BLOCKCHAIN & SHAREHOLDER VOTING: A HARD FORK FOR 21ST-CENTURY CORPORATE GOVERNANCE

Alexander Daniels[1]

INTRODUCTION

Shareholder voting is the linchpin of corporate governance, accountability, and legitimacy. Corporations[2] create countless jobs, generate indispensable products and services, and influence the national dialog on

1. Thank you to Professor David A. Skeel for his invaluable guidance with this Comment and his many classroom hours teaching me Corporate Law. Thank you to everyone at the University of Pennsylvania Journal of Business Law who assisted with their time, effort, and suggestions.

2. Unless otherwise stated, corporation in this Comment refers to a company incorporated in Delaware, publicly traded on a national exchange, and with at least 2,000 shareholders.

pressing issues. Yet all corporations must answer to their voters, the shareholders.

Unfortunately, modern shareholder voting is broken. The "current system was not created through intentional architecture and design,"[3] but through haphazard happenstance and necessity. Accurate lists of shareholders are non-existent. Ownership recordkeeping is painful. Some shareholders over-vote. Some savvy investors routinely manipulate the system. Modern shareholder voting undermines corporate governance.

Blockchain technology, considered by many as a once-in-a-generation breakthrough, offers a solution. Through its simple yet ingenious design, blockchain provides the accuracy, transparency, and trust currently missing from shareholder voting.

If blockchain takes hold, it may solve many problems with modern shareholder voting. The prevalence of street name ownership could diminish because a beneficial owner could hold and record shares in her own name. With easier ownership identification, some voting practices that aid over-voting and hedging may disappear. Vote counts could become accurate, precise, and verifiable. At least some legitimacy of corporate governance would be restored.

Corporate decision-making will remain board-centric under the law, but the future is bright for advocates of shareholder empowerment. Products built on blockchain could enable shareholders to engage with corporations in new ways. New tools and networks could eliminate structural obstacles impeding shareholder involvement in corporate governance.

This Comment discusses the potential *hard fork*[4] that blockchain may introduce to shareholder voting in the United States. Part I—The Present—reviews modern concepts of corporate governance and the problems afflicting the voting system. The first section introduces the guiding concepts of U.S. corporate governance. Ideally, governance is defined by a division of labor between boards of directors and shareholders. Boards are responsible for managing the business, while shareholders are empowered to vote on specific topics such as the election of directors. The laws incentivize a board-centric approach to decision-making. The second section explains why modern governance is broken. It analyzes how share ownership depends on a "street name" regime. Street name uses countless custodians to hold shares on behalf of a beneficial owner. This set-up is convenient, but carries consequences. Street name complicates tracking share ownership.

3. DEPOSITORY TRUST & CLEARING CORPORATION, EMBRACING DISRUPTION: TAPPING THE POTENTIAL OF DISTRIBUTED LEDGERS TO IMPROVE THE POST-TRADE LANDSCAPE 2 (2016).

4. A hard fork is a major change in a blockchain's protocol that rewrites fundamental information and makes previously invalid information valid.

Identifying owners is a challenge. Even when the street name system works as intended, the results are often incorrect. A practice called empty voting has emerged in which investors (by mistake or misconduct) are separated from their beneficial ownership. Some empty voting permits hedging and lending that leads to over-voting or voting without economic interests. Street name has also facilitated the domination of institutional investors over the U.S. equities market. These influential investors vote more often than retail investors, but their business models restrict their ability to express displeasure with a corporation's performance by selling stock. Consequently, as shareholder voting gains importance in equity markets, its flaws must be fixed to avoid eroding the legitimacy of corporate governance. One additional flaw is the vagaries of shareholder vote counting. Accurate counts and verifications are impossible. Directors disproportionately win close contests by using manipulation, personal influence, and blank checks to pursue their preferred policies.

Part II—The Future—delves into blockchain and its application to shareholder voting by examining the technology's immediate impact on modern problems and its long-term transformative potential. The first section gives an introduction to blockchain technology. Blockchain is a specialized database using cryptography, game theory, and economics to incentivize decentralized groups of people to record information in a public, transparent, shared, and secure manner. The technology is hampered by some weaknesses that are still being addressed. It is prone to potential attack by collusion, raises questions about privacy and sensible governance, and faces technical challenges of energy consumption, storage capacity, and personal information security. Some flexible variations of blockchain have developed to address many of these concerns. Public blockchains are entirely decentralized with no top-down decision-makers. Permissioned blockchains are run by a central authority that governs access and protocols. Between these extremes are hybrid forms that combine features of public and permissioned blockchains. The second section theorizes about blockchain-based applications for shareholder voting. Blockchain is a foundational technology—a development that lays the groundwork for additional inventions, innovations, and industries to grow. Using a framework for foundational technologies, blockchain's impact on shareholder voting is tracked through four distinct phases that build on each other. During the Single Use phase, innovations are low in novelty and complexity. Blockchain solutions will likely address many of the problems discussed in Part I. Shareholder voting seems to have already entered this phase. At the Localization phase, innovations are high in novelty and low in complexity. Blockchain will improve shareholder voting with new ideas and tools to

augment existing systems. Boards may use blockchain to issue intriguing new stock classes to attract investment. These stock classes could offer varying degrees of privacy, automatically execute options and warrants, establish tenured voting, or tie voting rights to company performance. In the Substitution phase, innovations are low in novelty and high in complexity. Deeply embedded business models will compete with or be replaced by new solutions. Major depository trusts, proxy service providers, and custodians that exist today will adapt their business models or lose market share and possibly perish. In the Transformation phase, innovations are high in both novelty and complexity. New industries and systems will emerge to service shareholder voting. Decentralized Autonomous Organizations (groups that run on blockchain protocols) may form to coordinate diffuse shareholders with similar interests.

PART I: THE PRESENT

A. Introduction to Shareholder Voting

In the United States, corporate governance and shareholder voting laws are guided by securities exchange regulations and the corporate law of the state where a company chooses to incorporate. For most publicly traded companies, this chosen state is Delaware—home to the widely-regarded dominant supplier of corporate law.[5]

Business owners create a corporation in Delaware by filing articles of incorporation (commonly referred to as the charter) with the Delaware Secretary of State. The charter establishes basic information about the corporation such as the total amount of authorized shares[6] which it is prohibited from over-issuing.[7] The filing also creates an entity recognized as a legal person[8] with a unique set of attributes, including a governance

5. *See* STEPHEN M. BAINBRIDGE & IMAN ANABTAWI, ET AL., CAN DELAWARE BE DETHRONED?: EVALUATING DELAWARE'S DOMINANCE OF CORPORATE LAW, 238 (2018) (noting that in 2016, about one million business associations—5% of all US business entities—were domiciled in Delaware, including 64% of the Fortune 500, 86% of that year's Initial Public Offerings (IPOs), and more than half of all companies traded on major exchanges such as the NYSE and NASDAQ).

6. DEL. CODE ANN. tit. 8, § 102(a)(4)(2018).

7. *Id.* at § 161.

8. *See Legal Person*, BLACK'S LAW DICTIONARY (10th ed. 2014) (defining artificial person as "[a]n entity, such as a corporation, created by law and given certain legal rights and duties of a human being"); *see generally* James G. Wright III, *A Step Too Far: Recent Trends in Corporate Personhood and the Overexpansion of Corporate Rights*, 49 J. MARSHALL L. REV. 889 (2016) (describing the historical development in U.S. law of the corporate personhood concept, which has granted corporations the legal rights of natural persons such

system centered upon centralized management.[9]

Under this governance system, a board of directors is elected and entrusted with overseeing the business affairs of the corporation.[10] Day-to-day authority is delegated by the board of directors to officers.[11] In managing the corporation's business, the directors owe fiduciary duties of care[12] and loyalty[13] to the corporation —not the shareholders or stakeholders. Delaware courts have repeatedly affirmed that the board of directors has the exclusive authority to regulate the corporation's capital structure by issuing new shares or classes of stock, while ensuring the soundness of the instruments upon which it is based.[14]

The corporation's shareholders, in turn, have more conditional and limited responsibilities. Shareholders hold equity stock in the corporation, granting them residual rights in the company's earnings and voting rights to approve particular matters.[15] Yet, unlike the one-vote one-person standard

---

as owning property, entering into contracts, engaging in litigation, and receiving protection under the Fourteenth Amendment).

9. Centralized management is an agreed upon fundamental attribute of a corporation, but some disagreement still exists about the exact list of traits. *See* REINIER KRAAKMAN & JOHN ARMOUR, ET AL., THE ANATOMY OF CORPORATE LAW: A COMPARATIVE AND FUNCTIONAL APPROACH 5-17 (2d ed. 2009) (listing a corporation's fundamental attributes as legal personality, limited liability, transferability of share, centralized management, and investor ownership); *see also* ALLEN & KRAAKMAN, COMMENTARIES AND CASES ON THE LAW OF BUSINESS ORGANIZATION 85-110 (3rd ed. 2009) (listing perpetual existence and appointed by equity as other attributes of a corporation).

10. DEL. CODE ANN. tit. 8, § 141(a)(2018).

11. This Comment does not discuss differences between a corporation's directors and officers because the comment focuses on how blockchain-based shareholder voting may impact the relationship between shareholders and the people responsible for managing the corporation's business.

12. Delaware law's duty of care is not codified in statute. It is derived from case law. *See, e.g.*, Smith v. Van Gorkom, 488 A.2d 858, 873 (Del. 1985) (explaining that the duty of care requires director to act in the same manner as a reasonable person would in making business decisions by keeping themselves reasonably informed when making business decisions, and holding that allegations of duty of care breaches are difficult to substantiate because they are adjudicated under a gross negligence standard).

13. Delaware law's duty of loyalty is also not codified in statute and is derived from case law. *See, e.g.*, Ivanhoe Partners v. Newmont Mining Corp., 535 A.2d 1334, 1345 (Del. 1987) (holding that directors have "an obligation to refrain from conduct which would injure the corporation and its stockholders or deprive them of profit or advantage. In short, directors must eschew any conflict between duty and self-interest.").

14. DEL. CODE ANN. tit. 8, § 161(2018); *but see* NYSE Listed Co. Manual §312.03(c)(2015) (requiring shareholder approval if the issuance of new shares equals or exceeds 20% of the outstanding stock).

15. Unless otherwise stated, shareholders are assumed to possess common stock or other classes of stock entitling them to vote. Share ownership also entails other rights such as instigating derivative lawsuits and receiving dividends, but these rights are not discussed in

in political elections, the dominant standard in corporate elections is the statutory voting of one-vote one-share.[16] Shareholder approval is required for some essential matters. Shareholders must vote annually to elect the board of directors.[17] Shareholders must approve management proposals such as bylaw changes,[18] equity compensation plans,[19] fundamental changes (amendments to the charter,[20] mergers with other companies,[21] substantial sales of a corporation's assets[22]) and other matters not expressly prohibited in statutes.[23] Shareholders may unilaterally propose changing bylaws[24] and make proposals for voting at an annual meeting.[25] However, a corporation's board of directors can exclude any shareholder proposals related to thirteen substantive areas that the Securities & Exchange Commission (SEC) has decided should not be determined by shareholders.[26] In recent years proxy

---

this Comment.

16. *See* DEL. CODE ANN. tit. 8, § 212(a)(2018) (providing that one-share one-vote is the default rule "unless otherwise provided in the certification of incorporation"); *see also* Grant M Hayden & Matthew T. Bodie, *One Share, One Vote and the False Promise of Shareholder Homogeneity*, 30 CARDOZO L. REV. 445, 447 (2008) (proclaiming that one share, one-vote is "the 'most basic statutory rule' of [corporate] voting").

17. DEL. CODE ANN. tit. 8, § 211(b)(2018); *see also id.* at §216 (making a plurality of votes necessary for election, but permitting corporations to set a higher standard through either the charter or the adoption of a unilateral shareholder proposal).

18. *See id.* at § 109(a) (allowing shareholders to unilaterally change bylaws and stating that the directors' powers to amend bylaws "shall not divest the stockholders . . . nor limit their power to adopt, amend or repeal bylaws.").

19. NYSE Listed Co. Manual § 312.03(a); *see also id.* at § 312.03(b) (requiring that a new issuance of stock compensation greater than 1% of the total must receive a majority of all shares present).

20. DEL. CODE ANN. tit. 8, § 242(b)(1)(2018).

21. *Id.* at § 251(c). *But see id.* at §251(f), § 253 (stating that shareholder votes are not required for a small-scale merger—merger in which the acquirer takes less than 20% of the survivor's common stock—nor a short-form merger—merger in which the acquirer already owns more than 90% of the subsidiary target).

22. *Id.* at § 271(a).

23. *Id.* at § 215(c).

24. *Id.* at § 109.

25. *See* 17 C.F.R. § 240.14a-8(b)-(e) (permitting a shareholder to make a proposal for voting at an annual meeting if she has owned $2000 worth of shares for at least 1-year, the proposal is less than 500-words, and it is submitted at least 120 days before the anniversary date of the company's last annual meeting); *but see* Financial CHOICE Act of 2017, H.R. 10, 115th Cong. § 844 (proposing, under a House-approved bill, more restrictive eligibility requirements for a shareholder to make proposals, including increasing the holding period from 1-year to 3-years, changing the minimum holding amount from $2000 to 1% of a company's shares, prohibiting proposals by proxy, and increasing the percentage of required previous support for a proposal resubmission).

26. 17 C.F.R. § 240.14a-8(i).

access[27] has grown amongst S&P 500-listed companies from about 1% in 2014 to over 60% in 2017.[28]

Voting occurs at officially-sanctioned shareholder meetings, which are either annual or special.[29] An annual meeting, as the name implies, must occur once per year (typically in the spring[30]) so that shareholders may meet in-person,[31] inquire about the corporation's performance, and vote on a list of pre-set topics such as the election of directors.[32] A special meeting, in contrast, is called when shareholders must approve a proposal such as a pending merger that cannot wait until the next annual meeting.

Delaware's formalistic law determines which shareholders are eligible to vote at meetings. The board of directors must declare a "record date" that "shall not be more than 60 nor less than 10 days" before a meeting.[33] Only registered shareholders on this date are deemed "record owners" and only they may vote.[34] Record owners are also the only persons entitled to other

27. Proxy access refers to bylaws granting shareholders the right to propose nominees for the board of directors despite SEC restrictions.

28. BROADRIDGE FINANCIAL SOLUTIONS & PWC, 2017 PROXY SEASON REVIEW (2d ed. 2017), http://proxypulse.broadridge.com/proxypulse/_assets/docs/broadridge-2017-proxy-season-review.pdf [https://perma.cc/P4YG-WC88].

29. DEL. CODE ANN. tit. 8, § 212; *see id.* at § 211(a),(d) (specifying that meetings are, by default, determined by the board of directors, but the corporation may specify in its charter or bylaws whether another person such as a senior officer or shareholder may call meetings); *see also id.* at § 222(a) (stating that the board of directors is also responsible for notifying shareholders about the applicable place, particular date, and purposes of a meeting, although the corporation can choose to delegate this responsibility differently).

30. *See* Staff, WELCOME TO PROXY SEASON: A PRIMER ON PROXY STATEMENTS AND SHAREHOLDER MEETINGS, FINRA (2016), https://www.finra.org/investors/welcome-proxy-season-primer-proxy-statements-and-shareholder-meetings [https://perma.cc/N64T4MWF], (explaining that spring is the most common season for annual meetings because companies typically schedule them to coincide with the end of the company's fiscal year, which often coincides with the calendar year).

31. *But see* BROADRIDGE FINANCIAL SOLUTIONS & PWC, *supra* note 28 (surveying the trends in shareholder meetings and finding that the while the vast majority of annual shareholder meetings are still held in-person, virtual-only meetings are becoming more common with 163 out of 3379 meetings in 2017 being virtual-only, a 33.6% increase from 2016).

32. DEL. CODE ANN. tit. 8, § 211(b); *see* New York Stock Exchange Listed Company Manual §302.00 (stating that a listed company must hold an annual meeting during each fiscal year).

33. DEL. CODE ANN. tit. 8, § 213.

34. *Id.* at § 219; *see also id.* at § 217(a) (applying the record date to shareholders with a fiduciary duty); *see also* Berlin v. Emerald Partners, 552 A.2d 482, 494 (Del. 1989) (recognizing the corporation's right to "rely upon record ownership, not beneficial ownership, in determining who is entitled to notice of and to vote" at shareholder meetings); *see also Id.* (stating that "[i]n dealing with its stockholders a Delaware corporation need not look beyond the registered [record] owners").

privileges such as appraisal rights.[35] The record date aids voting operations because it provides the corporation and shareholders with certainty about the electoral roll.[36] This certainty is necessary for corporations to comply with SEC rules for distributing the voting instructions and proxy materials[37] critical for attaining quorum at meetings.[38]

Before any meeting, the corporation must appoint at least one inspector who takes an oath to impartially conduct the voting process.[39] The inspector's role is ministerial rather than judicial. He is responsible for deciding the poll closing time and officially counting the vote.[40] He is given significant deference in validating voting materials.[41] Beyond these requirements, Delaware law is extremely vague about counting votes, especially in close contests. In a disputed vote, the courts are responsible for adjudicating claims and determining equitable remedies.[42]

These are the fundamental laws and regulations defining the relationship between the board of directors and shareholders of a corporations. They are formalistic and intended to give clear guidance. However, as Section B illustrates, their formality is often undone by the complex reality of shareholder voting.

B. Shareholder Voting's Shortcomings

Contemporary voting laws outline a corporate governance system epitomizing republicanism. Shareholders are the constituents, directors are the representatives. The shareholder constituents vote whether to re-elect their director representatives. Delaware courts have repeatedly recognized

35. *See* DEL. CODE ANN. tit. 8, § 262(a),(b) (making a record owner shareholder eligible for appraisal rights only if she does not in favor of the merger and continuously holds her shares).

36. Marcel Kahan & Edward Rock, *The Hanging Chads of Corporate Voting*, 96 GEO. L.J. 1227, 1233 (2008); *see also Enstar Corp.,* 535 A.2d at 1354-55 (holding that since shareholders enjoy the benefits of "street name" ownership, they must also bear the burden of establishing record ownership).

37. *See* 17 C.F.R. § 240.14b-2(b)(2)-(3) (requiring that a corporation give shareholders proxy statements, which allow a shareholder to authorize another person or entity to vote at the meeting on her behalf).

38. DEL. CODE ANN. tit. 8, § 216 (stating that the default quorum is 50% of all voting shares present in person or represented in proxy, but a corporation may raise or lower it to a minimum of one-third of such shares in its charter).

39. *Id.* at § 231.

40. *Id.*

41. *See id.* at § 231(d) (allowing an inspector to use proxy materials—paper and electronic—and other information for reconciling proxies and ballots that belong to street name owners).

42. *Id.* at § 225; Berlin v. Emerald Partners, 552 A.2d 482, 494 (Del. 1989).

the importance of shareholder democracy.[43] Voting is sacrosanct. Despite their extensive legal authority, directors cannot interfere with the voting process because it is the "ideological underpinning upon which the legitimacy of [their] power rests."[44]

In practice, the governance system is broken. Obstacles have created a "noisy, imprecise, and disturbingly opaque" arrangement.[45] Definitively knowing all shareholders is impossible. Tracking ownership is next to impossible. Some votes are counted, others are not. Shareholders vote when they should not and over-voting is typical. Savvy investors routinely bend the rules to their advantage. Fundamentally, corporations and shareholder cannot confidently trust election results.

These major problems have several causes. The modern dependence on street name ownership creates immense complexity. This complexity hinders accurate voter identification and has partly facilitated the dominance of U.S. equity markets by institutional investors. These investors vote more frequently and have more influence than retail investors, but their focus on pooled funds has left them more dependent on voting to express displeasure with a company. The vagaries of vote counting also lead to imperfect and impossible to verify results.

(a) Street Name

A shareholder's claim to voting rights is only as valid as her claim to stock ownership. Unfortunately, validating ownership claims today is often a challenge. Before addressing the current system and its ills, however, it is important to understand the prior practice.

From the founding of the earliest corporations in the 17th-century until the late 1960's, stock ownership depended on paper.[46] A person who bought a share of stock received a physical paper certificate that designated her as

43. MM Cos. v. Liquid Audio, Inc., 813 A.2d 1118 (Del. 2003); Williams v. Geier, 671 A.2d 1368 (Del. 1996); Stroud v. Grace, 606 A.2d 75 (Del. 1992); Schnell v. Chris-Craft Indus., Inc., 285 A.2d 437 (Del. 1971).

44. *See* Blasius Industries, Inc. v. Atlas Corp. 564 A.2d 615, 659 (Del. Ch. 1988) (establishing the Blasius-standard, which requires a board to demonstrate a compelling justification when it interferes with a stockholder vote and later affirmed by the Delaware Supreme Court in MM Cos. v. Liquid Audio, Inc., 813 A.2d 1118 (Del. 2003)). *But see* City of Westland Police & Fire Retirement System v. Axcelis Technologies, Inc., 1 A.3d 281, 289 (Del. 2010) (holding that the Blasius standard does not apply when a shareholder seeks information about a board's discretionary decision to refuse to accept the resignations of directors who failed to receive majority support).

45. Kahan & Rock, *supra* note 36.

46. Westfries Archief, *The Oldest Share*, https://www.westfriesarchief.nl/historie/thema-s/geld-en-handel/the-oldest-share [https://perma.cc/46MM-33SW].

the share's beneficial owner.[47] If a shareholder sold her share, the trade only settled when the buyer took physical possession of the certificate to become the new beneficial owner.[48] This clear-cut paper paradigm of the past worked remarkably well for centuries. Ownership was definite and tangible.

Gradually though, shareholder behavior changed and new technology emerged enabling exponentially more transactions. Trading volumes grew and turnover rates steadily increased. Paper-based ownership became untenable. By the late 1960s, Wall Street faced the infamous Paperwork Crisis in which back offices became so overwhelmed with backlogged filing work that the NYSE opened only four days per week (closing on Wednesdays).[49]

To overcome the Crisis, financial institutions and the SEC jointly reformed the system. They moved away from the traditional paper paradigm towards electronic automation and, more importantly for shareholder voting, the current system of multi-tiered custodial "street name" ownership[50]—an indisputable mess for tracking beneficial ownership[51]—that represents about 85% of all U.S. publicly traded shares.[52]

Today, an investor who buys a share of stock never sees, receives, or worries about safekeeping a physical certificate. Instead, corporations deposit their issued stock certificates at one institution—the Depository Trust Corporation (DTC)[53]—which tracks and holds the certificates in its vaults, while nominally owning and clearing them through its nominee Cede & Co.[54] The DTC's "participants" (typically banks and brokerages) buy

47. Tim Fernholz, *The Solution to Wall Street's 1960's Paperwork Crisis Could Also Save Bitcoin*, QUARTZ (Mar. 13, 2019), https://qz.com/370553/what-the-cigar-chomping-schleppers-of-1960s-wall-street-mean-for-bitcoins-future/; *see also* 17 C.F.R. § 240.13d-3 (defining the beneficial owner as the party with the legal power to vote or transfer the stock).

48. *Id.*

49. Staff, *When Paper Paralyzed Wall Street: Remembering the 1960s Paperwork Crisis*, FINRA (Aug. 19, 2015), https://www.finra.org/investors/when-paper-paralyzed-wall-street-remembering-1960s-paperwork-crisis, https://perma.cc/5PCT-29EG.

50. *See generally* John C. Wilcox et al., *"Street Name" Registration & The Proxy Solicitation Process*, SECURITIES & EXCHANGE COMM'N, 12-3 (2006) https://www.sec.gov/comments/4-537/4537-25.pdf [https://perma.cc/92TH-3P7S] (defining the street name owner as the third-party such as a bank or brokerage that nominally owns stock, but executes trades and holds the stock on behalf of the beneficial owner).

51. Kahan & Rock, *supra* note 36, at 1237-39.

52. Joseph L. Bower & Lynn S. Pain, *The Error at the Heart of Corporate Leadership*, HARV. BUS. R. (2017).

53. The DTC is a technically a subsidiary of the Depository Trust & Clearing Corporation (DTCC), which also owns the National Securities Clearing Corporation. For purposes of this Comment, the distinction between DTC and DTCC is ignored.

54. Fernholz, *supra* note 47; *see also* DTCC, 2016 ANNUAL REPORT: FROM WHERE WE STAND (2016), http://www.dtcc.com/annuals/2016/index.html#business [https://perma.cc/X4

these certificates, while the DTC tracks their holdings for a fee on their behalf.[55] An investor purchases her shares from a participant, which transfers beneficial ownership rights to the investor by giving her a fungible interest in its holdings at the DTC.[56] The participant becomes custodian of the shareholder's shares, while providing fee-based services such as account management, trade settlement, and information distribution (including meeting notifications and proxy forms).[57] In the simplest scenario of "street name" custodianship, the DTC is the custodian for the participants' shares, the participants are the street name custodians for the shareholders' shares, and shareholders anonymously trade their fungible street name shares with one another. Corporations are removed from the trading and tracking process, leaving the DTC, its participants, and shareholders responsible for coordinating amongst themselves.

Street name's complexity yields some benefits. Shareholders get a degree of convenience that is impossible in a paper-based world.[58] Street name supports a massively lucrative industry with the four-largest custodians in 2017 managing assets worth $103.3 *trillion*, growing 7%[59] since 2016 and 244% since 2007.[60] It is effective for transferring ownership and settling trades. Today, over three billion shares per day are routinely exchanged on the NYSE[61] and holding periods average, by some estimates, 8.3 months.[62]

ST-9992] (reporting that the Depository Trust & Clearing Corporation, DTC's holding company, processed $1.503 *quadrillion* worth of securities in 2016).

55. *See generally* DTC, FEE GUIDE, www.dtcc.com/~/media/Files/Downloads/legal/fee-guides/dtcfeeguide.pdf [https://perma.cc/692Q-RLPD] (outlining the DTC's fee schedule); *see also* DTCC, 2016 ANNUAL REPORT: FROM WHERE WE STAND (2017) (showing that DTCC's revenue from its services grew 7% to reach $1.712-billion in 2016).

56. Fernholz, *supra* note 47.

57. *See* Trefis Team, *What Proportion of Revenues for the 4 Largest Custody Banks Came From Custody Banking Fees in 2016?*, NASDAQ (Jan. 31, 2018), https://www.nasdaq.com/article/what-proportion-of-revenues-for-the-4-largest-custody-banks-came-from-custody-banking-fees-in-2016-cm750836 [https://perma.cc/3QPY-F9MG] (reporting that in 2016, the four largest custodian banks cumulatively earned about $18-billion in custodian fees with the two-largest custodian banks earning about 50% of their total revenue from such fees).

58. Wilcox et al., *supra* note 50.

59. Trefis Team, *Largest Custody Banks Saw Asset Bases Swell Almost 7% in Last Year*, FORBES (Jan 27, 2018), https://www.forbes.com/sites/greatspeculations/2017/05/08/largest-custody-banks-saw-asset-bases-swell-almost-7-in-last-year/#277d72a58f5d [https://perma.cc/6MJD-P6QR].

60. Kahan & Rock, *supra* note 36, at 1238.

61. *Market Data Center: Markets Diary: Closing Snapshot*, WALL ST. J. (Jan. 26, 2018), http://www.wsj.com/mdc/public/page/2_3021-tradingdiary2.html [https://perma.cc/3H8C-4A7Q].

62. Michael W. Roberge et al., *Lengthening the Investment Time Horizon*, MFS (2017). *But see* Mark Roe, *Are Stock Markets Really Becoming More Short Term?*, PROJECT SYNDICATE (Feb. 21, 2013), (contending that the perceived change in the average holding

In comparison, in 1968 the daily trading of just twelve million shares and an average holding period of four years[63] triggered the Paperwork Crisis on Wall Street. However, street name's convenience has led to problematic trends.

(i) Voter Identification

Mechanically, identifying the beneficial owners of street name shares is akin to taking a Dante's *Inferno*-like journey. Once a record date is announced, a corporation's directors contact the DTC which then notifies its participants holding the corporation's stock. Ideally, participants work in a timely manner[64] to check their records and give the DTC a list of beneficial shareholders.[65] The DTC then passes this list to the corporation, which often uses a proxy services company such as Broadridge to manage proxy distribution. Complicating matters, the street name system is plagued by a process dubbed "piggybacking" in which smaller banks or brokers deposit their shares at larger ones.[66] Each level of piggybacking requires another round of notifying, checking, and contacting custodians further removed from the DTC and the corporation. Piggybacking may repeat many times, creating an overlapping and multi-tiered knot of custodial ownership that is difficult, if not impossible, to untangle.

Even when a beneficial owner is found, voting discrepancies ensue. In a variety of circumstances collectively called "empty voting" a shareholder—by mistake or misconduct—is separated from her beneficial ownership.[67] All empty voting undermines the fundamental concept of corporate governance theory. That shareholders are the people best suited to vote on essential corporate matters because they are the most economically interested constituents.

In a common case of empty voting, a shareholder buys or sells shares

---

duration is caused by a small percentage of shareholders trading much more frequently, while most shareholder holding behaviors are similar to the past).

63. *See NYSE Annual Reported Volume, Turnover Rate, Reported Trades*, NYSEDATA.COM, http://www.nyxdata.com/nysedata/asp/factbook/viewer_edition.asp?mode=table&key=2206&category=4 (accessed Jan. 31, 2018).

64. *See* 17 C.F.R. § 240.14b-1(b)(1) (requiring brokers to respond to the DTC's requests within 7-business days); 17 C.F.R. § 240.14b-2(b)(1)(i) (requiring bankers to respond to the DTC's requests within 1-business day).

65. *See id.* at § 240.14b-1(b)(1)(i) (requiring banks and brokers to inform the DTC of beneficial owners, not counting other banks and brokers, within 7-business days).

66. Kahan & Rock, *supra* note 36, at 1237-39.

67. *See generally* Henry T.C. Hu & Bernard S. Black, *The New Vote Buying: Empty Voting and Hidden (Morphable) Ownership*, 79 S. CAL. L. REV. 811 (2006); Susan Christoffersen et al., *Vote Trading and Information Aggregation*, 62 J. FIN. 2897 (2007).

during the interlude between the record date and the meeting date. If a shareholder buys her shares during that interlude, she has no voting rights despite her exposure to the company's future. If a shareholder sells her shares during the interlude, she has voting rights but no economic interest in the outcome.[68]

In some intentional empty voting practices, savvy investors exploit the complexity of ownership tracking for hedging and profiteering purposes. Sometimes they purposely borrow shares immediately before the record date and repay the shares immediately afterwards. This gives them voting rights but no economic exposure to the market. Under calculated uses of equity derivatives and synthetic transactions, many hedge funds imitate economic rights while avoiding disclosure regulations triggered by beneficial ownership.[69]

As an example, in 2004, Mylan Laboratories, Inc. sought to acquire King Pharmaceuticals, Inc., pending approval by Mylan's stockholders.[70] At the time of the announcement, the hedge fund Perry Corporation already owned a significant stake in King, but hedged its position by acquiring and shorting[71] Mylan shares in case Mylan's stock price fell. First, Perry accumulated 10% of Mylan's shares after the markets closed to avoid SEC disclosure requirements. Then, Perry entered into swaps transactions protecting itself from a drop in Mylan's stock price. Perry, unlike other Mylan shareholders, established an empty voting position so it could vote Mylan's shares without any economic repercussions, risks, or stakes in the outcome. Regardless of whether Mylan's share price fell or rose, Perry had insulated its investments.

In other cases, empty voting arises when borrowing and lending leads to over-voting and multiple ownership claims for one share. A loaned share maintains voting rights. If a lender fails to track the temporary ownership change, then both the lender and borrower could vote via the same share

68. *See generally* Hu & Black, *supra* note 67 (describing the rise of empty voting and its consequences). *But see* Alon Brav & Richmond D. Mathews, *Empty Voting and the Efficiency of Corporate Governance*, 99 J. FIN. ECON. 289 (2011) (supporting empty voting as an efficient system because voting rights are priced to their highest value and minority shareholders have the opportunity to profit by selling or lending their votes).

69. *See generally* Michael C. Shouten, *The Case for Mandatory Ownership Disclosure*, 15 STAN. J.L. BUS. FIN. 127 (2009).

70. Press Release, SECURITIES AND EXCHANGE COMM'N, SEC Charges Perry Corp. With Disclosure Violations in Vote Buying Scheme, (Jul. 21, 2009), https://www.sec.gov/news/press/2009/2009-165.htm [https://perma.cc/PN97-DGE4].

71. The process of (hopefully) making profit by borrowing stock from a lender, selling it to others at a high price, pocketing the proceeds, and then buying the stock at a lower price in the future to return to the lender.

without anyone noticing.[72] The DTC's "chill" restrictions add more confusion to this situation. The DTC implements a "chill" to stop tracking share ownership when it recognizes an issue with a specific security. Issues that could trigger "chills" include legal, regulatory, or operational problems with a security. If a stock-based merger is about to close, then the DTC will "chill" tracking trades in that stock during the final three days before the merger closes, although trading continues.[73]

In 2013, David H. Murdock, the Chairman, CEO, and controlling shareholder of Dole Foods, Inc. (the world's largest producer of fruits and vegetables) used share lending empty voting and DTC chill restrictions to his advantage. Murdock took the company private in a single-step merger by giving $13.50 as consideration for each Dole share.[74] Dole shareholders claimed Murdock bought the shares for too little. The resulting class action lawsuit led to a settlement that gave an additional $2.74, plus interest, for each of the 36,793,758 outstanding shares in the class.[75] Unfortunately, valid claims arrived for 49,164,415 shares, representing 12,370,657 or 33.6% more shares than Dole had outstanding![76] Upon investigation, the attorneys discovered that the extra shares had resulted from a DTC "chill." In the three days before the merger closed, the DTC had ceased tracking ownership, despite nearly 32-million trades and 2.9-million short sales occurring during that period.[77] Vice Chancellor J. Travis Laster, in reviewing the Dole fiasco, found that "the problems raised . . . appear endemic to the depository system and hence [will] likely infect every claims process."[78]

As these examples demonstrate, street name's dominance hinders accurate voter identification and tracking.

(ii) Institutional Investors

Street name[79] has facilitated a notable change in who owns stocks.

72. Kahan & Rock, *supra* note 36, at 1237-39; NYSE Information Memo 04–58, "Supervision of Proxy Activities and Over-voting" (Nov. 5, 2004).

73. Steven D. Solomon, *Dole Case Illustrates Problems in Shareholder System*, N.Y. TIMES (Mar. 21, 2017), https://www.nytimes.com/2017/03/21/business/dealbook/dole-case-illustrates-problems-in-shareholder-system.html [https://perma.cc/9US6-5D42].

74. In re Dole Food Co., Inc. Stockholder Litig., 2015 WL 5052214, 1 (Del. Ch. 2015) (mem.), https://courts.delaware.gov/Opinions/Download.aspx?id=252690 [https://perma.cc/5UHG-YXWY].

75. *Id.*

76. *Id.*

77. *Id.* at 5-6.

78. *Id.* at 16.

79. *See* Patrick Jahnke, *Voice versus Exit: The Causes and Consequence of Increasing Shareholder Concentration* (2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=302

Institutional shareholders[80] now dominate retail shareholders.[81] Since 1950, institutional investors' share of U.S. equities has grown from approximately 6.1%[82] to at least 70.0%.[83] Among large companies, institutional investors own more than 74% of equity.[84] Simultaneously, since 1950 the NYSE's market capitalization has expanded more than 2,000% from $142.7-billion[85] to $18.9-*trillion*![86] Institutional investors not only own a larger share of U.S. equities than in the past, but the market itself is significantly more vast.

The institutional industry itself is extremely concentrated too. The ten largest institutional investors hold over 30% of the equity listed on the S&P 500.[87] By themselves, the so-called "Big Three" firms—BlackRock, State Street, and Vanguard—manage more than 90% of all assets in equity funds and are cumulatively the largest shareholders of 438 of the 500 firms listed on the S&P 500.[88] This dominance of U.S. equity has changed voting practices.

Voting rates are up because institutional investors vote their shares

---

7058 [https://perma.cc/5PTT-X2AS] (noting that the growing popularity of mutual funds and exchange traded funds (ETFs) has also played a significant role in changing stock ownership trends).

80. Large organizations such as pension funds, endowments, mutual funds, etc. that make significant investments on stock exchanges on behalf of its members. *See* Serdar Çelik & Mats Isaksson, *Institutional Investors and Ownership Engagement*, 2013 OECD J. 93 (2014) (describing institutional investors and identifying 7 features and 19 choices that differentiate their business models).

81. An individual investor who buys and sells securities her personal account and not another organization.

82. The Conference Board, *2010 Institutional Investment Report: Trends in Asset Allocation and Portfolio Composition* Table 10, 22 (2010).

83. BROADRIDGE FINANCIAL SOLUTIONS, INC & PWC, 2017 PROXY SEASON REVIEW (2d ed. 2017), https://www.pwc.com/us/en/governance-insights-center/publications/assets/pwc-proxypulse-2017-proxy-season-review.pdf [https://perma.cc/F8SL-PEAE].

84. *See* SULLIVAN & CROMWELL LLP, REVIEW AND ANALYSIS OF 2017 U.S. SHAREHOLDER ACTIVISM 3 (2018), https://www.sullcrom.com/siteFiles/Publications/SC_Publication_Review_and_Analysis_of_2017_US_Shareholder_Activism.pdf [https://perma.cc/EJZ6-P7TR] (defining a large company as one with a market capitalization exceeding $2 billion).

85. THE CONFERENCE BOARD, 2010 INSTITUTIONAL INVESTMENT REPORT: TRENDS IN ASSET ALLOCATION AND PORTFOLIO COMPOSITION TABLE 10, 22 (2010).

86. WORLD FEDERATION OF EXCHANGES, MARKET STATISTICS - SEPTEMBER 2016, (Feb. 15, 2018), https://www.world-exchanges.org/focus/index.php/in-every-issue/statistics/market-statistics/43-domestic-market-capitalisation [https://perma.cc/UU5W-LW7W]. The over 2000% growth also doesn't include the NASDAQ, which had a 2016 market capitalization of $7.6-trillion and was not founded until 1971. *Id.*

87. SULLIVAN & CROMWELL LLP, *supra* note 84, at 2.

88. Jan Fichtner & Eelke M. Heemskerk, *Hidden Power of the Big Three? Passive Index Funds, Re-Concentration of Corporate Ownership, and New Financial Risk*, 19 BUS. & POLITICS, 298-326 (2017).

much more frequently than retail investors. In 2017, retail and institutional shareholders voted 29% and 91%, respectively, of their shares; about 88% of all votes cast came from institutional owners.[89] Compared to diffuse retail investors, institutional investors suffer from fewer collective action problems. Numerous empirical studies show that greater concentration amongst fewer shareholders means that management proposals face more scrutiny.[90] As Luis A. Aguilar, SEC Commissioner from 2008 until 2015, acknowledged, "[i]nstitutional investors . . . have an important role in monitoring corporate governance issues" and they can determine outcomes "[g]iven the [high] percentage of company stock held by institutions, and the low participation rates of individual shareholders in corporate elections."[91] As a result of their power, institutional shareholders have recently tended to make more proposals related to environmental, social, and governance causes. In 2017 alone, hundreds of proposals were made that related to promoting environmental protection, diversity on boards, the gender pay gap, and workplace discrimination.[92] Over the last 20 years, institutional investors have also waged many successful campaigns against structural obstacles impeding affirmative shareholder rights.[93]

Still, institutional investors encounter greater limitations than retail investors in some circumstances. Institutional investors' business models

89. BROADRIDGE FINANCIAL SOLUTIONS, INC & PWC, *supra* note 83.

90. Randall S. Thomas & Patrick C. Tricker, *Shareholder Voting in Proxy Contests for Corporate Control, Uncontested Director Elections and Management Proposals: A Review of the Empirical Literature,* 70 OKLA. L. REV. 9, 71-124 (2017) (reviewing empirical studies on management proposals related to mergers, auditor ratifications, anti-takeover measures, and compensation, and concluding that institutional investors have led to greater shareholder suspicion and due diligence when considering many types of management proposals).

91. Luis A. Aguilar, Chairman, Securities and Exchange Comm'n, Institutional Investors: Power and Responsibility, Address at J. Mack Robinson College of Business, Center for Economic Analysis of Risk Workshop (Apr. 19, 2013).

92. Ronald O. Muller et al., *Shareholder Proposal Developments During the 2017 Proxy Season*, GIBSON, DUNN & CRUTCHER LLP (July 29, 2017), https://www.gibsondunn.com/shareholder-proposal-developments-during-the-2017-proxy-season/ [https://perma.cc/GU4F-8F2Q]; *see also* Joann S. Lublin, *New York State Fund Snubs All-Male Boards*, WALL ST. J. (Mar. 20, 2018), https://www.wsj.com/articles/new-york-state-fund-snubs-all-male-boards-1521538321 [https://perma.cc/G4MG-8VFQ] (reporting that New York's leading state pension fund will oppose the re-election of boards at hundreds of US corporations that lack a single woman on their boards because only 16.5% of directorships are held by women at Russel 3000 companies).

93. *See* LATHAM & WATKINS LLP, "EMPTY VOTING" AND OTHER FAULT LINES UNDERMINING SHAREHOLDER DEMOCRACY: THE NEW HUNTING GROUND FOR HEDGE FUNDS, M&A DEAL COMMENTARY (Sep. 18, 2007), https://www.lw.com/upload/pubContent/_pdf/pub1878_1.Commentary.Empty.Voting.pdf [https://perma.cc/RSG2-4ZFN] (showcasing the efforts made to increase shareholder democracy in the last 20 years).

depend on pooled funds.[94] Typically, a shareholder can express her displeasure with a corporation in one of two distinct ways: sell stock or vote against management. In the early 20th century shareholders much more frequently exercised their power by selling shares rather than using the "rarely exercised" right to vote.[95] However, pooled funds inherently restrict an investor's ability to sell shares. Institutional shareholders, unlike retail shareholders, are therefore much more reliant on voting to communicate their displeasure.

The breadth of an institutional investor's holdings also impedes effective voting. A large institutional investor may own shares in thousands of different companies, meaning it has many thousands of proposals to consider each year.[96] These investors have few incentives to spend the necessary time, money, and resources to perform adequate due diligence on every proposal.[97] Consequently, an industry of proxy advisors has emerged. Proxy advisors such as Institutional Shareholder Services (ISS) and Glass Lewis analyze corporate proposals and offer recommendations on how to vote. Although the ability of ISS and Glass Lewis to change voting outcomes is difficult to quantify, proxy advisors are certainly influential.[98] As institutional investors remain dominant, non-shareholder proxy advisories will remain important.

(b) Vote Counting

Adding to the street name problems is a faulty vote counting process. A process that "promotes certainty and speed over accuracy and

94. Patrick Jahnke, *supra* note 79.

95. Shaun Martin & Frank Partnoy, *Encumbered Shares*, 2005 U. ILL. L. REV. 775, 784 (2005).

96. *See* Carol J. Loomis, *BlackRock: The $4.3 trillion Force*, FORTUNE, July 7, 2014, http://fortune.com/2014/07/07/blackrock-larry-fink [https://perma.cc/ZDY6-GCUA/] (estimating that in 2012 alone, BlackRock received 129,814 management and shareholder proposals for consideration at shareholder meetings).

97. *See, e.g.*, Omari Scott Simmons, *Taking the Blue Pill: The Imponderable Impact of Executive Compensation Reform*, 62 SMU L. REV. 299, 354 (2009) ("Institutional investors, despite having greater capacity to monitor and gather information, may have too small a stake in a company or too limited industry expertise to monitor it actively."); *see also* Paul Rose, *The Corporate Governance Industry*, 32 J. CORP. L. 887, 897 (2007) ("Unless an institutional investor believes that it can conduct research for less, or that more expensive but discerning research will enable it to obtain better returns (after subtracting its own research costs), the investor may be better off outsourcing its corporate governance research.").

98. *See generally* Stephen Choi, Jill Fisch & Marcel Kahan, *The Power of Proxy Advisors: Myth or Reality?*, 59 EMORY L.J. 869 (2010) (analyzing the influence of proxy advisory firms on voting outcomes and finding that an ISS recommendation flips, on average, about 6% to 10% of shareholder votes).

perfection."[99]

History's largest and most expensive proxy contest[100] aptly demonstrates this reality. In the summer of 2017, Nelson Peltz, co-founder of Trian Fund Management, sought a seat on the board of Procter & Gamble (P&G).[101] The proxy contest was heated. By joining the board, Peltz argued he would enact profound changes to improve the company's languid growth.[102] In response, P&G argued that Peltz, a notorious activist investor, only sought a board position to facilitate breaking up the firm. Trian and P&G spent at least $25 million and $100 million, respectively, on their months-long campaigns.[103] Finally, the annual meeting arrived. The initial count showed Peltz had lost the election by 6.15 million votes, a margin of only 0.2% out of P&G's over 2.5 billion outstanding shares.[104] Peltz appealed for an independent recount, which found he had actually *won* by 42,000 votes; a margin of just 0.0016%![105] The uncertainty continued when another recount found Peltz *lost* by about 500,000 votes.[106] After months of embarrassing publicity and recounts, P&G refused to officially concede defeat, but added Peltz to the board in recognition of his substantial support amongst shareholders.[107] No one definitively knows and no one ever will know the actual voting results. Even one of the world's wealthiest, most powerful, and most renowned corporations could not escape the flaws of contemporary vote counting.

---

99. Kahan & Rock, *supra* note 36, at 1235.

100. David Benoit, *Trian Launches Proxy Fight Against Procter & Gamble*, WALL ST. J. (July 17, 2017), https://www.wsj.com/articles/trian-to-launch-proxy-fight-against-p-g-1500264242 [https://perma.cc/NZY2-9GZZ].

101. *See* PROCTER & GAMBLE CO., 2017 ANNUAL REPORT (2017) (reporting that P&G, owner of popular brands such as Tide, Gillette, and Pampers, is one of the world's leading providers of consumer-packaged goods with a $221.8-billion market capitalization and $65.1-billion in net sales in 2017).

102. TRIAN FUND MANAGEMENT, L.P., REVITALIZE P&G TOGETHER: VOTE THE WHITE PROXY CARD (2017),
(Sept. 6, 2017), https://trianpartners.com/content/uploads/2017/01/Trian-PG-White-Paper-9.6.17-1.pdf [https://perma.cc/SMD3-USGQ].

103. Chris Isidore & David Goldman, *Procter & Gamble Declares Victory in Expensive Proxy Fight*, CNN: CNN MONEY BLOG, (Oct. 10, 2017), http://money.cnn.com/2017/10/10/news/companies/procter-gamble-proxy-fight/index.html [https://perma.cc/H3GN-R787].

104. Sharon Terlep & David Benoit, *P&G Says Nelson Peltz Lost Bid for Board Seat by About 0.2% of Share Count*, WALL ST. J. (Oct. 16, 2017), https://www.wsj.com/articles/p-g-says-nelson-peltz-lost-bid-for-board-seat-by-about-0-2-of-share-count-1508190889 [https://perma.cc/5BS8-C3VN].

105. Sharon Terlep & David Benoit, *P&G Concedes Proxy Fights, Adds Nelson Peltz to Its Board*, WALL ST. J. (Dec. 15, 2017), https://www.wsj.com/articles/p-g-concedes-proxy-fight-adds-nelson-peltz-to-its-board-1513377485 [https://perma.cc/3KDN-DL54].

106. *Id.*

107. *Id.*

Management's influence also affects voting outcomes. An empirical statistical study of close contests—ones falling within a 5% margin of victory—finds that voting results disproportionately swing in favor of management.[108] Management-sponsored proposals are "overwhelmingly more likely to win a corporate vote by a very small amount than lose by a very small amount——to a degree that cannot occur by chance."[109] In contrast, shareholder-sponsored proposals (which are non-binding and precatory) show no irregularity in outcomes.[110] This suggests some inappropriate manipulation.[111]

The exact methods of manipulation are unclear. In close contests management may possess high-quality information about the vote count and intensify its campaign[112] knowing that the corporation will reimburse expenses.[113] In some cases, superstar managers with outsize influence may use their clout to affect the voting process. After all, management often has clear compensation incentives to sway voters. One study of 103 buyout transactions between 2003 and 2009 found that an average deal gave management $64.3 million in compensation and a 21.9% ownership stake in the new company.[114]

The 2011 leveraged buyout of the apparel company J. Crew Group, Inc. exemplifies how a manager's influence may affect outcomes. J. Cr few's legendary CEO Mickey Drexler—nicknamed the "Merchant Prince"[115] of retail for his successful stewardships of Gap and J. Crew—conspired for weeks with private equity firms TPG Capital and Leonard Green & Partners (LGP) to affect a leveraged buyout of the company for $3 billion. In a highly controversial process, Drexler hid many damaging procedural facts from

108. Yair Listokin, *Management Always Wins the Close Ones*, 10 AM. L. & ECON. REV. 159 (2008); *see also* Yair Listokin, *Does Shareholder Voting Reflect Shareholder Preferences*, UC Berkeley Law and Economics Workshop 4 (2007) (finding that in proxy contests management wins more close contests than it loses, but does not to the same degree as in other voting contests).

109. *Id.* at 161.

110. *Id.* at 173-5.

111. *Id.*

112. *See id.* at 173 (finding that the probability of the study's results occurring by chance is roughly one in one-billion).

113. CA, Inc. v. AFSCME Employees Pension Plan, 953 A.2d 227, 240 (2008) (holding that a board may expend corporate funds to reimburse expenses in disputes involving policy).

114. Matthew D. Cain & Steven Davidoff Solomon, *Form Over Substance? The Value of Corporate Process and Management Buy-Outs*, DEL. J. CORP. L. 849 (2011).

115. *See* Vanessa Friedman & Julie Creswell, *Mickey Drexler Steps Down as Chief of J. Crew, Ending an Era*, N.Y. TIMES (June 5, 2017), https://www.nytimes.com/2017/06/05/business/jcrew-mickey-drexler.html [https://perma.cc/2UTY-29BF] (reporting that, as of 2017, J. Crew is reaching the brink of bankruptcy and Drexler has stepped down as CEO amidst years of declining sales and hundreds of job cuts).

shareholders. Drexler waited seven weeks to notify the board of his dealings with TPG and LGP, he shared private company information to inform the private equity firms' offer, and he exerted his personal influence with the board to negotiate a $2 price reduction from the initial $45.50 offer.[116] With Drexler's persuasion, the deal closed and he received compensation of $200 million in cash and an 8.8% stake in the company worth $100 million.[117] Despite J. Crew's dismal performance since the deal's closing, TPG and LGP have paid themselves nearly $750 million in dividends and fees.

Whether caused by issues with street name, voter identification, or vote counting, the modern systems of shareholder voting and share ownership are defective. New tools and systems must emerge. Just as reform was needed when a purely paper-based paradigm created the Paperwork Crisis, Wall Street must again revise its ways. The legitimacy of corporate governance will erode as long as the dysfunction of shareholder voting persists. Fortunately, blockchain may offer a solution.

PART II: THE FUTURE

The hype surrounding blockchain technology is real. Seemingly every industry and every person is "buzzing about the potential for the Blockchain to revolutionize . . . well everything."[118] Studies predict that by 2027, 10% of the world's gross domestic product will be stored on blockchain technology.[119] Silicon Valley leaders describe blockchain as "the distributed trust network that the Internet always needed and never had."[120] From selling

116. Steven Davidoff Solomon, *J. Crew Buyout Raises Questions*, N.Y. TIMES: DEALBOOK BLOG (Dec. 10, 2010), https://dealbook.nytimes.com/2010/12/10/j-crew-buyout-raises-questions/ [https://perma.cc/2LBC-LHJU].

117. *Id.*

118. GOLDMAN SACHS, EMERGING THEME RADAR, (Dec. 2, 2015), http://www.goldmansachs.com/our-thinking/pages/macroeconomic-insights-folder/what-if-i-told-you/report.pdf [https://perma.cc/CC3L-A875].

119. WORLD ECONOMIC FORUM, DEEP SHIFT TECHNOLOGY TIPPING POINTS AND SOCIETAL IMPACT, 24 (Sept. 2015), http://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf [https://perma.cc/G7UH-RA4W].

120. Brian Fung, *Marc Andreessen: In 20 Years, we'll talk about Bitcoin like we talk about the Internet today*, WASH. POST: THE SWITCH BLOG (May 21, 2014), https://www.washingtonpost.com/news/the-switch/wp/2014/05/21/marc-andreessen-in-20-years-well-talk-about-bitcoin-like-we-talk-about-the-internet-today/?utm_term=.d272a20b71c4 [https://perma.cc/ARH2-XN9C].

CrytpoKitties[121] to redefining property rights,[122] blockchain seemingly has no limits.

Of course, that's just the hype. Revolutionary changes are not guaranteed. Yet in a modern world that produces 2.5 quintillion bytes of data per day,[123] blockchain promises a future of more transparent, tamper-proof, accurate, and secure digital recordkeeping. A new era for a world overwhelmed by data.

A. Introduction to Blockchain

(a) Mechanics

Blockchain technology, at its most fundamental level, is a special database: a so-called "trust machine."[124] Cleverly combining cryptography, game theory, and economics, blockchain ingeniously enables recordkeeping that anyone can access and verify, but no one can control or change.

To dispel one major misconception, blockchain is often used synonymously and interchangeably with bitcoin—the decentralized cryptocurrency released in January 2009 by the anonymous Satoshi Nakamoto.[125] This confluence is incorrect and short-sighted. In fact, the initial idea for blockchain dates to at least 1991 when researchers Stuart

121. Fitz Tepper, *People Have Spent Over $1M Buying Virtual Cats on the Ethereum Blockchain*, TECHCRUNCH (Dec. 3, 2017) https://techcrunch.com/2017/12/03/people-have-spent-over-1m-buying-virtual-cats-on-the-ethereum-blockchain/ [https://perma.cc/YF36-K6W4].

122. Phil Gramm & Hernando de Soto, *How Blockchain Can End Poverty*, WALL ST. J.: OPINION (Jan. 25, 2018), https://www.wsj.com/articles/how-blockchain-can-end-poverty-1516925459 [https://perma.cc/7XPK-FHEP].

123. IBM, 10 KEY MARKETING TRENDS FOR 2017 AND IDEAS FOR EXCEEDING CUSTOMER EXPECTATIONS 3 (2017), https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=WRL12345USEN [https://perma.cc/6GR4-Q4CL].

124. *The Trust Machine: The Promise of the Blockchain*, THE ECONOMIST, Oct. 31, 2015, https://www.economist.com/leaders/2015/10/31/the-trust-machine [https://perma.cc/4FAP-38P5].

125. Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, (2009), https://bitcoin.org/bitcoin.pdf [https://perma.cc/NW8T-T59E]. Satoshi Nakamoto has never been identified and it is generally believed that the name is a pseudonym for an author (or authors) who wishes to remain anonymous. Theories abound for Nakamoto's anonymity ranging from the self-defensive (he wishes to avoid legal trouble for his creation or personal safety issues since he owns 1-million bitcoin) to the purposeful (his anonymity generates ongoing publicity and reflects bitcoin's philosophy of total decentralizations). *See Who is Satoshi Nakamoto?*, THE ECONOMIST, Nov. 2, 2015, https://www.economist.com/the-economist-explains/2015/11/02/who-is-satoshi-nakamoto [https://perma.cc/VMC2-C366] (stating that Satoshi Nakamoto has not been heard from since 2011).

Haber and W. Scott Stornetta first proposed methods for tamper-proofing digital content.[126] Bitcoin is one innovative, high-profile, and perhaps politically motivated[127] application of blockchain, but the underlying blockchain technology itself is much more meaningful. Blockchain is the internet. Bitcoin is email.

In a blockchain,[128] each participant (referred to as a "node") starts with a blank ledger (referred to as a "block") for recording a finite and predetermined amount of transactional information. Nodes transact with each other by trading assets and sharing information. With each transaction, a node publicly announces what has occurred so that each node can simultaneously and automatically record the transaction on its block. Transactions continue until a block is filled.

At this point, without a blockchain, the participants in a transaction would normally need to rely on a trusted source (for example, a bank, government, or company) for two services. One is holding the completed ledger. The other is preventing people from changing that ledger. This is how most modern record-keeping systems work. If someone claims illegitimate activity has happened (transactions are missing, values are incorrect, or fraud has occurred), then the trusted source checks the official record, verifies claims, and makes modifications. Such a system suffers from several problems. The trusted source may have incorrectly recorded the transactions or even lost the completed ledger. Another person such as a hacker may have stolen or corrupted the ledger without the trusted source realizing it. Perhaps the trusted source was not actually trustworthy and

126. Stuart Haber & W. Scott Stornetta, *How to Time-Stamp a Digital Document*, 3 J. CRYPTOGRAPHY 99 (1991).

127. *See also* Satoshi Nakamoto, *Bitcoin Open Source Implementation of P2P Currency*, P2P FOUNDATION (Feb. 11, 2009, 10:27 PM), http://p2pfoundation.ning.com/forum/topics/bitcoin-open-source [https://perma.cc/7CDF-FWUH] (stating that "[t]he root problem with conventional currency is all the trust that's required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust."); *see also* Jamie Redman, *Bitcoin's Quirky Genesis Block Turns Eight Years Old Today*, BITCOIN, (Jan. 3, 2017), https://news.bitcoin.com/bitcoins-quirky-genesis-block-turns-eight-years-old-today [*https://perma.cc/L2NX-Z9VS*] (noting that Bitcoin's genesis block—that is, its first block—is encoded with the London Times's headline from January 3, Chancellor on brink of second bailout for banks," a likely reference to Nakamoto's distrust of centralized banking systems).

128. This Comment only provides a high-level, simplified, and plain-English description of blockchain mechanics. For a more technical and detailed description of blockchain the following sources are recommended: Michael Crosby and Pradhan Pattanayak et al., *BlockChain Technology: Beyond Bitcoin*, BERKELEY SUTARDJA CENT. FOR ENTRE. & TECH. (2015); Francois Zaninotto, *The Blockchain Explained to Web Developers, Part 1: The Theory*, MARMELAB (2016), https://marmelab.com/blog/2016/04/28/blockchain-for-web-developers-the-theory.html [https://perma.cc/4AFZ-EYGQ].

changed the record on its own.[129]

The ingenuity of blockchain kicks in when addressing these inherent imperfections of trusted sources. Instead of relying on flawed trusted sources, blockchain enables nodes to securely hold and protect a completed block on their own. Illicit changes are prevented by using a special type of cryptography called a universal one-way hash function. This hash function works by taking inputs and providing outputs based on arbitrary assignment. For example, in a hypothetical hash function the input "r3" outputs "29pmdsadipdasd" and the input of "12p" yields "asdnjsd1." No rhyme or reason exists for these input-output relationships. The only way to know which input leads to which output is to test *all* potential inputs. This is a "proof-of-work" system. If you are given an input, then it is extremely easy to calculate the correct output. But if you are only given an output, then it is extremely difficult and costly to determine the input. Using the simplified hash function example, you could quickly learn that inputting "10c" always yields the output "2ipdbme." But if you only have the output "2ipdbme" then you must use trial-and-error by inputting various values—"1a," "2d5," "x3i," and so on—until you found the only input ("10c") leading to the "2ipdbme" output.

Each completed block receives a randomly predetermined output value. Each completed block also contains three input values that, when combined, must equal the output value. Only two of these three input values are known. The first is the sum of all the transactions on the filled block. The second is a randomly predetermined value called a "nonce." The final input value is unknown (for this example, refer to it as the "seal number"). Through a process known as "mining," one of the nodes must find this missing seal number, add it to the completed block, and announce its discovery to the group.[130] When the majority of nodes agree that the seal number is correct,

129. Many countries have the luxury of relatively trustworthy and stable governments and institutions. However, it is important to remember that many parts of the world lack such foundations or are prone to extraordinary uncertainty. *See* Maureen Farrell, *Bitcoin Prices Surge Post-Cyprus Bailout*, CNN: CNN Money Blog (Mar. 28, 2013), http://money.cnn.com/2013/03/28/investing/bitcoin-cyprus/index.html [https://perma.cc/C7FZ-RQQ2] (reporting about depositors in Cyprus flocking to bitcoin as Cyprus's central bank teetered towards default); *see also* Rene Chun, *Big in Venezuela: Bitcoin Mining*, THE ATLANTIC, Sept. 15, 2017 (reporting on the rise in bitcoin mining in Venezuela as the government's monetary policies led to a hyperinflation rate of 1,600% in 2017).

130. Mining seal numbers requires significant effort and computing power, so as an incentive a blockchain gives successful miners a predetermined reward. For example, the bitcoin blockchain program originally awarded successful miners 25 bitcoins for each mined seal number with this reward halving every 210,000 blocks. The declining rewards simulates a controlled currency supply and inflation rate normally managed by a central bank such as the U.S. Federal Reserve. As of this writing, bitcoin's reward is 12.5 bitcoin worth about

the nodes seal the completed block, add it to the "chain" of previously filled blocks, and proceed to the next one. The process continues indefinitely, forming a growing chain of blocks. A blockchain.

Blockchain's ingenuity is further demonstrated by the confidence and security it generates. If a dishonest node changes any transaction history in a sealed block, then that sealed block's input value changes and the previously discovered seal number no longer leads to the correct output number. To conceal her actions, the dishonest node would need to identify a new seal number through the tedious proof-of-work process. However, while she is trying to discover a new seal number to create a new chain, the other honest nodes have continued transacting and building upon the original chain. These honest nodes produce and seal new blocks faster than the dishonest node constructs her version. In this way, the mistakes or ill-intentions of the few do not override the actions of the many. The honesty of the majority outweighs the dishonesty of the minority.

(b) Weaknesses

Blockchain, like any emerging technology, has weaknesses. Ones that must be addressed over time with complementary, supporting technologies. This Comment does not discuss in detail blockchain's many challenges and their proposed or possible solutions. Instead, this Comment assesses the essential primary weaknesses, threats, and risks inherent to any form of blockchain.

The first and arguably most significant risk is referred to as the "51% Attack." This arises when a miner or mining pool seizes a majority of the blockchain's mining power.[131] With this level of control, a majority can launch a "hard fork" by rewriting prior blocks and generating a new chain that the minority of nodes must follow.[132] A hard fork creates a permanent split between the original chain and the new version.[133] Theoretically, a 51% Attack is unlikely. The heart of blockchain relies on the assumption that at any given time a majority of nodes are honest and not collusive.[134] Game theory principles discourage 51% Attacks because if a majority controls a

---

$100,000 for successfully mining a seal number.

131. *See generally* Mauro Conti et. al., *A Survey on Security and Privacy Issues of Bitcoin*, (Dec. 25, 2017) (unpublished article) (on file with ArXiv), https://arxiv.org/abs/1706.00916 [https://perma.cc/AB4Z-MZ7Q] (detailing many of the vulnerabilities of bitcoin and blockchains generally).

132. *Id.*

133. *Id.*

134. *Id.*

blockchain, then fewer nodes join and the blockchain's value decreases.[135] As history demonstrates, these assumptions are not always true.

In 2016, a hacker group successfully 51% Attacked the cryptocurrencies Krypton and Shift to extort the founders for ransoms.[136] In other cases, hard forks and 51% Attacks have happened with good intentions. Several months before the Krypton and Shift attacks, hackers exploited a publicized vulnerability in an investment fund operating on the Ethereum blockchain (a leading cryptocurrency and competitor of bitcoin). The hackers seized about one-third of the fund's holdings, representing 3.6 million Ether tokens then worth about $55 million.[137] Shortly after, a heated debate erupted amongst Ethereum nodes about how to respond to this system breach. Some nodes wanted to hard fork and restore the lost tokens, while others argued such a hard fork would represent an inappropriate 51% Attack violating Ethereum's founding principles of immutability and trust. A vote was held. About 85% of the Ethereum community chose to execute a hard fork and restore the lost tokens, while the dissenting 15% refused to follow and founded Ethereum Classic.[138] Ethereum and Ethereum Classic still run in parallel today.

A lack of sensible governance is the other major risk[139] of a public blockchain. Governments and centralized institutions, despite their flaws, provide powerful processes for making decisions and resolving disputes. Bitcoin's history as a public blockchain is telling of what could happen without a centralized authority. As bitcoin has rapidly grown, developers have engaged in a multi-year debate about how to expand the cryptocurrency's capacity to keep up with demand.[140] The debate remains unresolved because no group has accrued the necessary consensus.[141] Investors have noticed this paralysis. Bitcoin's once dominant 87.6% market share amongst cryptocurrencies, as of January 1, 2017, has declined to 37.1%

135. *Id.*

136. Jamie Redman, *Small Ethereum Clones Getting Attacked by Mysterious '51 Crew'*, BITCOIN NEWS (Sept. 4, 2016), https://news.bitcoin.com/ethereum-clones-susceptible-51-attacks/ [https://perma.cc/2KMR-LRYP].

137. Matthew Leising, *The Ether Thief*, BLOOMBERG (June 13, 2017), https://www.bloomberg.com/features/2017-the-ether-thief/ [https://perma.cc/LA9U-SB5W].

138. Vitalik Buterin, *Hard Fork Completed,* ETHEREUM BLOG (July 20, 2016), https://blog.ethereum.org/2016/07/20/hard-fork-completed/ [https://perma.cc/XU9G-6EVH].

139. Some people with a more libertarian or anti-establishment bent may argue this is a strength.

140. Paul Vigna, *Bitcoin Dodges Split That Threatened Its Surging Price*, WALL ST. J. (Nov. 8, 2017), https://www.wsj.com/articles/bitcoin-dodges-split-that-threatened-its-surging-price-1510172701 [https://perma.cc/7J7K-KR3L].

141. *Id.*

one year later.[142]

Lost blockchain wallets are another weakness that needs a solution. Blockchain wallets hold a person's identification information. Without a trusted third party, a blockchain user is responsible for keeping her identification information safe. This information is typically stored on a private key, in the form of a large succession of alphanumeric characters. If a user's private key is lost or corrupted, then she has no method of recovery. Her transaction history and assets are orphaned forever on the blockchain. If a third party finds or steals her key, then her assets could be taken without recourse. Stories abound of fraud,[143] hacks,[144] and even physical muggings[145] to access a user's private key and empty her accounts. Making sure this personal identification information is as secure as the information on the blockchain is an ongoing challenge.

Privacy concerns also arise from blockchain. With a public or semi-public blockchain, all transactions are visible. However, certain shareholders or managers may wish to remain anonymous for strategic reasons. Even in a pure permissioned blockchain with full anonymity, live transaction history would give some nodes more complete and up to date information than they could get anywhere else today. Services may also develop that specialize in de-anonymizing nodes. Alternatively, too much privacy facilitates anonymity enabling improper or criminal activities. Balancing privacy and functionality is likely an issue that will never be resolved. It requires balancing cultural norms and expectations with the reality and potential power of blockchain's heightened transparency.

Lastly, a blockchain requires immense storage capacity and energy consumption. For example, only one bitcoin transaction in December 2017 required an estimated 250 kilowatt-hours of energy—enough to support an average U.S. household for 8 days.[146] Energy demands for bitcoin are so

142. COINMARKETCAP, PERCENTAGE OF TOTAL MARKET CAPITALIZATION (DOMINANCE), https://coinmarketcap.com/charts/ [https://perma.cc/NZ37-A2DJ] (last visited Nov. 16, 2018).

143. Nathaniel Popper, *As Bitcoin Bubble Loses Air, Frauds and Flaws Rise to the Surface*, N.Y. TIMES (Feb. 5, 2018), https://www.nytimes.com/2018/02/05/technology/virtual-currency-regulation.html [https://perma.cc/AV56-784D].

144. Steven Russolillo, *Hackers Steal More Than $70 Million in Bitcoin*, N.Y. TIMES (Dec. 7, 2017), https://www.wsj.com/articles/millions-may-be-missing-in-bitcoin-heist-1512625176 [https://perma.cc/ZBT2-BEFQ].

145. Nathaniel Popper, *Bitcoin Thieves Threaten Real Violence for Virtual Currencies*, N.Y. TIMES (Feb. 18, 2018), https://www.nytimes.com/2018/02/18/technology/virtual-currency-extortion.html [https://perma.cc/2WMD-BDXT].

146. Robert P. Murphy, *Does Bitcoin Use Too Much Electricity?*, INSTITUTE FOR ENERGY RESEARCH (Jan. 18, 2018), https://instituteforenergyresearch.org/analysis/bitcoin-use-much-electricity/ [https://perma.cc/VJ2P-273K].

large that many major bitcoin miners have resorted to extreme tactics to find plentiful and affordable energy sources. More than two-thirds of bitcoin mining comes from facilities in northern China's Inner Mongolia that use government-subsidized hydroelectric power and the region's cool climate.[147] Iceland's large bitcoin mining operations run on the country's renewable geothermal energy and arctic air cooling.[148] Storage capacity is also a worry because as any blockchain grows, the required computing power of a node increases. More nodes cannot meet these requirements and are unable to continue participating, threatening a blockchain's future growth potential.

(c) Variations

When discussing blockchain, it is important to recognize that the technology encompasses many forms. Blockchain's flexibility is a strength that should allow it to effectively evolve. Many variations have developed to offer differing degrees of control and decentralization across a spectrum of options.

A public blockchain is one side of the spectrum. On a public blockchain, anyone can join, read, edit, and verify information. Everyone may participate in the consensus-building process. These blockchains are entirely decentralized. Many advocates of public blockchains support them because they decrease dependence on the trusted third-party sources prone to error, corruption, and misbehavior.[149]

A permissioned (or private) blockchain is the other extreme. Permissioned blockchains are run by a central authority that controls the blockchain's protocols.[150] The central authority governs the community by restricting access and changing rules as desired. Permissioned blockchains are akin to traditional trusted source dependent databases, but ones built with blockchain's superior record-keeping architecture. This form offers some

147. Cao Li & Giulia Marchi, *In China's Hinterlands, Workers Mine Bitcoin for a Digital Fortune*, N.Y. TIMES (Sept. 13, 2017), https://www.nytimes.com/2017/09/13/business/bitcoin-mine-china.html [https://perma.cc/5EZD-ZHY2].

148. Nathaniel Popper, *Into the Bitcoin Mines*, N.Y. TIMES: DEALBOOK BLOG (Dec. 21, 2013), https://dealbook.nytimes.com/2013/12/21/into-the-bitcoin-mines/ [https://perma.cc/94QM-5MZE].

149. Ian Allison, *Nick Szabo: If Banks Want Benefits of Blockchains They Must Go Permissionless*, INT'L. BUS. TIMES (Sept. 11, 2015), https://www.ibtimes.co.uk/nick-szabo-if-banks-want-benefits-blockchains-they-must-go-permissionless-1518874 [https://perma.cc/MY9F-9L6S].

150. Giulio Prisco, *Nick Szabo on 'Permissioned Blockchains' and the Block Size,* BITCOIN MAG. (Sept. 9, 2015), https://bitcoinmagazine.com/articles/nick-szabo-permissioned-blockchains-block-size-1441833598/ [https://perma.cc/96ZF-MXSQ].

advantages. Transaction costs are cheaper because only a few nodes are needed to verify a completed block. The central authority also potentially provides sensible governance to address a blockchain's faults. These permissioned systems address concerns about collusion because the central authority can prevent any miner or mining pool from attaining a controlling stake. Culturally, they are likely more digestible among the public and government authorities who are accustomed to some degree of centralized management.

Between the two extremes are many hybrid forms combining features of public and permissioned blockchains. In a so-called "sidechain," permissioned systems operate independently but then periodically connect with a public blockchain.[151] Inversely, Ethereum is a public blockchain that allows everyone to create public and permissioned blockchain applications upon it.[152] The many hybrid forms of blockchain reveal that it is not a static, uniform technology. Instead, it offers flexibility and customization based on need.

B. Blockchain: A Foundational Technology

Blockchain is a foundational technology. A technology that creates groundwork in society for other innovations to grow. As an example, in 1974, Vint Cerf and Bob Kahn published a paper describing a system of rules allowing a digital network to share information.[153] These rules are now known as the Internet Protocol Suite (TCP/IP)[154]—the backbone of the Internet. As a foundational technology, TCP/IP has supported countless disruptive and value-adding innovations. The World Wide Web, e-commerce, text and video messaging, social media, office tools, streaming, sharing economies, search algorithms, and so on; these are only some of the innumerable innovations inextricably tied to the foundational TCP/IP.

Although accurately forecasting the impact of foundational technologies is impossible, Marco Iansiti and Karim R. Lakhani of Harvard Business School offer a framework to understand their development.[155] A

151. Adam Back et al., *Enabling Blockchain Innovations with Pegged Sidechains* (unpublished working paper) (accessible at https://blockstream.com/sidechains.pdf) [https://perma.cc/7TUQ-USL8].

152. *A Next Generation Smart Contract and Decentralized Application Platform*, GITHUB (Mar. 17, 2018), https://github.com/ethereum/wiki/wiki/White-Paper [https://perma.cc/KD5F-NMVA].

153. Vinton G. Cerf & Robert E Kahn, *A Protocol for Packet Network Intercommunications*, 22 IEEE TRANSACTIONS ON COMM. 637 (1974).

154. Commonly referred to as "TCP/IP" after its two major protocols.

155. Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, HARV. BUS. REV.

foundational technology evolves through four distinct phases—Single Use, Localization, Substitution, and Transformational—that build upon one another. Each phase is characterized by differing degrees of novelty and complexity. The more novelty a technology possesses, the more original it is to society. The more complexity a technology requires, the more networks of people and systems must adopt and support it.

Blockchain's development will require patience. Foundational technologies develop gradually. A current generation's long-standing norms, behaviors, and institutions considered concrete are set in motion. Society's modern and powerful institutions become more old-fashioned and weaker. Seemingly unrelated developments collide to yield unexpected changes. The history of U.S. retail is telling. TCP/IP arose in 1974, but forty years passed before most Americans felt comfortable shopping online rather than in stores.[156] In 1974, Sears dominated U.S. retail with annual sales approaching 1% of the nation's GDP and headquartered itself in the world's tallest building, aptly named the Sears Tower.[157] By 2017, Sears—the so-called "Amazon of the 20th-century"—teetered on bankruptcy amidst seismic shifts in retail partly led by the Internet. In October 2018, Sears filed for Chapter 11 bankruptcy protection, a possible prelude to a future end of operations and liquidation.[158] Few people in 1974 could have imagined e-commerce's rise or Sears' collapse spurred by the numerous new networks, consumer behaviors, and innovations formed over decades. Foundational technology revolutions are slow but steady.

This Comment presumes that blockchain-based applications in shareholder voting will become more common, but will not completely replace trust-based systems. This is based on several assumptions. As detailed in Part I, the current shareholder voting system is irreparable using existing non-blockchain technologies. Shareholders, especially institutional investors, will increasingly be frustrated by the current system's shortcomings. In response, blockchain-based innovations will progressively form new decentralized and transparent tools, networks, and institutions.

(2017).

156. *See* STATISTA, ONLINE SHOPPING PENETRATION IN CHINA AND THE UNITED STATES FROM 2010 TO 2013 WITH A FORECAST TO 2016 (Mar. 27, 2018), https://www.statista.com/statistics/373965/online-shopping-penetration-china-and-the-us/ (estimating that 50.4% of the total U.S. population would shop online in 2014).

157. Suzanne Kapner, *Inside the Decline of Sears, the Amazon of the 20th Century*, WALL ST. J. (Oct. 31, 2017), https://www.wsj.com/articles/inside-the-decline-of-sears-the-amazon-of-the-20th-century-1509472095 [https://perma.cc/PU7A-8L2Y].

158. Michael Corkery, *Sears, the Original Everything Store, Files for Bankruptcy*, N.Y. TIMES (Oct. 14, 2018), https://www.nytimes.com/2018/10/14/business/sears-bankruptcy-filing-chapter-11.html [https://perma.cc/EZZ5-C89W].

However, the law will continue to support centralized trusted sources as a check on greater decentralization and loss of control. Total decentralization of shareholder voting by blockchain will not occur in the foreseeable future.

Using the Iansiti and Lakhani framework, this Comment assesses how blockchain-based technologies may develop through each phase to address the problems of shareholder voting and share ownership.

(a) Single Use

The Single-Use phase is characterized by low levels of novelty and complexity. Innovations address existing problems with solutions that are more efficient, less costly, and more focused than the current alternatives. At this phase, blockchain solutions will not revolutionize shareholder voting so much as they will incrementally improve it.

Society has already entered the Single-Use phase. Blockchain-based technologies that address empty voting and street name ownership have already launched; in December 2016, Overstock.com became the first U.S. public company to issue stock through a permissioned blockchain-based platform based on the bitcoin blockchain.[159] Per Overstock.com's prospectus, these blockchain-based securities are intended to eliminate street name ownership and allow shareholders to trade directly in their name.[160] All transaction information is public, but personal shareholder identification information is private; only Overstock.com, the central authority, can see personal information.[161] In 2016, NASDAQ launched a pilot program on Estonia's Tallinn Stock Exchange that uses a blockchain-based e-voting service to record and track shareholder votes.[162] After a successful proof-of-concept, NASDAQ launched a similar program in South Africa.[163] In 2017, Broadridge announced a successful test use of blockchain to complete proxy votes in a private transaction.[164]

159. Cade Metz, *Overstock Begins Trading Its Shares Via the Bitcoin Blockchain*, WIRED (Dec. 15, 2016), https://www.wired.com/2016/12/overstock-com-issues-stock-via-bitcoin-blockchain/ [https://perma.cc/49TT-8FLF].

160. Overstock.com, Inc., Prospectus (Form 424(b)(3)) 34 (Dec. 9, 2015).

161. *Id.* at 36.

162. Press Release, NASDAQ, NASDAQ's Blockchain Technology to Transform the Republic of Estonia's e-Residency Shareholder Participation (Feb. 12, 2016), http://ir.nasdaq.com/releasedetail.cfm?releaseid=954654 [https://perma.cc/2FHE-JXPC].

163. Press Release, NASDAQ, NASDAQ to Deliver Blockchain e-Voting Solution to Strate, (Nov. 22, 2017), http://ir.nasdaq.com/releasedetail.cfm?releaseid=1049610 [https://perma.cc/X887-A7DB].

164. Pete Rizzo, *Broadridge Completes Blockchain Proxy Voting Trial*, COINDESK (Apr. 13, 2017), https://www.coindesk.com/broadridge-blockchain-proxy-voting-jpmorgan-santander/ [https://perma.cc/VS9N-VCDP].

If blockchain innovations prove cost-effective and efficient, they may become the technological foundation of modern shareholder voting systems. Within the next few years, corporations could increasingly rely on permissioned blockchain-based technologies to manage share registration, proxy voting, and vote counting. Management will recognize blockchain's cost-savings or shareholders will push for its transparency. In either case, blockchain-based support systems for voting and ownership will progressively become the rule, not the exception. Pure permissioned blockchain systems will probably be preferred because central authorities will not want to forfeit control. Share registration, proxy voting, and vote counting will likely be the first areas addressed because these represent the basic causes of problems afflicting shareholder voting and share ownership. They are known issues.[165] Cost-effective blockchain innovations offer the needed accuracy, security, and transparency to solve them.

Blockchain's impact on shareholder voting problems will be mixed. Some forms of empty voting will become more difficult to execute. Share ownership will be accurately tracked, limiting over-voting and multiple ownership claims for one share that result from borrowing and lending. Empty voting practices relying on discrepancies between record date and meeting date will continue. However, blockchain systems will better expose investors who hedge positions or re-arrange voting rights just prior to a meeting. With more exposure, regulators, fellow shareholders, or management could take countermeasures to fend off such tactics, re-shaping investor behaviors.

Dependence on street name ownership will decline too. The street name bureaucracy will diminish in size and power. Rather than using long chains of nominees and custodians to hold shares, a shareholder will more often own shares directly in her name. Corporations will have definitive and accurate ownership records. Identifying beneficial ownership will not require a Dante's *Inferno* journey. Instead, identification will be quicker, easier, and arguably more equitable for all shareholders.

Despite potential progress, some shareholder voting and ownership trends will likely remain. Institutional investors, assuming their dominance of equities continues, will still rely on voting shares rather than selling shares to voice their displeasure with a corporation. Proxy advisories will maintain their influence. Management will continue to exert power over the voting process, although inappropriate activities will be more difficult to hide. Corporations will remain board-centric. Throughout the Single-Use phase,

165. *See supra* Part I: The Present (outlining the well-known and frequently discussed issues of modern share ownership).

the relative weakness of shareholder voting will persist.

(b) Localization

The Localization phase comprises innovations with a high level of novelty but a low level of complexity. Innovations are visionary and revolutionary, while requiring only a small number of people or systems to implement them. Localization may take many forms as blockchain-based solutions expand beyond only addressing the underlying causes of current shareholder voting and share ownership problems. During this phase, corporations and shareholders will use blockchain-based technologies in ways that enhance and change the existing shareholder voting systems. Society has not yet reached this phase.

One possible innovation is the issuance of new stock classes. Blockchain's flexibility enables new strategic offerings. Boards could use this flexibility to design stock classes that attract or deter certain investors. For example, stock classes may offer differing degrees of privacy. Classes with significant privacy would attract investors interested in anonymity. Alternatively, classes with minimal privacy could act as a defensive measure against activists and potential takeovers. Boards may issue stock classes with built-in applications that provide automated services to shareholders. A blockchain application could issue stock options for employees or fulfill warrants for investors. Another application could facilitate tenured voting by granting more votes to shareholders who have held their shares for a specified period of time.

Boards possess the exclusive authority to regulate a corporation's capital structure and ensure the soundness of its instruments.[166] This legal fact is unlikely to change. However, the opportunity blockchain provides for enhancing shareholder voting and stock ownership is too significant to ignore. Powerful institutional investors will likely recognize this fact and seek to push boards to issue stock classes that favor their interests. For example, institutional investors may ask for tenured voting that rewards their holding of shares for long periods of time. They may even seek stock classes that award them additional votes if a particular corporate goal is not met. Boards will also benefit by using stock classes to support and protect their investment decisions.

166. DEL. CODE ANN. tit. 8, §§ 151-154, 157, 161 (2018).

(c) Substitution

The Substitution phase is distinguished by a low level of novelty and a high level of complexity. Solutions at this phase will compete with, and partly replace, existing traditional business models and deeply embedded institutions. New networks and behaviors will emerge.

The primary entities threatened by this phase of development are the incumbents: the depository trusts, proxy service providers, proxy advisories, and custodians that thrive and act as indispensable cogs in the current system. Entities such as the DTC, Broadridge, ISS, and BNY Mellon are enormous, wealthy, and entrenched titans. However, as blockchain technologies become more ubiquitous, new competitors will emerge offering unique services. As blockchain becomes easier to use, the cost of holding shares, distributing materials, reviewing proposals, and clearing trades should shrink dramatically. Corporations and shareholders will have new products to choose from. They will also become more comfortable performing many services on their own using blockchain innovations. Unless the incumbents evolve and alter their business models, they will likely not exist within several decades. Assuredly, they risk losing market share resulting from more competition.

Many incumbents recognize the threat of blockchain to their business models and have responded accordingly. They are heavily promoting permissioned blockchains to streamline operations and offer lower cost services.[167] As an example, the DTC has already declared blockchain technology is a "generational opportunity to reimagine the financial industry infrastructure."[168] It hopes to lead the financial industry in a "collaborative rearchitecture of core processes and practices to ensure standardization" as blockchain is tested and adopted.[169] Unsurprisingly, DTC opposes decentralized systems using public blockchains. DTC recognizes that a decentralized and trustless infrastructure is "the virtual opposite of the centralized, trusted, guarded, model of modern securities processing, which has long relied upon [DTC] . . . as a central authority"[170]—in short, decentralized and public blockchain systems are bad for its business. Still, DTC is probably correct to assume that central authorities will persist. The

167. MORGAN STANLEY, BANKING ON THE BLOCKCHAIN (May 18, 2016), https://www.morganstanley.com/ideas/big-banks-try-to-harness-blockchain [https://perma.cc/334U-J655].

168. DTCC, EMBRACING DISRUPTION: TAPPING THE POTENTIAL OF DISTRIBUTED LEDGERS TO IMPROVE THE POST-TRADE LANDSCAPE 11 (2016).

169. *Id.* at 2.

170. *Id.* at 1.

laws, rules, and regulations framing shareholder voting will demand a controlling entity responsible for decision-making and accountable for errors. Shareholders will also want such assurances before investing.

The threat to incumbents, then, will be the entrance of new, unexpected, and disruptive blockchain-based competitors. These incumbents are susceptible to the innovator's dilemma.[171] Under the innovator's dilemma theory, a powerful incumbent such as DTC or Broadridge is a prisoner to expectations. Its shareholders expect large earnings, its broad customer base expects sustained service, and its management expects proven monetization models to remain profitable. These expectations encourage a firm to maintain the status quo and avoid innovations that do not mesh with core customers. New entrants, in comparison, are beholden to no one. They enter a market and introduce new products possessing attributes the incumbent ignores. Consumer preferences shift and the new products mature. The incumbent is flat-footed. Still beholden to its time-tested ways, an incumbent's response to new entrants is often too late. The new entrant's market share grows and eventually surpasses the incumbent.

The incumbents of shareholder voting will feel a similar pressure. Many will lose market share as new competition arises. Sears and Amazon are apt examples of this dynamic. Although e-commerce has flourished at the expense of formerly giant legacy retailers such as Sears, in-store shopping still exists. In fact, Amazon has recently entered brick-and-mortar retailing by opening its own stores[172] and acquiring conventional retailers such as Whole Foods.[173] A similar trend will likely occur for firms involved in shareholder voting. The Substitution phase will not mean the end for every incumbent. Instead, it will signal the end of their hegemony over shareholder voting.

(d) Transformation

Transformation is the final phase. Innovations are characterized by

171. *See generally* CLAYTON M. CHRISTENSEN, THE INNOVATOR'S DILEMMA: WHEN NEW TECHNOLOGIES CAUSE GREAT FIRMS TO FAIL (2016) (introducing the theory of "disruptive innovation," which explains how successful incumbent companies are susceptible to losing market share or even failing as new entrants provide innovations that the incumbent fails to adequately anticipate or address).

172. Laura Stevens, *Amazon's Cashierless 'Go' Convenience Store Set to Open*, WALL ST. J. (Jan. 21, 2018), https://www.wsj.com/articles/amazons-cashierless-go-convenience-store-set-to-open-1516546801 [https://perma.cc/F57S-3WCX].

173. Laura Stevens & Annie Gasparro, *Amazon to Buy Whole Foods for $13.7 Billion*, WALL ST. J. (June 16, 2017), https://www.wsj.com/articles/amazon-to-buy-whole-foods-for-13-7-billion-1497618446 [https://perma.cc/4Y7K-TUQ9].

high levels of novelty and complexity. The potential is almost limitless. Entirely new industries built around entirely new products and new consumer behaviors will arise.

Up until the transformation phase, it seems likely that permissioned blockchains will be the norm amongst most blockchain technologies. The laws and regulations of corporate governance require a certain degree of formalistic security, privacy, and top-down decision-making that public blockchains cannot provide for shareholder voting. Assuming the fundamental structure of corporate governance law remains unchanged, corporate decision-making will remain board-centric and shareholders will be relatively less powerful. Predictions beyond that dynamic are purely speculative.

One fascinating idea in the very long-term is the emergence of Decentralized Autonomous Organizations (DAOs) for shareholder voting. DAOs are autonomous groups that run and make decisions based on pre-programmed blockchain protocols. They operate self-sufficiently through collective action independent of third-parties.[174] Although boards will remain the primary business decision makers, some DAOs could become important influencers of board membership and shareholder proposals. Proxy access has already increased the ability of shareholders to nominate directors in large publicly traded companies. If this trend holds, shareholder DAOs could form to promote particular social or business causes by nominating directors who support their views. For example, diffuse retail shareholders who advocate for workplace diversity could join a DAO that advocates for this cause. The DAO, using its blockchains protocols and algorithmic decision making, would then pool the votes of these separate shareholders to nominate and elect directors who focus on this initiative. These groups would be like self-sufficient proxy advisories. They perform the difficult work of assessing proposals, coordinating shareholders, and optimizing their votes to spark positive change for shareholder interests. Gradually, DAOs could shift the composition of boards and the importance of shareholder proposals.

The most transformational long-term effect of blockchain may be how it changes shareholder behavior. Retail investors currently vote at very low rates.[175] They suffer from collective action problems; retail investors cumulatively represent significant blocks of shares, but an individual retail

174. *See generally* AARON WRIGHT & PRIMAVERA DE FILIPPI, DECENTRALIZED BLOCKCHAIN TECHNOLOGY AND THE RISE OF LEX CRYPTOGRAPHIA (Mar. 12, 2015) (unpublished manuscript) (on file with Yeshiva University and Université Paris II) (discussing the drawbacks and benefits as blockchain leads to potentially more decentralization).

175. BROADRIDGE FINANCIAL SOLUTIONS, INC & PWC, *supra* note 83.

investor has few incentives to incur the time and effort costs of voting. Blockchain tools such as DAOs would lower these costs and potentially motivate more shareholders to vote. Blockchain has the potential to revolutionize the norms of shareholder engagement in corporate governance.

CONCLUSION

Modern shareholder voting is troubled.

In theory, a corporation gives its board of directors tremendous power to make business decisions, while shareholder voting checks the board. Reality is different. Fueled by the complexities of street name ownership, corporations do not know who their voters are and empty voting routinely results. Hedging and lending practices permit some shareholders to over-vote or avoid having an economic interest in the outcome. Vote counting is often inaccurate. Perhaps unsurprisingly, management disproportionately wins close contests, suggesting that votes are manipulated.

Blockchain presents a possible solution. With a simple yet ingenious design, blockchain provides the accuracy, transparency, and trust currently missing from shareholder voting. Weaknesses with the technology remain. Collusion, sensible governance, privacy, and technical shortcomings may hinder its potential. However, as blockchain evolves solutions should emerge. Variations already provide differing degrees of control and decentralization, facilitating flexibility and customization. Assuming blockchain's weaknesses are mitigated, the technology is poised to eventually revolutionize shareholder voting.

The Iansiti and Lakhani framework for foundational technologies helps theorize about how blockchain solutions will progressively apply to shareholder voting. Blockchain will proceed through four phases. In each, innovations will display varying degrees of novelty and complexity.

At first, in the Single Use phase, applications will have low novelty and complexity. They will provide more efficient, less costly, and more focused solutions than the other alternatives for shareholder voting. As an example, corporations may use blockchains to manage share registration, proxy voting, and vote counting. Street name ownership will decrease and empty voting will become much more difficult to accomplish. More manipulations by management will be exposed. Many of these innovations have already launched. During the Localization phase, applications will become more novel by enhancing the current shareholder voting procedures. One potential innovation may be new types of stock classes. Classes that provide unique services and incentives to attract (or deter) specific types of investors. Some may offer different degrees of privacy, automatic execution of options and

warrants, tenured voting, or the connection of voting rights to company performance. In the Substitution phase, new networks based on blockchain will emerge. Entire business models and institutions will perish unless they adapt. The depository trusts, proxy service providers, and custodians essential to share ownership will face extinction. Lastly, at the Transformation phase almost anything is possible. Novel innovations and complex new networks will form. Unpredictable developments will force everyone to re-evaluate core principles. The board-centric nature of governance will probably remain. But blockchain-based technologies will give shareholders new tools to coordinate and tear down obstacles thwarting their engagement, influence, and ability to hold boards accountable. Activist DAOs are only one intriguing outcome. For shareholder advocates, the future is as bright as their imagination.