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## Blockchain Stock Ledgers

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## Blockchain Stock Ledgers

KEVIN V. TU\*

*American corporate law contains a seemingly innocuous mandate. Corporations must maintain appropriate books and records, including a stock ledger with the corporation's shareholders and stock ownership. The importance of accurate stock ownership records is obvious. Corporations must know who owns each of its outstanding shares at any point in time. Among other things, this allows corporations to determine who receives dividends and who is entitled to vote. In theory, keeping accurate records of stock ownership should be a simple matter. But despite diligent efforts, serious share discrepancies plague corporations, and reconciliation is often functionally impossible. Doing so may require the examination of records from millions of trades, including records from hundreds of participant brokers and custodial banks (not to mention records from their individual clients). So, when disputes arise, there is frequently no easy answer.*

*This Article charts the use of blockchain technology as a potential solution to the systemic issues hindering efforts to maintain accurate records of stock transactions. In doing so, this Article accomplishes three goals. First, it establishes that federal efforts to resolve the "paperwork crisis" of the 1970's created a concomitant problem—the lack of reliable records of stock ownership, which now threatens the exercise of shareholder rights. Second, it demonstrates that practical constraints, not legal barriers, stand as the most significant impediment to the application of blockchain technology to corporate recordkeeping and global capital markets. Third, it argues that despite reasons for skepticism, states should proactively amend corporate codes to authorize the use of blockchain technology because it enables corporate choice and facilitates efforts by private actors to assess the viability of innovative solutions. This Article concludes by drawing transferable lessons to improve law and policy as new applications of blockchain technology continue to emerge.*

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## INTRODUCTION

It is not unreasonable to expect that at any moment in time, a corporation should know who owns each share of the corporation's outstanding stock. But due to system constraints, corporations simply cannot make a real-time determination of something as fundamental as stock ownership.<sup>1</sup> Moreover, when disputes arise, no reliable means of reconciliation may exist.<sup>2</sup>

Consider the Dole Food Company, Inc. (“Dole”)—one of the largest fruit and vegetable producers in the world.<sup>3</sup> Despite diligent efforts, Dole recently encountered a share discrepancy of over 12.3 million shares.<sup>4</sup> In an opinion for the Delaware Chancery Court, Vice Chancellor Laster dubbed the discrepancy “functionally impossible” to resolve and took note of the “insuperable difficulties” facing those who attempted to do so.<sup>5</sup> Vice Chancellor Laster opined further that the “resulting process would be lengthy, arduous, cumbersome, expensive, and fundamentally uncertain.”<sup>6</sup> In short, no one could establish the owners of Dole stock at the time in question.

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

2. *Id.*

3. Geoffrey Mohan, *Dole, The World's Largest Fresh Fruit and Vegetable Company, Is Stepping Back from Southland*, L.A. TIMES (Aug. 30, 2017), <https://www.latimes.com/business/la-fi-dole-socal-20170830-story.html> [<https://perma.cc/HP7F-UT6Y>].

4. *Dole*, 2017 WL 624843, at \*1.

5. *Id.*

6. *Id.*

Uncertain stock ownership records create far-reaching ramifications. Imagine that a corporation intends to issue a dividend or give legally required notices.<sup>7</sup> Suppose the corporation must hold a vote on a significant matter like election of directors<sup>8</sup> or a potential merger.<sup>9</sup> What if the corporation settles class action stockholder litigation and needs to identify the members of the class for purposes of issuing payment?<sup>10</sup> Each of the foregoing demands an accurate record of the corporation's shareholders and a verifiable record of each transaction involving the corporation's stock. In short, there must be confidence in the corporation's records of stock ownership.

If corporations have an incentive to maintain accurate records, what is the problem? How is it possible that major discrepancies occur? More importantly, why do corporations and the judiciary lack the tools to efficiently reconcile such a discrepancy?

Much of the problem stems from the system that arose from the Wall Street "paperwork crisis" of the 1960s and 1970s.<sup>11</sup> The growth of capital markets and increased stock trading made continuation of the paper-based system of buying/selling stock impracticable.<sup>12</sup> Clerks simply could not keep up with the required paperwork.<sup>13</sup>

The federal solution was a policy of share immobilization.<sup>14</sup> The new policy ushered in an indirect holding system with electronic book entries and the addition of one or more tiers of intermediaries (e.g., participant brokers and custodial banks) between the corporation issuing the share and the investor.<sup>15</sup> As a result, the modern corporation often does not have a stock ledger that lists the investor's name.<sup>16</sup> Instead, the corporation's stock ledger reflects an intermediary as a registered holder

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7. See generally DEL. CODE ANN. tit. 8, §§ 170, 213(a), 222(a) (2020).

8. See generally *id.* §§ 211(b), 219, 223(c).

9. *Id.* § 251(c).

10. See *Dole*, 2017 WL 624843, at \*4.

11. See *id.* at \*4 n.1. See generally Carl S. Bjerre, *Investment Securities*, 71 BUS. LAW. 1311, 1320–21 (2016) (discussing the "paperwork crisis" and rise of the current indirect holding system); David C. Donald, *Heart of Darkness: The Problem at the Core of the U.S. Proxy System and Its Solution*, 6 VA. L. & BUS. REV. 41, 50 (2011) (describing the "paperwork crisis," which was also referred to as a paperwork crunch or paperwork blizzard).

12. See *In re* Appraisal of Dell Inc., No. 9322-VCL, 2015 WL 4313206, at \*1 (Del. Ch. Jul. 13, 2015); Bjerre, *supra* note 11, at 1320–21.

13. See Donald, *supra* note 11, at 50.

14. See *Dole*, 2017 WL 624843, at \*4 n.1; *Dell*, 2015 WL 4313206, at \*3–7.

15. See David Brooks, Comment, *Depository Trust Company and the Omnibus Proxy: Shareholder Voting in the Era of Share Immobilization*, 56 S. TEX. L. REV. 205, 210–11 (2014); Charles W. Mooney, Jr., *Beyond Negotiability: A New Model for Transfer and Pledge of Interests in Securities Controlled by Intermediaries*, 12 CARDOZO L. REV. 305, 317 n.23 (1990).

16. Brooks, *supra* note 15, at 210–11; see also *Apache Corp. v. Chevedden*, 696 F. Supp. 2d 723, 726 (S.D. Tex. 2010); J. Robert Brown, Jr., *The Shareholder Communication Rules and the Securities and Exchange Commission: An Exercise in Regulatory Utility or Futility?*, 13 J. CORP. L. 683, 722 (1988); Russell A. Hakes, *UCC Article 8: Will the Indirect Holding of Securities Survive the Light of Day?*, 35 LOY. L.A. L. REV. 661, 711 (2002) (discussing the process of netting); Stephen J. Massey, *Chancellor Allen's Jurisprudence and the Theory of Corporate Law*, 17 DEL. J. CORP. L. 683, 716 (1992).

(or record holder) who is not the ultimate investor (or beneficial owner). This bifurcation means that there is no single comprehensive record of ownership. Rather, reconciling share ownership may require examination of records maintained by hundreds of intermediaries and their clients.<sup>17</sup>

The current system effectively solved the “paperwork crisis” by making the settlement of transactions more efficient through the use of a central depository and bookkeeping entries. However, the layers of complexity have made it more difficult (if not functionally impossible) to obtain a real-time, auditable record of stock ownership—resulting in a new set of problems, including impairment of shareholder rights.<sup>18</sup>

Technological advances such as blockchain technology<sup>19</sup> may provide a solution.<sup>20</sup> Known as the technology underlying cryptocurrencies like Bitcoin, blockchain is simply a particular type of digital ledger for recorded transactions.<sup>21</sup> As such, it has many other applications.<sup>22</sup> In the context of corporate recordkeeping,

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17. See *Dole*, 2017 WL 624843, at \*1.

18. *Id.* at \*4 n.1; see also John C. Kelly & Maximilian J. Mescall, *Taking Stock of the Block: Blockchain, Corporate Stock Ledgers, and Delaware General Corporation Law—Part II*, 1 J. ROBOTICS, A.I. & L. 235, 237 (2018) (noting that intermediaries increase the risk of intervening causes derailing shareholder rights).

19. The terminology surrounding blockchain technology is unsettled and suffers from lack of consensus as to meaning. As such, terms are often used interchangeably. These terms include blockchain technology, the blockchain, blockchains, distributed ledger technology, shared ledger technology, consensus ledger technology, decentralized database, and distributed database. See Angela Walch, *The Path of the Blockchain Lexicon (and the Law)*, 36 REV. BANKING & FIN. L. 713 (2017) (discussing the unsettled vocabulary and contested terms surrounding blockchain technology).

20. See *Dole*, 2017 WL 624843, at \*4 n.1; see also Matthew J. O’Toole & Michael K. Reilly, *The First Block in the Chain: Proposed Amendments to the DGCL Pave the Way for Distributed Ledgers and Beyond*, HARV. L. SCH. F. ON CORP. GOVERNANCE (Mar. 16, 2017), <https://corpgov.law.harvard.edu/2017/03/16/the-first-block-in-the-chain-proposed-amendments-to-the-dgcl-pave-the-way-for-distributed-ledgers-and-beyond/> [<https://perma.cc/KT3U-NZFM>]; Marco A. Santori, *Governor Jack Markell Announces Delaware Blockchain Initiative*, GLOBAL DEL. BLOG (Jun. 10, 2016), <http://global.blogs.delaware.gov/2016/06/10/delaware-to-create-distributed-ledger-based-share-ownershipstructure-as-part-of-blockchain-initiative/> [<http://perma.cc/BRG9-4YFU>].

21. See Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, HARV. BUS. REV. (Jan. –Feb. 2017 Issue), <https://hbr.org/2017/01/the-truth-about-blockchain> [<https://perma.cc/Q34N-2CTP>] (noting that Bitcoin is the first application of blockchain technology); Coindesk, *What Can a Blockchain Do?*, BLOCKCHAIN 101, <https://www.coindesk.com/information/what-can-a-blockchain-do/> [<https://perma.cc/66R9-BYJY>] (Mar. 9, 2017) (Cryptocurrencies were the first platform developed using blockchain technology).

22. See, e.g., Bernard Marr, *How Blockchain Will Transform the Supply Chain and Logistics Industry*, FORBES (Mar. 23, 2018), <https://www.forbes.com/sites/bernardmarr/2018/03/23/how-blockchain-will-transform-the-supply-chain-and-logistics-industry/#7a63834c5fec> [<https://perma.cc/GD3W-FJ6S>]; Guang Chen, Bing Xu, Manli Lu & Nian-Shing Chen, *Exploring Blockchain Technology and its Potential Applications for Education*, 5 SMART LEARNING ENV’TS 1 (Jan. 3, 2018), <https://slejournal.springeropen.com/track/pdf/10.1186/s40561-017-0050-x> [<https://perma.cc/ZC9J-6Q43>] (discussing use of blockchain

blockchain technology could allow corporations to “maintain multiple, current copies of a single and comprehensive stock ownership ledger.”<sup>23</sup> In doing so, it has the potential to maintain the paperless nature of the current system while eliminating the unintended consequences of indirect holding and bifurcated ownership. Thus, blockchain has the potential to address many of the systemic problems highlighted by cases like *Dole*. It is no surprise then that some states have passed (or at least considered) amendments to their corporate codes to expressly enable the use of blockchain-based records by corporations.<sup>24</sup>

I am by no means the first to observe wide-reaching applications of blockchain, and its potential impact on existing legal structures.<sup>25</sup> I do, however, provide the first comprehensive survey of impediments to the development and implementation of blockchain-based innovations in corporate law. I break new ground by: (1) giving recommendations for policymakers and corporations experimenting with blockchain solutions and (2) shifting the conversation away from cryptocurrency towards the legal and policy ramifications of other blockchain applications.<sup>26</sup>

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technology for academic degree management and to support summative evaluation of learning outcomes); Suveen Angraal, Harlan M. Krumholz & Wade L. Schulz, *Blockchain Technology: Applications in Healthcare*, 10 CIRCULATION: CARDIOVASCULAR QUALITY & OUTCOMES 1 (Sept. 14, 2017), <https://www.ahajournals.org/doi/full/10.1161/CIRCOUTCOMES.117.003800> [<https://perma.cc/PB3Z-X9YD>] (discussing the use of blockchain in connection with healthcare records and managing permissions to access health data); RESEARCH HANDBOOK ON DIGITAL TRANSFORMATIONS 243 (F. Xavier Olleros & Majlinda Zhegu eds., 2016) (discussing blockchain based voting systems designed to increase transparency by recording every vote on the blockchain).

23. *Dole*, 2017 WL 624843, at \*4 n.1.

24. See, e.g., H.R. 2603, 53d Leg., 2d Reg. Sess. (Ariz. 2018) (signed by Arizona’s governor on Apr. 3, 2018); S. 838 (Ca. 2018) (approved by California’s governor on Sept. 28, 2018); S. 3768, 218th Leg. (N.J. 2018); H.R. 101 64th Leg. (Wyo. 2018) (signed by Wyoming’s governor on Mar. 10, 2018); S.B. 136 (Md. 2019) (effective Oct. 1, 2019).

25. See, e.g., Joshua A. T. Fairfield, *Bitproperty*, 88 S. CAL. L. REV. 805 (2015) (discussing blockchain technology and property transactions).

26. Cryptocurrencies remain a hot topic. But as a burgeoning legal and regulatory regime for cryptocurrency develops, the popular conversation has shifted to the value of cryptocurrency, its staying power, and the human problems associated with it—like environmental sustainability. The future is unknown. The consensus view, however, is that the growing value of cryptocurrencies such as Bitcoin is a byproduct of an unsustainable speculative bubble. Prominent skeptics include Warren Buffet and Professor Robert J. Shiller. Buffet has opined that cryptocurrencies will with almost certainty “come to a bad ending.” Professor Shiller has offered a parallel between the rise of Bitcoin and tulip-mania in seventeenth century Holland when a speculative frenzy caused the price of some tulip bulbs to exceed the cost of a mansion—predicting that the collapse of Bitcoin was a “good likely outcome.” To a degree, the hyper-focus on cryptocurrencies has overshadowed the potentially wide-ranging and transformative impact of the technology underlying cryptocurrencies—the blockchain. No matter the future of cryptocurrency, other applications of blockchain technology may have a more lasting effect on law and policy. One of the objectives of this Article is to shift the conversation and draw greater attention to the law and policy implications of blockchain technology more broadly. See Kevin V. Tu, *Perfecting Bitcoin*, 52 GA. L. REV. 505 (2018); Anthony Cuthbertson, *Bitcoin Mining on Track to Consume All of the World’s Energy by 2020*, NEWSWEEK (Dec. 11, 2017), <http://www.newsweek.com/bitcoin-mining->

This Article unfolds as follows. Part I begins with a description of the important role of stock ledgers in corporate law and in the exercise of shareholder rights. It then discusses the evolution of corporate recordkeeping and systemic problems that currently contribute to the persistence of recordkeeping errors and discrepancies.

Part II briefly examines blockchain technology and its application to the administration of corporate records and more broadly to global capital markets. It goes on to survey the benefits and disruptive potential of blockchain records and stock transactions. The upside of blockchain technology is the potential to simplify recordkeeping, reunify bifurcated ownership interests, and improve transparency. All of these contribute to greater certainty in determinations of stock ownership and the elimination of impediments to the rightful exercise of shareholder rights.

Part III turns to the future of blockchain and American corporate law. I conclude that overcoming legal barriers to blockchain technology is only a necessary first step. The primary barriers relate to development and implementation. They include: (1) questions about security, functionality, and scalability; (2) uncertainty about widespread adoption; (3) transition issues; (4) first mover disadvantage; (5) incumbency advantage; and (6) collective action problems. As a result, the removal of legal obstructions does not guarantee that blockchain will become the new norm. Even though the triumph of a blockchain system is not assured, I argue that states should act now to expressly authorize the use of blockchain technology for the administration of corporate records. Why amend corporate law for a technology that may fail or fade away? I contend that proactive amendment of American corporate law is justified because it is consistent with the enabling philosophy of corporate choice. Giving corporations the freedom to opt into the use of blockchain allows for experimentation and meaningful assessment of blockchain's viability. It also levels the playing field by abolishing any unintended statutory advantage that corporate law currently provides to the incumbent system, which allows the market to determine the future of blockchain.

To assist policymakers in considering whether and how to accommodate other new applications of blockchain technology, I end by drawing transferable lessons

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track-consume-worlds-energy-2020-744036 [https://perma.cc/JWG4-MRK6]; Chris Mooney & Steven Mufson, *Why the Bitcoin Craze Is Using Up So Much Energy*, WASH. POST (Dec. 19, 2017), [https://www.washingtonpost.com/news/energy-environment/wp/2017/12/19/why-the-bitcoin-craze-is-using-up-so-much-energy/?utm\\_term=.c5bed71b233c](https://www.washingtonpost.com/news/energy-environment/wp/2017/12/19/why-the-bitcoin-craze-is-using-up-so-much-energy/?utm_term=.c5bed71b233c) [https://perma.cc/S2LD-MF6C]; Ben Leubsdorf, *Is Bitcoin a Bubble? 96% of Economists Say 'Yes'*, WALL ST. J. (Dec. 13, 2017), <https://blogs.wsj.com/economics/2017/12/13/is-bitcoin-a-bubble-96-of-economists-say-yes/> [https://perma.cc/PFE3-VU5B] (51 of 53 economists surveyed agreed that Bitcoin was experiencing a speculative bubble); Ali Montag, *Warren Buffett Explains One Thing People Still Don't Understand About Bitcoin*, CNBC (May 1, 2018), <https://www.cnb.com/2018/05/01/warren-buffett-bitcoin-isnt-an-investment.html> [https://perma.cc/2HDR-VKQL]; Brad Tuttle, *Bitcoin Is Likely to 'Totally Collapse and Be Forgotten,' Nobel Prize-Winning Economist Says*, YAHOO! FIN. (Jan. 19, 2018), <https://finance.yahoo.com/news/bitcoin-likely-apos-totally-collapse-145045431.html> [https://perma.cc/BR9B-6DD8]; Lorraine Boissoneault, *There Never Was a Real Tulip Fever*, SMITHSONIAN MAGAZINE (Sep. 18, 2017), <https://www.smithsonianmag.com/history/there-never-was-real-tulip-fever-180964915/> [https://perma.cc/5P74-UPJJ]; ANNE GOLDFAR, *TULIPMANIA: MONEY, HONOR, AND KNOWLEDGE IN THE DUTCH GOLDEN AGE* (2007).

from the examination of blockchain's probable impact on corporate stock transactions and American corporate law.

### I. STOCK LEDGERS AND SHAREHOLDER RIGHTS

Corporations have an obligation to keep and maintain appropriate books and records.<sup>27</sup> Among these records is a stock ledger setting forth the corporation's shareholders and share ownership.<sup>28</sup> The maintenance of a stock ledger is a seemingly mundane topic. However, having an accurate and up to date record of share ownership is far from a mere administrative chore. Stock ledgers hold the key to a shareholder's most significant rights, including the ability to vote on matters at shareholders meetings<sup>29</sup> and the ability to inspect corporate records.<sup>30</sup> Errors and inaccuracies in stock ownership records, therefore, can lead to real problems.<sup>31</sup> Even so, stock ledger errors are far from uncommon.

This Part proceeds by: (1) outlining how corporate law relies on a corporation's own stock ownership records to provide access to shareholder rights, (2) setting forth the methods used by corporations to maintain share ownership records, and (3) examining the question of whether current corporate practices and recordkeeping tools suffice to ensure accuracy. Ultimately, I show that current recordkeeping methods suffer from systemic limitations that contribute to the occurrence of stock ledger errors and discrepancies in share ownership.

#### *A. The Fundamental Role of Stock Ledgers*

State corporate codes often include an affirmative obligation to keep and maintain a stock ledger.<sup>32</sup> For example, Section 16.01(c) of the Revised Model Business Corporation Act provides that "a corporation or its agent shall maintain a record of its shareholders, in a form that permits preparation of a list of the names and addresses of all shareholders, in alphabetical order by class of shares showing the number and class of shares held by each."<sup>33</sup> However, the clerical nature of this obligation belies the import of stock ownership records (such as corporate stock

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27. See, e.g., MODEL BUS. CORP. ACT § 16.01 (1984) (AM. BAR ASS'N, revised 2002).

28. *Id.*

29. See, e.g., DEL. CODE ANN. tit. 8, §§ 213, 219 (2017).

30. See, e.g., MODEL BUS. CORP. ACT § 16.02; tit. 8, § 220.

31. See, e.g., *Dole*, 2017 WL 624843, at \*4; *In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206, at \*9–10 (Del. Ch. Jul. 13, 2015); *In re Appraisal of Dell Inc.*, 143 A.3d 20, 59 (Del. Ch. 2016).

32. Even where there is no affirmative obligation to maintain a stock ledger provided for by statute, courts have held that corporations have an implicit duty to do so. See *Rainbow Navigation, Inc. v. Pan Ocean Navigation, Inc.*, 535 A.2d 1357, 1359 (Del. 1987) (noting that the corporation's decision not to maintain a stock ledger cannot frustrate Delaware's statutorily guaranteed right to examine the corporation's stock ledger and finding that implicit in that right is an affirmative duty on the part of Delaware corporations to maintain a stock ledger).

33. MODEL BUS. CORP. ACT § 16.01(c).



ledgers and transfer books) in both American corporate law and the exercise of shareholder rights.

The rights of shareholders to control and manage a corporation are illustrative. The corporate form largely separates ownership from management because the business and affairs of a corporation are managed by or under the direction of a board of directors—not the corporation’s shareholders.<sup>34</sup> As such, the corporation’s owners (its shareholders) relinquish management to the board of directors. Shareholders do, however, retain certain limited rights of management and control. Specifically, shareholders have the right to be present at meetings (either annual meetings or special meetings called by the board of directors) and the right to vote on certain fundamental matters. Matters requiring a shareholder vote include election/removal of directors,<sup>35</sup> charter and bylaw amendments,<sup>36</sup> and approval of significant transactions such as the sale of all or substantially all of the corporation’s property and assets.<sup>37</sup> Because shareholders have few other means of influencing the corporation, access to these voting rights is essential.<sup>38</sup> Access, however, hinges in large part on the corporate records of share ownership.

Consider the relevant stockholder meeting and voting provisions in the Delaware General Corporation Law (“DGCL”). Corporations must provide written notice whenever stockholders are required or permitted to take any action at a meeting.<sup>39</sup> In addition, corporations must prepare a complete list of stockholders entitled to vote at the meeting.<sup>40</sup> To ensure that corporations have sufficient time to accomplish these tasks, the DGCL allows corporations to fix a “record date” for the determination of stockholders entitled to notice of and to vote at the meeting.<sup>41</sup> Those who are shareholders on the record date are shareholders for purpose of notice and voting, even if they cease to be shareholders after the record date and before the vote.<sup>42</sup> Conversely, those who are not shareholders on the record date are not entitled to notice and do not have the right to vote, even if they become shareholders after the record date and before the vote.<sup>43</sup>

But to actually determine who qualifies as a shareholder entitled to notice and the right to vote, state statutes and corporate charter provisions tell corporations to rely on their own records of registered shareholders.<sup>44</sup> For example, section 219(c) of the

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34. *See, e.g.*, tit. 8, § 141 (“The business and affairs of every corporation . . . shall be managed by or under the direction of a board of directors . . .”).

35. *Id.* §§ 211(b), 141(k); *see also* MODEL BUS. CORP. ACT § 8.08.

36. *See, e.g.*, tit. 8, §§ 242(b), 109(a).

37. *Id.* § 271.

38. *See* *Blasius Indus., Inc. v. Atlas Corp.*, 564 A.2d 651, 659 (Del. Ch. 1988) (“[The shareholder vote] is critical to the theory that legitimates the exercise of power by some (directors and officers) over vast aggregations of property that they do not own.”).

39. tit. 8, § 222(a).

40. *Id.* § 219(a).

41. *Id.* § 213(a) (“[T]he record date shall not be more than 60 nor less than 10 days before the date of the meeting.”).

42. *See* JAMES D. COX & THOMAS L. HAZEN, *BUSINESS ORGANIZATIONS LAW* (3d ed. 2011).

43. *See id.*

44. *See id.*; *see also* *Bryan v. Western Pac. Ry.*, 35 A.2d 909 (Del. Ch. 1944).

DGCL expressly states that “[t]he stock ledger shall be the only evidence as to who are the stockholders entitled by this section . . . to vote in person or by proxy at any meeting of stockholders.”<sup>45</sup> Thus, the corporation’s stock ledger<sup>46</sup> acts as the key to the exercise of shareholder voting rights because corporate law presumes that the person whose name appears in the stock ledger (as the owner of the share) has the right to vote. Accordingly, the accuracy of the corporation’s stock ledger affects the exercise of important shareholder rights, and any unresolvable errors or discrepancies can give rise to complications, including shareholder litigation.

Although corporate stock ledgers figure most prominently in the context of shareholder voting rights, the corporation’s records of stock ownership may affect other shareholder rights. Consider the remedial rights, which arise under both common law and statute, of shareholders to inspect corporate records.<sup>47</sup> The right to inspect is significant because it is the shareholder’s primary mechanism for ascertaining how the directors conduct the affairs of the business.<sup>48</sup> It follows then that the right to inspect stems from the desire to protect the shareholder’s ownership interest.<sup>49</sup> Accordingly, the right to inspect is appropriately limited to those who are shareholders.<sup>50</sup>

State statutes typically define the term more broadly for the purposes of inspection rights. As such, they typically include shareholders of record and the beneficial owners of shares.<sup>51</sup> Even so, the corporation’s records of share ownership can influence the exercise of inspection rights. The Delaware Chancery Court has held that inclusion on a corporation’s stock ledger is “prima facie evidence of stock ownership . . . , but . . . the corporate defendant may rebut that presumption by clear and convincing evidence.”<sup>52</sup> As such, inclusion on a stock ledger does not conclusively establish shareholder status for purposes of inspection. But the stock ledger does establish a presumption in favor of shareholder status because the stock ledger is presumed accurate.<sup>53</sup>

The corporation’s records of stock ownership can also influence the exercise of appraisal rights by dissenting shareholders. Under state law, dissenting shareholders

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45. DEL. CODE ANN. tit. 8, § 219(c) (2020).

46. The Delaware General Corporation Law defines the term “stock ledger” as “1 or more records administered by or on behalf of the corporation in which the names of all of the corporation’s stockholders of record, the address and the number of shares registered in the name of each such stockholder, and all issuances and transfers of stock of the corporation are recorded . . . .” *Id.*

47. See tit. 8 at § 220; MODEL BUS. CORP. ACT § 16.02 (AM. BAR. ASS’N 3d ed., 2003); COX & HAZEN, *supra* note 42, § 13.2.

48. See COX & HAZEN, *supra* note 42, § 13.2.

49. See *id.*

50. See tit. 8, § 220; MODEL BUS. CORP. ACT § 16.02.

51. See tit. 8, § 220; MODEL BUS. CORP. ACT § 16.02.

52. Pogue v. Hybrid Energy, No. 11563-VCG, 2016 WL 4154253, at \*3 (Del. Ch. Aug. 5, 2016); see also Holtzman v. Gruen Holding Corp., No. 13500, 1994 WL 444756 (Del. Ch. Aug. 5, 1994).

53. See Testa v. Jarvis, No. 12847, 1994 WL 30517, at \*6 (Del. Ch. Jan. 12, 1994) (“Where the company’s ledgers show record ownership, no other evidence of shareholder status is necessary.”); John W. Noble, *Fixing Lawyers’ Mistakes: The Court’s Role in Administering Delaware’s Corporate Statute*, 18 U. PA. J. BUS. L. 293, 313 (2016).

who do not vote in favor of a merger may have the right to an appraisal of the fair value of their shares.<sup>54</sup> To demand an appraisal, shareholders must qualify as holders of record and satisfy any continuous holding requirement.<sup>55</sup> Who qualifies as a holder of record is determined by the issuing corporation's own records (and those of its transfer agent).<sup>56</sup>

The examples above highlight the fundamental role of the stock ledger and corporate records in American corporate law. The corporation's stock ledger is more than a mere record of share ownership. It provides access to important shareholder rights such as voting and serves as prima facie evidence of stock ownership for purposes of exercising shareholder rights such as inspection of books and records. As such, errors in the stock ledger are more than an internal corporate matter. Errors can adversely affect shareholders and give rise to litigation. Therefore, corporations and their shareholders have an interest in ensuring the accuracy of the corporations' stock ledgers.<sup>57</sup>

### *B. The Evolution of Recordkeeping Practices*

The importance of stock ledgers and the universally shared interest in ensuring accurate records of stock ownership raise an important yet underappreciated issue—whether the methods currently used by corporations to maintain stock ledgers are up to the task. Related is the question of whether the modern system of recording stock transactions (or trades) facilitates or obstructs the objective of accurate and verifiable records. In a world where the purchase and sale of shares can occur in the blink of an eye, do corporations have the tools to quickly verify transactions and efficiently update stock ownership records? Does the system of recording stock transactions do enough to mitigate the risk of inaccuracies and allow for efficient reconciliation of discrepancies? To assess these questions properly, it is necessary to have a basic understanding of how corporations go about recording stock transactions, including share issuances and transfers.

In days gone by, corporations uniformly recorded stock transactions in paper ledgers. Few modern corporations of any size continue this practice today. However, it is a useful starting point. In a 1914 Yale Law Journal article, Thaddeus D. Kenneson described the typical method of recording a stock transfer as follows:

[A company] will probably have three books; one known as the "transfer" book, another as the stock certificate book, and a third as the stock ledger. In the "transfer" book will be printed blank "transfers" in this form: "For value received . . . hereby assign and transfer unto . . . shares in the capital stock of [the company]." The certificate will contain printed blank certificates with margins for entering the time of issuing the certificate, the number of shares, the number of the certificate and to whom issued. The stock ledger will contain an account with each

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54. See, e.g., tit. 8, § 262(a).

55. *Id.*

56. Bjerre, *supra* note 11, at 1320.

57. *Id.* at 1320–21 ("[I]ssuers need a fixed and reliable list of their security holders.").

shareholder, in which he is credited with all shares “transferred” by others to him and debited with all shares “transferred” by him to others.<sup>58</sup>

Today, the system of transferring shares and the manner of keeping ownership records are drastically different. The story, however, involves more than just the advent of new technology and a shift to electronic recordkeeping. While some corporations still maintain the equivalent of a paper stock ledger via use of electronic bookkeeping software,<sup>59</sup> the growth of capital markets has led to: (1) an increasingly complicated structure of stock ownership,<sup>60</sup> and (2) the outsourcing of stock records to agents of the corporation.<sup>61</sup> All of this contributes additional layers of complexity when it comes to the once simple task of a corporation itself recording ownership of stock held directly by the corporation’s shareholders.

The most significant changes arose as a response to Wall Street’s “paperwork crisis” of the late 1960s and early 1970s.<sup>62</sup> At the time, transferring ownership of stock involved a labor-intensive process, which required the delivery of paper stock certificates between buyers and sellers.<sup>63</sup> However, processing and settling each transaction also required clerks, working at the securities firms, to complete all of the accompanying transfer paperwork.<sup>64</sup> By some accounts, the accompanying paperwork averaged “thirty-three different forms for a single security transfer.”<sup>65</sup> However, the growth of capital markets and increase in trading volume made the continuation of this paper-based system impracticable.<sup>66</sup> As is well known, brokerage firms simply could not keep up with the paperwork demands, which caused delays in the processing of transaction settlements and failed deliveries.<sup>67</sup>

One particularly vivid account described the scene as involving stock certificates and related documents piled halfway to the ceiling, clerical personnel working overtime, and firms adding a second or third shift to process daily transactions.<sup>68</sup>

58. Thaddeus D. Kenmeson, *Purchases for Value Without Notice*, 23 YALE L.J. 193, 200 (1914).

59. *See, e.g.*, *Boris v. Schaheen*, No. 8160-VCN, 2013 WL 6331287, at \*4 (Del. Ch. Dec. 2, 2013) (discussing documentation of stock issuances on an Excel stock ledger).

60. *See Massey, supra* note 16, at 716.

61. *See Bjerre, supra* note 11, at 1320–21 (discussing the outsourcing of stock ledgers to transfer agents).

62. *See id.*; Donald, *supra* note 11, at 50.

63. *See* Marcel Kahan & Edward Rock, *The Hanging Chads of Corporate Voting*, 96 GEO. L.J. 1227, 1237 n.48 (2008) (discussing the labor-intensive process of delivering stock certificates between buyers and sellers); Jeanne L. Schroeder, *Is Article 8 Finally Ready This Time? The Radical Reform of Secured Lending on Wall Street*, 1994 COLUM. BUS. L. REV. 291, 310 (1994) (noting that delivery of a physical certificate was required for transfer of ownership); Bryn R. Vaaler, *Revised Article 8 of the Mississippi UCC: Dealing Directly with Indirect Holding*, 66 MISS. L.J. 249, 254–60 (1996) (noting that delivery of a physical stock certificate was required to evidence a change in ownership).

64. *See* Donald, *supra* note 11, at 50.

65. *Id.* (citing a study performed by North American Rockwell Information Systems).

66. *See In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206, at \*1 (Del. Ch. Jul. 13, 2015); Bjerre, *supra* note 11, at 1320–21.

67. *See* Donald, *supra* note 11, at 50.

68. Suellen M. Wolfe, *Escheat and the Concept of Apportionment: A Bright Line Test to*

Ultimately, to give members time to catchup on paperwork, the New York Stock Exchange opted “to close for one day per week and hold abbreviated trading hours during their remaining business days.”<sup>69</sup>

To resolve the “paperwork crisis” and increase the efficiency of settlement activity, the Securities and Exchange Commission (“SEC”) adopted a national policy of share immobilization, which eliminated the need for the majority of legal transfers.<sup>70</sup> To accomplish this, the SEC added a central depository to the ownership chain—the Depository Trust Company (“DTC”).<sup>71</sup> With DTC in place as the only domestic depository, banks and brokers could now participate as members of DTC with accounts maintained at DTC.<sup>72</sup> Banks and brokers no longer needed to hold shares through their own nominees.<sup>73</sup> Instead, shares could be registered in the name of DTC’s nominee—Cede & Co. (“Cede”).<sup>74</sup>

Today, DTC (through its nominee Cede) effectively holds shares on behalf of its participants (over 800 custodial banks and brokers) in fungible bulk.<sup>75</sup> DTC uses electronic book entries to reflect net changes in the ownership of its participants each trading day—debiting participant accounts for sales and crediting participant accounts for purchases.<sup>76</sup> Cede, however, remains the registered owner on the books of the corporation that issued the stock.<sup>77</sup> As a result, share transfers today largely take place via book-entry transactions at a central depository and do not require registration of transfers with the corporation who issued the stock. This solves the “paperwork crisis” by eliminating the need for physical delivery of stock certificates<sup>78</sup> and increases efficiency by allowing for an unlimited number of trades or transactions among participants without changing the registered owner of the share.<sup>79</sup>

Despite solving the “paperwork crisis,” the adoption of a policy of share immobilization and the consequent rise of an indirect holding system<sup>80</sup> has

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*Slice a Shadow*, 27 ARIZ. ST. L.J. 173, 181 n.49 (1995) (citing SECURITIES AND EXCHANGE COMMISSION STUDY OF UNSAFE AND UNSOUND PRACTICES OF BROKERS AND DEALERS, H.R. Doc. No. 92-231, 92d Cong., 2d Sess., at 35 (1971)).

69. Donald, *supra* note 11, at 52.

70. In re *Appraisal of Dell Inc.*, 2015 WL 4313206, at \*1–2 (Del. Ch. July 30, 2015).

71. *Id.*

72. *Id.*

73. *Id.*

74. *Id.*; see also NASDAQ, <https://www.nasdaq.com/investing/glossary/c/cede> [<https://perma.cc/D7JD-QQZK>] (defining Cede & Co. as the nominee name for The Depository Trust Company, a large clearing house that holds shares in its name for banks, brokers and institutions in order to expedite the sale and transfer of stock).

75. See Brooks, *supra* note 15, at 210–11; Mooney, *supra* note 15, at 317 n.23.

76. Brooks, *supra* note 15, at 210; see also *Apache Corp. v. Chevedden*, 696 F. Supp. 2d 723, 726 (S.D. Tex. 2010); Brown, *supra* note 16, at 722; Hakes, *supra* note 16, at 711 (discussing the process of netting); Kahan & Rock, *supra* note 63, at 1239; Vaaler, *supra* note 63, at 297.

77. *Id.*; see also Donald, *supra* note 11, at 62.

78. Donald, *supra* note 11, at 62.

79. Brooks, *supra* note 15, at 210–11.

80. See Bjerre, *supra* note 11, at 1320–21; Donald, *supra* note 11, at 50 (discussing the rise of the indirect holding system); Matt Levine, *Dole Food Had Too Many Shares*,

complicated the maintenance of stock ownership records. As an initial matter, modern stock ownership commonly involves the bifurcation of record holders (those legally recognized as shareholders) from economic or beneficial owners (those with a financial stake in the corporation).<sup>81</sup> As such, stock ownership is no longer a simple matter involving the corporation and a shareholder who directly holds shares in their own name.<sup>82</sup> In some cases, a broker holds shares on behalf of their client/customer (the beneficial owner), but has the legal status of shareholder because those shares are registered in the brokers' names.<sup>83</sup> In other cases, brokers hold shares in "street name" on behalf of their clients/customers (the beneficial owners) but actually hold the shares in accounts with DTC (with DTC's nominee Cede registered as the record holder of the share).<sup>84</sup> Accordingly, the name listed in the corporation's stock ledger as the registered holder can be several layers removed from the true beneficial owner of the share. The Delaware Chancery Court described the increasingly complex structure of stock ownership as follows:

CEDE & Co. is the name utilized by Depository Trust Company . . . . [DTC] is an association of . . . brokerage houses and financial institutions[,] which was formed for the purpose of owning shares held in street name for the beneficial interest of customers of the brokerage firms and financial institutions. In other words, the name "CEDE & Co." appearing on the corporate stock ledger is thrice removed from the true beneficial owner. The brokerage house owns the stock for the benefit of its customer, but it holds title through the Depository Trust Company[,] which in turn uses the name CEDE & Co. for this purpose.<sup>85</sup>

From a recordkeeping perspective, this means that records (other than those maintained by the corporation itself such as the corporation's stock ledger and stock list) are now essential to the determination of stock ownership (both legal and beneficial) along with the associated rights of such ownership. The relevant records may now include the transfer agent's books, DTC's transfer books, and the Cede breakdown.<sup>86</sup> Absent these additional records, it would be impracticable (perhaps

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BLOOMBERG (Feb. 17, 2017, 10:00 AM), <https://www.bloomberg.com/opinion/articles/2017-02-17/dole-food-had-too-many-shares> [<https://perma.cc/4EF2-ZZWC>].

81. See Donald, *supra* note 11, at 62.

82. See Massey, *supra* note 16, at 716 (noting the increasingly complicated structure of stock ownership, which includes beneficial owners holding shares in their own names, brokers and banks holding shares in their own names on behalf of clients, and depositories holding shares of such nominees as Cede & Co.).

83. *Id.*

84. *Id.*; see also Kahan & Rock, *supra* note 63, at 1237; Donald, *supra* note 11, at 60–61 (noting that in 2009, the central depository held almost \$34 trillion in securities and processed and average of over ninety million transactions a day); Brown, *supra* note 16, at 687–88 (describing the term "street name").

85. RB Assoc.'s. of New Jersey, L.P. v. Gillette Co., No. 9711, 1988 WL 27731, at \*3 (Del. Ch. Mar. 22, 1988).

86. Kurz v. Holbrook, 989 A.2d 140, 171 (Del. Ch. 2010) (noting that corporations outsource a part of their stock ledger, the Cede breakdown, to DTC); See Bjerre, *supra* note 11, at 1320–21 (noting that corporations outsource a part of their stock ledger to transfer

even impossible) to decipher the layers of stock ownership. In fact, in many cases, a corporation's stock ledger may simply list Cede as the registered shareholder. Corporations, therefore, have effectively outsourced a part of their stock ledgers and corporate recordkeeping.<sup>87</sup> The result of this system is that, in many cases, there is no efficient and reliable way to audit discrepancies in stock ownership. As discussed below, there are simply too many layers to untangle.

*C. The Current System and the Problem of Indirect Holding*

The move to a national policy of share immobilization has effectively resolved the paperwork crisis,<sup>88</sup> but the potential for errors and unresolvable discrepancies in stock ownership records persists. To be certain, no system of recordkeeping is immune from errors. A paper stock ledger suffers from the possibility of a data entry error or miscalculation. In addition, the number of errors in broker records is known to have exacerbated the "paperwork crisis" of the late 1960s and early 1970s.<sup>89</sup> Even so, the complexity of the current system—with its layers of beneficial owners, custodians, nominees, and record holders—has created a new set of problems. The complexity prevents corporations from determining stock ownership in real time. Moreover, it hinders the ability of corporations and the judiciary to effectively audit transactions or otherwise reconcile discrepancies.

Legal disputes involving stock ownership records are far from unusual. However, the Delaware Chancery Court's decision in *In re Dole Food Co., Stockholder Litigation* stands out because it highlights the limitations of current methods of recordkeeping and hints at a better technology-based alternative. In that particular case, Dole completed a going-private transaction via a single-step merger.<sup>90</sup> Dole distributed the merger consideration, \$13.50 per share, to its stockholders of record.<sup>91</sup> Cede (as nominee for DTC) was among the stockholders of record.<sup>92</sup> DTC then distributed the merger consideration to its participant members in accordance with DTC's centralized ledger.<sup>93</sup> A class action suit ensued. For purposes of this Article, the legal claims alleged by the plaintiffs in the class action are irrelevant. However, the events that followed parties' agreement to settle are not.

According to the settlement agreement, the plaintiffs agreed to settle the class action claims in exchange for payment of \$2.74 per share plus interest.<sup>94</sup> For purpose of identifying those entitled to payment, the class was defined as including "all record holders and beneficial owners of common stock of Dole during the period commencing June 11, 2013, and ending November 1, 2013, together with their

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agents).

87. *Id.*

88. *In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206, at \*2 (Del. Ch. July 30, 2015).

89. *See Wolfe*, *supra* note 68, at 181 n.49.

90. No. 8703-VCL, 2017 WL 624843 (Del. Ch. Feb. 15, 2017).

91. *Id.* at \*1.

92. *Id.*

93. *Id.*

94. *Id.*

successors and assigns.”<sup>95</sup> However, the definition expressly excluded certain holders of Dole stock—specifically the defendants, those affiliated with the defendants, and ten petitions in a related appraisal action.<sup>96</sup> After excluding these holders, the class was comprised of holders of 36,793,758 shares of In re stock.<sup>97</sup> Despite the size of the class, facially eligible claims were submitted by holders of 49,164,415 shares—a discrepancy of over 12.3 million shares.<sup>98</sup>

On its face, the sheer size of the discrepancy found in *Dole* is significant. But the truly eye-opening admission was that there was simply no way to reconcile the discrepancy.<sup>99</sup> Despite diligent efforts by the settlement administrator and the class counsel, Vice Chancellor Laster described the exercise as “functionally impossible” and “fundamentally uncertain.”<sup>100</sup>

Vice Chancellor Laster noted that resolving the discrepancy would require detailed records from millions of trades.<sup>101</sup> Complicating matters was the fact that no single entity maintained a comprehensive record of each trade. DTC’s centralized ledger, for example, only showed the net change in number of shares by its participants.<sup>102</sup> Consequently, unraveling ownership would require records from over 800 participants (i.e., brokers and custodial banks) and their individual clients.<sup>103</sup> Even if all the records were obtained, determining actual ownership of the shares would demand “a forensic audit of herculean proportions.”<sup>104</sup> Such an audit would likely uncover additional disputes, making resolution of the discrepancy impracticable.<sup>105</sup>

The result in *Dole* highlights serious shortcomings in the indirect holding system that arose from the federal policy of share immobilization. Specifically, the policy of share immobilization (and its bifurcation of record holders from beneficial owners) prevents a real-time determination of ownership because the system involves too many record-keepers.<sup>106</sup> Moreover, the added layers of intermediaries make reconciliation of share discrepancies expensive and uncertain.<sup>107</sup>

It is also important to mention that *Dole* is not an outlier. Rather, many corporations have encountered problems with the indirect holding system.<sup>108</sup> Two recent cases involving Dell Inc. (“Dell”) illustrate the scope.<sup>109</sup>

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95. *Id.*

96. *Id.*

97. *Id.*

98. *Id.*

99. *Id.* at \*3–4.

100. *Id.*

101. *Id.* at \*3.

102. *Id.* at \*4.

103. *Id.* at \*3.

104. *Id.* at \*4.

105. *Id.*

106. *See id.*

107. *Id.*

108. *See id.* at \*4, n.1 (noting that despite efforts to keep the system going, the problems have grown); *see also In re Appraisal of Dell Inc.*, 143 A.3d 20, 59 (Del. Ch. 2016); *In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206, at \*1 (Del. Ch. Jul. 13, 2015).

109. *See Dell*, 143 A.3d 20; *Dell*, 2015 WL 4313206 (Del. Ch. July 30, 2015).



In the first case, the Delaware Chancery Court held that the beneficial owners of 922,257 shares of Dell's common stock (three mutual funds and two retirement plans) forfeited their appraisal rights.<sup>110</sup> The beneficial owners sought appraisal rights in connection with a going-private merger announced by Dell.<sup>111</sup> Unfortunately, as beneficial owners, neither the mutual funds nor the retirement plans, held legal title.<sup>112</sup> Rather, they held the shares indirectly through intermediaries (in this case accounts at custodial banks). Accordingly, the record holder of the shares was Cede & Co.<sup>113</sup> Despite having beneficial ownership at all relevant times, the mutual funds and retirement plans did not continuously hold the shares (as required by statute).<sup>114</sup> The court reasoned that an administrative name change in the record holder of the shares—an act necessitated by the indirect holding system—broke the chain of title.<sup>115</sup> In doing so, the court observed that the indirect holding system solved the “paperwork crisis” while complicating other aspects of the legal system—like the exercise of appraisal rights.<sup>116</sup> Specifically, the complexities of the indirect holding system impeded the exercise of appraisal rights because the beneficial owners were not the legal holders identified in Dell's records.

In the second *Dell* case, the Delaware Chancery Court again held that certain beneficial owners of Dell stock (mutual funds sponsored by T. Rowe Price & Associates) forfeited their appraisal rights.<sup>117</sup> Despite beneficial owners opposing the merger, the beneficial owners' shares were inadvertently voted in favor of the merger via a “daisy chain” of intermediaries.<sup>118</sup> In short, the complexities of the indirect holding system—specifically, required approvals from a series of intermediaries—resulted in the record holder's voting the shares for the merger against the wishes of the beneficial owner.<sup>119</sup> Thus, bifurcation of ownership and the policy of share immobilization created what the court described as a “byzantine and path-dependent system.”<sup>120</sup> The resulting procedural complexities prevent beneficial owners from interfacing directly with the issuing company, opening the door for intervening problems.<sup>121</sup> As such, the complexities of the indirect holding system contributed in part to the inability of stockholders to effectively exercise their rights.

The foregoing illustrates systemic problems associated with the current policy of share immobilization, indirect holding, and bifurcated ownership. *Dole* shows how the introduction of intermediaries complicates recordkeeping in two significant ways. First, no person maintains a single comprehensive record of current stock ownership. Because of this, there is no way to make reliable real-time determinations

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110. *Dell*, 2015 WL 4313206, at \*3 (Del. Ch. July 30, 2015).

111. *Id.* at \*1.

112. *Id.*

113. *Id.*

114. *Id.* at \*8–10.

115. *Id.* at \*3, 8–10.

116. *Id.* at \*2.

117. *In re Appraisal of Dell Inc.*, 143 A.3d 20, 59 (Del. Ch. 2016).

118. *Id.* at 21, 56.

119. *Id.* at 22.

120. *Id.*

121. *Id.*

of beneficial stock ownership.<sup>122</sup> Rather, the process requires significant time and effort—specifically, the aggregation of corporate records with those maintained by involved intermediaries and their clients.<sup>123</sup>

Second, the sheer number of transactions, records, and parties involved raises legitimate questions about the viability of any attempt to audit.<sup>124</sup> Initially, obtaining all necessary records may prove difficult if not impossible. Without a single comprehensive record of ownership, any person conducting an audit would need to gather records of thousands of transactions spread across all involved intermediaries and their clients.<sup>125</sup> Even if all necessary records were collected, the audit could uncover additional disputes or record-keeping errors.<sup>126</sup> Attempts to audit simply suffer from too many records and too many recordkeepers. Because of this, the potential exists for missing records or other errors among records maintained by various entities to prevent an audit from accurately tracing ownership through all relevant stock transactions. As such, the realities of the current system effectively prevent verification of stock ownership in the event of a dispute.

The two *Dell* cases highlight a wholly different problem with the current system. Specifically, bifurcated ownership can complicate the ability of beneficial owners of stock to exercise their rights by creating needless administrative technicalities.<sup>127</sup> Among other things, the addition of intermediaries can lead to procedural complexities that result in record holders of stock acting contrary to the wishes of the beneficial owner.<sup>128</sup> In short, it creates an increased risk of process failure interfering with important shareholder rights like voting.

In sum, the current system effectively redressed problems created by the explosion of stock transactions and the inability of a paper-based system of recording trades to keep pace. However, a concomitant problem has emerged. Recent cases accentuate the adverse consequences of the federal policy of share immobilization and bifurcated ownership. Notwithstanding unsatisfactory results, the current system remains entrenched. Despite little real effort to improve or replace the current system, the decision in *Dole* may be a tipping point as it makes explicit mention of the potential of a technological solution—specifically, the blockchain.<sup>129</sup> Thus, it signals a need for development of technological improvements to simplify corporate recordkeeping and ensure that stock ownership records are both accurate and verifiable.

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122. See *In re Dole Food Co., Inc., Shareholder Litigation*, No. 8703-VCL, 2017 WL 624843, at \*3 (Del. Ch. Feb. 15, 2017) (noting that without obtaining millions of records, it is impossible to determine who owned the shares at closing, and that obtaining those records is not realistic).

123. *Id.*

124. *Id.*

125. *Id.* at \*4.

126. *Id.*

127. See *In re Appraisal of Dell Inc.*, 143 A.3d 20, 59 (Del. Ch. 2016); *In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206 (Del. Ch. Jul. 13, 2015).

128. See *Dell*, 143 A.3d 20; *Dell*, 2015 WL 4313206 (Del. Ch. July 30, 2015).

129. *Dole*, 2017 WL 624843, at \*4 n.1.

## II. THE BLOCKCHAIN SOLUTION?

Given the systemic problems outlined in Part I and the judiciary's signaling of a need to examine the ongoing efficacy of the current system, some state legislatures have started to revisit the process of effectuating and recording stock transactions. The Delaware Chancery Court's decision in *Dole* foreshadowed the arrival of technological solutions focused on the application of blockchain to corporate recordkeeping.<sup>130</sup>

For example, the Delaware General Assembly amended the DGCL to permit the use of blockchain technology in the maintenance of corporate records.<sup>131</sup> Delaware's openness to blockchain-based corporate records is noteworthy. Delaware is the preeminent state for incorporation.<sup>132</sup> The state is home to a well-developed body of corporate law,<sup>133</sup> and its judiciary is highly regarded for corporate law expertise.<sup>134</sup> As such, Delaware's embrace of corporate law applications for blockchain technology has the potential to influence American corporate law more broadly.

Delaware, however, is not the only state to explore the ways in which blockchain technology may benefit corporate law. Arizona, California, Maryland, Texas, and Wyoming have also enacted amendments to expressly accommodate blockchain-based corporate records.<sup>135</sup> Other states, such as New Jersey, have considered similar legislation.<sup>136</sup> This legislative activity marks a significant step because it paves the way for corporations to start developing and testing blockchain-based solutions for the systemic issues that currently hinder the ability of corporations to maintain accurate stock ownership records. Specifically, amending state corporate codes enables a meaningful examination of whether the blockchain offers a technological solution for the reality facing many corporations—the inability to determine with certainty who owns each of the corporation's shares at any moment in time. If so, corporations may have a means of preventing or at least mitigating the problems that arise from the current policy of share immobilization.

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130. *Id.*

131. S.B. 69, 149th Leg. (Del. 2017); see also DEL. CODE ANN. tit. 8, § 219(c), § 224 (2020); Allison L. Land & Edward P. Welch, *Delaware Law Amendments and the Maintenance of Corporate Records via Blockchain*, HARV. L. SCH. F. ON CORP. GOVERNANCE, (May 1, 2017) <https://corpgov.law.harvard.edu/2017/05/01/delaware-law-amendments-and-the-maintenance-of-corporate-records-via-blockchain/> [https://perma.cc/CV39-LXN3]; O'Toole et al., *supra* note 20.

132. Ehud Kamar, *A Regulatory Competition Theory of Indeterminacy in Corporate Law*, 98 COLUM. L. REV. 1908, 1909 (1998).

133. See Edward B. Rock, *Saints and Sinners: How Does Delaware Corporate Law Work?*, 44 UCLA L. REV. 1009, 1016–17 (1997); Leo E. Strine, Jr., *The Delaware Way: How We Do Corporate Law and Some of the New Challenges We (and Europe) Face*, 30 DEL. J. CORP. L. 673, 679–81 (2005).

134. Strine, *supra* note 133, at 682–83; see also, Kamar, *supra* note 132, at 1925.

135. See S.B. 136 (Md. 2019) (effective Oct. 1, 2019); S.B. 838 (Cal. 2018) (approved by California's governor on Sep. 28, 2018); H.B. 2603, 53d Leg., 2d Reg. Sess. (Ariz. 2018) (signed by Arizona's governor on Apr. 3, 2018); H.B. 101 64th Leg., Budget Sess. (Wyo. 2018) (signed by Wyoming's governor on Mar. 10, 2018).

136. See Assemb. B. 3768, 218th Leg. (N.J. 2018).

*A. State Blockchain Amendments*

The substance of amendments to enable the use of blockchain technology in corporate recordkeeping are relatively simple. For example, the central component of the DGCL amendment provides express statutory authority for Delaware corporations to use blockchain technology in creating and administering internal corporate records (including the corporation's stock ledger).<sup>137</sup> Accordingly, the amendments make necessary technical changes to enable the use of blockchain technology by Delaware corporations. The core changes appear in Section 224 and Section 219 of the DGCL.

Section 224 contains the express statutory authority to use blockchain technology. In relevant part, it now provides that:

“Any records *administered by or on behalf of* the corporation . . . including its stock ledger . . . may be kept on, or by means of, or be in the form of, any information storage device, method, or *one or more electronic networks or databases (including one or more distributed electronic networks or databases)*.”<sup>138</sup>

As amended, Section 224 makes it clear that Delaware corporations need not maintain the records directly or through an agent.<sup>139</sup> Instead, corporate records may be administered on behalf of the corporation.<sup>140</sup> Section 224 also adds “[one] or more distributed electronic networks or databases” as a permissible method of administering corporate records.<sup>141</sup> In doing so, Section 224 expressly recognizes the use of distributed ledgers and blockchain technology, which function without a central administrator.

Regardless of how a Delaware corporation elects to maintain or administer its records, Section 224 preserves the requirement that corporate records must be capable of conversion into clearly legible paper form within a reasonable time.<sup>142</sup> Section 224, however, requires additional minimum requirements for stock ledgers. With respect to stock ledgers, the records must: (1) permit preparation of a list of stockholders; (2) record the information specified in Sections 156, 159, 217(a), and 218 of the DGCL; and (3) record transfers of stock.<sup>143</sup> Therefore, any Delaware corporation that implements a blockchain-based stock ledger must ensure that it is capable of satisfying the foregoing requirements.

Other necessary changes appear in Section 219 of the DGCL. For example, the amendments delete the Section 219(a) requirement that the officer who has charge of the stock ledger prepare a complete list of stockholders before every meeting of stockholders.<sup>144</sup> Instead, Section 219(a) simply requires that the corporation prepare

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137. See, e.g., Santori, *supra* note 20; O'Toole et al., *supra* note 20.

138. DEL. CODE ANN. tit. 8, § 224 (2020) (emphasis added).

139. *Id.*

140. *Id.*

141. *Id.*

142. *Id.*

143. *Id.*

144. DEL. CODE ANN. tit. 8, § 219(a) (2020).

the list of stockholders.<sup>145</sup> This recognizes that a distributed ledger, by definition, does not have a central administrator.<sup>146</sup> No corporate officer (or any single person) will have direct charge of a blockchain-based stock ledger. Instead, the use of distributed ledgers means that the corporation's record of stock transactions is shared and synchronized across multiple sites, institutions, or geographies.<sup>147</sup>

In addition, Section 219(c) adds a new definition for the term "stock ledger."<sup>148</sup> The definition is consistent with Section 224 and similarly contemplates blockchain stock ledgers. In relevant part, a stock ledger is defined as:

"[One] or more records administered by or on behalf of the corporation in which the names of all the corporation's stockholders of record, the address and number of shares registered in the name of each such stockholder, and all issuances and transfers of stock of the corporation are recorded in accordance with [the DGCL]."<sup>149</sup> This definition specifically addresses the distributed nature of the blockchain, which means that there is no central store of transaction data. Rather, a network of computers store and independently update copies of the ledger.

In sum, the scope of the amendments is relatively limited. At core, the amendments comprise several technical changes necessary to expressly allow for the use of blockchain technology in corporate recordkeeping. But the significance of the amendments is in opening the door to the development and implementation of blockchain-based technological solutions to the longstanding problem of discrepancies in stock ownership records. By amending the DGCL to expressly permit blockchain records and stock ledgers, Delaware has eliminated a legal impediment to innovation and progress. That is not to say that blockchain will solve all the systemic problems that have contributed to needless complexity and discrepancies in stock ownership records. In fact, it may take years for corporations to move en masse to blockchain-based corporate records (if they ever do). But Delaware's amendments to the DGCL (and similar amendments to other state corporate codes) remove uncertainty and provide an important opportunity to evaluate the potential of blockchain solutions.

### *B. The Potential of Corporate Blockchains*

What is blockchain and how can it be applied to corporate recordkeeping? Blockchain is best known as the technology underlying cryptocurrencies such as Bitcoin.<sup>150</sup> Cryptocurrency, however, is just one application of blockchain

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145. *Id.*

146. Shaan Ray, *The Difference Between Blockchains and Distributed Ledger Technology*, TOWARDS DATA SCI. (Feb. 19, 2018), <https://towardsdatascience.com/the-difference-between-blockchains-distributed-ledger-technology-42715a0fa92> [<https://perma.cc/KWX3-2DME>].

147. *Id.*

148. Tit. 8, § 219(a).

149. *Id.*

150. See Fairfield, *supra* note 25, at 808; Santori, *supra* note 20; Adam Sulkowski, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers?*, 43 DEL. J. CORP. L. 303, 305 (2019); Kevin V. Tu,

technology.<sup>151</sup> In that context, blockchain technology creates a record of cryptocurrency transactions—each transfer of Bitcoin from one person to another. But the technology is not limited to cryptocurrency transactions.<sup>152</sup> At core, the technology simply provides a method of creating and storing an ongoing record of transactions. Any kind of transaction can be created and stored. A blockchain, therefore, is simply “a ledger of transactions between parties on a network.”<sup>153</sup>

To proponents of blockchain technology, the potential applications are boundless. Outside the cryptocurrency context, it has been suggested that blockchain technology could disrupt and create efficiencies in wide-ranging areas such as: (1) real estate and land titling,<sup>154</sup> (2) global supply chain management,<sup>155</sup> (3) education,<sup>156</sup> (4) healthcare,<sup>157</sup> and (5) voting.<sup>158</sup>

Similarly, blockchain technology has the potential to transform global stock trading and improve the ability of corporations to maintain accurate records of each stock transaction, including up to date ownership information.<sup>159</sup> Understanding the

*Perfecting Bitcoin*, 52 GA. L. REV. 505, 524 (2018).

151. Santori, *supra* note 20 (noting that advocates praise the potential of the technology to clear and settle nearly any transaction imaginable); *see also* Carla L. Reyes, *Moving Beyond Bitcoin to an Endogenous Theory of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 VILL. L. REV. 191 (2016).

152. Santori, *supra* note 20; *see also* Reyes, *supra* note 151.

153. Santori, *supra* note 20; *see also* Victor Li, *Bitcoin’s Useful Backbone*, 102 A.B.A. J. 31 (2016) (“The simple answer is that blockchain is really just a ledger.”).

154. Fairfield, *supra* note 25; Nat’l Archives and Rec. Admin., *Blockchain White Paper* (Feb. 2019), <https://www.archives.gov/files/records-mgmt/policy/nara-blockchain-whitepaper.pdf> [<https://perma.cc/93RZ-BWHW>].

155. *See* Sulkowski, *supra* note 150, at 305–06; *see also* Niels Hackius, Moritz Petersen, *Blockchain in Logistics and Supply Chain: Trick or Treat?*, in DIGITALIZATION IN SUPPLY CHAIN MANAGEMENT AND LOGISTICS 23, (Wolfgang Kersten, Thorsten Blecker & Christian M. Ringle eds., 2017) [https://tore.tuhh.de/bitstream/11420/1447/1/petersen\\_hackius\\_blockchain\\_in\\_scm\\_and\\_logistics\\_hicl\\_2017.pdf](https://tore.tuhh.de/bitstream/11420/1447/1/petersen_hackius_blockchain_in_scm_and_logistics_hicl_2017.pdf) [<https://perma.cc/X7KF-CEM5>] (discussing how blockchain could be used to facilitate origin tracking and to identify counterfeit goods); Marr, *supra* note 22; Deloitte, *Using Blockchain and Internet of Things in Supply Chain Traceability*, <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/technology/lu-blockchain-internet-things-supply-chain-traceability.pdf> [<https://perma.cc/4XD9-X5T2>].

156. *See* Guang Chen, Bing Xu, Manli Lu & Nian-Shing Chen, *Exploring Blockchain Technology and its Potential Applications for Education*, SMART LEARNING ENV’TS (Jan. 3, 2018), <https://slejournal.springeropen.com/articles/10.1186/s40561-017-0050-x#Sec6> [<https://perma.cc/32GD-GA85>] (discussing use of blockchain technology for academic degree management and to support summative evaluation of learning outcomes).

157. *See* Angraal et al., *supra* note 22 (discussing the use of blockchain in connection with healthcare records and managing permissions to access health data).

158. *See* Marc Pilkington, *Blockchain Technology: Principles and Applications* 243 (Université Bourgogne Franche Comté, 2015) (discussing blockchain based voting systems designed to increase transparency by recording every vote on the blockchain).

159. *See* Jonathan Rohr & Aaron Wright, *Blockchain-Based Token Sales, Initial Coin Offering, and the Democratization of Public Capital Markets*, 70 HASTINGS. L.J. 463, 464 (2019); Brandon Ferrick, *Modernizing the Stockholder Shield: How Blockchains and Distributed Ledgers Could Rescue the Appraisal Remedy*, 60 B.C. L. REV. 621 (2019); OLIVER

intricacies of blockchain technology is beyond the scope of this Article. But understanding the features of blockchain technology that have the potential to provide a more efficient method of administering and recording stock trades provides essential context about innovating corporate recordkeeping and global capital markets (including corresponding improvements to American corporate law).

First, blockchain technology provides a digital mechanism for recording information about a transaction.<sup>160</sup> At its core, blockchain technology functions as a type of electronic database.<sup>161</sup> Accordingly, corporations can use blockchain technology to record transaction specific information regarding each transfer of the corporation's stock such as number of shares and the participants involved.<sup>162</sup>

Second, blockchain creates a continuous record of all transactions.<sup>163</sup> Transaction records are never deleted.<sup>164</sup> Instead, blockchain technology updates and adds new

WYMAN, BLOCKCHAIN IN CAPITAL MARKETS THE PRIZE AND THE JOURNEY (Feb. 2016), <https://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2016/feb/BlockChain-In-Capital-Markets.pdf>. [https://perma.cc/K2VQ-RBW9]; Brooke Navarro, *Opinion: Blockchain Will Soon Revolutionize Our Opaque and Inefficient Capital Markets*, MARKETWATCH (Sept. 17, 2019, 1:29 PM), <https://www.marketwatch.com/story/blockchain-will-revolutionize-our-opaque-and-inefficient-capital-markets-2019-09-17> [https://perma.cc/7QB5-67MY].

160. See Trevor I. Kiviat, *Beyond Bitcoin: Issues in Regulating Blockchain Transactions*, 65 DUKE L.J. 569, 578 (2015); Nathan Reiff, *Blockchain Explained*, INVESTOPEDIA (Feb. 1, 2020), <https://www.investopedia.com/terms/b/blockchain.asp> [https://perma.cc/M6CT-7UBA]; *The World Bank, Blockchain & Distributed Ledger Technology (DLT)* (Apr. 12, 2018), <https://www.worldbank.org/en/topic/financialsector/brief/blockchain-dlt> [https://perma.cc/25ZW-7CSP]; Iron Mountain, *What is Blockchain and Why Should Records Management Professionals Care?*, <https://www.ironmountain.com/resources/general-articles/w/what-is-blockchain-and-why-should-records-management-professionals-care> [https://perma.cc/RXF7-S6HS].

161. John C. Kelly & Maximillian J. Mescall, *Taking Stock of the Block: Blockchain, Corporate Stock Ledgers, and Delaware General Corporation Law—Part I*, 1 J. OF ROBOTICS, ARTIFICIAL INT'L & L. 145, 152–54 (2018); Coindesk, *Blockchain 101* (Mar. 17, 2017), <https://www.coindesk.com/information/what-is-the-difference-blockchain-and-database> [https://perma.cc/2LV7-9HZ8]; Alan R. Elliott, *The Blockchain Technology Revolution is About to Remake the Stock Market*, INV.'S BUS. DAILY, (Dec. 24, 2018) <https://www.investors.com/news/technology/blockchain-technology-blockchain-stock-market-revolution/> [https://perma.cc/9Z3V-QYVY].

162. Reiff, *supra* note 160.

163. Kiviat, *supra* note 160, at 578; Robert W. Rust II, *Banking on Blockchains: A Transformative Technology Reshaping Latin American and Caribbean Economies*, 50 U. MIA. INTER-AM. L. REV. 184, 193 (2019); Reggie O'Shields, *Smart Contracts: Legal Agreements for the Blockchain*, 21 N.C. BANKING INST. 177, 177–85 (2017).

164. Kiviat, *supra* note 160, at 578; Rust, *supra* note 163, at 193; O'Shields, *supra* note 163, at 177–85; see also Alma Angotti & Anne Marie Minogue, *Risk and Rewards: Blockchain, Cryptocurrency and Vulnerability to Money Laundering, Terrorist Financing and Tax Evasion*, 2018 WL 6037317 (Nov. 19, 2018) (noting that blockchain is described as immutable because there is an unchangeable record of the transaction's path); Claire Henly, Sam Hartnett, Buck Endemann, Ben Tejblum & Daniel S. Cohen, *Energizing the Future with Blockchain*, 39 ENERGY L.J. 197, 200 (2018) (noting that the blockchain is immutable because once it is created, it cannot be changed); Randolph A. Robinson II, *The New Digital Wild*

transaction records to an ever growing “chain” of data.<sup>165</sup> In doing so, blockchain creates an immutable record of every transaction from the very first to the most recent.<sup>166</sup> As applied to stock transactions, blockchain could record every issuance, trade, put, and call, including number of shares and ownership of those shares.

Third, blockchain is both decentralized *and* distributed, which distinguishes it from traditional electronic databases.<sup>167</sup> The blockchain is decentralized because there is no central authority or trusted administrator charged with maintaining the ledger.<sup>168</sup> This means that neither the corporation nor any agent of the corporation is responsible for updating the ledger. Blockchain is distributed because there is no central store of data.<sup>169</sup> Instead, blockchain relies on the use of independent computers in a network to simultaneously record transactions in multiple places at the same time.<sup>170</sup>

How then does a blockchain-based ledger operate? Without a central authority or trusted administrator, blockchain relies on consensus to approve each record before it is added to the chain.<sup>171</sup> Blockchain technology, therefore, depends on a transfer of trust from institutions to systems. Instead of a central authority, blockchain records rely on a system of consensus.<sup>172</sup> In short, each computer on a network maintains its own identical copy of the ledger. Each computer works independently to reach a conclusion on approval of new transaction records. The computers then come to an agreement via an algorithm before blockchain is updated. In a sense, the computers work independently then communicate with the most “popular” result becoming the

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*West: Regulating the Explosion of Initial Coin Offerings*, 85 TENN. L. REV. 897, 910, 914 (2018).

165. Kiviat, *supra* note 160, at 578; Rust, *supra* note 163, at 193; O’Shields, *supra* note 163, at 177–85; *see also* Angotti & Minogue, *supra* note 164; Henly et al., *supra* note 164, at 200; Robinson, *supra* note 164, at 910, 914.

166. Kiviat, *supra* note 160, at 578; Rust, *supra* note 163, at 193; O’Shields, *supra* note 163, at 177–85; *see also* Angotti & Minogue, *supra* note 164; Henly et al., *supra* note 164, at 200; Robinson, *supra* note 164, at 910, 914.

167. Julia Poenitzsch, *What’s the Difference Between Decentralized and Distributed?*, MEDIUM (Oct. 3, 2018), <https://medium.com/nakamo-to/whats-the-difference-between-decentralized-and-distributed-1b8de5e7f5a4> [<https://perma.cc/83C5-9W58>].

168. *See* Fairfield, *supra* note 25, at 814; Gautam Gujral, *Column: It’s About Time for Stock Ledgers on the Blockchain*, BANKLESSTIMES (May 12, 2019), <https://www.banklesstimes.com/2019/05/12/column-its-about-time-for-stock-ledgers-on-the-blockchain/> [<https://perma.cc/3HAP-W887>] (discussing how involvement of intermediaries increases settlement times, transactions costs and potential for errors); Ferrick, *supra* note 159, at 652.

169. *See* Fairfield, *supra* note 25, at 814; Gujral, *supra* note 168; Ferrick, *supra* note 159, at 652.

170. *See* Matthew Beedham, *Here’s the Difference Between Blockchain and Distributed Ledger Technology*, THE NEXT WEB, <https://thenextweb.com/hardfork/2018/07/27/distributed-ledger-technology-blockchain/> [<https://perma.cc/M6JW-Y38G>]; Ray, *supra* note 146; Sloane Brakeville and Bhargav Perepa, *Blockchain Basics: Introduction to Distributed Ledgers*, IBM DEV. (Jun. 1, 2019), <https://developer.ibm.com/tutorials/cl-blockchain-basics-intro-bluemix-trs/> [<https://perma.cc/MZE7-TL4Z>].

171. Fairfield, *supra* note 25, at 814.

172. *Id.*



official record. Thus, blockchain operates by consensually sharing and synchronizing data across multiple computers in a network.<sup>173</sup>

Collectively, the features of blockchain technology (described above) hold the potential to address the issues giving rise to the “paperwork crisis” while also solving many of the systemic problems that have arisen from the current policy of share immobilization.<sup>174</sup> As an electronic mechanism of recordkeeping, blockchain obviates the need for physical stock certificates and transfer paperwork. Accordingly, if a blockchain solution were operationalized, it would likely function without giving rise to the same “paperwork crisis” that ushered in the current system of share immobilization and indirect holding.

More significantly, the features of blockchain could mitigate the systemic problems highlighted in *Dole* and both *Dell* cases by eliminating the role of intermediaries and restoring direct ownership of shares.

First, blockchain could eliminate the need for intermediaries in the process of settlement and recording of stock transactions. Since blockchain is decentralized, a central administrator does not authorize transactions or update the ledger.<sup>175</sup> Instead, a blockchain-based ledger is automatically updated to add new stock transactions as consensus is achieved without the involvement of any intermediaries.<sup>176</sup> A blockchain stock ledger, therefore, theoretically allows for faster verification and settlement of stock transactions by eliminating the need for third-party approval.<sup>177</sup> The plausible result is fewer delays and errors in the process of updating corporate records. This carries the practical benefit of aiding corporations in making more accurate (and potentially near real-time) determinations of stock ownership—an improvement over both the prior paper-based system and the current policy of share immobilization.<sup>178</sup>

Second, blockchain technology could create a single comprehensive record of all transactions, rendering the need for intermediaries (like DTC, Cede, participant brokers and custodial bank, or their customers) and indirect holding of shares unnecessary.<sup>179</sup> Instead, blockchain would record and store each stock transaction along with associated transaction data.<sup>180</sup> The most significant consequence of this

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173. See Christina Majaski, *Distributed Ledgers*, INVESTOPEDIA (May 12, 2020), <https://www.investopedia.com/terms/d/distributed-ledgers.asp> [<https://perma.cc/4LK5-8LBQ>]; Ray, *supra* note 146.

174. See, e.g., *In re Dole Food Co., Inc. S'holder Litig.*, No. 8703-VCL, 2017 WL 624843, at \*4 n.1 (Del. Ch. Feb. 15, 2017); *In re Appraisal of Dell Inc.*, 143 A.3d 20 (Del. Ch. 2016); *In re Appraisal of Dell Inc.*, No. 9322-VCL, 2015 WL 4313206 (Del. Ch. Jul. 13, 2015).

175. See *supra* Section II.B.

176. See *supra* Section II.B.

177. Eric Ervin, *Blockchain Technology Set to Revolutionize Global Stock Trading*, FORBES (Aug. 16, 2018, 11:57 AM), <https://www.forbes.com/sites/ericervin/2018/08/16/blockchain-technology-set-to-revolutionize-global-stock-trading/#5d89814e4e56> [<https://perma.cc/8NZJ-R6QB>].

178. Daniel DeConinck, *Overstock Completes First Public Stock Issuance Using Blockchain*, 36 REV. BANKING & FIN. L. 416, 419 (2017).

179. See J. Travis Laster, V.C., Council of Institutional Investors, *Using Technology to Clean Up Proxy Plumbing and Take Back the Vote* (Sep. 29, 2016) (transcript available at [https://www.cii.org/files/09\\_29\\_16\\_laster\\_remarks.pdf](https://www.cii.org/files/09_29_16_laster_remarks.pdf) [<https://perma.cc/L6JR-GEJV>]).

180. *Id.*

being the reunification of legal and beneficial stock ownership—eliminating the need for registration of shares (and vesting of legal ownership) in a nominee (such as Cede).<sup>181</sup> By removing this step, a blockchain system could restore direct ownership of shares between the issuing corporation and the shareholder.<sup>182</sup>

Simply put, if Suzy Shareholder purchases ten shares of Amazon.com, Inc. (“Amazon”) stock, a blockchain-based system would update the record to add the transaction and identify Suzy Shareholder as the new owner of those Amazon shares. Amazon’s stock ledger would then list Suzy Shareholder’s name as the shareholder. With Suzy Shareholder’s name registered as the owner in the corporation’s records, the ultimate investor (a mere beneficial owner under the current system of share immobilization) would stand as the legal owner. Suzy Shareholder is both the legal owner and the beneficial owner of the share. There is no longer any distinction because the process no longer involves DTC, Cede, or any of DTC’s participant brokers or custodial banks. There is no longer a separate and distinct record holder of the shares. Therefore, the elimination of these intermediaries results in simplification because ownership returns to a matter between two parties—the corporation issuing the share and the person acquiring the share.

This restoration of direct holding could strip away layers of procedural complexity. In doing so, blockchain addresses the two principal problems of the current system—impracticability of auditing share ownership and impairment to the exercise of shareholder rights by beneficial owners.<sup>183</sup>

Under the current system, the resolution of a discrepancy in share ownership necessitates a “forensic audit of herculean proportions.”<sup>184</sup> As described by Vice Chancellor Laster in *Dole*, the process would require examination of detailed records from millions of transactions spread across hundreds of participant banks and brokers and each of their customers.<sup>185</sup> Even then, the result is far from certain because such an effort is likely to turn up additional disputes and discrepancies.<sup>186</sup> Vice Chancellor Laster, therefore, concluded that any attempt to reconcile a share discrepancy under the current system of share immobilization amounts to a functional impossibility.<sup>187</sup> But having a single comprehensive record of all stock transactions on blockchain obviates the issue. Reunification of bifurcated stock ownership means that there is no need to reconcile legal and beneficial owners. Jettisoning intermediaries removes the need to obtain and examine the disbursed records cited by Vice Chancellor Laster. Instead, a single comprehensive record on blockchain increases transparency and enables tracing of share ownership, which allows for meaningful audits in the event of a share discrepancy or dispute.<sup>188</sup> In short, it makes resolution of discrepancies feasible instead of a functional impossibility.

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181. *Id.*

182. *Id.*

183. *Id.*

184. *In re Dole Food Co., S’holder Litig.* No. 8703-VCL, 2017 WL 624843, at \*4 (Del. Ch. Feb. 15, 2017).

185. *Id.*

186. *Id.*

187. *Id.*

188. *Delaware Provides Legal Clarification for Blockchain Maintenance of Corporate Records – The View from Canada*, NORTON ROSE FULBRIGHT (Sep. 2017),

The other problem posed by the current system is that procedural complexities from the separation of legal and beneficial ownership have interfered with the fair exercise of shareholder rights.<sup>189</sup> Bifurcation of ownership impedes shareholder rights in different ways. At the onset, it complicates attempts by corporations to accurately determine the group of shareholders entitled to rights—whether voting, dissenters or otherwise.

Recall that *Dole* centered on the corporation's inability to properly distribute settlement funds to the appropriate class of shareholders because of unresolvable discrepancies in share ownership.<sup>190</sup> *Dole* was simply unable to identify with certainty the shareholders entitled to settlement funds.<sup>191</sup> As discussed, blockchain technology can facilitate audits and reconciliation of share discrepancies when a dispute arises. By recording all stock transactions in a comprehensive electronic ledger, blockchain improves transparency, eliminates the need for third-party records, and allows for traceability of ownership.<sup>192</sup> But the corollary benefit is that this feature of blockchain also increases accuracy and certainty of initial determinations of ownership by corporations. Restoration of direct share ownership means that corporations will have access to a comprehensive record of each stock transaction, including all current shareholders (not just legal owners). Not only does this preclude the need for third-party records to identify beneficial shareholders, it makes the additional step of identifying beneficial shareholders wholly unnecessary.

By simplifying the process, blockchain stock ledgers could minimize potential errors or problems in reconciling disbursed records from different sources. Blockchain stock ledgers could, therefore, allow corporations to make more accurate determinations of ownership, providing greater certainty from the onset. The potential impact goes beyond the specifics of *Dole*. While blockchain technology could have provided greater accuracy and certainty in *Dole*'s initial determination of the shareholders entitled to settlement funds, the benefit extends to any situation where accuracy of share ownership is consequential—for example the identification of shareholders entitled to vote on important matters such as director elections or mergers. Thus, the reunification of share ownership via blockchain could improve certainty in proxy voting and the exercise of all shareholder rights.<sup>193</sup>

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<https://www.nortonrosefulbright.com/en/knowledge/publications/82a6366f/delaware-provides-legal-clarification-for-blockchain-maintenance-of-corporate-records---the-view-from-canada> [<https://perma.cc/9PUK-6LM4>] (discussing how use of blockchain can eliminate intermediaries and allow corporations to take back control of recordkeeping—ensuring traceability and increasing certainty in proxy voting); Ai Deng, *Smart Contracts and Blockchains: Steroid for Collusion?*, 28 COMPETITION, no.1, 2008, at 103; Angotti & Minogue, *supra* note 164.

189. Laster, *supra* note 179.

190. *In re Dole Food Co., Inc. S'holder Litig.* No. 8703-VCL, 2017 WL 624843, at \*4 (Del. Ch. Feb. 15, 2017).

191. *Id.*

192. Laster, *supra* note 179; see also Trevor Dodge, *Delaware Authorizes Stocks on Blockchain*, NEW MEDIA & TECH. L. BLOG (Aug. 2, 2017), <https://newmedialaw.proskauer.com/2017/08/02/delaware-authorizes-stocks-on-blockchain/> [<https://perma.cc/9PRD-4W8T>].

193. Laster, *supra* note 179; NORTON ROSE FULBRIGHT, *supra* note 188.

Even if no question exists as to those entitled to shareholders' rights, the current system of indirect holding can interfere with the actual exercise of those rights by beneficial owners. In both *Dell* cases, beneficial owners of Dell stock were prevented from exercising appraisal rights due to procedural complexities of indirect holding and the bifurcation of stock ownership.<sup>194</sup>

In the first *Dell* case, shareholders were foreclosed from appraisal rights because they failed to continuously hold the shares for the period required by statute.<sup>195</sup> However, there was never a change in the ultimate investor who purchased the shares (i.e., the beneficial owner). But because of share immobilization, the record holder of the shares differed from the beneficial owner, and an administrative name change of the record holder interrupted the required period of continuous holding.<sup>196</sup> Thus, a technicality necessitated by bifurcation of share ownership prevented shareholders from obtaining appraisal rights—an incongruous, absurd and likely unintended consequence of the current system of indirect holding.<sup>197</sup>

A blockchain-based system provides a fix. Recording stock transactions on blockchain restores direct holding of shares, which abolishes the distinction between record and beneficial holders of stock. Instead, the investor who acquires the shares is registered as the owner in the books and records of the corporation. So the investor is effectively both the record and beneficial holder of the shares. By removing the intermediary, a blockchain system protects against the problem in *Dell*. Since a distinct record holder no longer exists, the beneficial holder of the Dell shares would now satisfy the “continuous holding” requirement for exercise of appraisal rights. Reunification of ownership via administration of stock transaction blockchain, therefore, has the ability to protect against the risk of intervening issues from derailing the proper exercise of shareholder rights by beneficial holders of stock.

In the second *Dell* case, shareholders lost their appraisal rights by voting in favor of a merger—a result that is consistent with the statutory limitation of those rights to those shareholders who vote against the merger.<sup>198</sup> However, the shares were voted contrary to the wishes of the beneficial owners who actually opposed the merger.<sup>199</sup> The procedural complexities of the indirect holding system—specifically required approvals from a series of intermediaries—contributed to a breakdown in process.<sup>200</sup> As a result, shares were inadvertently voted in favor of the merger, which led to the forfeiture of appraisal rights.<sup>201</sup> Again, the ability of beneficial owners to exercise their rights as shareholders suffers because of the complexities of indirect holding.

A blockchain-based system may again offer a solution. By removing intermediaries from the process of administering and recording stock transactions, the potential for procedural complexities to derail the exercise of shareholders' rights by beneficial owners is minimized. In *Dell*, for example, direct ownership of shares

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194. See *In re Appraisal of Dell Inc.*, 143 A.3d 20 (Del. Ch. 2016); *Dell*, 2015 WL 4313206 (Del. Ch. July 30, 2015); see also Laster, *supra* note 179.

195. *Dell*, 2015 WL 4313206, at \*3, 8–10 (Del. Ch. July 30, 2015).

196. *Id.*

197. See Laster, *supra* note 179 (noting that the absurdity of the outcome).

198. *Dell*, 143 A.3d at 59; see also DEL. CODE ANN. tit. 8 § 262(a).

199. *Dell*, 143 A.3d at 21, 56.

200. *Id.* at 29.

201. *Id.* at 22, 29.

via blockchain would mean that no intermediaries exist between the issuing corporation and the shareholder. Without intermediaries (and the need for a “daisy chain” of approvals from a series of intermediaries), it is more likely that the shares would have been voted in accordance with the intent of the shareholders seeking appraisal rights in *Dell*. Thus, a blockchain-based system may reduce the likelihood of process failure by eliminating layers of intermediaries along with their associated complexities. Shareholders could also benefit to the extent that these procedural complexities thwart their exercise of appraisal rights, voting rights, and the like.

Both *Dell* cases highlight how the current system hinders the exercise of shareholder rights. In contrast, one of the chief advantages of a blockchain-based system is that it not only resolves the problems in both *Dell* cases, but also facilitates the exercise of shareholder rights more broadly.<sup>202</sup>

In sum, a blockchain-based system could offer many advantages over the current system of share immobilization through elimination of: (1) intermediaries, (2) indirect holding, and (3) bifurcated share ownership.<sup>203</sup> Corporations that adopt a blockchain stock ledger may obtain several benefits, including greater certainty in initial determinations of stock ownership, the ability to audit and trace ownership in the event of a dispute, and the removal of procedural complexities that may prevent the valid exercise of shareholders rights.<sup>204</sup> Therefore, blockchain technology has the potential to revolutionize the way that corporations administer and record stock transactions.

The potential of blockchain, however, is not necessarily restricted to improved efficiencies for corporate recordkeeping and governance. The benefits could extend more broadly to global capital markets.<sup>205</sup> To the extent that blockchain technology is scalable, it could replace the underlying infrastructure of stock markets and exchanges for all stock issuances and trades, increasing transparency and speed of settlement.<sup>206</sup> Accordingly, the potential of blockchain in corporate law ranges from causing incremental disruption to growth into a sustaining innovation.<sup>207</sup>

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202. Dodge, *supra* note 192.

203. See Laster, *supra* note 179; Dodge, *supra* note 192; Gujral, *supra* note 168.

204. *Id.*

205. See Syed S. Hussain, *3 Ways Blockchain Will Transform Capital Markets*, NASDAQ (Apr. 9, 2019), <https://www.nasdaq.com/articles/3-ways-blockchain-will-transform-capital-markets-2019-04-09> [<https://perma.cc/N5FK-969M>]; WYMAN, *supra* note 159; Navarro, *supra* note 159; David Yermack, *Corporate Governance and Blockchains*, 21 REV. FIN. 7 (Mar. 2017), <https://academic.oup.com/rof/article/21/1/7/2888422> [<https://perma.cc/R9KB-HJBP>].

206. *Id.*

207. Clayton M. Christensen, Michael E. Raynor & Rory McDonald, *What is Disruptive Innovation?*, HARV. BUS. REV. (Dec. 2015), <https://hbr.org/2015/12/what-is-disruptive-innovation> [<https://perma.cc/WBK4-MDD2>] (distinguishing incremental innovation from sustaining innovation).

### III. THE FUTURE OF BLOCKCHAINS IN CORPORATE LAW

Despite the potential of blockchain to resolve problems inherent in the standing policy share immobilization,<sup>208</sup> the future of blockchain stock ledgers is far from certain. Development and implementation of a new blockchain-based system is far from assured. Any number of challenges could derail it from successfully supplanting the entrenched system.<sup>209</sup> As such, a valid question arises about whether states ought to alter corporate law to accommodate a technology that may never develop or attain widespread acceptance. Perhaps counterintuitively, this Article concludes that now is the time to amend corporate codes to expressly permit the use of blockchain-based records.

#### *A. Potential Hurdles*

As the application of blockchain technology to corporate stock ledgers moves from theory to reality, it is necessary to acknowledge that potential hurdles exist to its successful implementation as an alternative to the current system. A brief discussion of the chief challenges follows. These include legal uncertainty, cost, and various challenges of operationalization.

#### 1. Legal Uncertainty and Risk

State corporate law is the most obvious potential impediment to the development and adoption of blockchain stock ledgers. Most states do not clearly authorize the administration of corporate records on blockchain.<sup>210</sup> Instead, state corporate law often generally indicates that the corporation must maintain corporate records.<sup>211</sup> This, however, rules out the use of blockchain technology, or at least calls it into question.<sup>212</sup> Blockchains are decentralized and have no central administrator.<sup>213</sup> Accordingly, neither the corporation nor any other person would have responsibility for maintaining records on blockchain.<sup>214</sup> The functionality of the technology, therefore, creates an incongruence with the corporate law of most states.

While a handful of states have amended their corporate codes to expressly authorize the use of blockchain technology,<sup>215</sup> legal uncertainty persists in all other jurisdictions. In the absence of express authorization, development of a blockchain-

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208. *See supra* Part II.

209. *See infra* Section III.A.

210. *See, e.g.*, TENN. CODE ANN., tit. 48 § 48-26-101 (noting that the corporation or its agent must maintain required records); NORTON ROSE FULBRIGHT, *supra* note 186 (discussing how Delaware amended corporate law to clarify and expressly authorize administration of corporate records using blockchain technology).

211. *Id.*

212. *See* NORTON ROSE FULBRIGHT, *supra* note 188.

213. *See* Fairfield, *supra* note 25, at 814; Ferrick, *supra* note 159, at 652.

214. *See* NORTON ROSE FULBRIGHT, *supra* note 188.

215. *See, e.g.*, S.B. 136 (Md. 2019); S.B. 1859, 86th Leg., Reg. Sess. (Tex. 2019); H.B. 2603, 53rd Leg., 2nd Reg. Sess. (Ariz. 2018); H.B. 101 64th Leg. (Wyo. 2018); S.B. 838 (Cal. 2018); S.B. 69, 149th Leg. (Del. 2017).

based system of recordkeeping is hamstrung. There is less incentive for corporations or other private actors to invest in and further explore the viability of blockchain for corporate records if there is no assurance that American corporate law will ever evolve to accommodate it. Simply put, why spend the time and resources to develop a blockchain system if corporate law does not currently (and may never) permit its use? Even if someone accepts that risk, the process of creating and implementing a viable blockchain solution is still hampered. The lack of express authorization to use blockchain in most jurisdictions restricts real-world testing, making it more difficult to meaningfully assess any developing blockchain system. In short, corporate law seemingly creates a misalignment of incentives and helps to preserve the status quo by deterring innovation—specifically, efforts to leverage blockchain to improve the problems created by the current system.

The legal risk created by state corporate law could contribute to the failure to develop a successful blockchain stock ledger and system of administering corporate records. However, a relatively simple solution exists. States that have not done so could follow the lead of states like Delaware, and adopt an enabling amendment, which expressly authorizes the use of blockchain technology.<sup>216</sup> Such an amendment is an appropriate and measured step. Rather than wholly replace the incumbent system and mandate that corporations switch to blockchain, states that follow the Delaware approach would simply open the door to blockchain.<sup>217</sup> Corporations could then choose to use blockchain stock ledgers or not. Removal of the legal barrier to blockchain records would not assure its development and success. Instead, corporations might still decide against pursuing blockchain for reasons other than legal risk and uncertainty—for example cost. Therefore, amending state corporate law would simply pave the way for incremental progress and adoption of blockchain stock ledgers if it proves to be the right solution.

## 2. Cost

Moving away from any entrenched system is a potentially expensive proposition. In this case, the costs start with development of new systems and tools (or the acquisition of such systems and tools) for the administration of corporate records on blockchain. Additional costs of moving to a blockchain-based system include transition costs such as installation, testing, and education. Learning to operate a new system may continue to impose costs as well—for example a lack of experience to rely upon when issues or problems arise for the first time. Together, these costs may deter both the pursuit of blockchain stock ledgers and their widespread adoption.

Although all corporations would benefit from a solution that eliminates the problems of the current system of intermediaries and share immobilization, joint action is unlikely due to a collective action problem of sorts. Without cooperation and cost/risk sharing, fewer may be willing or able to bear the cost of developing a

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216. S.B. 69.

217. *See, e.g.*, DEL. CODE ANN. tit. 8 § 224 (allowing corporations to choose administration of corporate records via blockchain technology, not mandating that they do so).

blockchain-based alternative on their own.<sup>218</sup> In addition, little incentive may exist to independently do so.

First, the problems presented by the current system, while significant, have not risen to the level of the “paperwork crisis,” which threatened to grind capital markets to a standstill.<sup>219</sup> Absent such a dire problem to drive change, the ease of accepting the status quo may win out over investment in a new and uncertain technological solution.

Second, the first to develop and adopt a blockchain-based system may face something akin to a first-mover disadvantage.<sup>220</sup> That is, the first mover bears the brunt of the costs and the entirety of the risk of failure—either in development of a workable solution or with its widespread adoption. Even if blockchain stock ledgers become the norm, there may be little lasting advantage from being the first to successfully develop and implement a blockchain-based system of administering corporate records.<sup>221</sup> Instead, others could move quickly to adopt blockchain stock ledgers and obtain the benefits of an improved system without the same cost or risk. In addition, any marketing, branding, or reputational benefit of being first would likely fade over time.<sup>222</sup>

To be clear, cost alone will not deter all investment in a blockchain solution. Some still see a place for blockchain technology in the future of stock transactions, including in the issuance and transfer of shares. Most notably NASDAQ, several foreign exchanges, and tZERO (a subsidiary of Overstock.com) continue to develop applications, which include blockchain-based securities marketplaces and exchanges.<sup>223</sup> Even so, cost may factor into decisions by others to forego pursuing blockchain. Cost, therefore, may reduce the number of firms actively working toward a blockchain solution—ultimately slowing efforts to assess its viability. As a result, cost may still hinder the development, implementation, and adoption of a blockchain system.

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218. *But see* Jordan French, *Nasdaq Exec: Exchange is ‘All-In’ on Using Blockchain Technology*, THE STREET (Apr. 23, 2018), <https://www.thestreet.com/investing/nasdaq-all-in-on-blockchain-technology-14551134> [<https://perma.cc/J5XN-FHJE>] (discussing continued investment in blockchain solutions).

219. Donald, *supra* note 11, at 54.

220. William Boulding & Markus Christen, *First-Mover Disadvantage*, HARV. BUS. REV. (Oct. 2001), <https://hbr.org/2001/10/first-mover-disadvantage> [<https://perma.cc/Q646-ZBEP>].

221. *Id.*

222. *Id.*

223. *See* Ervin, *supra* note 177; French, *supra* note 218; Elliott, *supra* note 161; Daniel DeConinck, *Overstock Completes First Public Stock Issuance Using Blockchain*, 36 REV. BANK. & FIN. L. 416, 416 (2017); Ryan Browne, *London Stock Exchange CEO Hints at How the 300-Year-Old Trading Venue Could Use Blockchain*, CNBC (May 2, 2019), <https://www.cnbc.com/2019/05/02/london-stock-exchange-ceo-on-blockchain-and-cryptocurrency.html> [<https://perma.cc/9EJ3-8JW4>]; Prableen Bajpai, *How Stock Exchanges are Experimenting with Blockchain Technology*, NASDAQ (June 12, 2017), <https://www.nasdaq.com/articles/how-stock-exchanges-are-experimenting-blockchain-technology-2017-06-12> [<https://perma.cc/295B-MTJB>].



### 3. Operationalization Challenges

The challenges of operationalizing blockchain for stock ledgers and more broadly for effectuating global stock transactions fall into three general categories—functionality concerns, transition issues, and incumbency advantage.

#### i. Functionality Concerns

Functionality concerns include various questions about the technical capability of blockchain to provide a workable solution that improves upon the current system. For example, questions persist about cybersecurity—specifically the susceptibility of a blockchain-based system of stock ownership to a cyberattack from malicious actors.<sup>224</sup> Perhaps unfairly, new applications of blockchain technology may suffer from a negative association with cryptocurrencies.<sup>225</sup> Large scale hacks have plagued cryptocurrency exchanges.<sup>226</sup> To be clear, these hacks have not exposed security weaknesses in blockchain itself—instead targeting linked systems by users of blockchain.<sup>227</sup> Even so, any system of blockchain stock ledgers must allay worries that stockholders might suffer similar losses—even if those worries prove unfounded. The challenge then is not only building a sufficiently secure system, but also earning public trust and confidence in the strength of that system’s security.

Another functionality issue is the immutability of blockchain records. Blockchain technology can prevent alteration or deletion of transaction data after it has been recorded.<sup>228</sup> Immutability as a feature, however, is a double-edged sword. If accuracy of the recorded data is assumed, the benefits of immutability include the creation of a transparent and auditable record that indicates the status of each share at any moment in time.<sup>229</sup> But if a mistake is made in recorded data, immutability would make it more difficult to correct.<sup>230</sup> Development of a successful blockchain solution must, therefore, account for the practical problems of immutability by minimizing the possibility of erroneous records and establishing a protocol for remedying any mistakes that occur.

224. Kelly & Mescall, *supra* note 18, at 242 (describing security risks in Overstock’s prospectus); Kelly & Mescall, *supra* note 161, at 152–54; *see also* Gaurav Yadav, *The Collision of Stock Exchanges and Blockchain*, HACKERNOON (June 25, 2018), <https://hackernoon.com/the-collision-of-stock-exchanges-and-blockchain-55d222b87a8> [https://perma.cc/4DAV-SDK5] (noting difficulty of maintaining security standards).

225. *See* Kevin V. Tu, *Perfecting Bitcoin*, 52 GA. L. REV. 505, 523 (2018).

226. *Id.*

227. Iansiti & Lakhani, *supra* note 21 (noting that hacks to Bitcoin exchanges have not exposed weaknesses in the blockchain itself). Rather, certain features of the blockchain may even offer enhanced security. For example, blockchains are decentralized, which means no single entity is responsible for maintaining the records. Instead, consensus is required across a network of independent computers, making it more difficult for a cyberattack to overcome the system.

228. *See* Kiviat, *supra* note 160; Angotti & Minogue, *supra* note 164; Henly et al., *supra* note 164, at 200; Robinson, *supra* note 164, at 914.

229. Iansiti & Lakhani, *supra* note 21.

230. *Id.*

A final functionality concern is the scalability of blockchain technology for widespread use in global capital markets. Blockchain does not present the same physical limitations as the prior paper-based system. However, blockchain technology is not currently capable of handling the daily transaction volume of capital markets.<sup>231</sup> A solution to this scalability challenge is necessary if blockchain is to disrupt global capital markets and serve as the architecture underpinning stock markets and exchanges.<sup>232</sup> Otherwise, lack of scalability will restrict the benefit of blockchain to some limited subset of stock issuances.

The above examples accentuate that development of a blockchain solution of direct share ownership turns in large part on the resolution of practical questions about how a blockchain system will operate. A blockchain-based system must show that the technology will function reliably and improve upon the current indirect holding system without introducing a new set of problems. Addressing these functionality concerns, however, involves more than just ensuring that the technology works effectively. It also requires establishing public trust in the functionality of a blockchain-based system. The foregoing notwithstanding, scalability presents an overarching functionality concern that may derail the successful development and implementation of a blockchain system.<sup>233</sup> A blockchain system, therefore, must prove that it is capable of functioning as a platform for securities exchanges and the backbone of global securities markets. Otherwise, the benefit of applying blockchain to stock transactions is muted, which may result in blockchain having a negligible impact on the future of stock transactions.

#### ii. Transition Issues

Replacing any incumbent system runs the risk of both anticipated and unanticipated difficulties. Accordingly, transitioning from the current system to blockchain may raise issues that slow or even prevent adoption of a blockchain system.

One potential transition issue is the treatment of certificated securities in a blockchain system. Corporate law continues to provide that shares of a corporation shall be represented by a certificate.<sup>234</sup> Although the board of directors may pass a resolution to make some or all of a corporation's stock uncertificated,<sup>235</sup> the practice

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231. *Id.*; see also Elliott, *supra* note 161 (noting the need to figure out trading speed challenges); Ryan Browne, *Five Things That Must Happen for Blockchain to See Widespread Adoption, According to Deloitte*, CNBC (Oct. 1, 2018), <https://www.cnbc.com/2018/10/01/five-crucial-challenges-for-blockchain-to-overcome-deloitte.html> [<https://perma.cc/ZLB9-LZZV>] (noting work on improving transaction speed); Yadav, *supra* note 224 (noting scalability problems with current projects); Bajpai, *supra* note 223 (discussing the need to resolve scalability issues); *Blockchain Revolutionizing Global Stock Trading*, CIOREVIEW (July 25, 2019), <https://www.cioreview.com/news/blockchain-revolutionizing-global-stock-trading-mid-30017-cid-176.html> [<https://perma.cc/6549-GCHY>] (discussing scalability and managing security standards).

232. *Id.*

233. *Id.*

234. See, e.g., DEL. CODE ANN. tit. 8 § 158.

235. *Id.*

of issuing certificated shares of stock remains common. Since blockchain provides a wholly digital mechanism for issuing and recording stock transactions, it may not accommodate the stock that is represented by paper certificates. To the extent that a blockchain system is inconsistent with paper stock certificates, transition to a wholly blockchain-based system may necessitate abandonment of certificated securities—those already issued and future issuances. Alternatively, a blockchain-based system may not become ubiquitous, operating instead as an optional platform for transactions involving uncertificated shares if corporations wish to continue issuing certificated shares.

A second potential transition issue is whether moving records of existing stock issuances onto blockchain is feasible. Adopting a blockchain system for new stock issuances is comparatively straightforward. Since a blockchain ledger creates a running record of all transactions,<sup>236</sup> it is built to record the first issuance of a class or series of stock and every transaction thereafter. Existing stock issuances, however, present a possible complication. Blockchain was not used to record the first issuance or subsequent transactions. Obtaining transaction data for all prior stock transactions may not be possible—especially for long-issued stock in corporations with high transaction volume. Even if all the records from prior transactions are available, the accuracy of those records may be questionable. This effectively defeats some of the most significant advantages of a blockchain stock ledger—specifically, the provision of an accurate and auditable record of stock ownership. Ultimately, blockchain may be better suited to new stock issuances as questions remain about the ability to transition existing stock issuances onto blockchain.

Other transition issues could arise, but the above examples show how practical problems with moving from the current system of indirect ownership and intermediaries may adversely impact the adoption of a blockchain solution. The inability to satisfactorily resolve transition issues would seemingly deter or even stop adoption. Moreover, difficulties in transition, even if solvable, may ultimately provide a preference for and retention of the incumbent system.

### iii. Incumbency Advantage

A final challenge to the operationalization of blockchain technology in capital markets is the need to generate a shift in mindset. The current system of share immobilization, flawed as it is, enjoys the benefit of incumbency. Overcoming this incumbency advantage may prove difficult.

For example, adoption of a blockchain solution requires a transfer of trust from institutions to systems. But distaste for change and skepticism of new technology may result in a preference for the status quo. Corporations and investors may prefer the current system (with its known problems and legal risks) to the uncertainty of a new blockchain system. That is, years of experience with the current indirect holding system may have bred a level of comfort with both the system and the intermediaries that make it work.

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236. Kiviat, *supra* note 160, at 578; Rust, *supra* note 163; O'Shields, *supra* note 163, at 177–85.

Skepticism of new technology and distaste for change aside, it is important to note that moving to blockchain is also against the interest of many participants in the current system.<sup>237</sup> A blockchain system would facilitate a return to direct ownership and holding of shares by the investors, eliminating the need for intermediaries such as DTC (the world's largest central securities depositories).<sup>238</sup> Intermediaries such as DTC currently play an important role in facilitating stock transactions, but have no place if blockchain replaces the indirect holding system. As such, there is little reason for incumbents to embrace a change, even if blockchain improves upon the current system.<sup>239</sup> This lack of incentive for incumbents to support a solution that makes them irrelevant together with a bias toward current systems is likely to present a challenge for widespread adoption of a blockchain solution.

*B. The Case for Proactive Amendment of Corporate Law*

A future where global capital markets run on blockchain technology and blockchain stock ledgers constitute the norm is far from certain. Reasons for skepticism abound.<sup>240</sup> A blockchain-based system may prove impracticable, or it may never attain widespread adoption.<sup>241</sup> Even so, this Article concludes that policymakers should amend state corporate codes to expressly authorize corporations to administer corporate records, including stock ledgers, on blockchain.

Why amend American corporate law to accommodate a future that may never come to pass? Such action may seem premature as it runs the risk of expending time and effort to pass needless legislation. But to the contrary, taking proactive action to amend corporate codes is prudent for several reasons.

One is that amending state corporate codes to accommodate blockchain technology aligns with the “enabling” philosophy underlying American corporate law.<sup>242</sup> American corporation statutes have long been characterized by freedom of choice rather than dictates as to operation of the business.<sup>243</sup> As such, giving corporations the ability to decide whether to use blockchain for administration of corporate records is consistent with this tradition of corporate freedom and choice.

A second reason is that proactively seeking a solution to the problem provides the time for a more meaningful exploration and assessment of a blockchain alternative. The problems created by the current system of share immobilization have not reached crisis level. Even so, a clear rationale exists for taking action to evaluate potential solutions prior to the existence of a crisis. The absence of an emergency, such as the threat of a stock exchange shutdown,<sup>244</sup> allows for intentionality in development,

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237. See Laster, *supra* note 179.

238. NASDAQ, *Glossary of Stock Market Terms* (Mar. 13, 2020), <https://www.nasdaq.com/glossary/d/depository-trust-company> [<https://perma.cc/4Y47-LDFC>].

239. See Laster, *supra* note 179.

240. See *supra* Section III.A.

241. *Id.*

242. See Strine, *supra* note 133; Elvin R. Latty, *Why Are Business Corporation Laws Largely “Enabling”?*, 50 CORNELL L. REV. 599, 599 (1965).

243. Latty, *supra* note 242.

244. See Donald, *supra* note 11, at 54.

testing, and implementation. Moreover, it allows for any adoption of a new system to occur organically. Amending corporate codes now eliminates legal risk and uncertainty, which frees corporations to work toward blockchain exchanges and stock ledgers.<sup>245</sup> In contrast, neglecting to do so may hinder its development and assessment, increasing the risk of haphazard consideration and implementation of a blockchain system if it becomes necessary. Simply stated, the appropriate time to evaluate potential alternatives is before a solution is compelled by the adverse effects of the current system. Proactively amending corporate codes maximizes the opportunity for full vetting of a blockchain solution. This, in turn, will mitigate the potential risk of reactionary attempts to find a solution, including system issues, transition problems, and other unforeseen consequences.

A third reason is that removal of roadblocks to modernization of corporate recordkeeping (and more broadly, the infrastructure for effectuating stock transactions) allows the market to decide the fate of blockchain in capital markets. For the sake of clarity, this Article does not suggest that corporate law should take a stand on promoting a particular mechanism of recordkeeping or effectuating stock transactions. Rather, it contends that corporate law should be indifferent. Amending corporate law to allow corporations to opt into the use of blockchain technology does exactly that by removing the legal risk that currently disadvantages a blockchain-based system—freeing the market to decide whether it improves upon the current system. Proactively amending corporate codes, therefore, prevents corporate law from indirectly contributing to entrenchment of the incumbent system. Further, electing not to accommodate blockchain may perpetuate stagnation in corporate recordkeeping and the system of effectuation stock transactions. Even if blockchain technology does not ultimately take hold, removing barriers to entry may spur action from incumbents and efforts to improve the current system.<sup>246</sup> Thus, amending corporate law to authorize use of blockchain facilitates innovation, progress, and exploration of new solutions.

Amending corporate law to grant corporations the freedom to opt into blockchain stock ledgers brings many benefits. Chief among these is enabling corporate choice and facilitating innovation. More specifically, amending now provides more time, and with it, opportunity—to develop, explore, and assess various blockchain applications (including blockchain-based stock ledgers, issuances, and exchanges). Most importantly, it levels the playing field by remedying the preference that corporate law currently creates for the incumbent system.<sup>247</sup> This frees the market to determine whether blockchain will fade away or become the new norm in global capital markets. At minimum, the foregoing reasons justify serious consideration of legislative action.

On the flip side, amending corporate law to accommodate blockchain carries little downside. Simply allowing corporations to opt into the use of blockchain does not force change. Corporations can continue to use existing methods of effectuating and recording stock transactions. Moreover, the current system of share immobilization remains intact, including intermediaries such as DTC. As such, the risk of harm from

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245. See *supra* Section III.A.1.

246. See Laster, *supra* note 179 (discussing incumbents).

247. See *supra* Section III.A.3.iii.

wholesale replacement of an existing system is minimized. The downside then is largely related to the expense of time and effort to enact legislation that may become extraneous. As compared to the potential benefits, states seemingly have much to gain and little to lose from amending corporate codes to accommodate blockchain.

If the above is not enough justification for states to amend their corporate code, a final point is worth highlighting. States may also gain an advantage in the competition for corporate charters by proactively amending corporate law to accommodate blockchain.<sup>248</sup> In short, the pursuit of blockchain-based systems to disrupt traditional stock exchanges and markets continues both domestically and abroad.<sup>249</sup> If these efforts show promise or ultimately succeed, corporations may choose (in part) to incorporate in jurisdictions that clearly authorize the use of blockchain technology. Early adopters may see increased interest as a destination for corporate organization, and states that do not act to accommodate blockchain may be left behind. Self-interest aside, jurisdictions that have not done so would do well to amend their corporate codes to give corporations the flexibility to opt into blockchain-based administration of records.

The foregoing analysis also provides useful lessons for policymakers more broadly grappling with the intersection of new applications of blockchain and existing law. Blockchain has vast potential to disrupt traditional industries and the legal frameworks that govern them.<sup>250</sup> Policymakers, however, have the ability to take a measured approach without neutering progress and innovation. Instead, they can look to accommodate new applications of blockchain technology when there is minimal risk of harm. In those situations, it is appropriate to modify existing law to remove legal uncertainty around the use of new technology and ensure that the law does not create an incumbency advantage (or otherwise contribute to entrenchment of an incumbent system). By ensuring that the law is neutral, policymakers can allow the market to freely decide the future of disruptive innovations and legacy systems. This approach strikes a balance between accommodating progress, incentivizing improvement, and preventing stagnation.

#### CONCLUSION

American corporate law should enable innovation and the modernization of corporate recordkeeping. To that end, policymakers should support amending state corporate codes to permit the use of blockchain technology. Just as the “paperwork crisis” once brought the inadequacies of a paper-based system to the fore, recent cases now raise legitimate concerns about the continuing efficacy of the federal policy of share immobilization.

Blockchain may offer a technological solution—one that allows for reunification of legal and beneficial stock ownership without the morass of paper-based records. But finding out whether blockchain (or any other technological solution) can in fact deliver on its potential requires an investment in the development and

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248. See Omari Scott Simmons, *Branding the Small Wonder: Delaware’s Dominance and the Market for Corporate Law*, 42 U. RICH. L. REV. 1129, 1129–30 (2008).

249. See Bajpai, *supra* note 223; Elliott, *supra* note 161.

250. See *supra* Section II.B.

implementation of an alternative system, including an assessment of its viability and scalability for widespread use by corporations and capital markets. Because most states do not expressly authorize the use of blockchain technology for the administration of corporate records, corporate law presently stands in the way of progress. Absent express statutory authorization, corporate law provides a disincentive to those who might otherwise explore alternatives to maintaining the status quo. By amending corporate codes to expressly permit the use of blockchain, states would remove a significant barrier to innovation in corporate recordkeeping.

To be clear, removing legal uncertainty does not assure success. Development of a viable blockchain solution faces several challenges. But whether a blockchain system supplants the current policy of share immobilization is wholly beside the point. The eventual success of blockchain-based stock ledgers and stock transactions has zero bearing on the conclusion that corporate law should permit the use of distributed ledger technology. Putting the potential benefits and efficiency gains of moving to blockchain aside, reasons abound for proactively amending corporate law to authorize the use of a technology that has not yet (and may never) take hold.

Corporate law generally operates to enable and provide corporations with freedom of choice. Corporate law, therefore, should not preempt the opportunity to pursue a better system—blockchain based or otherwise. Instead, it should enable innovation in recordkeeping and open the opportunity to pursue a blockchain solution. Absent amendment, corporate law will support entrenchment of the incumbent system. With a degree of insulation from competition, little incentive exists for incumbents to work towards improving or remedying systemic problems of the current system. Corporate law can level the playing field by giving corporations the choice to opt into the use of blockchain technology. This allows the market to decide. Moreover, potential competition from a new blockchain solution may also push incumbents to improve the current system.

Expressly authorizing the use of blockchain also makes practical sense. While serious, the problems created by the federal policy of share immobilization have not risen to the level of the “paperwork crisis,” which allows for development of a blockchain solution to occur organically and intentionally. Amending corporate codes at this juncture allows for both the space and time to truly evaluate blockchain-based record keeping as an alternative. Simply put, it is prudent to consider potential solutions before a replacement becomes necessary. A corollary benefit of early action by states is the possibility of obtaining an advantage in the competition for charters. So states have added incentive to amend.

Collectively, the case for proactive amendment outweighs the potential downside—the possibility of expending time and energy to enact legislation that ultimately proves unnecessary. Policy makers, therefore, have ample reason to amend corporate law to authorize the use of blockchain, and now is the appropriate time to do so.