforts and building a related taxonomy for analytical purposes.

²⁴⁵ See, e.g., text and accompanying citations discussed *supra* Sections II.A–B.

²⁴⁶ See *supra* Section II.B.

designing an autonomous business.²⁴⁷ Even if it is technologically possible to create a fully automated business with absolutely no human intervention beyond initial software launch,²⁴⁸ why would entrepreneurs do so? LoPucki believes the end game of such entities would be to facilitate criminal enterprise.²⁴⁹ Perhaps another reason to create such an entity is merely to show it can be done.²⁵⁰ The map of autonomous business reality reveals a landscape of businesses that adopt technology to automate different aspects of their business to achieve a variety of different end goals, including to improve the bottom line, provide new economic incentives for art production, create interoperable technology architecture, and reduce the difficulty in facilitating a large democratically run workers collective, among others.²⁵¹ Ultimately then, the gap between the current literature and autonomous business reality persists because it tends to ignore the fact that the probability of automating any given aspect of a business is a result of a founder's view of how to make design tradeoffs in order to reach specific business goals.²⁵²

In other words, the goals of the entrepreneur dictate the types of tradeoffs they are willing to make when designing business governance mechanisms and overall business structure. This reality does not mean that traditionally hierarchical corporate structures will not evolve over time, or that their evolution will not be connected to the use of autonomous technologies in corporate governance. The autonomous business map in Figure 1 reminds us that business aims are not monolithic and that the means to achieve those aims vary significantly in practice, including through significant variance in when and how businesses adopt technology to facilitate governance. In doing so, the map in Figure 1 suggests that it is not the presence of autonomous technologies in business that may impact the trajectory of corporate governance. In that regard, the thirteen examples represented in Figure 1 do not represent an exhaustive list. The map portrayed in Figure 1 should be expected to further populate over time, with, perhaps, a larger number of businesses employing greater levels of operational and managerial

²⁴⁷ This is an example of how, as Professors Jane Bambauer & Tal Zarsky put it, "the legal literature has focused on the effect of algorithms in static mode." Jane Bambauer & Tal Zarsky, *The Algorithm Game*, 94 NOTRE DAME L. REV. 1, 3 (2018). Autonomous business reality, however, "is dynamic, and individuals change their behavior in anticipation of how they are judged and what the consequences will be." *Id.*

²⁴⁸ This, however, is a scenario that this author finds seriously improbable with the current state of the technology.

²⁴⁹ LoPucki, *Algorithmic Entities*, *supra* note 22, at 890.

²⁵⁰ See generally Yochai Benkler, *Coase's Penguin, or, Linux and The Nature of the Firm*, 112 YALE L.J. 369 (2002).

²⁵¹ Bambauer & Zarsky, *supra* note 247, at 3 ("Within limits, people game the system for a range of altruistic and self-serving reasons.").

²⁵² These design tradeoffs, and leaving open avenues for founders to choose pathways that respect their goals, have been one of the core motivating factors in my prior work on the use of business trusts to form legally-recognized blockchain-based businesses, and on creating public blockchain governance mechanisms that rest in contract and private-ordering. See, e.g., Reyes, *supra* note 26; Reyes, *supra* note 43.

automation.²⁵³ Thus, the framework begun here, and further developed below—in which autonomous businesses can be unpacked and better understood by considering the operational and managerial automation design tradeoffs undertaken by business founders, owners, and managers—will become increasingly valuable as the number and variety of autonomous entities continues to grow.

B. Identifying Trends in Autonomous Businesses to Illuminate True Differences

Although the map of existing autonomous businesses demonstrates the diversity in design tradeoffs made by owners and managers when implementing autonomous technologies, trends across entities also emerge. Specifically, at least five generalizable combinations of operational and managerial automation exist.²⁵⁴ Further, similarities among certain businesses using these five general types of autonomous technology combinations reveal three groups with similarities at an even higher level of abstraction.²⁵⁵ Taking a step back to look at these three groups at a macro level allows us to consider the landscape of autonomous businesses through a different lens. Indeed, the taxonomy of autonomous businesses created by this disaggregation and re-categorization challenges common assumptions and narratives in the existing literature. Up to this point, the literature often appears to assume that the unique element of autonomous businesses lies in the fact that businesses are automating at all, or that they are automating to a more significant extent than before. Such assumptions construct a narrative in which design trade-offs are of little import in the analysis. The autonomous business taxonomy being constructed here, on the other hand, demonstrates that the most meaningful differences between types of autonomous businesses lies in the new economic models enabled by technology and the design tradeoffs in business structures and governance mechanisms made to achieve those models, rather than merely the use of technology standing alone. The autonomous business taxonomy is outlined in Table 1 and visually depicted in Figure 2 below.

²⁵³ But we should also expect additional businesses to employ higher levels of operational automation and low levels of managerial automation. Where operations require particularly intricate labor, we might also expect further managerial automation with a low level of operational automation. In other words, the map will likely further populate in all directions, with the diversity of enterprises reflecting the diversity in business owners and their goals.

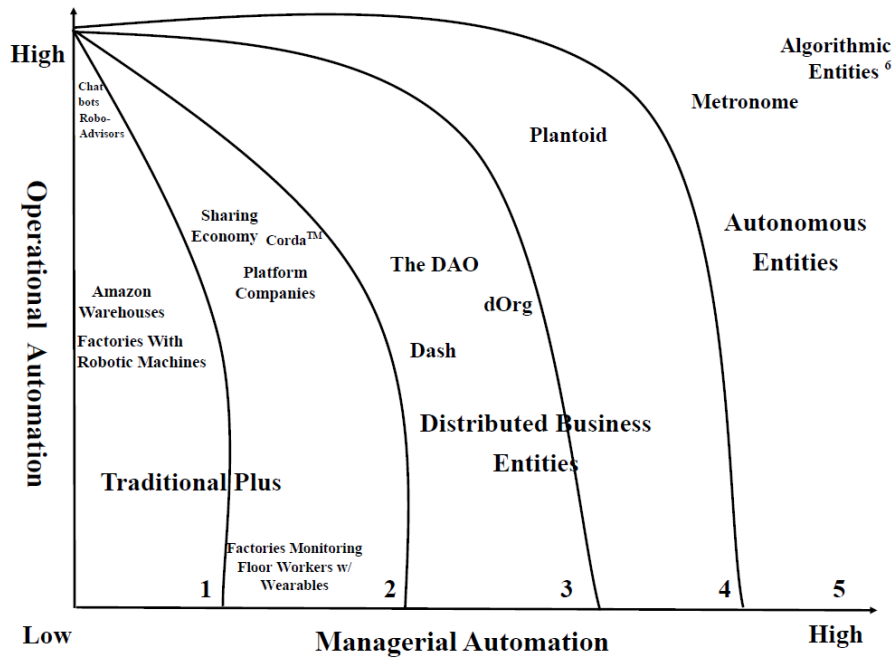
²⁵⁴ The total number of discrete categories sits at six, *infra* Table 1, once Professor LoPucki's Algorithmic Entities are added to the end of the spectrum. *See generally* LoPucki, *Algorithmic Entities*, *supra* note 22.

²⁵⁵ *See infra* Table 1 (The three groups are traditional plus, distributed business entities, and autonomous entities.).

TABLE 1²⁵⁶

Traditional Plus		Distributed Business Entities		Autonomous Entities	
1	2	3	4	5	6
Primarily Operationally Automated	Managerial Automation Light	Autonomous Mediating Hierarchy	Mostly Autonomous	Fully Autonomous	Algorithmic Entities

FIGURE 2: GROUPING AUTONOMOUS BUSINESSES BY SHARED CHARACTERISTICS



The first category of autonomous businesses includes those for which automation primarily resides in the operational realm, while management structures resemble traditional corporate governance structures. This Article refers to these businesses as “Primarily Operationally Automated” businesses. For example, if Amazon suddenly removed all its warehouse robots and replaced them with human workers, its management structure would not necessarily be affected. The second category of autonomous businesses, the “Managerial Automation Light” businesses, are characterized by a combination of some level of operational automation and a relatively low level of managerial automation.²⁵⁷ These corporations automate middle-level management (e.g. various levels of supervisors) or

²⁵⁶ Note, however, that each of the categories in Table 1 contain within them a rich variance in type and degree of automation, as depicted in Figure 2, below. The numbers in Table 1 correspond to the numbers on Figures 2–4, showing where each category in the taxonomy overlays the autonomous business reality map.

²⁵⁷ Fenwick et al., “Corporate” Governance, *supra* note 139, at 174–77.

tangential oversight structures like those required to oversee joint ventures or strategic partnerships. Sharing economy companies like Uber and Airbnb fit here.²⁵⁸ The service uses artificial intelligence to search driver or host offerings and pair riders or renters with appropriate services.²⁵⁹ Meanwhile, the companies also remove infrastructure like a ride dispatcher or a hotel concierge by automating those functions.²⁶⁰ Notably, Primarily Operationally Automated businesses and Managerial Automation Light businesses share certain governance characteristics. In particular both types of businesses continue to be governed by traditional structures like corporate officers, a board of directors and shareholders. Together, therefore, the Primarily Operationally Automated and Managerial Automation Light businesses form a broader group of “Traditional Plus” businesses: those businesses that at least use autonomous technologies to partially automate operational functions and may, to a limited degree, engage in middle-management automation, but ultimately retain a traditional corporate governance structure with a centralized hierarchy at the upper levels of management.

The third category of autonomous businesses includes those businesses that have almost fully automated their services or production process and have eliminated human management at all levels such that owners directly manage the business. In other words, these businesses automate the mediating hierarchy traditionally thought to be provided by the corporate form.²⁶¹ These “Autonomous Mediating Hierarchy” businesses include the democratized venture capital firm created by The DAO, which fully automated the investment process but required the vote of the investors to determine which investments to actually make.²⁶² Dash is also an Autonomous Mediating Hierarchy business. While Dash otherwise automated all other operational and managerial functions, masternode owners, trust protectors, and the trustee make strategic decisions.²⁶³ The fourth category, “Mostly Autonomous” businesses, eliminate the Autonomous Mediating Hierarchy businesses’ final layer of management by eliminating owners altogether. Nevertheless, humans remain necessary to perform certain functions such that, although completely automating operations, Mostly Autonomous businesses do not completely automate all managerial functions. For example, the

²⁵⁸ *Id.* (Indeed, many of the “platform” companies discussed by Fenwick et al. fall into the Managerial Automation Light category).

²⁵⁹ See, e.g., Zoubin Ghahramani, *Uber AI in 2019: Advancing Mobility with Artificial Intelligence*, UBER ENG’G: AI BLOG (Dec. 18, 2019), <https://eng.uber.com/uber-ai-blog-2019/> [perma.cc/54MQ-SHSB].

²⁶⁰ *Id.*

²⁶¹ Margaret M. Blair & Lynn A. Stout, *A Team Production Theory of Corporate Law*, 24 J. CORP. L. 751, 753 (1999) (“We argue that public corporation law can offer a second-best solution to team production problems because it allows rational individuals who hope to profit from team production to overcome shirking and rent-seeking by opting into an internal governance structure we call the ‘mediating hierarchy’” (footnote omitted)).

²⁶² See *supra* notes 198–201 and accompanying text.

²⁶³ See *supra* notes 216–18 and accompanying text. Note that The Dash Trust owns the Dash Core Group, which is probably a Traditional Plus business. *Id.* This offers an example of the complexity that can be accommodated by the autonomous business reality taxonomy.

Plantoid uses automated processes to earn the funds necessary to reproduce, but requires humans to actually select and create a new Plantoid. Together, Autonomous Mediating Hierarchy businesses and Mostly Autonomous businesses compose a second group of businesses: Distributed Business Entities.²⁶⁴ Distributed Business Entities share certain characteristics, regardless of whether they fall within the sub-category of Autonomous Mediating Hierarchy or Mostly Autonomous businesses. Namely, Distributed Business Entities exhibit a high or nearly complete level of operational automation and a high or nearly complete level of managerial automation.

The fifth category, “Fully Autonomous” businesses, employ full operational and managerial automation, but still retain human involvement at some level. Fully Autonomous businesses do not have human owners or human managers, and do not distribute proceeds or dividends to humans. Metronome, for example, sets the price of its program using an algorithm, sells its product via smart contract, and does not report to, or take directions from, any person.²⁶⁵ Fully Autonomous businesses, however, must be distinguished from LoPucki’s vision of a future state of “Algorithmic Entities,”²⁶⁶ which never experience human touch points after initial launch.²⁶⁷ Rather, at least one example of a Fully Autonomous business actually exists (Metronome), wherein humans remain required to update and maintain the code that makes them function.²⁶⁸ Together, Fully Autonomous businesses and Algorithmic Entities comprise a generalizable group of “Autonomous Entities.”²⁶⁹

²⁶⁴ I first introduced the concept of a distributed business entity (or, “DBE”) in Reyes, *supra* note 26. Although the DBEs discussed in that article were limited to blockchain-based businesses, and although all of the examples I could find in commerce for use in the autonomous business map are blockchain-based businesses, I do not want to rule out the possibility of artificial intelligence or other networked technology-based businesses falling into the categories of businesses that comprise Distributed Business Entities. I simply have not found an example of such a business as of this writing.

²⁶⁵ See *supra* notes 238–39 and accompanying text.

²⁶⁶ LoPucki, *Algorithmic Entities*, *supra* note 22, at 897 (“An entity is ‘algorithmic’ if an algorithm controls it. . . . For the purposes of this Article, an algorithm controls an entity only if the algorithm makes the entity’s decisions without human participation. That a human created the algorithm does not disqualify the algorithm from status as a controller, provided that the human no longer has the ability to modify the algorithm.”).

²⁶⁷ It is difficult to find an existing example of what LoPucki defines as an algorithmic entity. This is generally because complicated code needs to be updated and maintained by humans, and even for simple code, a human must tell the AI what kind of program to create. Matt Reynolds, *AI Learns to Write Its Own Code by Stealing from Other Programs*, NEWSIDENTIST (Feb. 22, 2017), <https://www.newscientist.com/article/mg23331144-500-ai-learns-to-write-its-own-code-by-stealing-from-other-programs/> [perma.cc/K6WZ-NAA8].

²⁶⁸ See *supra* notes 237–45.

²⁶⁹ Here, I adopt Professor LoPucki’s term for the broader group of autonomous businesses of which Algorithmic Entities only form a part. LoPucki, *Algorithmic Entities*, *supra* note 22, at 897 (“An entity is ‘autonomous’ if the entity controls itself, as opposed to being controlled by owners or members. All algorithmic entities are autonomous by definition. But not all autonomous entities are algorithmic.”).

Much of the narrative around technology and business entities predicts that technology will bring an end to corporate governance, corporate law, and business activity as it is currently understood and experienced.²⁷⁰ For example, Mark Fenwick and Erik P.M. Vermeulen describe the move from a Primarily Operationally Automated business to a Managerial Automation Light business as a move from hierarchical governance to platform governance.²⁷¹ However, the autonomous business taxonomy built here demonstrates that the types of autonomous businesses and the design trade-offs made by those that create and manage them can be further disaggregated beyond a dichotomy of hierarchical management and managerial flattening via platform use. Rather, upper managerial structures remain hierarchical at the board and c-suite level, while operations become flatter. Operational automation and managerial automation are neither the same nor are they co-extensive. A deeper move toward flatter management structures does not occur until deeper in the taxonomy. Instead, many platforms are actually managed by a traditionally hierarchical corporate structure.²⁷² Ultimately then, the autonomous business taxonomy developed here makes clear that behind the curtain of the “disruption” and “automation” hype, the landscape of autonomous businesses is really much more varied. That variety, and the patterns that emerge from it, suggests that if something about the use of autonomous technology in business rises to the level of exceptional circumstances requiring new laws, legal doctrine, or legal theory, it is not the use of technology standing alone. Rather, the taxonomy of autonomous business reality calls for consideration of the deeper implications of autonomous technology for business, recognizing that those implications may be as varied as the combinations of automation adopted by businesses today.

C. *Automation Is Not What Makes Autonomous Businesses Exceptional*

Technology neutrality represents a core principle of law-making and regulation in areas that touch on emerging technology.²⁷³ Remaining technology neutral

²⁷⁰ See, e.g., Fenwick & Vermeulen, *supra* note 139; Fenwick et al., “Corporate” Governance, *supra* note 139, at 172; Kaal et al., *supra* note 139, at 92; LoPucki, *Algorithmic Entities*, *supra* note 22.

²⁷¹ Fenwick et al., “Corporate” Governance, *supra* note 139, at 174–78, 187–89.

²⁷² See, for example, Amazon, Uber, Google, etc., all of which operate under a traditional corporate management structure of a board of directors and c-suite executives. *AMZN Profiles*, WALL ST. J.: MARKETS, <https://www.wsj.com/market-data/quotes/AMZN/company-people> [https://perma.cc/SYJ6-UTR8]; *UBER Profiles*, WALL ST. J.: MARKETS, <https://www.wsj.com/market-data/quotes/UBER/company-people> [https://perma.cc/M7A9-DQFV]; *GOOGL Profiles*, WALL ST. J.: MARKETS, <https://www.wsj.com/market-data/quotes/GOOGL/company-people> [https://perma.cc/4Z6M-QEKA].

²⁷³ See, e.g., U.N. COMM’N ON INT’L TRADE L., UNCITRAL MODEL LAW ON ELECTRONIC COMMERCE WITH GUIDE TO ENACTMENT 1996, at 17, U.N. Sales No. E.99.V.4 (1999) (“The objectives of the Model Law, which include enabling or facilitating the use of electronic commerce and providing equal treatment to users of paper-based documentation and to users of computer-based information, are essential for fostering economy and efficiency in

requires law-makers to consider which activities to regulate, regardless of whether the regulated person or entity uses a specific technology to undertake those activities.²⁷⁴ Focusing on activity-based regulation forces policy makers to explicitly consider the tradeoffs inherently involved when making decisions about scope and application of any given law.²⁷⁵ Occasions may arise, however, when an emerging technology so fundamentally disrupts the existing social order that new, technology-specific regulation may be warranted.²⁷⁶ Professor Ryan Calo offers the idea of exceptional technology as the threshold for determining when technology-specific laws may be necessary.²⁷⁷ Professor Calo defines exceptional technology as a technology that, when introduced into mainstream society, “requires a systematic change to the law or legal institutions in order to reproduce, or if necessary displace, an existing balance of values.”²⁷⁸ Whether a technology rises to the level of exceptional, depends upon that technology’s essential characteristics—“the characteristics that distinguish [a new technology] from prior or constituent technology.”²⁷⁹ Applied in the context of business law, the question becomes the following: What are the essential characteristics of autonomous businesses? The existing literature seems to assume that automation is the essential characteristic that makes autonomous businesses exceptional and in need of different legal treatment. The autonomous business reality taxonomy, however, demonstrates that even traditional companies automate in some way. Automation standing alone does not make autonomous businesses exceptional.

In fact, restating the taxonomy in terms of effects of the operational-managerial automation design tradeoff on ownership reveals the truly essential characteristics of autonomous businesses. Traditionally, governance mechanisms in business law aim to mitigate the effects of separating ownership from control of the enterprise.²⁸⁰ The autonomous business reality map (Figure 2), however,

international trade. By incorporating the procedures prescribed in the Model Law in its national legislation for those situations where parties opt to use electronic means of communication, an enacting State would create a media-neutral environment.”); *see also id.* at 23–24 (“It was felt during the preparation of the Model Law that exclusion of any form or medium by way of a limitation in the scope of the Model Law might result in practical difficulties and would run counter to the purpose of providing truly ‘media-neutral’ rules.”); Bert-Jaap Koops, *Should ICT Regulation Be Technology-Neutral?*, in 9 *STARTING POINTS FOR ICT REGULATION: DECONSTRUCTING PREVALENT POLICY ONE-LINERS* 77 (Bert-Jaap Koops et al. eds., 2006).

²⁷⁴ Koops, *supra* note 273, at 82 (“In general, regulation aims at regulating people’s behavior. It does not regulate the behavior of machines, except to the extent that machine behavior influences people’s behavior. Moreover, behavior as such is not the point of regulation, it is rather the effect of behavior on society or on other people that is the focus of regulation.”).

²⁷⁵ *Id.* at 88 (“[A]n appropriate regulatory instrument may be chosen depending on the extent to which specific technologies should be regulated.”).

²⁷⁶ Calo, *Robotics*, *supra* note 67, at 550.

²⁷⁷ *Id.* at 550–53.

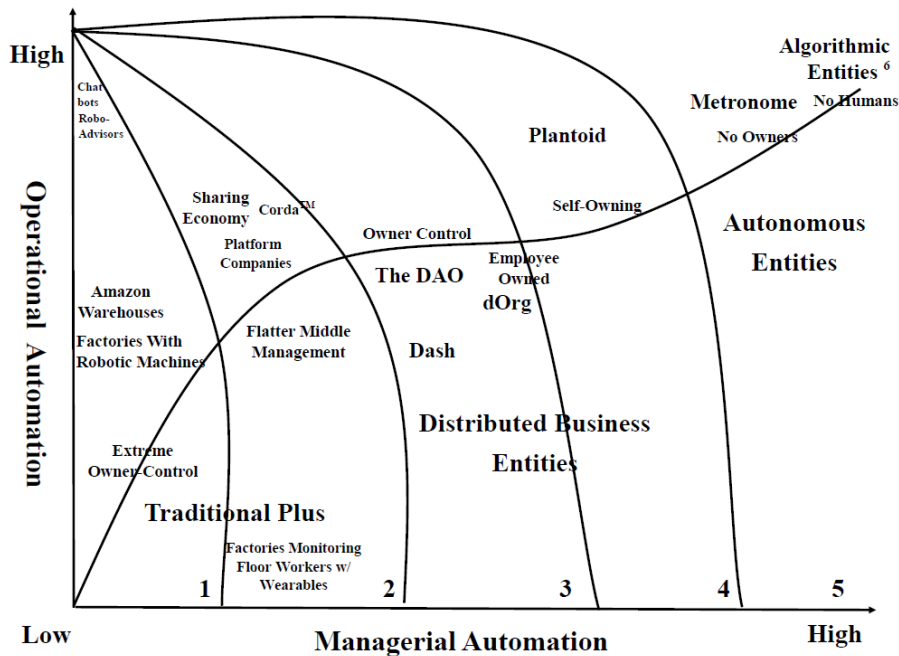
²⁷⁸ *Id.* at 552.

²⁷⁹ *Id.* at 514.

²⁸⁰ Ruth V. Aguilera et al., *Regulation and Comparative Corporate Governance*, in *THE OXFORD HANDBOOK OF CORPORATE GOVERNANCE* 23, 23 (Mike Wright et al. eds., 2013). Corporate governance has long focused on the divergence of interests between principals and

shows that specific combinations of operational and managerial automation can change the level of separation between ownership and control. Indeed, if instead of thinking about business entity structures as inevitably creating a significant separation between ownership and control, we invert the idea and consider whether and to what extent autonomous businesses can *collapse* ownership and control closer together, the autonomous business taxonomy offers some surprising lessons.

FIGURE 3: AUTONOMOUS BUSINESS REALITY MAPPED BY DEGREE OF COLLAPSE BETWEEN OWNERSHIP AND CONTROL



As visually depicted in Figure 3, traditional corporate governance—characterized by shareholders who elect directors, directors who hire officers, and officers that hire employees—represents an extremely low degree of collapse between ownership and control. This represents the phenomena described by Adolf Berle and Gardner Means nearly ninety years ago,²⁸¹ and which remains the predominate dynamic in the Traditional Plus businesses. On the other end of the autonomous business spectrum, Autonomous Entities represent a complete

agents, known as the principle-agent problem. *Id.* “The key idea is that unmonitored managers will pursue goals that are not in the interests of shareholders—ranging from actions that allow them to profit personally (embezzlement, misappropriations) to empire building (hubris).” *Id.* at 25.

²⁸¹ ADOLF A. BERLE & GARDINER C. MEANS, *THE MODERN CORPORATION & PRIVATE PROPERTY* 17 (Routledge 2017) (1932).

collapse of ownership and control—no owner exists to control anything. Algorithmic Entities and Fully Autonomous businesses like Metronome live at this end of the spectrum. The space between these extremes offers the greatest opportunity for exploring the frontiers of possible new corporate governance structures.

For example, Managerial Automation Light businesses might be described as a slightly increased degree of collapse between ownership and control from Predominately Operationally Automated businesses. While shareholders remain just as separated from management in Managerial Automation Light businesses as Predominately Operationally Automated businesses, several of the other levels of hierarchy that characterize Predominately Operationally Automated businesses have been eliminated by automating middle management. Fenwick and Vermeulen's description of a movement from "hierarchical and formalized governance" to "platform governance"²⁸² helps explore the variety of autonomous technology tradeoffs made among different Traditional Plus businesses. However, the platform governance explanation ends there because the Autonomous Mediating Hierarchy businesses collapse ownership and control further by using technology as the functional equivalent of the corporate form in order to return managerial control to the owners. Mostly Autonomous businesses represent yet another incremental degree of the collapse between ownership and control and might be described as self-owning. Thus, the move from traditional corporate governance to platform governance is just the beginning of the type of corporate governance flattening and re-imagining enabled by autonomous technologies.

Distributed Business Entities, for example, allow for the reimagining of corporate governance structures which enable greater shareholder participation and control over the course of the business. Distributed Business Entities eliminate the professional manager class and return control to the hands of the entity's owners, taking governance to a pre-Berle and Means world.²⁸³ Notably, however, not all entrepreneurs, investors, or venture capital firms are interested in embracing a pre-Berle and Means world.²⁸⁴ Does that mean Traditional Plus businesses may forever be excluded from any incremental governance improvements enjoyed by Distributed Business Entities? Not if we consider the function for which Distributed Business Entities and Autonomous Entities use autonomous technologies instead of focusing on the automation itself.

For example, Traditional Plus businesses could build low-technology corporate governance structures that enable owner participation functionally approximate to that enjoyed by Distributed Business Entities. If Traditional Plus

²⁸² See Fenwick et al., "*Corporate*" Governance, *supra* note 139, at 174–78, 187–89.

²⁸³ It is worth noting that, to do so, the DBEs on the map and the LAO and MetaCartel Ventures all chose either a limited liability company or a business trust structure, not a corporation.

²⁸⁴ Uber and Airbnb, for example, the alleged platform companies that will eat the business world, are traditional corporations using technology in innovative ways for their internal business affairs. See generally Alexandra Jonas, Note, *Share and Share Dislike: The Rise of Uber and AirBNB and How New York City Should Play Nice*, 24 J.L. & POL'Y 205 (2016).

autonomous corporations adopt innovative board structures and management practices to approximate Distributed Business Entities-type owner democracy, without sacrificing access to traditional capital markets, then Traditional Plus businesses may seize on governance reforms as an opportunity to disrupt the path of their own disruptors—the Distributed Business Entities. Indeed, recognizing the role corporate governance reforms could play in this regard may incentivize greater adoption of novel corporate governance structures.²⁸⁵ Perhaps recognizing what appears to be the gradual trajectory toward a complete lack of structure, as represented in the autonomous business taxonomy, may enable greater creativity in constructing the corporate form²⁸⁶ and enable a more diverse discussion in corporate theory, which has been dominated by a discussion of the separation between ownership and control since 1932.²⁸⁷

In other words, it is not inevitable, yet, that platform governance will eat corporate governance, or that corporate charter competition will cultivate a threat to humanity through Autonomous Entities. At this juncture, there still remain at least two possible futures. On the one hand, Traditional Plus businesses might adopt technology that enables a transition to Distributed Business Entities. This, arguably, may shift the whole taxonomy of autonomous business reality toward greater numbers of Distributed Business Entities and Autonomous Entities. Alternatively, Traditional Plus businesses might adopt low-technology governance mechanisms that achieve the same ends of enabling greater individual shareholder control. The result, as further explored below, is a framework that may incentivize the use of low-technology governance improvements that approximate some of the features of the technology-enabled business structures found in Distributed Business Entities and Autonomous Entities.

²⁸⁵ Corporate governance scholars already argue that “corporations must be encouraged to enhance the level of communication between shareholders and the board,” and further, “that the benefits of increased engagement are significant enough that we should consider developing standards for incentivizing, if not mandating, more robust board-shareholder engagement for corporations that fail to respond to such encouragement.” Lisa M. Fairfax, *Mandating Board-Shareholder Engagement?*, 2013 U. ILL. L. REV. 821, 821.

²⁸⁶ I briefly foreshadow the implications of the fact that the Autonomous Business Reality taxonomy appears to project a general trend towards businesses with less structural formality and the implications for regulation in Section IV.B. However, this topic deserves its own separate in-depth treatment, in order to contribute to the discussion begun by scholars like Andrew Verstein regarding economic productivity without formal business organization. *See generally* Andrew Verstein, *Enterprise Without Entities*, 116 MICH. L. REV. 247 (2017). I take up that separate investigation in a separate article.

²⁸⁷ William W. Bratton, *Berle and Means Reconsidered at the Century's Turn*, 26 J. CORP. L. 737, 759, 769–70 (2001) (describing the dominance of the Berle-Means thesis in corporate law, theory, literature).

IV. WHAT AUTONOMOUS BUSINESS REALITY MIGHT TEACH²⁸⁸

The autonomous business reality taxonomy, standing alone, contributes to the current scholarly discussion at the intersection of business law and emerging autonomous technologies in two ways. First, the taxonomy challenges several of the leading narratives by demonstrating their incompatibility with the current industry state of the art. Second, the taxonomy demonstrates that the truly disruptive characteristic of increasingly autonomous business entities lies not in the technology itself, but in the creative organizational models undertaken by autonomous businesses. However, the potential insights to be reaped from the autonomous business taxonomy do not end here. Rather, the taxonomy can be used as an analytical tool to assess a variety of areas in business law. Although this Article leaves most such analysis for further research and discussion,²⁸⁹ this Part briefly undertakes two initial inquiries into what autonomous business reality might teach business law. First, this Part investigates the extent to which autonomous businesses may incentivize corporate governance reform among Traditional Plus businesses. Second, this Part briefly introduces the idea that rather than encourage lawlessness, autonomous businesses may actually result in more efficient business regulation through the use of autonomous regulatory technology (e.g. “crypto-legal structures” or “RegTech”).²⁹⁰

A. *Autonomous Business Reality Might Incentivize Low-Technology Traditional Plus Corporate Governance Reform.*

In the wake of corporate scandals and increasing concern over corporate social responsibility, the corporate governance literature recommends many corporate governance reforms, including, for example, diversification of board of

²⁸⁸ The title of this part pays respect to Professor Larry Lessig, whose pioneering work on the law of cyberspace demonstrated that the intersection of law and technology never only causes single-direction impacts. Law must account for technology, yes, but technology often also teaches new insights about existing legal approaches to low-tech issues. Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501, 502 (1999).

²⁸⁹ I personally plan to, at the very least, consider the implications of the taxonomy for corporate personality and corporate rights determinations, conduct a more in-depth analysis of implications of the taxonomy for corporate governance, and investigate the potential for autonomous regulatory technology (or crypto-legal structures) to improve the UCC filing system and more quickly address emerging securities laws issues for new types of tokens in forthcoming work. My hope is that this Article and its taxonomy invites discussion by others as well.

²⁹⁰ I described the potential of using blockchain-based smart contracts to create RegTech in *Conceptualizing Cryptolaw*, calling such regulatory technology “crypto-legal structures.” Reyes, *supra* note 33, at 397–99, 407–08.

directors,²⁹¹ greater director transparency,²⁹² and increased shareholder power.²⁹³ Meaningful adoption of such measures by industry, however, remains lacking. While the autonomous business reality taxonomy makes clear that technology is unlikely to consume traditional business structures and related governance mechanisms anytime soon, the governance experiments conducted by Distributed Business Entities and Autonomous Entities may pressure Traditional Plus businesses to adopt some measure of reform. In particular, where the high-technology governance mechanism in a Distributed Business Entity or Autonomous Entity proves useful, and where that mechanism can be functionally approximated by a low-technology reform, resistance to reform proposals may weaken.

How might a low-technology governance reform functionally approximate the high-technology mechanisms adopted by Distributed Business Entities and Autonomous Entities? One of the key insights offered by the taxonomy lies in the way increasingly autonomous businesses narrow the separation between ownership and control. What happens when we overlay that key insight onto the function of corporate governance reform proposals prevalent in the literature? Many such reform proposals work to reduce the agency costs created by the separation of ownership and control.²⁹⁴ The obvious functional equivalent to the approach taken by Distributed Business Entities is to give shareholders greater power in managing the enterprise, however no consensus exists in the literature regarding the extent to which increased shareholder power represents the appropriate remedy.²⁹⁵ Nevertheless, most commentators concur that at least some

²⁹¹ See generally Yaron Nili, *Beyond the Numbers: Substantive Gender Diversity in Boardrooms*, 94 IND. L.J. 145 (2019) [hereinafter Nili, *Beyond the Numbers*].

²⁹² See generally Yaron Nili, *The “New Insiders”: Rethinking Independent Directors’ Tenure*, 68 HAST. L.J. 97 (2016); Kobi Kastiel & Yaron Nili, *“Captured Boards”: The Rise of “Super Directors” and the Case for a Board Suite*, 2017 WIS. L. REV. 19 (2017); Usha Rodrigues, *Let the Money Do the Governing: The Case for Reuniting Ownership and Control*, 2 STAN. J.L. BUS. & FIN. 254, 255–56 (2004) [hereinafter Rodrigues, *Let the Money Do the Governing*] (arguing for one seat on the board to be held by the wealthiest shareholder willing to serve).

²⁹³ See generally Lucian Arye Bebchuk, *The Case for Increasing Shareholder Power*, 118 HARV. L. REV. 833, 835 (2005); Lisa M. Fairfax, *Shareholder Democracy on Trial: International Perspective on the Effectiveness of Increased Shareholder Power*, 3 VA. L. & BUS. REV. 1, 2 (2008); ANITA INDIRA ANAND, *SHAREHOLDER-DRIVEN CORPORATE GOVERNANCE* (2020). But see Usha Rodrigues, *Corporate Governance in an Age of Separation of Ownership from Ownership*, 95 MINN. L. REV. 1822, 1822–24 (2011) and the literature she cites in footnote 1 criticizing the shareholder empowerment argument.

²⁹⁴ Eugene F. Fama & Michael C. Jensen, *Separation of Ownership and Control*, 26 J.L. & ECON. 301, 304 (1983) (“Agency costs include the costs of structuring, monitoring, and bonding a set of contracts among agents with conflicting interests.”); Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J. FIN. ECON. 305, 308–10 (1976); Ronald J. Gilson & Charles K. Whitehead, *Deconstructing Equity: Public Ownership, Agency Costs, and Complete Capital Markets*, 108 COLUM. L. REV. 231, 231–32 (2008).

²⁹⁵ Compare Bebchuk, *supra* note 293, with Theodore N. Mirvis et al., *Bebchuk’s “Case for Increasing Shareholder Power”: An Opposition*, 121 HARV. L. REV. 43, 43–53 (2007). See also Fairfax, *supra* note 285, at 825 (in favor of increased shareholder engagement); Stephen M. Bainbridge, *Director Primacy and Shareholder Disempowerment*, 119 HARV. L. REV.

increase in shareholder involvement would likely improve corporate governance.²⁹⁶ As a result, scholars offer a variety of proposals for giving shareholders more voice in management.

One line of literature suggests that, at the very least, boards should be representative of the shareholders as a proxy for increased shareholder involvement. Indeed, a variety of scholarly work over the course of the last several years reflects a growing trove of evidence that board diversity positively impacts corporate performance.²⁹⁷ Yet most such scholarship simply looks at what Yaron Nili calls “quantitative gender diversity”—the number of female directors in comparison to their male counterparts.²⁹⁸ Such quantitative gender diversity on corporate boards represents a step in the right direction, but in terms of a functional equivalent with the approaches of Distributed Business Entities, does very little to reduce the gap between ownership and control. When, however, a corporation achieves some meaningful level of “substantive diversity,” gender or otherwise, the board might be said to representatively reflect the diversity of shareholders, thereby narrowing one type of separation between those that control the organization and those that own the organization.²⁹⁹ In other words, such diversity may enable management to better approximate and anticipate what shareholders would want if they could manage the company directly. In this way, substantive board diversity may enable a very rough approximation of the more democratic governance characteristics of Autonomous Mediating Hierarchy businesses.

Other scholars encourage increased “board-shareholder engagement”—“a mechanism for facilitating the exchange of information between the board and shareholders.”³⁰⁰ While the increase in information may provide greater transparency to the investors’ market, it only marginally closes the degree of

1735, 1745 (2006); William W. Bratton & Michael L. Wachter, *The Case Against Shareholder Empowerment*, 158 U. PA. L. REV. 653, 666–67 (2010).

²⁹⁶ Yaron Nili, *Missing the Forest for the Trees: A New Approach to Shareholder Activism*, 4 HARV. BUS. L. REV. 157, 159 n.6 (2014) (“Even some of the strongest opponents to Professor Bebchuk’s suggested reforms acknowledge the importance of some form of shareholders’ involvement.” (citing Martin Lipton & Steven A. Rosenblum, *Election Contests in the Company’s Proxy: An Idea Whose Time Has Not Come*, 59 BUS. LAW. 67, 69 (2003))). Nili argues that the debate should really be about “what forms of activism are efficient and what forms are destructive.” *Id.* at 159–60 (footnote omitted); see also *id.* at 160 & n.8 and accompanying text and cites.

²⁹⁷ See generally DELOITTE GLOB. CTR. FOR CORP. GOVERNANCE, WOMEN IN THE BOARDROOM: A GLOBAL PERSPECTIVE (4th ed., 2015); BORIS GROYSBERG ET AL., SPENCER STUART & WOMEN CORP. DIRS. FOUND., 2016 GLOBAL BOARD OF DIRECTORS SURVEY (2016); Joana Marinova et al., *Gender Diversity & Firm Performance: Evidence from Dutch & Danish Boardrooms*, 27 INT’L J. HUM. RES. MGMT. 1777 (2016); Jasmin Joecks et al., *Gender Diversity in the Boardroom & Firm Performance: What Exactly Constitutes a “Critical Mass?”*, 118 J. BUS. ETHICS 61 (2013); Nada K. Kakabadse et al., *Gender Diversity and Board Performance: Women’s Experiences and Perspectives*, 54 HUM. RES. MGMT. 265 (2015).

²⁹⁸ Nili, *Beyond the Numbers*, supra note 291, at 166.

²⁹⁹ *Id.* at 166–67.

³⁰⁰ George S. Georgiev, *Shareholder Vs. Investor Primacy in Federal Corporate Governance*, 62 UCLA L. REV. DISCOURSE 71, 75 (2014).

separation between ownership and control.³⁰¹ Another proposal for improving corporate governance involves increasing transparency in the board of directors.³⁰² Others recommend installing one shareholder on the board of directors—namely, the wealthiest shareholder willing to serve on the board of directors.³⁰³ Irrespective of the specific proposal, the goal appears to be increasing shareholder influence on corporate management. In other words, these corporate governance mechanisms attempt to, through low-technology means, approximate either increased shareholder management of the business, as in Managerial Automation Light businesses, or the level of shareholder control prevalent in Autonomous Mediating Hierarchy businesses.

Still other scholars argue that only meaningful proxy access—“shareholders’ ability to nominate directorial candidates of their choice to the corporation’s proxy statement”—will suffice as an improved governance mechanism.³⁰⁴ Proxy access ensures that shareholders enjoy the real potential of electing a director of their choosing, and not just management’s proposed slate of directors.³⁰⁵ Proxy access is also believed to promote diverse stakeholder participation in the corporate electoral process.³⁰⁶ However, even with meaningful proxy access, other scholars argue that, without an additional nudge, retail investor apathy will prevent most shareholders from participating in the corporate electoral process.³⁰⁷ Proxy access and other mechanisms designed to “nudge” shareholders to exercise their voting rights in the corporation resemble the increased ease of voting offered by Autonomous Mediating Hierarchy businesses. Even this brief consideration of the connections between corporate governance reform proposals and the autonomous business taxonomy reveals the first lesson yielded by using the taxonomy as an analytical tool: low-technology governance reforms can serve

³⁰¹ *Id.*

³⁰² See, e.g., Sean J. Griffith, *Corporate Governance in an Era of Compliance*, 57 WM. & MARY L. REV. 2075, 2138 (2016) (“A more promising regulatory strategy might therefore be to focus not on the substance of compliance reform but rather on the transparency of the compliance function.”).

³⁰³ Rodrigues, *Let the Money Do the Governing*, *supra* note 292, at 256.

³⁰⁴ Lisa M. Fairfax, *The Future of Shareholder Democracy*, 84 IND. L.J. 1259, 1260–61 (2009).

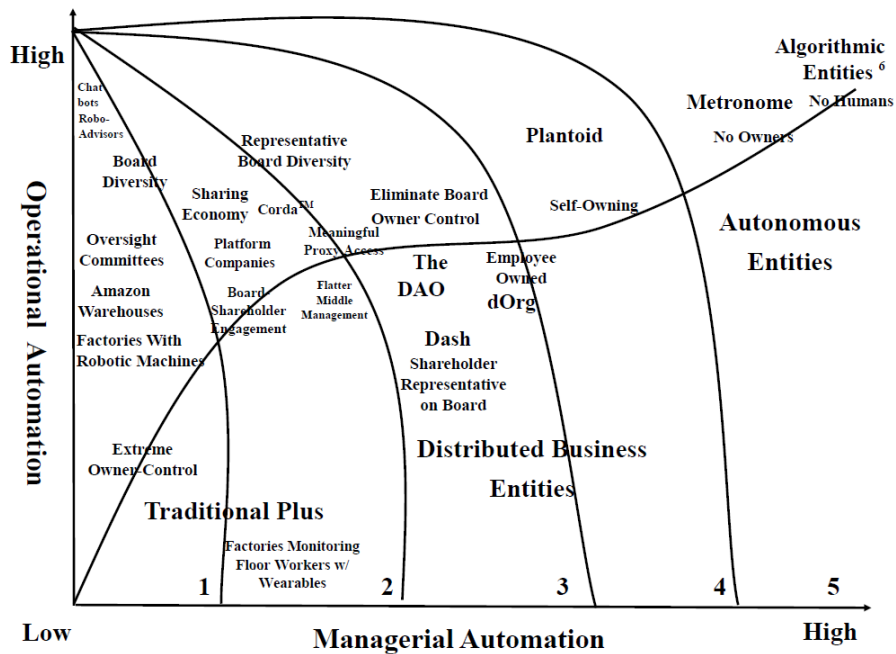
³⁰⁵ *Id.* at 1267.

³⁰⁶ *Id.* at 1267–68 (“By ensuring that shareholders have a cost-effective means of nominating directorial candidates, proxy access enables participation by a broad range of shareholders. . . . Such proposals thus ensure that a broad array of shareholders will have the ability not only to nominate candidates to the corporate ballot, but also to influence the election process, and hence corporate affairs.”); Lisa M. Fairfax, *Making the Corporation Safe for Shareholder Democracy*, 69 OHIO ST. L.J. 53, 56 (“[T]his Article rejects the presumption that expanding shareholder power will have a negative impact on stakeholders, and instead argues that at least some shareholders will use their increased power to advance stakeholders’ concerns.”).

³⁰⁷ Kobi Kastiel & Yaron Nili, *In Search of the “Absent” Shareholders: A New Solution to Retail Investors’ Apathy*, 41 DEL. J. CORP. L. 55, 58–59 (2016) (“In particular, we propose to facilitate retail investors’ participation in the voting process by providing them with a little ‘nudge’ in the form of highly-visible default arrangements that would dramatically reduce the economic and mental costs associated with voting.”).

functionally equivalent roles to reforms implemented via autonomous technologies. The relative functional equivalence represented by the connections identified above are visually depicted in Figure 4 below.

FIGURE 4: AUTONOMOUS BUSINESS REALITY MAPPED TO LOW-TECHNOLOGY FUNCTIONAL EQUIVALENTS



Just as building the taxonomy revealed limitations in the dominant narratives about autonomous businesses, recognizing the functional equivalence of certain low-technology corporate governance measures and Autonomous Mediating Hierarchy-type democratization illustrates the limits of more traditional reforms in reducing the traditional gap between ownership and control. As depicted above in Figure 4, increasing board diversity, board-shareholder engagement, and merely installing oversight committees all arguably perpetuate the existing governance used in Traditional Plus autonomous businesses. These measures all offer the appearance of governance changes; however, studies show those governance reforms are more changes in form than substance.³⁰⁸ Without substantive changes, such corporate governance reforms may merely move Traditional Plus businesses from the functional equivalent of Primarily Operationally Automated to the functional equivalent of Managerial Automation Light business, but do not alter their fundamental status as corporations characterized by an overall

³⁰⁸ See, e.g., Nili, *Beyond the Numbers*, supra note 291; Bernard S. Black, *Agents Watching Agents: The Promise of Institutional Investor Voice*, 39 UCLA L. REV. 811, 814 (1992); Hu & Black, supra note 4, at 1011.

relatively small degree of collapse between ownership and control. The second lesson from the taxonomy of autonomous business reality, then, is that just as “platform governance” does not represent the end of anything, including the end of corporate governance, quantitative board diversity, oversight committees, and increased board-shareholder engagement, each represent moderate reforms, at best.

On the other hand, other reforms—such as board diversity that attempts to substantively approximate shareholder diversity, meaningful proxy access, a minority shareholder representative on the board of directors, and eliminating the board altogether—all represent corporate governance mechanisms that more closely approximate the high degree of collapse between ownership and control that characterizes Autonomous Mediating Hierarchy businesses. As a result, such reforms offer low-technology means for shifting a corporation from Traditional Plus businesses to an approximation of Distributed Business Entities without increasing managerial automation. Interestingly, when viewed in this light, proposals to use blockchain technology or other autonomous technologies to reform the proxy system can be understood as merging an originally low-technology governance reform with emerging technology. Thus, the third lesson of autonomous business reality for corporate governance is really a call to consider how low-technology governance reforms might be combined with emerging technologies to create a middle ground of truly innovative governance rooted in both industry reality and technological capacity.

Law and technology scholars routinely caution that integrating law and technology may result in unintended ripple effects.³⁰⁹ Most of the literature on autonomous businesses and corporate governance seems to assume that such ripple effects will only be present when selecting emerging technology tools to reform the proxy process.³¹⁰ For example, Professor George Geis argues that reforming the proxy system through traceable shares will cause ripple effects in corporate law more broadly.³¹¹ Professor Geis expects traceable shares to alter the nature of derivative lawsuits, alter the allocation of corporate governance rights, and require broader recalibration of shareholder responsibility for corporate activity (particularly negative corporate activity).³¹² As to that last ripple effect, Professor Geis points out that if an improved proxy system enables greater shareholder participation in decision-making, then perhaps shareholders ought to shoulder more responsibility for corporate actions.³¹³ Others argue that blockchain-based corporate voting systems may exacerbate problems of majority shareholder

³⁰⁹ See e.g., Reyes, *Conceptualizing Cryptolaw*, *supra* note 33.

³¹⁰ Andhov, *supra* note 17, at 3; Panisi et al., *supra* note 18, at 189–90; Kaal, *Blockchain-Based Corporate Governance*, *supra* note 17, at 4.

³¹¹ Geis, *supra* note 18, at 231.

³¹² *Id.* at 270–71, 273.

³¹³ *Id.* at 273–74.

oppression of minority shareholders.³¹⁴ Although tempting to assume that these potentialities only exist when applying blockchain technology to the proxy system, history shows ripple effects can occur in the context of low-technology reforms as well.³¹⁵ Thus, the fourth lesson illuminated by the autonomous business reality taxonomy is a need for heightened vigilance for ripple effects in low-technology reform scenarios as much as for high-technology reforms.

Other lessons for corporate governance will likely emerge from applying the autonomous business reality taxonomy to questions of reform over time. Indeed, the taxonomy can be applied in other areas where emerging technology collides with business law. For example, applying the taxonomy to the doctrines of corporate personality and related corporate rights determinations exposes the need to reassess current justifications for the bundle of rights afforded corporations.³¹⁶ Essentially, the taxonomy can act as a mirror in the discussion on the intersection of autonomous technologies and business law, forcing us to ask not only how does business law apply when businesses use autonomous technology, but also, what do autonomous businesses require us to reassess in business law? In that regard, this short discussion of the four lessons of autonomous business reality discussed above merely represents the beginning of the inquiry.

B. Autonomous Business Reality May Enable More Efficient Business Regulation

Despite the potential to incentivize corporate governance reforms in Traditional Plus businesses, autonomous business reality may also increasingly push business toward creative business structures powered by autonomous technology. In the event of increased movement of business governance beyond platform governance to the flatter structures found among Distributed Business Entities and Autonomous Entities, it becomes tempting to worry about LoPucki's predictions of unregulatable business entities with legal capacity to act in society. Although an in-depth inquiry into the potential theoretical underpinnings of structureless business entities lies beyond the scope of this Article and deserves separate treatment,³¹⁷ it raises a possibility that should be briefly outlined here—namely that autonomous technology itself can serve as an element of the solution to LoPucki's concern.³¹⁸

³¹⁴ See, e.g., Michael Abramowicz, *The Very Brief History of Decentralized Blockchain Governance*, 22 VAND. J. ENT. & TECH. L. 273, 276–77 (2020) (citing Robert C. Art, *Shareholder Rights and Remedies in Close Corporations: Oppression, Fiduciary Duties, and Reasonable Expectations*, 28 J. CORP. L. 371, 372 (2003)).

³¹⁵ See, e.g., James S. Linck et al., *The Effects and Unintended Consequences of the Sarbanes-Oxley Act on the Supply and Demand for Directors*, 22 REV. FIN. STUD. 3287, 3287–89 (2009).

³¹⁶ I take up this issue in a subsequent paper, *Autonomous Corporate Personhood*, *supra* note 99.

³¹⁷ I hope to take up this discussion in a subsequent paper also, in order to contribute to the discussion begun by Verstein, *supra* note 286.

³¹⁸ Each potential instance of using autonomous technology as RegTech can and should be thoroughly investigated separately. By way of two such examples, I hope to take up the use of

Just as autonomous technology powers creative business structures, it can power creative regulation and enforcement. For example, consider Securitize, a company that harnesses the power of smart contracts and blockchain technology for regulatory technology to enable compliant token securities offerings and help issuing companies manage the compliance life-cycle beyond the initial capital raise.³¹⁹ Essentially, Securitize uses smart contracts to automate compliance with the securities regulations applicable to an issuer's capital raise.³²⁰ Say a company wants to conduct a capital raise, and, for whatever reason, wants to offer some or all of that capital raise in a tokenized manner—namely, by offering investors the option to hold evidence of their investments through tokens. The company sets the terms of the capital raise and obtains the necessary underwriting and other financial deal requirements as it would for any other capital raise. Once the terms of the deal are set, the company could turn to Securitize to essentially digitize many of the documents that would evidence the deal after its conclusion. Securitize, a regulated Transfer Agent, starts by on-boarding investors through its platform and conducting required know-your-customer and anti-money laundering diligence.³²¹ Securitize then issues tokens to investors that represent their investment in the company and uses blockchain-based smart contracts to technologically ensure compliance with regulatory and contractual requirements.³²² For example, if shares are subject to a twelve month lock-up, Securitize uses smart contracts to technologically prevent the transfer of tokens prior to the end of the lock-up period.³²³ Securitize also offers a variety of technology enhanced investor management services, such as investor communication channels and automated dividend payments, among others.³²⁴

The hypothetical company conducting the capital raise could be a Distributed Business Entity as easily as it could be a Traditional Plus corporation. Securitize's automated securities regulation compliance tools work just as well for Traditional Plus corporations as for Distributed Business Entities and Mostly Autonomous businesses. And while Autonomous Entities don't have investors, and thus no need for Securitize's services, that's not the point. The point of the

crypto-legal structures for securities regulation compliance in a follow-up paper, and I am currently developing a smart contract-based UCC Article 9 financing statement (UCC-1 form). I hope to see investigation and discussion of crypto-legal structures in a variety of other contexts as well.

³¹⁹ CARLOS DOMINGO ET AL., SECURITIZE, DS PROTOCOL – SECURITIZE'S DIGITAL OWNERSHIP ARCHITECTURE FOR COMPLETE LIFECYCLE MANAGEMENT OF DIGITAL SECURITIES 2 (2018), <https://securitize.sfo2.digitaloceanspaces.com/whitepapers/DS-Protocolv1.0.pdf> [perma.cc/HG4R-45CQ].

³²⁰ SECURITIZE, EQUITY-BACKED TOKENIZATION: A HYPOTHETICAL CASE STUDY, 1–2, 5, https://securitize.sfo2.digitaloceanspaces.com/case-studies/Equity-Case-Study-Securitize-091818_181005_013056.pdf [perma.cc/3STH-357Q].

³²¹ DOMINGO ET AL., *supra* note 319, at 6, 10.

³²² *Id.* at 4, 7.

³²³ *Id.* at 14; *see also* SECURITIZE, *supra* note 320.

³²⁴ DOMINGO ET AL., *supra* note 319, at 3.

Securitize example lies in the use of the same autonomous technology that creates Autonomous Entities to automate legal compliance for businesses, including Fully Autonomous and Algorithmic ones. Notably, Securitize does not stand alone in pursuing innovative compliance solutions. For example, R3 CEV³²⁵ conducted an experiment with the United Kingdom's banking regulator, the Financial Conduct Authority (FCA).³²⁶ The prototype R3 developed allows banks to automatically notify the FCA each time the banks issue a mortgage.³²⁷ The prototype aims to reduce error and generate cost savings for banks that must comply with the FCA's mortgage regulatory requirements.³²⁸

Other possibilities for using autonomous technologies to increase efficiencies in corporate governance and compliance exist, but these two examples suffice to make the point: concerns about the dangers of autonomous businesses can be mitigated by strategic use of the technology itself.³²⁹ Thus, even as the autonomous business reality taxonomy makes clear that industry's current state of the art lies far from realizing the promise of Algorithmic Entities, it also offers the possibility of mitigating some of the threats scholars often worry that Algorithmic Entities may pose in the future. And between that future reality and now, the autonomous business reality taxonomy stands as a call for further research and innovation in creating RegTech and crypto-legal structures to govern the new business structures and assets that autonomous technologies can create.

CONCLUSION

This Article offers the first attempt to document the full range of technology-enabled automation at play among today's business entities. The resulting taxonomy of autonomous business reality reveals exaggerations in existing literature about the effect of autonomous businesses on business law. By focusing on Algorithmic Entities, leading scholars recommend changes to existing law to remedy ills that do not yet exist. Meanwhile, by focusing on Managerial

³²⁵ R3 CEV is the software development company that developed the Corda permissioned distributed ledger for automating certain elements of financial transactions. *About R3*, <https://www.r3.com/about/> [<https://perma.cc/LV9Q-FYUG>].

³²⁶ Anna Irrera, *R3, UK Regulator and Banks Team Up on Blockchain-Based Mortgage Reporting*, REUTERS (Sept. 12, 2017, 1:05 AM), <https://www.reuters.com/article/us-r3-fca/r3-uk-regulator-and-banks-team-up-on-blockchain-based-mortgage-reporting-idUSKCN1BN0QX> [perma.cc/6225-EXQC].

³²⁷ *Id.*

³²⁸ *Id.*

³²⁹ The emphasis on strategic use of autonomous technology as regulatory technology is important. RegTech will not be appropriate in all areas of the law. In a variety of areas, privacy concerns may prevent, as a policy matter, the use of RegTech. For a more fulsome discussion of the potential concern here, see Reyes, *Conceptualizing Cryptolaw*, *supra* note 33. In disclosure-based regimes, however, such as financial regulation and corporate governance, RegTech poses less of a privacy concern where the data used to fuel the technology must be disclosed by regulatory requirement anyway. See JO ANN BAREFOOT, ALL. FOR INNOVATIVE REGUL., A REGTECH MANIFESTO: REDESIGNING FINANCIAL REGULATION FOR THE DIGITAL AGE 48–49 (2020).

Automation Light businesses, other scholars predict an end to traditional corporate governance when, in reality, such businesses merely represent a small shift within traditionally governed corporations. Identifying such exaggerations and the gaps they create enables the deeper and more robust policy discussion required for law to adequately help Distributed Business Entity entrepreneurs manage risk through appropriate business entity structures and corporate governance.

Furthermore, the autonomous business taxonomy offers a new tool for analyzing the potential effect of the many governance reform proposals in the literature on the nature of the core governance issue faced by corporations: the separation of ownership and control.³³⁰ That tool forces a recognition that technological disruption of business may not be the only path to creating alternative governance structures. Indeed, the taxonomy of autonomous business reality points to potential innovation in governance of both corporations and society. By identifying new business structures enabled by autonomous technologies, the need for new regulatory enforcement and compliance mechanisms also become clear. Rather than paint a doomsday picture of human-less businesses manipulating society, however, the taxonomy sheds light on the potential of the technology itself to help law keep pace with entrepreneurial developments. Ultimately, then, the taxonomy highlights the ripple effects of ever-increasing business automation and stands as a call for further research into the implications and challenges posed by those ripple effects.

In this way, the taxonomy of autonomous business reality provides further evidence that even in the high-technology contexts of Distributed Business Entities and Autonomous Entities—characterized by code that performs functionally equivalent roles as business organization law—the idea of code-as-law remains a subsystem of regulatory norms within the greater legal system. Even as the code informs the application of corporate governance mechanisms, the law inversely informs business decisions about which design trade-offs are worth pursuing. For example, even where Traditional Plus businesses may have previously resisted certain substantive governance reforms, lessons from their Distributed Business Entity and Autonomous Entity counterparts may incentivize more substantive governance changes. Recognizing such interplays between technology and law underscores the importance of grounding technology-related discussions in the reality of the technology and its actual use in industry. Getting caught up in the technology hype-cycle suppresses recognition of deeper jurisprudential lessons.

³³⁰ See, e.g., Hu & Black, *supra* note 4, at 1012 (proxy system reform); David Yermack, *Shareholder Voting and Corporate Governance*, 2 ANN. REV. FIN. ECON. 2.1, 2.2–2.3 (2010) (proxy system reform); Lucian Arye Bebchuk & Jesse M. Fried, *Executive Compensation as an Agency Problem*, 17 J. ECON. PERSP. 71, 71–72 (2003) (executive compensation reform); Lucian A. Bebchuk et al., *The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000–2008*, 27 YALE J. ON REGUL. 257, 257–58 (2010).